

Socio-Economic Perceptions of Livestock Grazing in Miombo Woodlands: Insights from Pastoralists, Agro-Pastoralists, and Crop Farmers

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Abstract

Grazing in miombo woodlands has been increasing in Tanzania and Sub-Saharan Africa where miombo ecosystems exist. The livestock keepers face various pressures that intensify grazing in these areas. The pressures include population growth, climate change, livelihood needs and lack of alternative grazing land. It is vital to sustainably address these pressures to ensure the long-term health of miombo woodlands. This also supports the livelihoods of local communities by ensuring sustainable management of livestock keeping and miombo woodlands. This research objective is to comprehend the perspectives of pastoralists, agro-pastoralists and farmers regarding grazing in miombo and factors influencing these perceptions so as to mitigate the stated problems. The study was conducted in Kilosa, Kilombero and Handeni districts in Tanzania. The study involved 435 respondents through Focus group discussions, Key Informant Interviews and Questionnaires surveys. The study observed diversified perceptions amongst pastoralists, agro-pastoralists and farmers. The positive perceptions towards grazing in miombo woodlands were prominent amongst the pastoralists and agro-pastoralists unlike what was amongst the farmers. The study concludes that it is important to consider diverse perspectives of livestock keepers and farmers for sustainable management of miombo woodlands. The study recommends livestock grazing should be managed using rotational grazing practices to ensure regeneration of vegetation in miombo woodlands, there should be collaboration and common agreements between livestock and policy makers so as to come up with appropriate policies which suit all groups of pastoralists, agro-pastoralists and farmers.

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I. Introduction

Miombo woodlands constitute a larger part of Sub-Saharan countries from Eastern, western and southern Africa (Chidumayo and Gumbo 2010, Dewees 2011). According to NAFORMA (2013), 44 million hectares or 51% of Tanzania mainland land area are covered with miombo woodland, which accounts for 92% of the forest ecosystem (Kitereja, 2015). This symbolizes miombo not only as an ecosystem but also a focal point of interactions between humanity and nature in Tanzania (Ribeiro *et. al.*, 2020, Dziba *et. al.*, 2020). Most of Tanzanians live in rural areas whereby they heavily depend on natural resources from miombo woodlands. The increase in population accelerates pressures in exploitation of miombo woodlands, which ultimately end up into degrading and killing the forests. Following nearly all miombo woodlands in Tanzania are under significant pressure with increasing in livestock grazing (Abdallah and Monela 2007, Lusambo, Monela and Katani, 2007, Njana *et. al.*, 2013). As a consequence, to climate change, population increase of both human and livestock, there is a tremendous change in land use pattern which poses a challenge to sustainable management of the miombo ecosystems as shown by Gumbo *et. al.*, (2019). Consequently, understanding the perspectives of those directly engaged in livestock keeping and farming becomes paramount. Hence, understanding the relationships which exists among different groups of users within miombo ecosystems; specifically, the pastoral, agro-pastoral and farmers communities and their perceptions on grazing in miombo woodlands should become a focal point for sustainable management of the miombo (Dziba, 2020). The three groups has been defined as , “Pastoral communities are the communities which are culturally strictly pastoralists such as Maasai and Barbaigs, agro pastoral communities are the communities which are culturally involved in both cultivating crops and livestock keeping such as Sukuma and Mbulu and famers are tribes which culturally do not practice livestock keeping such as Zigua, Hehe, Sambaa and Bena although some of them keep few livestock as livelihood support” (Maregesi, 2024).

The interactions between pastoralists, agro-pastoralists and farmers are multifaceted, influenced by cultural, ecological, socioeconomic contexts and the demands in land use changes which affects their livelihoods (Tilahun, 2021; Kumar *et al.*, 2025; Tofu *et al.*, 2025). However, the interaction between these land use has placed an increasing pressure on miombo woodlands and has contributed to the emergence of social conflicts. Nevertheless, miombo woodlands continues to serve as a primary source of livelihoods to pastoralists, agro-pastoralists and farmers (Njana *et al.*, 2013; Ruvuga, 2020; Bovee, 2025). Each group has its specific needs and uses of the ecosystems; pastoralists depend on miombo woodlands to acquire forages for their livestock, agro pastoralists depend on miombo woodlands for forages, farming lands, poles for building where as farmers depend for resource use such as fire woods, water, medicines and farming lands. As population grows, the demand on land increases and striking the delicate equilibrium between sustaining different land uses such as livestock keeping, farming, charcoal production and biodiversity appear to be difficult (Williams, 2017; Msofe 2019; Lulandala, 2022). Against this backdrop, the study endeavors to reveal the ecological, socio-economic and cultural context that underpin the perceptions of pastoralists, agro-pastoralists and farmers on grazing in miombo woodlands.

This study assumed that pastoralists, agro-pastoralists and farmers have different perceptions on grazing in miombo woodlands. The distinction in their perceptions comes from their distinct livelihood activities, their relationship with the land and their cultural values. The assumption is made based on what Ripkey *et al.* (2021) and Kuyah *et al* (2023) found in their study that; Pastoralists rely primarily on livestock keeping, agro-pastoralists combine livestock and cultivating crops while farmers rely primarily on cultivating crops. The study asserted that, these differences shape these distinct groups’ views and perceptions on resource use in miombo woodlands, land use and sustainability (Tilahun, 2016).

The importance of studying pastoralists, agro-pastoralists and farmer's perceptions comes in so especially because are often ignored despite the debate about their role in sustainable land and miombo woodlands management (Mtimbanjaye, 2017). Yet, these groups who have lived with these ecosystems for centuries are known to have extensive ecological knowledge which could compete scientific knowledge and contribute to sustainable management of miombo woodlands. The perceptions of pastoralists, agro-pastoralists and farmers towards grazing in miombo woodlands need to be taken into account as the groups are main providers and beneficiaries of resources in miombo woodlands, their perceptions can therefore be a determinant in policy making as postulated by G Leroy, (2018). Hence the main objective of this paper which is to explore the perceptions of pastoralists, agro-pastoralists and farmers on livestock grazing in miombo woodlands in order for the results to inform the policy processes to sustain the miombo woodlands which are the main type of forests in Tanzania.

II. Methodology

Study area

This study was conducted in Kilosa, Kilombero and Handeni districts in Morogoro and Tanga region, Tanzania. The districts are located at latitude of 5°55' and 7°53'S, 8°15'0" S and 4°55' and 6°04' S respectively (Benard *et. al.*, 1024; Magehema *et. al.*, 2014). The miombo characteristics in the districts differ, Kilosa districts has drier miombo woodlands due to lower rainfall of 800mm to 1100mm, Kilombero district has wet miombo woodlands due to high rainfall of 1200mm to 1800mm and Handeni district has dry miombo woodlands because the district is susceptible to anthropogenic human activities. The natives of this areas were farmers such as Sagara, Kaguru and Ndamba, who came first into these areas. Other tribes who migrated into these areas were Maasai, Sukuma, Barbaigs, Mbulu, Nyakyusa and Kurya who came to find areas for crop cultivation and grasses for their livestock. The main economic activities of these communities were livestock keeping and crop cultivation. There were nine study villages which were Ulaya mbuyuni, Chabima, Ihombwe, Miyomboni, Utengule, Iduindembo, Gole, Kwamsundi and Madebe. The reasons for choosing this villages were presence of livestock keepers and presence of miombo woodlands.

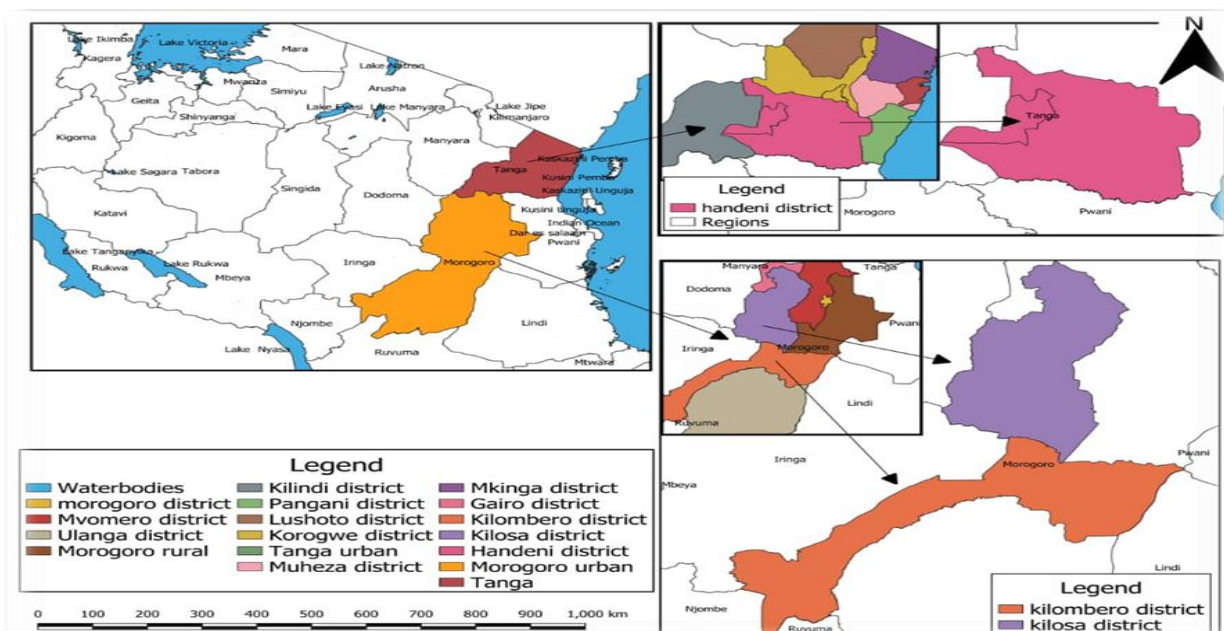


Fig 1: Map of study area

Source: Maregesi *et al.*, 2024

Study design

The research covered three groups which were pastoralists, agro-pastoralists and farmers communities residing in miombo woodlands.

Data collection methods

Fieldwork was conducted from November 2022 to April 2023 in Kilosa, Kilombero and Handeni districts, Morogoro and Tanga region, Tanzania. This study was a qualitative and quantitative research. In qualitative we collected data by using two methods; Key informant interviews (KII) and Focus Group Discussions (FGD). Semi structured interviews with open ended questions were prepared as a guideline of questions.

Key informant interviews

There were two groups of Key informants. The first group comprised of village chairperson, an elder village man, a woman elder who was a leader and a youth leader. The participants were interviewed altogether. The aim of this group was to gather insights on community profile, history of the study village and livestock keeping practices in the village. The total number of participants in the first group were 36 participants. The second group comprised of three participants who were interviewed separately, these were Village executive officers, District livestock officer and Forest officer. The aim of this group was to give in-depth information on livestock keeping and forestry in the study villages and district as whole. The total number of participants in the second group were 15 participants.

Focus Group Discussions

In each village, there were three groups of focus discussion conducted. Before conducting the first focus group discussions pre testing was done in the nearer village to make sure the questions were well understood by the participants. The questions constructed was about livestock keeping. Each group consisted of 8 participants. The first group was made of farmers both male and female farmers in the study village. It comprised of 4 male farmers and 4 female farmers. The second group was made of male pastoralists and agro-pastoralists. The third group was made of female pastoralists and agro-pastoralists. The reason for separation of male and females in pastoralists and agro-pastoralists groups was because the patriarch system in these communities does not allow female to give out their views in front of male, especially in the pastoralists communities.

The limitations were not all participants were able to participate in the focus Group discussion because of distance and other female were not allowed by their husbands to participate in the discussions. There were two villages which had no pastoralists. The total number of participants in the focus Group discussions were 173.

The topics asked in Focus group discussion were on perceptions of each group towards grazing in miombo woodland, factors influencing their perceptions towards grazing in miombo woodland and their awareness and strategies on sustainability grazing in miombo woodlands.

Questionnaire survey

A survey was conducted out in the study villages using structured questionnaire. Questions were asked to respondents face to face in Swahili language. The questionnaire was developed by the researcher and revised by the Swahili experts. Before conducting survey pre testing was done to some respondents in a village that was not included in the study. Pre testing ensured clarity, with unclear statements being corrected. All participants were fluent in Swahili. The questionnaire included Likert scale statements translated from

English to Swahili. The included Likert scale statements translated from English to Swahili covered which positive and negative effects of grazing in miombo woodlands, as well as economic benefits, with response categorized on Likert scale of 5 from Strongly agree (5), Agree (4), Neutral (3), Disagree (2) to Strongly Disagree (1). Respondents had to rank their perceptions in that order.

A sample was selected from 5% of households in each village using a sampling intensity of 5%. The required sample size was subsequently determined using the sample size determination formula developed by Krejcie and Morgan (1970), as cited in Mohammad Ali (2021):

$$S = \frac{X^2 NP(1 - P)}{d^2(N - 1) + X^2 P(1 - P)}$$

Where:

- S = Required sample size;
- X^2 = Table value of the chi-square for one degree of freedom at the desired confidence level (3.841 at the 95% confidence level);
- N = Population size;
- P = Population proportion, assumed to be 0.50 to provide the maximum sample size;
- d = Degree of accuracy (margin of error), set at 0.05.

The formula was applied to determine a statistically representative sample size from the target population while maintaining the desired level of confidence and precision (Krejcie & Morgan, 1970, as cited in Mohammad Ali, 2021).

Proportionate stratified sampling was employed to ensure that all groups of pastoralists, agro-pastoralists and farmers were included in the study. However, each group constituted its own distinct stratum, with sample size determined using the formula below:

N_s =Sample size Population size* stratum size

Where:

N_s =number of households per strata

Data Analysis

The qualitative data gathered from Focus Group Discussion and Interviews underwent transcriptions and subsequent thematic analysis using NVIVO 12 software. This process involved condensing the data into codes, which were later amalgamated to establish themes and yield results. These themes encompassed different factors which led to the perceptions of pastoralists, agro pastoralists and farmers in miombo woodlands.

Quantitative data gathered from questionnaires survey were analyzed by using SPSS version 27 software. Jonckheere Terpstra test was used to compare medians among perceptions of different ordered respondents (pastoralists, agro pastoralists and farmers) to test the trend across the groups.

III. RESULTS AND DISCUSSION

Social demographic characteristics of the respondents

During questionnaire survey, we interviewed 246 respondents from nine villages (Ulaya mbuyuni, Gole, Kilombero, Kilosa, Handeni) Table (1) shows the sex, education level and age of the respondents

Table (1): Social demographic characteristics of respondents in questionnaire survey with a total of 246 respondents.

	Subcategory	Pastoralists	Agro-pastoralists	Farmers
Sex	Male	29	56	69
	Female	16	20	56
Education level	No education	32	27	16
	Primary education	10	46	97
	Secondary education	0	3	11
	University education	2	0	0
	Informal education	1	0	1
Age of respondents	Youth	19	22	31
	Older	22	50	73
	Adult	4	4	21

Number of participants who participated in Focus group discussion and Key informant interviews were not included in the table above. During Focus Group Discussions and Key Informant Interviews, we interviewed 189 respondents from nine villages. Each village had five groups and they were interviewed separately. The first group comprised of village leaders which were village chairperson and Village executive officers (VEO). The second group comprised of village elders and group leaders of women groups and youth. The third group comprised of District Veterinary Officer (DVO) and Forest Officer. The third group comprised of men only from pastoral and agro pastoral communities with 8 participants. The fourth group were made of women only from pastoral and agropastoral communities and the fifth group comprised of men and women from farmers. The last three groups had 8 participants from men and women as these was done to balance gender and bring insights from both groups. The participants were aged 18 years and above. Therefore, making a total of 435 participants.

Perceptions of pastoralists, agro pastoralists and farmers towards grazing in Miombo

Relationship and interaction between people and their land resource have a paramount significant in shaping what they think regarding the resources. Benefits people acquire through the interaction stand behind each activity people engage with land. Pastoralists, agro-pastoralists and farmers are societies which solely rely on land for their survival. As Miombo woodland stand as potential land for the three groups, grazing livestock in is perceived differently as these groups use land for different activities. In the study villages the societies were asked on the continuation of grazing in miombo woodland, Figure (2), show that these groups have different views regarding grazing in Miombo woodland forest.

The trend in Figure (2) illustrates variation of views and supports in grazing in Miombo woodland: Pastoralist being the most supportive, followed by Agro-pastoralist and farmers appeared to be less supportive to grazing in Miombo woodland. Results shows that pastoralist group exhibit strong positive perception toward grazing in Miombo woodland. This is rooted in their dependence in livestock rearing as their main livelihood activity and as they take grazing to have positive impacts to miombo woodland. For pastoralist grazing is not merely a just a form of land use but their livelihood and identity. This was well complimented during FGD when a pastoralist said; “We do not cut down trees. We preserve the trees, that’s our culture. We just feed our cattle in the forest so that they do not die of hunger.” Moreover, pastoralists have their back on the positive impacts

grazing benefits the miombo woodland such as wildfire control, seed dispersal and plant regeneration of the forest. In FGD pastoralist said, *“It helps to prevent wildfires; the cattle eat dry grasses and thus prevent fire to spread in the forest. He added, “The dung of cows carries seeds from one place to another in the forest and after a few days you find a place with dung with a new seedling.”* Another agro-pastoralist added, *“Previously, the non-grazed parts had highly scattered trees, the introduction of cattle has caused the increase tree density and improved the plants health.”* However, the presence of outliers indicates the minority of the pastoralist understand the long-time impacts of grazing in Miombo woodland, impacts which can be caused by overgrazing. This finding is consistent with the study by Ruvuga (2021), which explained that livestock grazing in ecological capacity provide benefits to both herders and the miombo woodland, as it provides forage while at the same time it prevents wildfire occurrence as animals consumes dry grasses, distribution of herbaceous seeds, and nutrients recycling.

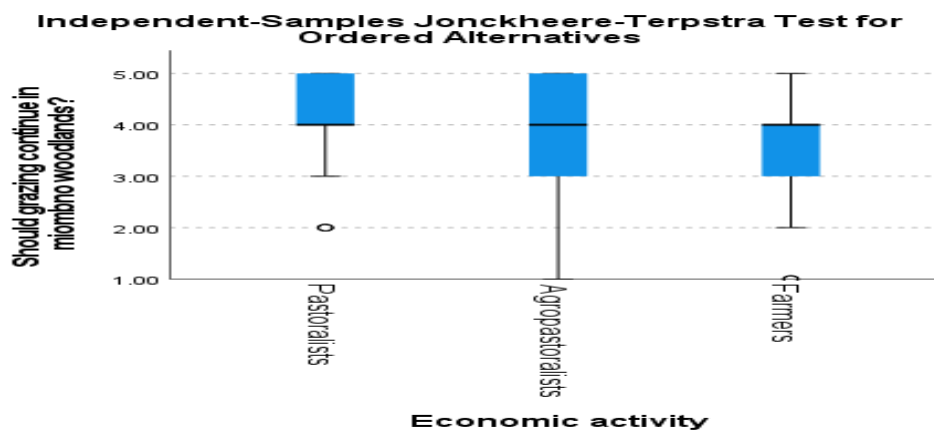


Figure 2: Perceptions of pastoralist, agro-pastoralist and farmers on grazing in Miombo woodland'

Agro pastoralist shows mixed perception (positive and negative) reflecting their dual nature of their livelihood. They are both livestock herder and farmers which make them caught by the benefits from livestock rearing and cultivation. Their livelihood nature drives them to bring forward clouded view of grazing in Miombo woodland by trying to balance compared to the clear view given by pure pastoralists. It shows that farmers are less supporting grazing in miombo woodland as they see grazing as threat to themselves and the environment as there is competition of land, land degradation, destruction of water sources essential for human use and irrigating their crops and soil compaction. It was identified that majority of the farmers see grazing in Miombo woodland as a problem, however, presence of the outlier indicates the minority of them acknowledge the importance of livestock grazing in Miombo woodland. During the Focus group discussion one of the farmers said that, *“The grazing pressure has caused water disruption. Ihombwe villagers mainly depend on river Ruhembe for water supply but grazing has caused the residents to get dirty water”*. Another famer added: *“During dry season when there is a large herd of livestock that is when soil erosion occurs but in normal conditions livestock grazing do not cause soil erosion.”*This highlights the conflict of interests between crop farmers and grazing in the Miombo woodland as it acts as a potential land and source of materials for faming activities.This view from the farmers from this study is consistence with the finding from Maregesi *et al.*, (2024) who found that Miombo woodland is not only important for pastoralist but also provide fertile land for crop farmers, source of water for home use and for irrigation. Also, the finding from (Bwalya and Chibwe, 2018), shows that grazing activities in the forests have caused disruptions in the water sources within the ecosystem and livestock grazing can lead to increased sedimentation and increased runoff in water sources (Naiman *et al* 2010).

Factors influencing different user's perceptions towards grazing in Miombo woodlands.

Pastoralists, Agro pastoralist and Farmers rely on Miombo woodland for different needs such as water, forage areas, shades for their livestock (Ruvuga, 2021). These benefits and interaction between these groups and with Miombo woodland forests results in varying perception among these groups holding either positive or negative perception towards grazing in Miombo woodland forest. The following are different factors which lead to differentiation in their perceptions;

I. Cultural factors

Cultural traditions, identity and social cohesion strongly influence perceptions (Tilahun, 2021). Traditions is what shape us, and different land users do what they do because of their culture and traditions. Pastoralists do not take grazing as only an economic activity, but as a cultural activity that upholds their way of life. Their traditions guide them how they use rangelands often emphasizing communal grazing practices, rotational grazing systems or seasonal migrations (Olekao and Sangeda, 2020). This is the reason pastoralists practice pastoralism from years to years and they inherit from one generation to another. They had pathways which they followed and traditionally they practiced rotational grazing because they knew at what season and time a place will be having pasture and water sources (Catley et. al., 2013; Koocheki and Gliessman, 2005). This study also found the same that, it is their tradition to practice seasonal migration grazing and they have inherited it from their fore fathers. Moreover, due to the change in climate and weather patterns, the extreme bad climate changes such as shortage of rainfall for a long time leading to drought, have made pastoralists to shift from grazing into the rangelands and move to the forests including miombo so as to get pasture for their livestock. During the focus group discussion one of the pastoralists commented that,

"First of all, I am a Maasai and it is my nature to practice rotational grazing or seasonal grazing. This is what I have being doing since I was a kid., we shift from one place to another to search for pastures cannot leave my cattle to die while I see there are places where there is plenty of grasses. Today, someone cannot tell me to stop shifting from one place to another to search for grasses for my cows and start cutting grasses for them to feed them, how many will I feed?? That is done by farmers who have fewer cattle. But for me and my family we must shift to find good pastures and water for our cattle."

On the other side, the agro pastoralists are grazing in miombo forest because it's their culture and their tradition. Before migrating into the study village, they were practicing ngitili conservation and seasonal migration of livestock herds (Selamani, 2012). Due to shortage of grazing lands in the study villages they do not practice ngitili conservation, they just graze their livestock herds in miombo woodlands and during the dry season they shift from one place to another (seasonal migration). Another grazing method, they give their livestock maize stalks (stall feeding) especially during the dry season because they practice both livestock keeping and crop cultivation. After they harvest their crops, they take their livestock into the farm so as they can eat the remaining of the crops and clean the farms. Sometimes, pastoralists pay them so that they can take their livestock in their farms and get feeds.

Majority of the farmers do not graze their livestock in miombo forest. This is because their culture and tradition are not livestock keeping, many of them keep chicken and a few goats. Many of the farmers started keeping livestock when the pastoralists and agro pastoralists migrated into their areas. After seeing the benefits which livestock keepers acquire, they then started to keep livestock (Olekao and Sangeda, 2020). Moreover, some farmers own large number of livestock and pay the pastoralists youth to graze for them. This is not known

because most of farmers are being taken to own few little from one livestock to eight (According to the village bylaws). Many of the farmers aspiration is to own large number of cattle, although their biggest fear is that there are no enough grazing lands and they do not like the conflicts which the pastoralists and agro pastoralists face from grazing in the forests which are restricted. One of the farmers commented that,

“It is not our culture to own and keep livestock, but since the livestock keepers came, we see the benefits they get from it and that’s why we have start to keep livestock. “He added that, “I like to have many cattle, but I cannot graze them, it will be very cost full to cut grasses for them and since it’s their culture to move with cattle that’s why it’s easier for them to do so. The children of pastoralists can graze a large herd of livestock while our children cannot do so, because it’s not our ways of life.”

Culture and traditions of pastoralists, agro pastoralists and farmers have triggered different perceptions on livestock grazing. Livestock grazing is intertwined in the cultural practice that is passed down from one generation to another, crucial for maintaining their ways of life and social structures within the pastoral and agro-pastoral communities, that’s why it is not easy for them to stop going in the miombo forest to graze. Farmer’s views defy grazing in Miombo woodland forest as they do not do grazing but crop farming as their culture.

II. Ecological factors

Livestock keepers perceive grazing as a part of dynamic ecological system. Ecological system means a place where grazing occurs but is affected by different factors making it to not be stable (Jandreau and Berkes, 2016). Such factors are like availability of grazing land, grasses and its quality and water resources, which make the livestock keepers (pastoralist and agro-pastoralists) to make decision on where grazing can take place. These societies have a robust knowledge of determining the quality of the pasture and the season variation and time to move their cattle from place-to-place following quality forages and water (Jandreau and Berkes, 2016; Goldman 2007). The study found that, during drought or dry season, the pastoralists and agro pastoralists perceive the grazing land as overgrazed and shift to miombo forest to feed their livestock. It’s the environment and other factors such as shortage of grasses, shortage of water resources and climate variability which leads them to graze their livestock in miombo.

“We do not have choice and that’s why we take our livestock in miombo. Although, there are places where we are allowed to graze and there are other areas in the miombo where it’s conserved and we are not allowed to graze. But I cannot just see my livestock want to die due to lack of grasses and I see there are grasses and limit myself from grazing my cattle there. That’s is impossible. And the places which are restricted are the ones which have plenty of grasses. So, we just graze our livestock by force and when they catch our livestock, we pay fines and life goes on. The important thing is that my cattle has got enough feeds.”

Furthermore, pastoralists and agro pastoralists view grazing in miombo forest as a part of the natural ecosystem, they believe in its role of promoting forest regeneration, reducing wildfire intensity and sustainability when well managed. Pastoralists and view grazing as a tool for forest generation. According to their culture, they preserve trees, they do not cut trees. This is the reason the places where the pastoralists are occupying (Miyomboni village) have plenty of trees. A pastoralist commented that,

“We do not cut down trees. Cows do not eat trees, they eat grasses. That’s why we wonder, on how farmers are pointing fingers on us that we are cutting down trees.”

Another agro pastoralists added that, *"Before they came on one of the study villages, there were few trees but when they established grazing livestock on the area, the trees started to grow and regenerate. He added that, "Before coming of cows, the forest would catch fire easily because of many dry grasses. But when livestock feed on grasses, they put a barrier on wildfire and control it to not burn the whole forests."*

On the other hand, farmers view grazing in miombo woodland as destruction of ecosystem. Farmer value Miombo woodland ecosystem as source of vital raw materials such as water, medicine, timber, poles for construction, fish and fruits, thus grazing in Miombo woodland is viewed as destruction of these ecosystem products essential for day-to-day use. During focus group discussion, one of the farmers said that, *"During the dry seasons, large group of pastoralists come in our village and they graze their livestock in miombo forest. When there is a large group of livestock, they pollute the water sources in the forest and we villagers use the water for home chores and other activities."* This is observed in

III. Economic factors

Pastoralists and agro pastoralists perceive grazing as an important tool for ensuring health and productivity of livestock, which directly impact their economic well-being. Health of livestock is very important, when livestock are suffering from diseases the livestock keepers tend to incur treatment cost which is a setback to their economic. Pastoralist and agro-pastoralist measure the forage quality by productivity of the livestock such as health of the livestock (weight gain), quantity of milk and quality of meat which in turn are the sources of direct source of income. Other measures of quality forage areas include risk to diseases, parasite loads, water availability (Butt, 2011). Pastoralists and agro-pastoralist in the study villages, graze in miombo forest in Kilosa, because its grasses are saltier compared to grasses of another places. This helps them to reduce the cost of buying iron supplements and helps the cow to product more milk. *"Grazing in miombo is beneficial as the grasses are salty compared to other areas. When we graze our cows in other places, we incur costs of buying iron stone so that they can get enough supplements for the production of milk. But when we take them in miombo they get enough iron, grasses and milk and produces quality and quantity milk."*

Another comment was given by the District Veterinary Officer on the availability of salty grasses in miombo especially in Kilosa district, *"Pastoralists do not cut down trees, they do not have that tendency. They are sure of getting pastures, since they have grazing areas but use Miombo as a reserve for getting pastures. It minimizes the risk of getting livestock infectious diseases as grazing in Miombo reduce the interaction between herds of cattle. Improves livestock productivity as grazing in Miombo helps to increase the weight of cattle and thus increase the income to the livestock keepers."* He also added that, *"the grasses found in the miombo are salty and contains a lot of nutrients, so when the cattle eat the salty grasses, they become too thick and they produce a lot of milk. Although these are the beliefs that are not scientifically proven. But that's what many pastoralists believe: that when livestock stay in the forest, they are being breed in large number and milk becomes plentiful because the grass there contains a lot of salt and nutrients, unlike in other areas which do not have miombo trees. The grasses which have more salt and nutrients are the common grasses in Miombo, such as Guinea pig grass and legumes, aid in the fattening of cows."* According to Ogunbiyi 2023 aligns with this study that improving disease management and livestock welfare leads to healthier livestock and increased productivity.

IV. Political / institutional factors

The political factors such as access to land, rights to grazing and policies shape how pastoralists, agro pastoralists and farmers perceive grazing in miombo forest. Some of the pastoralists and agro pastoralists are migrants and still lament that they do not have access to land. Some follow the process of entering in the village while others enter in the village by force, invitation by their fellow and come with large number of cows. This makes it difficult for them to get permission to register and graze in the village, and due to shortage of grasses and water during dry period, they graze in miombo by force and end being considered as people who are neglecting the laws. They enter in conflicts with the village leaders when found grazing in the forest. One of the agro pastoralist commented that,

"We were given enough grazing land in 2003; however, the hunting block operators have been arresting us claiming that we are grazing in their land pushing us further and now we have left with a very small area."

"He went on explaining that,

"In 2012, the government came with the plan to decrease the number of cattle in an area, I decreased my cattle some of them were sent to 'Liwale' and we remained with only 110 cattle. The area was very enough by the time. However, the expansion of the hunting block is causing more decrease of the grazing area."

Another village chairman said that,

"Not so long ago; around 2017, there was a strong drought in the district. The Kilosa district security committee upon seeing this and how much the cattle were dying from the sun, decided to let the pastoralists to go to these villages that had their forests well conserved, Chabima being one of them. They were given 3-to-4-year terms to graze their cattle and once the rough patch was done, they were to go back to their respective villages. Now, once their time was finished, there was no specific push to force them out of the villages. There was only a statement which told them to evacuate the villages, so, some left, some did not; and the ones who left, since they now already knew the routes back to the village, whenever hunger struck again, they would just come back to the village and you would find them in the forests grazing their cattle."

DVO said that,

"Livestock keeping in miombo forests is beneficial because, during dry seasons there are some grasses which are still found in miombo forest. This is because there are some laws which prevent the livestock keepers to graze their livestock in the forest. These laws are like; the livestock keepers are not allowed to graze their livestock in miombo forest. During the dry seasons the livestock keepers especially pastoralists and agro-pastoralists are just being left to graze in the forest despite the laws, they just adjust themselves because there is no way out due to lack of pastures and water, although when they are caught, they pay fines but they don't care as long as their cattle are fed and satisfied."

On the other side, farmers are not being tied by the laws because they are natives and they are taken as they own little number of cows. There is unclear land tenure which leads to conflicts. Village government should make sure to have a proper land use planning to avoid conflicts and enhance proper access of land to different land users. The findings are in line with Ruvuga 2020 which reported unclear land tenure regime as one of the challenges facing rangeland management in miombo woodlands

Perceptions, awareness and strategies of pastoralists, agro pastoralists and farmers on sustainable grazing in Miombo woodlands.

The rate of change in Miombo woodland forest is alarming, leaving the pastoralist, agro-pastoralists and farmers fail to obtain their needs from it regardless of moving from one place to another for pastoralist and agro-pastoralists. In addition to that these societies face other challenges such as increase in conservation and administrative areas which reduce their land ownership. This has brought forward the local and tradition knowledge and awareness on the accelerating changes. These triggers have been well amplified in the discussions as pastoralists, agro-pastoralists and farmers were aware of the changes and need to bring in action the sustainable grazing in Miombo woodland forest paradigm as a strategy to which can make these societies use the Forest in a long run without destructing it and conserving its ability to regenerate. In this study, we defined sustainable livestock keeping in miombo referring to livestock grazing that meet people's needs today without destroying the resources and thereby the possibility to graze livestock and carry out other activities in the miombo in the future.

During discussions pastoralists, agro-pastoralists and farmers didn't know the meaning of sustainability as they commented that;

"We do not really understand the meaning of sustainability. The forest is conserved for future generation, but we have no idea what is the future generation, maybe we are that future generation".

However, they gave their views and strategies on what should be done to ensure long life of miombo woodland forest. In FGD one of the members highlighted the need to have minimal viable number of livestock which suits the available grazing land as a first strategy to bring life of these forests.

"To set areas for grazing cattle and reducing number of cattle that will help feed the cattle well and maintain their health stating that such sustainable livestock keeping practices will also benefit their kids."

Without living aside, the need to have enough land for livestock rearing and cultivation as another way of sustaining the Miombo woodland forest. One of the respondents said that,

"Sustainable livestock keeping is when there is availability of large grazing land because they have a large number of cattle. So, for sustainable livestock keeping to be met there should be large grazing lands which will accommodate their livestock."

Awareness and knowledge of these societies can well be supported by the scientific findings and explanations on sustaining Miombo woodland forests such as Pulido *et al.*, (2018) who explained how increasing in stocking rate also increase the rate of degradation of the forest. Moreover, Jandreau and Berkes, (2016), concluded that local knowledge is essential and important in sustainable conservation and have to be considered more than anecdotal or strategies.

IV. CONCLUSION AND POLICY IMPLICATIONS

Conclusion

This manuscript explored the perceptions of pastoralists, agro-pastoralists and farmers regarding grazing in Miombo woodlands. It appears that, positive effects that results in positive perceptions are well recognized by all groups whilst negative perceptions have been highly shown by farmers. This divergence of perspectives is due to strong differentiation of uses within community in time and space as pastoralist and agro-pastoralists rely on the Miombo woodland ecosystem for livestock grazing whilst farmers uptake raw materials

from miombo ecosystem resources such as water, firewood and charcoal, timber, poles and wild fruits both at different season of the year and location. The varying perspective indicates of pastoralist and agro-pastoralist and farmers reveal the challenges in managing grazing practices within Miombo woodland ecosystems. Pastoralist depend on these ecosystems to sustain livestock on the other hand farmers prioritize access to other resources and employing diverse livelihoods strategies.

In terms of cultural background, pastoralists and agro-pastoralists move their cattle from one piece of land to another in search of pastures and forages from where they based to other locations depending on seasons and needs. Numerous farmers and village leaders advised that in order to practice sustainable livestock keeping, pastoralists and agro-pastoralists should reduce the number of animals they have due to the limited size of grazing land. This provides a focal point for researchers to examine the potential effects of this transformation on the livestock keepers' culture and traditions.

The study shows the importance of incorporating diverse viewpoints when developing policies and management strategies for Miombo woodlands. Collaborative approaches that involve all stakeholders are crucial for addressing the complex challenges associated with livestock grazing practices in these woodlands.

Policy implications

The study provides the following policy implications; Grazing should be managed using rotational grazing practices, where livestock are moved from one area to another periodically. This will prevent overgrazing in miombo woodlands and allow for grasses to recover during the dry season. There should be collaboration between livestock keepers and farmers as it will encourage cooperation between livestock keepers from different villages to avoid excessive grazing pressure in villages. This can be done through the establishment of community-based grazing management plans. However, policy makers should make policies which suits all groups of pastoralists, agro pastoralists and farmers as they differ in livestock dependence and cultural aspects.

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