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HERDERS' PERCEPTIONS TOWARDS LIVESTOCK CONTRIBUTION TO WETLAND DEGRADATION: A CASE STUDY OF MUELA, BOTHA-BOTHE DISTRICT, LESOTHO

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ABSTRACT

Wetland degradation has become a global challenge, because of the overutilization of wetland resources, ever-increasing population growth, and livestock grazing. Livestock grazing in Lesotho is attributed to wetland degradation through the removal of vegetation cover, trampling, and compaction, which result in accelerated erosion negatively impacting the potential of wetlands to store water. This study aimed to determine herders' perceptions concerning their animals' contributions to wetland degradation. The study was conducted in Botha-Bothe, Lesotho, where the Thaba Chitja herders' association has been established in Muela village. A qualitative approach was used where open-ended questions were used to obtain opinions from herders. The findings revealed that herders are aware of wetland degradation caused by grazing. However, the demand for green grass, water accessibility, and lack of rangeland grazing area due to the spread of invasive species are driving factors for wetlands grazing. Herders seemed worried about the wetlands and their animals as well. They reported willingness to change grazing management whenever they can get a conducive environment satisfying their livestock.

Keywords: wetland degradation, livestock grazing, herders' perceptions, Lesotho

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1. INTRODUCTION

Wetlands are essential for Lesotho as they play an integral part in supplying streams and main rivers with water. Furthermore, they provide a safe environment for plants and animals. The Ramsar Convention on Wetlands (Ramsar Convention on Wetlands 2018, p.12) defines wetlands as: "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters". It is estimated that in Lesotho, wetlands have decreased by 50% when compared with the 19th century (DRRM 2014). The main activities contributing to wetland loss are development activities and overuse of wetland resources by the people. The loss of wetlands adversely affects water quality and plays a role in the spread of invasive alien species. Wetlands serve as natural water decontamination filters, control excessive water, and provide a living environment for wildlife (Ryan & Squillance 2004). Wetland degradation is turning out to be a global environmental problem due to unsustainable usage of scarce natural resources, rapid population growth, and reduction of productive land (Reed & Stringer 2016).

The Lesotho Highlands Development Authority has identified wetlands of great significance for water delivery in both the Katse and Mohale dam catchments. Twelve priority wetlands were found in the Katse catchment while eight catchments were recognized in the Mohale catchment. They were listed based on the size and type of wetland (LHDA 2017). In general, wetlands have been damaged because of livestock grazing and a field assessment revealed a negative impact on the condition of most of the wetlands. The most important wetlands were targeted for conservation and restoration to safeguard and, wherever feasible, to enhance the water supply function of the system. Wetland prioritization was based on the size and type of peat wetlands (LHDA 2017). The water supply into the dams is highly crucial as the dams are the main reservoirs of water pumped to South Africa's main cities. These wetlands are considered economically viable for their contribution to Lesotho's income generation from royalties received from South Africa. Some wetlands are also important for their ecosystem services, particularly for the local communities that utilize them for medicinal plants, food plants, and water supply in subsistence agriculture (LHDA 2017). Furthermore, the wetlands are considered a critical grazing resource by local herders because of the vegetation they possess, especially in summer during transhumance (Du Preez & Brown 2011).

The main livestock farming in Lesotho is practiced in the lowlands and at the cattle posts where herders spend most of their summer. The herders start looking after animals at the age of six years, tending sheep, goats, calves, and donkeys within a reasonable distance from their homes (Pitikoe 2016). The cattle posts are usually in the mountains where there are no trees for fires and no proper shelters. Most of the herders earn a living through being employed by wealthier families whereby they are remunerated with animals after 12 months (Pitikoe 2016). These herders are vulnerable and illiterate people who have dropped out of school due to financial constraints. They acquire informal indigenous knowledge, however, through social learning and interaction with other herders, the environment, and the elders.

The Department of Range Resources Management was established under the Ministry of Forestry, Range, and Soil Conservation. One of the Department's roles is to select the wetland areas that require immediate attention for restoration and to come up with interventions necessary for their restoration, which include fencing and demarcation using beacons (DRRM 2014). The Department also plays a role in the formation of grazing associations and herders'

associations where they discuss challenges regarding proper rangeland management and provide herders with various training opportunities.

The wetlands in Lesotho face serious human-induced pressures which involve overuse of grasslands and exploitation for rural economic benefits through development. The water catchments' importance in Lesotho highlands has been emphasized, and the conservation of the associated wetlands together with its water demand is considered very necessary (Chatanga & Sieben 2019). The Department of Range Resources Management has erected fences around some wetlands, and, as mentioned above, established herders' associations and conducted training for herders about the importance of wetlands. Enforcements have been done by technical staff in conjunction with other stakeholders to impound animals found in wetlands, but there is still no significant improvement (Tumwebaze 2018). The problem of wetland grazing by livestock is persistent even after so many initiatives including the demarcation of wetland areas.

The overall objective of this study was to improve the level of sustainability of wetlands in Lesotho.

This study's objectives were to assess herders' perceptions of wetland degradation:

(a) To determine the perceptions of herders concerning livestock contribution to wetlands degradation.
(b) To determine whether the herders are aware of the management tools currently in place to protect wetlands.
(c) To find out the opinions of herders on how efficient current management tools are in preventing animals from entering the wetland areas and how wetlands could best be protected.

To fulfil the study objectives, the following research questions were asked:

1. What views do herders have concerning grazing their animals in wetlands and their influence on wetland degradation?
2. What are the herders' opinions about the management tools to prevent animals from entering wetland areas?
3. How do herders perceive the efficiency of the tools and how, according to their views, can wetlands be better protected from animal grazing?

The study findings should be valuable for policymakers as they provide important information about the views of herders regarding the use and management of wetlands. The opinions documented in this report provide a basis for reference, and it should be easy to incorporate the herders' opinions into policy development to attain sustainability of wetlands. The opinions of herders will help relevant institutions to plan their duties in line with herders' interests.

2. LITERATURE REVIEW

2.1 Wetlands and livestock grazing

The importance of the highlands of Lesotho is not only of great significance for sustaining the life and wellbeing of local communities, but they are also the main source of ecosystem services and provide universal environmental benefits for a large part of Southern Africa (United

Nations Development Programme n.d). The mountainous kingdom is, for example, the source of water for the rivers that flow to the Atlantic Ocean in the west.

Wetlands do exist in all countries of the world but they are being destroyed at an alarming rate across countries in terms of development (LHDA 2017). When the importance of wetlands has been recognized, there should be a good chance of conserving them.

In Lesotho, the land tenure system in the mountains is communal and all the grazing rights are vested in the principal chiefs. That is, livestock can graze everywhere, and no or very limited areas are privately owned (Olaleye et al. 2022). The mountain wetlands are located within the rangelands. Before livestock are allowed to go into the mountains for the summer, the technical staff of the Department of Range Resources Management must examine the area in terms of the availability of forage. The livestock owners must acquire grazing permits to move their livestock to recommended areas in the cattle posts and herders take care of them (M Manama, 19 May 2022, Department of Range Resources Management, personal communication).

Agricultural practices including livestock and crop production are assumed to be the main factors leading to wetland pollution and degradation in both the mountains and foothills, while liquid waste and domestic waste disposal are thought to be the main reasons for wetland pollution in the city and small towns in the lowlands (Olaleye et al. 2022). The Lesotho Highlands Water Project reported that it plans to target high-value wetlands that are important for wetland supply and recommend sustainable management and restoration measures because these wetlands are useful in supplying water to the streams and rivers in the mountains of Lesotho (LHDA 2019). The characteristics of the wetlands are that they naturally have peat and perform vital hydrological work in the watershed, thus cleansing, reducing flow, and minimizing the siltation of rivers and streams.

The major threat to wetland management in Lesotho is livestock grazing (LHDA 2019). The strategic plan for the Lesotho Highlands Development Authority proposes an increase of protected areas in Lesotho to incorporate the high-rated wetlands in order for them to fulfil the water supply mandate (LHDA 2019). Wetlands in Lesotho have a broad distribution of which nearly all are in the high rainfall areas of the highland territory. The palustrine, lacustrine, and riverine wetlands found in Lesotho are different both floristically and physically from those found in the highland territory because of the soils and vegetation (National University of Lesotho 2009). However, wetlands are already at high-risk in Lesotho because they are mostly considered for animal grazing and the problems related to wetlands management, such as soil erosion, are related to overgrazing (National University of Lesotho 2009). Land degradation in highland areas is a major contributing factor to the increased conversion of wetlands to cropland. This is the result of the decline in productivity of arable land due to erosion; therefore, wetland areas are used as an alternative medium of production. Rehabilitation projects have been undertaken in some wetlands in the mountains of Lesotho, including Ha Matela in 2006, to rehabilitate degraded wetlands back to functionality. These wetlands are, however, still utilized for animal grazing, drinking, growing crops, and gathering useful plants (Olaleye et al. 2022).

Climate change can also be accounted for by the destruction of wetlands in the uplands of Lesotho through its effect on rainfall inconsistency (LHDA 2017). The increased rate of soil erosion in wetlands is purported to be influenced by several drivers such as overgrazing, trampling by animals, and likely burning. The number of animals, as well as the control and period that they use the wetlands, and the catchment of the wetlands are believed to be crucial

aspects contributing to the acceleration of overgrazing which in turn leads to uncontrolled runoff, thus soil erosion occurs in the wetlands (LHDA 2017).

Much of the grazing in the highlands of Lesotho takes part within the wetlands because they contain the most palatable vegetation (Grab & Deschamps 2004). The wetlands are considered a critical grazing resource by local herders because of the vegetation they possess, especially in summer during transhumance when great numbers of sheep, cows, goats, and equines would be seen feeding on the open wetlands (Du Preez & Brown 2011). Wetlands are also crucial for carbon sequestration and storage capacity (Mitsch & Gosselink 2015). Even though the importance of wetlands for fish and wildlife safeguarding has been recognized a long time ago, some benefits have only been observed more recently. The importance of wetlands is recognized worldwide and has led to conservation, protection laws, regulations, and management plans being put in place (Mitsch & Gosselink 2015). Despite the massive functional benefits that wetlands offer, 50% of wetlands in South Africa have vanished and 48% of the remaining wetlands are badly damaged (Fisher 2017). This damage is the result of clear historical degradation, pollution, and intentional tapping of wetlands for urban development and increases in agriculture areal (Fisher 2017).

In Uganda, the drainage of wetlands is attached to population pressure and people view the wetlands as open land which ought to be used. Wetlands conversion into provision for villages, public services expansion, and properties are also part of the reason for wetlands destruction in Uganda (Businge 2017). Livestock grazing contributes to wetland deterioration mainly through the elimination of vegetation cover, leaving the soil susceptible to water erosion and adversely disturbing the wetland's capacity to lessen water velocity and trap deposits into which impurities might be captured (George & Ngole-jeme 2022). Animal grazing could also damage the soil structure because of trampling, the accumulation of nutrients, in particular nitrates, and phosphates from their dung and urine bringing hormones and other materials used to improve animal production. In a study by Nakiyemba et al. (2020), Ugandan farmers pointed out that the communal land they had used for grazing for a long period included wetlands. In the late 1990s, the highlands were generally enclosed by sugarcane production and therefore the female farmers turned to wetlands for food production as an alternative. Grazing in Uganda is turning into a problem because of the scarcity of land, particularly during dry spells, with alteration of animal grazing arrangements from shared to personalized grazing controlled by fences.

The wetlands in Lesotho are generally used for livestock grazing and drinking. The vegetation in the wetlands is healthy and green throughout wintertime while the other rangelands are dry, which increases usage pressure (George & Ngole-jeme 2022). The overgrazing problem is aggravated by livestock overstocking, a condition that is linked with wealth in Lesotho. The grazing of animals in wetlands continues even though the wetlands and their surroundings are not designated for grazing as they are not considered to be part of rangelands.

In Semonkong, all protected wetlands are demarcated by rocks coated in white as a mark of fencing and to ban human-caused pressures that might damage the protected wetlands (Semonkong Wetlands Restoration and Conservation Project 2016). Efforts have been made to sensitize several stakeholders, including government departments, herders, representatives of traditional doctors, and grazing associations about the need to rehabilitate and restore damaged wetlands. Field trips were organized in order to raise awareness among stakeholders regarding critically degraded rangelands and wetlands in comparison with those which have recovered (LHDA 2019). The involvement and integration of herders in the project implementation has

been a success because they portrayed high interest in safeguarding the ecosystem (Semonkong Wetlands Restoration and Conservation Project 2016).

The laws and policies governing wetlands are in general not strong in Lesotho. They are not up to date and are not working hand in hand with each other. Therefore, it is necessary to amend them while also striving for total enforcement (National University of Lesotho 2009). The Environment Act 2008 implies that no person shall use wetlands as a resource without the approval of the director of the Ministry of Environment, Tourism, and Culture. It also states that any person who contravenes the provision of the section is committing an offense and is liable to be charged and receive a fine of no less than M500.00 (Kingdom of Lesotho 2008).

2.2 Livestock and rangeland management

Livestock grazing beyond limits in Lesotho has triggered widespread land destruction and soil loss, thereby endangering communities' livelihoods. The high load of animals on public pastureland has led to a huge amount of soil being washed away annually, bringing about a great loss in natural vegetation cover and environmental goods and services. Inadequate grazing administration has contributed to vast land degradation (Rampai 2017). Most Lesotho men who work in South African mines come back to Lesotho if they lose their jobs in the mines. They play a significant part in the increase of livestock numbers because they buy many sheep and goats that in turn contribute to rangeland deterioration. About 50% of the communities living in remote areas rely on wool and mohair for household income (World Bank 2018). Livestock is generally categorized according to the size of animals into two major groups: large animals, cattle and equines; and small animals, sheep, and goats. It is a tradition in the summer season that herds comprising both small and large animals are relocated to the mountainous sites for grazing. In the winter, they will be taken to the lowlands and foothills due to snow. This management style can be called seasonal rotational grazing or transhumance (Ross et al. 2016).

Although rangelands are a public resource, a grazing association has been established in some villages to manage the rangelands by incorporating traditional knowledge into the rotational systems. A good example is the case of Ha Masitha, where the land is sustainably used (Rampai 2017). During colonial times in Lesotho, a clear boundary was introduced within the areas of control for chiefs. Headmen were formed to control grazing in the cattle posts and grazing permits were issued by the chiefs (Quinlan 1995). The government wanted to control grazing because they were aware of the overutilization of resources and sought measures to intervene. The organization, which was asked by the government to bring solutions, suggested that high livestock numbers were causing overuse of rangelands, hence farmers should reduce livestock numbers for sustainable use of the rangelands. However, farmers refused to reduce livestock numbers because they perceived grazing small and large animals together as the cause of vegetation loss rather than too large herds (Quinlan, 1995). The chiefs at that time were given power to rule over all the resources of the community until the late 1990s, when the local government ministry took away some of the powers of the chiefs.

The mountains of Lesotho were historically covered by grasses but the diversity of grasses has declined due to grazing pressure (Nusser 2002). Species composition of the grassland vegetation was probably also transformed, depending on the resilience to grazing and relative palatability of individual grassland species. Subtropical *Themeda triandra* grasslands (seboku) are usually confined to the lower and warmer north-facing slopes. These grasslands are considered an economically valuable pasture type but are considered to decrease in abundance as grazing intensity increases (Nusser 2002). This species is used as a measure of how good the rangelands are because it is palatable to animals. The wetland areas are regularly bordered by

Mexmuellera drakensbergensis patches at water surplus sites. This less preferred tussock grass is regularly set on fire to get fresh green leaves which make better forage for cattle. It is also well utilized for making grazing post roofs and ropes.

The grazing area in the lowlands within and around the villages is the responsibility of chiefs and headmen who impose local regulatory measures to prevent free grazing animals during the cropping season. Important areas are rested for regeneration of grass, roofing grass, and fuel wood. This is an example of indigenous knowledge applied to restrict the usage of resources to allow regrowth. It is the reverse scenario to the cattle post where control over resources is hard to maintain. The principal chiefs hold the power to allocate grazing and grant permits. There is no limit in terms of the number of livestock allowed to graze the mountains (Nusser 2002). Herders are the end-users of the rangelands and tend to set fire to grasslands to get fresh forage early. Such fire is perceived to be a causal agent for the encrouchment of invasive species (Hae 2016). The current rotational grazing takes place in three agroecological zones: zone A is the mountains; zone B is the foothills and zone C is the lowlands in or around the villages. The system was adopted to facilitate rotational grazing, yet the degradation continues (Likoti 2019).

A study conducted by Pitikoe (2018) found that herding produces an abundance of indigenous knowledge that Lesotho herders apply in taking care of the animals in the mountains. The herders know the ecosystem but their knowledge is not documented. They gather this knowledge through social interaction, communication with friends, and informal learning from elders and the environment itself (Pitikoe 2018). Lesotho herders utilize local indigenous knowledge to gather medicinal plants from around their cattle posts for both personal basic health and veterinary care. The herders learn about different cultural medicinal plants and the illnesses that can be treated with such plants. For example, they would dig and prepare *Ralikokotoanoa* and *Monna-mots'o* which they get from bush sites. They use it as a slight cleansing to regulate gall bladder levels as well as discharge. The herders also use indigenous knowledge for the decoration of their blankets and they produce hats from *Moseea* grass that is found in the mountains. They sell the hats as a form of income-generation, incorporating it with the herding (Pitikoe 2018). The isolated and traveling nature of herding practice limits access to social services for herders but facilitates close contact between the herders and the environment. Thus, they tend to take advantage of the limited resources available to survive in difficult circumstances. The herders' illiteracy does not seem to have any impact on identifying their livestock numbers as they manage to keep large herds of animals by checking their earmarks (Morojele & Pitikoe 2017).

3. METHODS

3.1 Study area

Lesotho is a small southern African country (30,588 km^2) and is completely landlocked by the Republic of South Africa. This study was conducted in Muela village in the northern district of Lesotho, called Botha-Bothe. The area is popularly known because it is the site for the main hydro-power station in Lesotho. Soils in Lesotho are generally derived from either basalt or sedimentary rock formations (Majara 2005). The study area soils are of sediment rock origin and is deep on the foot hill slopes where there is a settlement. Cropland farming is only done above settlements while the upper slopes are grassed with some patches of bare areas where there is rangeland. Based on the four agroecological divisions of the country (mountains, lowlands, foothills, and the Senqu river valley) the study area is within the foothills where the

elevation ranges between 1,800 m and 2,000 m above sea level (Majara 2005). Figure 1 shows a map of Lesotho with the four agroecological zones and the study district Botha-Bothe in the north.

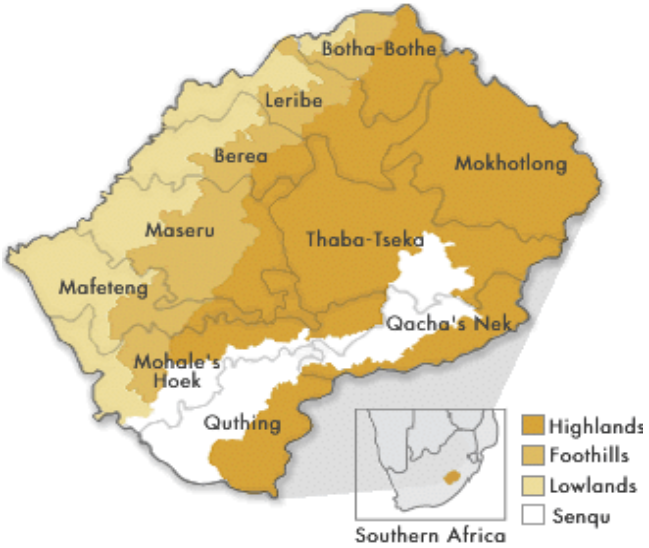

Figure 1. The districts and agroecological zones of Lesotho. (Source: Mekbib et al. 2015).

The foothills constitute 14% of the total land surface in Lesotho while mountains constitute 54% of the land. The study area is mainly used for grazing by livestock, and it is an essential watershed area (Majara 2005). Yearly rainfall ranges between 500 mm and 1,300 mm across the country, but between 650 mm and 850 mm in the lowlands (Majara 2005). The study's catchment area comprised of eight villages: 'Muela, Boinyatso, Sentelina, Bela-Bela, Phamistone, Moholeng, Pote, and Palehong.

In 2016, the population of the study area was 374 in total, with 183 males and 181 females from 98 households (Bureau of Statistics 2016). Land in the study area includes the rangelands with a lot of indigenous shrubs on the slopes, some exotic forest plantations, cropland, and settlements. Farming comprises livestock and crop production. The study focused on Muela village because it has organized herders and grazing associations, hence they were considered to have a good understanding of the environment and, specificly, on the issues this study focuses on, as they live within an area where wetlands are degrading.

3.2 Research method and data collection

This study incorporated two distinctive approaches in its research design. The first approach was to conduct a detailed literature review by gathering information from websites, books, journal articles, reports, peer-reviewed publications, dissertations, and conference papers. Additionally, hard copies of other credible reports that examined the perceptions of societies towards livestock contribution to wetland degradation were reviewed, while the study focused on the perception of herders regarding livestock grazing as a contributing factor to wetland degradation. The second approach was to conduct face-to-face interviews with herders, whereby two officers, a Range Technical Officer and an Assistant Conservation Officer from the Ministry of Forestry, Range and Soil Conservation, were engaged as research assistants to administer the questionnaires. Semi-structured open-ended questions were used to collect the primary data (Appendix II). This method was used because it allows for probing and the use of

follow-up questions for clarity. The herders were interviewed on their respective farms as they were busy with winter farming activities. Data were collected between the 27th and 30th of June, 2022. The research assistants recorded the interviews and the recordings were sent to the researcher for transcription and analysis.

A qualitative approach was used as it is relevant to understanding people's experience of a phenomenon or situation (Nowell et al. 2017). The research was aimed at herders who were involved with livestock grazing both in the village and at the cattle post in the mountains. The researcher used a purposeful sampling technique because the method allowed the sample to be selected based on the researcher's interest in the phenomenon (Patton 2015). The chief appointed and arranged for two participants who were first interviewed. As the entry point to the community, he was briefed about the characteristics of participants prior to the interviews and the snowball strategy was used to reach the next participants.

The snowball strategy involves locating a few key participants who easily meet the criteria a researcher has established for participation in the study. The researcher then asks each of these early participants to refer him to other participants with the same characteristics (Patton 2015). The participants in this study were eight herders from Thaba-Chitja Herders Association (see Appendix II).

Before each interview, a letter was read to the interviewee, which introduced the research assistants, the study aims, and the ethical considerations of the study (Appendix I). The senior officers whom the researcher originally intended to use as research assistants had experience in qualitative data collection. However, they had other commitments at the time of data collection. Therfore, two officers without previous interview experience were engaged in the data collection. This might have affected the results of the study somewhat since only one participant responded to question 8b (Appendix II), the last follow-up question.

3.3 Data analysis

All the field records were translated by the researcher into English. The data were analyzed using thematic analysis, which was seen as the most relevant tool for this study as it allows for investigating similarities and differences in the views of the respondents (Nowell et al. 2017). The transcripts were coded and grouped into themes. With the initial codes, the researcher narrowed down relevant responses as participants had the freedom to answer in their own way because of the open-ended questions. Similar quotes were grouped and named under sub-themes and then into themes. The thematic analysis involves investigating participants' responses and the underlying reasons behind their answers (Maguire & Delahunt 2017). The established themes were interpreted in the context of previous studies on similar issues.

4. RESULTS

This chapter presents the findings obtained on the perception of herders concerning livestock grazing in wetlands and their contribution to wetlands degradation. Their views and the underlying reasons behind their responses were investigated. The themes are presented below, supported by direct quotes from the participants.

4.1 Herders' opinions on wetland grazing

To understand how participants perceive livestock grazing in wetlands, they were asked to give their opinions regarding the matter. They were asked what are the driving factors that influence them to graze animals in the wetlands and which type of animals like grass in the wetlands. They were also asked about the signs that show when the wetland is damaged and what could be the condition of wetlands, provided they were not grazed.

The herders gave their opinions on wetlands grazing and they all confirmed that it is not correct to graze animals in the wetlands. A few herders highlighted that those wetlands are important because they get water from there, they supply dams with water, and they are a source of drinking water for animals. Most of the herders mentioned that the animals cause compaction through trampling, which destroys the "sponge" that holds water, hence reducing wetland water holding capacity. They also attested that the vegetation is reduced. One herder voiced his opinion in this way:

> *... my view is painful because as we graze animals in the wetlands, we know for sure that grazing in the wetlands is not good because we destroy the water source. For example, when animals are walking in the wetlands you know they are compacting. When we are attending training of herders, we are told there is something like a sponge in the wetland, and animals walking there are compacting meaning we are preventing the water from being there, of which we are supposed to live from it. However, we have a small grazing area so there is nothing we can do but graze animals there.*

Most herders stated that the demand for green grass for their animals is the common driving factor that influenced them to graze animals in wetlands. They also expressed that their animals access water easily during the early summer months when the rain has not begun falling. Table 1 below shows the responses per herder and livestock owned. Afew herders added that they graze animals in wetlands because they don't have enough rangelands as their rangelands are full of invasive species. Moreover, they said that wetland grass is nutritious. One of the herders gave his opinion as follows:

> *It is water and demand for grass. Because in wetlands there are always green grasses, especially in summer when it is green in wetlands, while the rangelands are still dry, preparing to be green.*

Table1. Driving factors behind wetlands grazing.

Herders and livestock owned	Drivers of wetland grazing
Herder 1. Sheep & Goats	Demand for green grass, cattle post rangelands destroyed by invasive species
Herder 2. Cattle	Access to drinking water in dry spells, lack of grazing area
Herder 3. Cattle	Access to drinking water, wetland grass is nutritious
Herder 4. Cattle	Farmers want their animals to fill their stomachs
Herder 5. Cattle, donkey, horses & sheep	Demand for green grass
Herder 6. Cattle & goats	Grasses that livestock prefer are found in wetlands
Herder 7. Cattle, horses, donkeys & sheep	Demand for the green grass in wetlands & scarce grass in rangelands
Herder 8. Sheep	Demand for green grass & access to drinking water

The herders shared similar opinions about the type of animals that like to graze in wetlands. They said that horses and cattle are the animals that prefer to graze there. However, some of the herders indicated that the sheep and goats like the green grass while they are unable to graze well on tall grasses. The opinions were uttered in this way by one herder:

> *I think it is the large animals, the likes of horses and cattle. Because the small stock, the way I see, they like short grasses and in most cases wetlands have long grasses which habitually small stock are not able to eat or graze.*

The herders had quite similar experiences regarding the indicators of wetland degradation. They stated that when wetlands are degrading, they saw deterioration in water flow from the wetland outlet and wetlands drying up as major signs. Some herders had additional opinions on these signs, mentioning that the wetlands declined in vegetation, animals like birds disappeared and the wetlands eventually developed gullies. One of the herders revealed his opinion:

> *The signs showing when the wetlands are damaged, you will see that wetlands dry up fast during dry spells, and other wetlands develop gullies. The wetlands dry up and water becomes scarce*.

The herders seemed to have similar views about what might be the condition of the wetlands if they were not grazed. They reported that the wetlands could not be damaged if they were not grazed as they attributed wetland degradation to livestock grazing. One herder added that maybe climate change could influence wetlands degradation, and he expressed himself as follows:

> *… there is this condition called climate change, it might be one of those.*

4.2 Herders' perceptions and awareness of management tools

The herders gave their opinions on management tools whereby they said they were aware of a tool named beacons as they have been used in years. Most of the herders acknowledge that they knew the beacons and their function. Some herders added that rock paintings are also used in the cattle posts, and they are also used as a sign to prevent herders from entering rested or protected areas or grazing animals beyond their placement. One herder explained how he realizes when the area is not allowed for grazing:

> *In the mountains, when the area is closed from grazing, we often see the herds coming down to the lowlands. The beacons are still working in some places. In other places they are not used. I don't know why they are not put into practice. Here they were used as a sign showing that the area is closed, and animals are no longer allowed there.*

The herders perceived the responsibility for the maintenance of the management tools diversely. Some herders articulated that it is the responsibility of the principal chief, some indicated that it is the task of civil servants, and some said that it is the responsibility of the cattle post rangers. Although their answers were greatly varied in this issue, one of them said that the cattle post rangers and civil servants are jointly responsible:

> *Those people who made them should be the ones to see that the beacons are visible to herders, although we as herders sometimes destroy them after they're erected. This is done by some herders, not all. I mean to say, the cattle post rangers and the civil servants are the ones who impound our animals.*

Regarding what happens to animals that are found grazing in the wetlands or areas restricted from grazing, the herders seemed to share common views. They attested that the animals which are found in any area that is restricted from grazing are impounded and the farmer would be fined for trespassing. One herder described the process:

> *In rangelands, when animals are found there, they just write how many they are, and the owner will be asked to pay. While in the highlands they are impounded and given penalties which the farmers always pay, or pay with one of the animals.*

4.3 Herders' opinions on efficiency of management tools

Most of the herders confirmed that the beacons are useful as management tools to control grazing. On the other hand, a few herders were uncertain about the tools while only one herder stated that the tool is not efficient:

> *For me, I see them as statues without communication because it is not like we want to destroy good things, but we are also concerned about satisfying the animals. If you have been in the mountains, you will agree to it that rangelands are covered by invasive species.*

The herders gave their views about who they thought was responsible to ensure that management tools are recognized and enforcement is done to ensure the tools are respected. Most of them stated that the principal chief and the civil servants are responsible. One of the herders mentioned that it is not easy to monitor the cattle posts because they are far away. Another herder stated that it was the task of civil servants:

> *To talk the truth, it was supposed to be us taking care of the beacons but since we have small rangeland, we tend to leave them to officers and cattle post rangers because we want to graze everywhere*.

The herders had varied opinions on what could be done as a lasting solution to sustainably protect wetlands from animal grazing. Some of them suggested that the government should help them remove invasive species and, upon recovery of rangelands, the government should put high penalties. Furthermore, some herders indicated that communities should be made aware of the importance of wetlands and made resposnisble for guarding their wetlands. One herder mentioned that there should be a collaboration between livestock owners and relevant departments in the discussion of which strategy could be used to prevent wetland grazing. However, one herder stated that livestock owners are the ones allowing their animals into wetlands:

> *This is a difficult one because sometimes the animals that are found grazing in wetlands will be herded by the owner, so in my view, I think animals should not be allowed to graze in wetlands. Maybe there should be people employed to guard them.*

5. DISCUSSION

This study investigated herders' insights on the wetland degradation problem, which results mainly from livestock grazing in the cattle posts in the Botha-Bothe district in Lesotho. The findings will be discussed in the context of both the research questions and the literature reviewed.

5.1 Herders' understanding of wetlands degradation

The interviews revealed that herders are aware of wetland degradation as it is happening in the environment in which they live. The herders stated that it is not correct to graze animals in wetlands because they destroy water sources. They highlighted that the wetlands are important because they are sources of water. They alluded that the animals cause compaction through trampling which destroys the sponge that holds water, thereby reducing the wetlands' water holding capacity. This will affect the duration in which wetlands release water from the end of rainfall to when it resumes. The wetlands need to have enough vegetation cover to minimize the evaporation rate by covering the water from direct sunlight. The herders also claimed that wetland grazing is impacted by reduced vegetation cover. This understanding is in line with the theory that livestock grazing contributes to wetland deterioration mainly through the elimination of vegetation cover. This loss of cover leaves the soil susceptible to water erosion and adversely disturbs the wetland's capacity to lessen water velocity and trap deposits into which impurities might be captivated (George & Ngole-jeme 2022).

The herders described several factors that influence how they graze animals in wetlands. They rated the demand for green grass to be the major factor. Herders are end users of rangelands and they sometimes set fire to grasslands to get early fresh forage (Hae 2016). The burning of rangelands is according to their experience, the cause of green grass but they are not aware that burning grass bears negative effects, such as destroying the litter that is protecting the soil from heavy raindrops and the seed banks, from which new grass may sprout. The burning also gives an advantage to the growth of invader species hence there is less grass, and the herders see wetland grazing as an alternative. This is in alignment with the theory that the wetlands of Lesotho are considered a critical grazing resource by local herders because of the vegetation they possess especially in summer during transhumance, when great numbers of sheep, cows, goats, and equines can be seen feeding on the open wetlands (Du Preez & Brown 2011). The herders said that their animals access water easily during the early summer months when the rain has not started falling. They also mentioned additional driving factors, such as the lack of rangelands, because of the invader species in the cattle posts and they consider wetlands grass as nutritious. Much of the grazing in the highlands of Lesotho takes part within the wetlands because they have got the most palatable vegetation (Grab & Deschamps 2004). The rangelands are a public resource for the community, hence they should be managed by the users. A grazing association was established in some villages to manage the rangelands by incorporating traditional knowledge into rotational systems for sustainable use of resources. Ha Masitha is a good example of that (Rampai 2017).

The herders indicated that they perceived cattle and horses to be the animals that mostly prefer wetlands grass. They continued to say that the sheep and goats also like green grass, but they could not graze well in tall grass. The cattle are animals that graze long grasses while sheep graze well in short grass, so in combination they become critical degreasers of vegetation in wetlands. It is a traditional practice in Lesotho in the summer season that a herd composition

of small (sheep and goats) and large animals (cattle, horses, and donkeys) is relocated to the mountainous sites for grazing (Ross et al. 2016).

The study's findings revealed that, although the herders continue to put their animals in the wetlands, they were aware of the effects of livestock on wetland degradation. Most of them agreed that the wetlands are degrading, and they pointed out deterioration of water flows from the wetland outlet and wetlands which dry up as the major signs that indicated degradation. Because the herders are always around the wetlands, they experience the changes. They stated that there was always a decline in vegetation in degrading wetlands to the extent that some animals that used to live there, such as birds, would disappear and the trend eventually lead to gully formations as degradation continues. These opinions of herders support by others' observations that erosion in the wetlands takes the form of channel incision and gully erosion which lowers the local water table within the wetlands (LHDA 2017). The herders' opinions also agree with the idea that the number of animals, as well as the periods in which they use the wetlands, are crucial aspects contributing to the speeding up of overgrazing which in turn leads to uncontrolled runoff and soil erosion in the wetlands (LHDA 2017).

The herders attributed the wetland degradation to livestock grazing and believed that the wetlands would be less affected if they were not grazed. One herder mentioned that, apart from livestock grazing, wetland degradation might also be attributed to climate change. This herder's view is in line with a report stating that climate change may also play a role in the degradation of wetlands in the highlands through its impact on rainfall variability (LHDA 2017). The impact of climate change on wetland degradation may not be as severe as livestock trampling because climate change may not affect the storage capacity of wetlands. The vegetation in the wetlands is healthy and green throughout wintertime while the other rangelands are dry, which increases the usage pressure (George & Ngole-jeme 2022).

5.2 Herders' awareness of current management tools

There are specific tools that are used to demarcate rested and protected areas for grazing in Lesotho and most of the herders were knowledgeable about these tools. They knew the beacons and could interpret their functions when they are erected. In the Semonkong Wetlands Project, the wetlands were demarcated with rocks painted in white as a sign of fencing and to prohibit human-induced pressures that would affect the protected wetlands (Semonkong Wetlands Restoration and Conservation Project 2016). The project was successful in protecting wetlands because the community was involved in its various structures and institutions. They were given training about the benefits and importance of protecting wetlands, which helped them consider participation in wetlands restoration. Some of the herders added that beacons and rock paintings are used to protect the rested or protected areas so that herders control that their livestock do not graze beyond their placement. This is in line with one of the Department of Range Resources' roles which is to select the wetlands areas that require immediate attention for restoration and to come up with necessary interventions for the restoration of wetlands, including fencing and demarcation using beacons (DRRM 2014). The herders perceived the responsibility for the erection and maintenance of management tools in quite a varied way. Some herders knew only about the principal chief's responsibility, while others said that it was the responsibility of the civil servants, while still others indicated that it was the task of the cattle posts.

In Lesotho, the land tenure system in the mountains is communal. All the powers conecerning grazing are vested in the principal chiefs, meaning that livestock can graze anywhere, and no

areas are privately owned (Olaleye et al. 2022). The grazing in the cattle posts is regulated through grazing permits, which are produced by the Department of Range Resources Management and delivered to the principal chief to be issued to farmers. There is collaboration between the Department of Range Resources Management and the principal chief in executing the demarcation of areas while the herders' role is to respect rested areas by controlling livestock grazing. It is common that the cattle post rangers and officers from the Department of Range Resources Management monitor the cattle post together. The herders said that while the monitoring takes place, animals that are found in the wetlands are impounded and driven to the royal kraal where the farmers will be given penalties. The confiscation of animals has never been a solution because the farmers own large herds so selling a few animals to pay the penalties is usually not be a problem. Clearly, there is a need to create productive rangelands for animals and to increase the penalties for infringing animals while, at the same time, instilling knowledge in herders through continuous training.

5.3 Herders' perception of the efficiency of management tools

The study's findings revealed that most of the herders found the beacons to be a useful management tool to control grazing. The herders reported that beacons might be more efficient with regular monitoring. They claimed that young herders destroy erected beacons mindful that, should they be caught grazing animals beyond them, they could plead innocent because nothing was there to show that the area was protected from grazing. Some of them stated that they are uncertain because they had to make sure that their animals were satisfied and the rangelands are reducing because of invasive species, so they tend to graze even in protected areas.

The herders explained that although beacons do not work well on their own, because animals can still graze beyond their placement, they are better in the lowlands where rangelands committees and villagers monitor grazing. In this way, important areas in the lowlands can be rested for regeneration of grass, roofing grass, and fuel wood. It is a reverse scenario to the cattle post where control over resources is hard to maintain. The principal chiefs hold the powers to allocate grazing and grant permits. There is, however, no limit in terms of the number of livestock allowed in the mountains (Nusser 2002). The use of beacons or boundary stones can vary both between areas and the purpose for which they are used. This was shown by a study carried out in Tanzania where they were used to demarcate village boundaries. Nilsson (2001) reported in his study that, when he took a transect walk, he saw boundary stones:

> I crossed between the officially demarcated village boundaries together with a younger farmer who was fluent in English, chatting with people, dusting off boundary stones, observing tiny trickles of water, and watching cows, mules, sheep, and goats with special interest. This was maybe the dustiest part of the fieldwork. We covered hilltops, slopes, and valleys, including some grazing areas in neighbour villages, while taking notes and sketching eagerly on the map copies I had brought. (p.33).

Among the herders interviewed, one of them mentioned that a fence was once used in the mountains to protect wetlands, but it was cut down and taken away until there was no piece left. I observed the usage of an electrical fence, during a study trip to a wetland restoration site close to Reykir in Iceland, as another way of effectively protecting wetlands from grazing because electric shocks could install fear in animals and herders as well. This approach can also be practical in Lesotho, but it needs political will to be put into action.

The study asked about herders' perceptions of who is responsible for awareness of management tools and enforcement of their function. The herders' opinions were similar on this issue. They perceived the principal chief and civil servants as responsible for ensuring that beacon functions are observed. Ratner et al (2022) argued that multistakeholder platforms are beneficial for increasing awareness and investment in the field of natural resource governance. They highlighted that in Tanzania, multistakeholder platforms supported the coordination among responsible land governance and administration institutions in the Chemba district and that led to the establishment of village land councils which helped to realize the need to allow natural resources to be managed by the people at village level.

The herders' perceptions about who is responsible can also be connected to the fact that, during colonial times in Lesotho, a clear boundary was introduced within the areas of control for chiefs and headmen were formed to control grazing in the cattle posts in accordance with the permits issued by the chiefs (Quinlan 1995). Defining the boundaries of the communally owned resources and specifying those authorized to use them can be thought of as the first step in organizing for collective action (Ostrom 2015). A key step in a participatory rangeland management process is the establishment of a rangeland management body, committee, or institution (Flintan et al. 2019). One herder mentioned that the barrier to close monitoring of cattle posts was the difficulty in reaching these areas, as some of them are far from the vehicle road. Moreover, sometimes herders will set their aggressive dogs on monitoring officers who therefore claim they need more security when monitoring.

The herders gave a suggestions on what could be done to sustainably protect the wetlands. They proposed that the government should assist them with clearing invasive species in the rangelands and upon their recovery, the government should install high penalties that would scare farmers so that they in turn would strongly command their herders to avoid grazing in wetlands. They also suggested that communities should be made more aware of the importance of wetlands and that they should be allowed to guard their wetlands. The herders came up with a suggestion that there should be a collaboration between livestock owners and relevant government departments in the discussion of wetlands protection. In rangeland or silvopastoral systems, herding and grazing practices should be based on herders' detailed integration of situated knowledge of the livestock, landscape, plant phenology, and weather patterns (Wheeler and Root-Bernstein 2020).

Participatory rangeland management is often seen as the appropriate approach to sustainable resources management through the communities and other stakeholders examining rangeland resources. It sets up a platform for establishing a governing community association (Flintan et al. 2019). Participatory rangeland management provides common ground for developing a rangeland management plan based on detailed rangeland inventory and community action planning. Rangeland grazing is regulated by a legally binding rangeland management agreement between communities and local governments with rules and regulations clearly defined according to the rangeland management plan (Flintan et al. 2019). It is important to note that seven of the eight herders interviewed in this study are owners of livestock while the remaining one was employed by a livestock owner. The involvement of herders can be important as is evidenced in one restoration project in Lesotho Semonkong. Here the involvement and integration of herders in the project implementation has been a success because they showed high levels of interest in saving the ecosystem with a higher number placing importance on safeguarding the environment (Semonkong Wetlands Restoration and Conservation Project 2016).

The interviews in this study were not conducted by the researcher because the data was collected from Lesotho while the reseracher dwelled in Iceland. This led to some limitations because some follow-up questions were mostly not answered by the participants. The number of participants was also limited because of time constraints.

6. CONCLUSIONS AND RECOMMENDATIONS

Wetland degradation is becoming a major environmental problem in the world, with unsustainable utilization of limited resources, population increases, desertification, soil erosion, and decline in agricultural land productivity (Reed & Stringer 2016). The study's objectives were to investigate the opinions of herders residing in the Botha-Bothe district of Lesotho, specifically in Muela village where the Thaba Tjitja herders' association is based. The results showed that the herders were knowledgeable about wetlands, and they expressed without hesitation that wetland grazing is not correct, saying that the animals' trampling destroys the capacity for water storage. From the findings, it is clear that herders are aware of wetland degradation. They said that their herding practices were influenced by the demand for green grass and easy access to drinking water for animals. The study found that a lack of rangelands due to the spread of invasive species is also a contributing factor to wetland grazing. Community based natural resources management becomes successful when the resource is community centred. Therefore, herders' opinions are required to achieve sustainable management of wetlands and rangelands.

Based on the findings of this study, the following recommendations are proposed:

- Communities should be made aware of wetland laws and regulations through continuous sensitization because they are the beneficiaries and primary users of the resource and the extinction of wetlands would affect both their livestock and humans since water is a basic need to support life.

- Livestock farmers should be sensitized about fodder production. The government should provide farmers with fodder seed in adequate quantities as the basis to reduce grazing pressure on the rangelands.

- The Ministry of Forestry, Range, and Soil Conservation should devise the means to rehabilitate the rangelands in the cattle posts.

- Wetlands which have been restored should be guarded to prevent animal grazing and trampling.

- Communities in Lesotho have indigenous knowledge about the environment supporting their lives. Therefore, the communities using wetlands should be at the center when developing plans and strategies to protect wetlands. As end users, their opinions are important and they have knowledge about their environment.

- More grazing associations and herders' associations should be established, and training should be continuous to ensure the transfer of indigenous and scientific knowledge in natural resources management as members of associations are not permanent, but the purpose is permanent. Community-based natural resources management becomes successful when the resource is community-centred. It is clear that although rangelands are a public resource,

grazing associations were established in some villages to manage the rangelands by incorporating traditional knowledge in rotational systems, and Ha Masitha was reported as a good example of well-managed resources.

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APPENDICES

APPENDIX I

Introduction letter from the researcher

Request for your participation as part of a Land Restoration Training Programme

Dear Sir

My name is Khotso Monyane, a public servant in the Ministry of Forestry, Range, and Soil Conservation in the Mokhotlong district. I am currently undertaking a restoration training in Iceland and this research forms part of the fulfilment to complete the course. I, therefore, plead for your participation in this study, by responding to the questions I prepared. The interview is intended to be anonymous which is why even your name is not required, what is essential is your views because I feel you know the mountainous cattle post more than anyone else. You hold key information that can play a critical part in the protection of wetlands. I want to highlight that there are no wrong answers it's your opinions you know best just feel free to give out your views as they are.

I would like to know your views on wetland degradation concerning livestock contribution in the mountains, and how they affect wetlands through grazing. I also want to find your opinion about driving factors that influence you to allow animals to graze in wetlands. If you are willing to participate, research assistants, who are also employees of the ministry will take you through the questions. The conversation will be recorded so that I get the answers directly to my ears and remember this is for this study. No part of the interview or the report, in the end, will be used against you as an individual, or anyone, confidentiality, and anonymity will be maintained. Your participation is voluntary.

Thank you in advance for your time

Kind Regards

Khotso Monyane

APPENDIX II

Interview Frame for Muela Herders

Background Information

Please place a tick where applicable

1. Age	<30	30-39	40-49	50>	
2. Education	None	Primary	High School	Tertiary	
3. Type of livestock	Sheep	Goats	Donkeys	Horses	Cattle
4. Livestock ownership	Owner	Employed			
5. Do you practice transhumance	Yes	No			

Herder's opinion concerning animals grazing in wetlands

6 a. What is your opinion about animals grazing in wetlands? Is it correct according to your knowledge?
b. What do you consider as driving factors that influence you to allow animals to graze in wetlands?

c. Which types of animals according to you prefer the grasses found in wetlands?

d. What signs do you see in the wetlands in the highlands that show they were damaged?

e. In your view could the wetlands be damaged if the animals were not grazing there?

Herder's views about management tools

7 a. How do you know or notice when a certain area is protected from grazing without being told? It may be in rangelands, wetlands, or crop fields.

b. Who is responsible to ensure that those management tools are maintained especially in the cattle post area?

c. What happens to animals that may be found grazing in protected or rested areas? Explain the process and charges for penalties if any

Herder's perception of management tool's efficiency

8 a What is your opinion about the efficiency of the management tools used to demarcate rested or protected areas from grazing?

b. In your opinion who is supposed to take responsibility to ensure that tools are recognized, and enforcement is done to avoid grazing in wetlands what may be hindering their initiative?

c. What do you think can be done as a lasting solution to sustainably protect wetlands from animal grazing?