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LIVESTOCK MANAGEMENT STRATEGIES IN A CHANGING CLIMATE IN ROMBO DISTRICT, TANZANIA

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Abstract: *Livestock are important socio-economic assets essentially kept for food, manure, income, bride prize and prestige. This study was conducted in Rombo District to assess the effectiveness of livestock management strategies in a changing climate. Triangulation of the methods of data collection, analysis and presentation facilitated production of comprehensive research report. The study found that about 94 percent of the heads of household used different strategies to reduce the impact of climate change and variability on livestock. The devised strategies include fodder fetching, planted fodder, store fodder, keeping manageable livestock, and livestock keeping avoidance. The constraints to strategies used in livestock-keeping were risks associated with pasture fetching, lack of funds, denying farm supply of manure, and loss of households' assets. The projected climate change and variability would have less effects on livestock keeping because about 66.7 percent of the heads of household had plans on it. For effective livestock management in a changing climate, appropriate strategies are recommended.*

Key words: Climate change and variability; fodder; livestock management strategy.

Introduction

Livestock constitutes important socio-economic assets to the majority of population globally. According to Hartung (2013), domestication of livestock can be traced back to 11,000 years ago when man began to domestic sheep followed by goats and cattle. Livestock keepers have been trying to manage their livestock in a changing climate using different strategies. For example, pastoralists of the Sahel managed to adapt to climate change and variability by using emergency fodder during droughts to feed their livestock (Nyong *et al.,* 2007). Similar findings have been reported in India where farmers in Hindu Khush region use indigenous systems to select and store nutritious tree fodders to reduce drought risk for their livestock (Srinivasan, 2004). Also, because of increasing grazing scarcity, crop residues are increasingly stored to feed livestock during the dry season in Northern Burkina Faso (Barbier *et al.,* 2009).

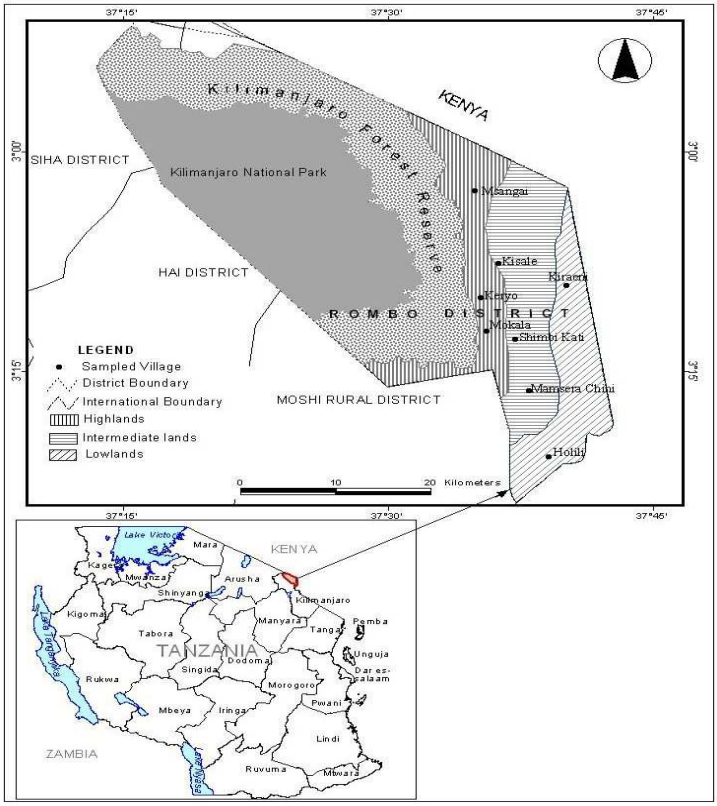
A study conducted in the Sahel shows that pastoralists and agro-pastoralists change from cattle to sheep and goat husbandry as the feed requirements of the later are less than those of the former (Nyong *et al*., 2007) when their numbers are the same. In Swaziland, local people have shifted to more drought-resistant livestock breeds such as kraal sheep (Stringer *et al*., 2009). The nomadic pastoralists in the Sahel managed to survive the changing climate by moving from the dry northern areas to the wetter southern areas of the Sahel (Nyong *et al.,* 2007). Similarly, pastoralists in Same District, Tanzania, use traditional rotational techniques to overcome pasture problems resulting from climate change and

variability (Mahoo and Mpeta, 2011). Barabaig and the Masaai of Northern Tanzania uses transhumance to overcome pasture problems caused by unreliable and poor distribution of rainfall (Shemsanga *et al.,* 2010). The effects of climate change and variability on livestock keeping in Rombo District should keenly be considered because livestock are zero grazed. Zero-grazed livestock require special management strategies because a slight change in climatic variables such as rainfall and temperature may bring awful effect on pasture (Kotir *et al.,* 2011). A study conducted in the lowland of Rombo District revealed differentiated magnitudes of drought (Mongula, 2000) leading into a spatial variation in pasture deterioration. Since little is known on the strategies employed by local community to manage livestock in a changing climate, this study is important.

Research area and Methodologies

This study was conducted in Rombo District, which is one of the six districts of Kilimanjaro Region located in northern Tanzania.

Figure 1: Study area



The climate of Rombo District varies from semi-arid, tropical to subalpine. This area receives bimodal average annual rainfall that varies from 400 to 2,000mm from the lowlands to the highlands (Meena and O'Keefe, 2007). The long rains generally occur between March and May and the short rains from October to December (Mongula, 2000). There was average decrease of about 300mm of rainfall from 1974 to 2004 (Meena and O'Keefe, 2007). Such decrease potentially has impacts on livestock keeping. Data were collected using questionnaire, focus group discussion, and field observation. Direct questionnaires

were administered to 611 heads of household selected randomly in eight villages in three AEZs (Fig. 1) to assess the effectiveness of the livestock management strategies in a changing climate. Field observations were done to collect none verbal data concerning some strategies devised to manage pasture. Collected data were analysed both quantitatively using SPSS Version 20 and qualitatively based on themes. Results were presented in frequency tables and narrations.

Results and discussion

Characteristics of respondents

Some characteristics of the respondents are summarised in Table 1.

Table 1: Characteristics of households (n = 611)

Household Characteristics	**Description**	**Responses based on the AEZ (%)**			
		Highland (n=230)	Intermediate (n=274)	Lowland (n=107)	Average
Sex	Male	32.1	38	14.2	**85.3**
	Female	4.6	6.9	3.3	**14.7**
Size of land	> 1 acre	24.2	28.0	5.0	**19.1**
	2 acres	50.4	47.4	40.0	**45.9**
	3 acres	17.0	23.2	20.0	**20.1**
	4 + acres	8.3	1.1	35.0	**14.8**
Livestock Number Cattle	0	28.7	58.8	27.4	**38.3**
	1	45.2	21.2	19.8	**28.7**
	2	20.4	16.1	29.2	**4.3**
	3	2.6	3.6	6.6	**21.9**
	4	1.3	0.4	3.8	**1.8**
	5+	1.7	0.0	13.2	**5.0**
Goat/sheep	0	7.8	0.7	14.2	**7.6**
	1	8.7	2.9	0.9	**4.2**
	2	18.3	25.5	3.8	**15.9**
	3	15.2	19.3	3.8	**12.8**
	4	17.0	19.3	6.6	**14.3**
	5+	33.0	32.1	70.8	**45.3**

In addition to cattle, goats and sheep (Table 1), respondents also mentioned to rear pigs and poultry. Poultry keeping is done through both free range and zero grazing systems depending on the status of farm crops. Other animals are zero-grazing fed with crop residues, grass, life fences, and trees that provide shade to coffee. Some households supplement the pasture with protein food such as cotton and sunflower seed cakes and grain husks.

Livestock Management Strategies

Findings presented in Table 2 show that the study community has devised different strategies to ensure that pasture deterioration resulting from climate change and variability and other environmental stressors would not bring about awful effects on livestock-keeping. Table 2 shows that fetching fodder away from home constitutes a major livestock management strategy with more heads of household in the highland AEZ. This could be attributed to the small size of the land they possessed (See Table 1). Thus the heads of household in the highland AEZ to get involved in pasture fetching to withstand pasture deterioration primarily because the highland AEZ does not offer opportunities for increasing

the pasture area. Strategies mentioned to be involved in the fetching fodder include begging, buying and stealing. Begging and/or buying pasture is mainly done on the Kenya side where they sell fodder or exchange it with banana or any other edibles including local brew. Heads of household interviewed and FGD participants revealed that a round trip to fetch fodder far from home, particularly on the Kenyan side or Kilimanjaro Forest Reserve, took four to five hours depending on the AEZ where their households were located. Pasture fetching consumes time that could otherwise be dedicated to other economic activities. Continuous begging may lead to someone being labelled a 'beggar' thereby lowering the status of that particular individual in the eyes of other members of the community. Stealing is unlawful and if a culprit is caught, she or he might be harmed or jailed.

Table 2: Livestock management strategies (n = 611)

Strategies	**Responses based on the AEZ (%)**			
	Highland (n=230)	Intermediate (n=274)	Lowland (n=107)	**Average**
Fodder fetching	34.2	29.2	23.7	**30.2**
Planted fodder	26.5	18.2	20.1	**21.7**
Manageable livestock	8.1	17.1	26.6	**15.3**
Store fodder	14.5	13.8	16.5	**14.5**
Small livestock	6.1	16	9.4	**11.1**
Not keeping	2.1	0	0.7	**1.2**
Seasonal migration	0	0	2.9	**0.5**
No practice	7.7	5.8	0	**5.5**

The findings in Table 2 show that the study community has embarked on pasture management by planting fodder trees and grasses. Different names have been given to the types of the planted fodder including *uwata* and *kimongo* and the management techniques involved signify a long interaction with the practice. The study also show that the households were found to be knowledgeable about fodder trees as being important despite the fact that trees limit crop production (Albrecht and Kandji, 2003). This indicates that local people are experts of their environments and that their undertaking reflects long-established interaction with the environment.

The practice of planting fodder was reported to be undermined by the small land lots, soil infertility, aged trees and climate change and variability. It was noted during the FGD conducted in the lowland AEZ that trees for fodder were no longer forming branches and plots for pasture were underperforming nowadays compared to the past for the former and climate change and variability for both. Field observation also verified that plots for fodder (*kimongo*) were characterised by stunted grasses. One participant in the FGD held in the lowland AEZ presented the testimony that: "*Before the 1980s we used to prune trees and harvest grass twice a year. But things have now changed ... we do it yearly*". This testimony corroborate with the findings that about 40 percent of sub-Saharan African countries will be at risk of significant declines in pasture production due to climate change (Kotir *et al.,* 2011). The findings revealed that "manageable" is a relative term since manageability differs from one household to another. What is regarded to be manageable to a certain household could not be manageable to another and vice versa. For example, the findings presented in Table 2 show that there were more heads of household in the lowland AEZ who opted for few livestock to adapt to pasture deterioration than in other areas. On the other hand, Table 1

shows that the same AEZ had many heads of household who mentioned keeping a bigger number of livestock than other zones. This could be attributed to the large sizes of lands at their disposal. In other words, manageability in livestock keeping is not only a case of number but is associated with many other factors. Livestock keepers in Bolivia saw livestock as a potential adaptation strategy for the future and indicated the need for assistance in acquiring and managing larger herds (McDowell and Hess, 2010). Possessing large herds of cattle is prestigious since it is considered to be an indicator of wealth in many traditional societies (Fisher *et al*., 2010).

Storage of fodder found in this study is similar to those reported by in the Hindu Khush Region (Srivasan, 2004), African Sahel (Nyong *et al.,* 2007) and northern Burkina Faso (Barbier *et al.,* 2009). It is important, however, to note that the mode of keeping livestock in the study area differs substantively with other regions because animals are completely kept in sheds. In the study area, the stored fodder was predominantly maize straws probably because they are easily obtainable and do not require special preparation as other forms of grass. The effectiveness of fodder storage in ensuring the availability of fodder was found to be hindered by the high cost of constructing the *banda*, environmental conditions and unavailability of fodder. It is anticipated that with increasing rainfall unreliability and temperature, fodder will become increasingly scarcer and hence limited storage.

This study found that households have adapted to pasture deterioration by keeping small livestock types and varieties (see Table 2). The findings presented in Table 1 show that small livestock types such as poultry and goats/sheep were the most preferred probably because it is easy to feed and curl them whenever deemed necessary. Small animals such as guinea pigs and poultry supplement household diets and help to generate small income (McDowell and Hess, 2012). Although the practice of keeping small livestock types and varieties has been recommended by some scholars, this study found that poultry keeping in the study area was affected by limited market. This means that, keeping small livestock types is of more dietary importance than income generation. Similarly, most of the families have a few large animals which they slaughtered in times of serious need for food or cash (McDowell and Hess, 2012). As for this study, no individuals mentioned having slaughtered large animals for food but rather to sell them whenever their number becomes too big to be fed easily or when there is a serious problem or need like a need to build a house.

During the FGD held in the lowland AEZ, the participants reported that some households did not keep any livestock at all due to pasture deterioration. This strategy should be discouraged because livestock are important in solving immediate events that use money such as sudden illness, accidents, paying of school fees, and sometimes buying of food. In this regard, 80.1 percent of the heads of household stated that they kept livestock for manure. This means that avoiding livestock-keeping is not a sustainable strategy in livestock management because livestock remains centripetal to guaranteeing household income, food and soil fertility by providing manure. As such very few heads of household have resorted to it (Table 2).

The findings presented in Table 2 show further that adapting to pasture deterioration through seasonal migration was not common in the study area probably due to its ineffective. Its ineffective could be deduced from interview with a head of household, a veteran in seasonal migration with cattle from Holili Vijijini Village to Mabogini, Moshi (about 25 km.) who claimed that: *"During 2006/2007, I migrated with cattle from Holili Vijijini Village to Mabogini, Moshi for pasture. On the way, I quarrelled with the Tanzania Road Agency despite the fact that I had a permit from the Rombo District Council since trans-district animal movement demands such permission. Some cattle died due to sickness caused by passing through a contaminated environment.....it is very disturbing"*. Similar quarrelling had been reported in Kilosa District in Morogoro Region (Mwamfupe and Mung'ong'o, 2003) and Pangan Basin in Tanga Region (Mbonile, 2005), both in Tanzania.

Future Plans in Livestock Management

The plan to reduce the number of livestock kept was apparent in all studied AEZs (Table 3).

Table 3: Planned livestock management strategies (n = 611)

Plans	**Location**			
	Highland (n=230)	Intermediate (n=274)	Lowland (n=107)	**Average**
Reduce number of livestock	17.7	29.1	40.3	**29.0**
Store fodder	15.3	18.6	21.0	**18.3**
Planting fodder	14.9	8.1	13.7	**12.2**
Keeping small livestock	2.8	11.5	2.4	**5.6**
Not keeping livestock	1.6	1.7	1.6	**1.6**
No plan	47.6	31.1	21.0	**33.2**

The findings in Table 3 show that majority of respondents from the highland AEZ would be hit the hardest in case of persistent pasture deterioration because they dominated in "no plan" responses. In other words, if pastures continue being affected by climate change and variability, these respondents could adapt reactively as they are based on the wait-and-see stance. Available literatures indicate that the wait-and-see attitude provokes reactive adaptation, which may lead to unnecessary uses of the resources (Fussel *et al.,* 2006). It is interesting to note, however, that the plan to avoid keeping livestock is low and almost similar to the three AEZs (see Table 3) probably because respondents are aware of the importance of livestock keeping.

Conclusion and recommendations

The study community has to some extent managed to reduce the impact of climate change and variability on livestock using different strategies. The strategies applied in livestock management in a changing climate are less effective due to different factors. It is also worth to acknowledge that the projected climate change and variability would have less impact on livestock-keeping due to some plans the studied community had. For effective livestock management in a changing climate, there is a need for capacity-building at various levels coupled with alternative sources of income that suit the study environment.

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