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Influence of Drought Duration on Livestock Feeding Practices by Maasai Pastoralists in Kajiado County, Kenya

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ABSTRACT: Droughts manifested in the changes in frequency, duration and changes in rainfall patterns directly impact on livestock assets of pastoral households of which Maasai community in Kajiado County of Kenya exemplifies. The community is seasonally exposed to drought effects and has adjusted their livestock feeding practices to cope but knowledge gaps exists as to whether the adjusted feeding practices adequately aligns to the magnitude of change experienced, This study established the influence of drought duration on livestock feeding practices from sample of 136 households, selected using simple random sampling procedure. A large majority of the sampled households had noticed changes in the frequency of droughts (98.5 %), increased drought duration (97.8%), unpredictable onset and patterns of rains (99.3%) and longer droughts lasting 7 to 12 months on average. Despite noticing increased trends of changing and variable climate, a large majority of the sample households (87.5%) continues with traditional herd mobility in coping with drought effects and limited uptake of supplementary feeding, demonstrating non uptake of planned adaptation strategies, which poses threats to livestock assets of pastoral community. Urgent interventions is therefore advised for the Maasai community to include introduction and promotion of harvesting and storing natural hay for drought feeding, use of drought tolerant livestock breeds, targeted livestock off-take to reduce economic losses and construction of watering facilities in the area and regular desilting of existing water pans to ensure adequate water harvesting during the rains for watering livestock during drought periods.

KEYWORDS: Drought feeding, Climate variability, Herd mobility, Maasai community.

1 BACKGROUND

The Arid and Semi Arid Lands (ASALs) in Kenya are characterized by low rainfall amounts with erratic and unreliable timing associated with recurring droughts. Climate change is worsening drought effects, manifested in drying up of water pans supporting livestock assets managed under production system, characterized by mobility and flexibility to counter extreme environmental fluctuations. Although drought affects the country as a whole, its effects is felt most dramatically by the livestock based economies and livelihoods in the Kenyan ASAL areas ([28]).

Droughts in the ASALs has three distinguishing features: intensity, duration and spatial coverage ([26]) and does directly impact on the livestock assets of pastoral households [28]. According to ([12]), recurrent drought and climate change have over the years put additional strains on the already limited livelihood resources in the ASALs predominantly occupied by pastoralist and mobile communities. ([9]) reports that drought in Kenya has been the most common hazard encountered by households on a widespread level in ASAL areas where the government has declared five drought related national disasters between 1993 and 2011.

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Drought variability affects pastoralism by reducing carrying capacity of rangelands inducing changes in plant species compositions favourable to less palatable species and reducing availability of water for livestock use ([2]). Drought diminishes the primary production of crops and rangeland vegetation and the secondary production of livestock which depends on primary production ([3]).

Climate variability and traditional adaptation strategies have long been part of pastoral production systems. However, convergence of unprecedented levels of land use change coupled with increasing climate uncertainty is eroding the resilience of ecological and social systems alike ([19]). Hartmann and Sugulle (2009) reports that traditional knowledge and information systems have a prominent role in rangeland and livestock management because it is sensitive and comprehensive and can be adapted to changing conditions. Pastoralists can tell the change in droughts, rainfall patterns, distribution and intensity when comparing the present and the past.

Drought variability attributed to climate change has put sustainability of pastoralism which is the main livelihood for the Maasai community in Kajiado County under threat ([11])). The community has in the past developed elaborate traditional knowledge, natural resource management practices and cultural rituals ([13])). However, now more than ever the Maasai community is facing serious challenges such as diminishing natural resource base impacting on food security and poverty which are attributable to drought variability ([21]). The Maasai community has reported noticing changes in plant species composition with some plant species increasing while others declined. Working with the community, ([5])) noted that reduction in species composition and diversity was as a result of drought variability and not over grazing *per se*. This paper examined the influence of duration of droughts on livestock feeding practices of the Maasai pastoralists.

STUDY AREA

The study was conducted in Mailwa sub-location in Kajiado County, purposely selected because it is an ASAL area inhabited by Maasai pastoralists still practicing pastoralism in the face of challenges posed by drought variability, experiencing increased sub-division of communal grazing areas and immigration of other communities in search of land for settlement. The pastoralists keep mainly cattle, sheep and goats, camels and donkeys. The average annual rainfall ranges between 500 mm to 1250 mm. The rainfall pattern is bimodal with short rains between October and December; and long rains between March and May. The average annual potential evapotranspiration ranges from 1600 to 2200 mm which means that for the greater parts of the year there is a moisture deficit. Mailwa sub-location has a population of 2,130 and 437 households. The vegetation cover is open grassland, wooded grassland and bushed grassland. Wood and bush land makes this area suitable for pastoralism.

2 METHODS

DATA COLLECTION

A cross-sectional survey was conducted in August 2013 in Mailwa sub-location of Kajiado County which was purposively selected because the area is inhabited mainly by Maasai who practice pure pastoralism. The study targeted 437 household heads (295 male and 142 female). Proportionate simple random sampling was used to ensure representation of both male and female household heads were included in the sample. A sample size 136 household heads consisting of 92 males and 44 females were selected. Interviews were conducted on each sampled household and responses entered in the interview schedule. Data collected through the survey indicated changes in duration of drought in the area over a period of 10-20 years.

DATA ANALYSIS

Data on changes in the duration of droughts as experienced by the sampled households was cross tabulated and association between feeding practices and experienced drought related events tested with Chi-square test statistics

3 RESULTS AND DISCUSSION

DROUGHT OCCURRENCES EXPERIENCED

These findings of this study indicate that pastoralists were consciously aware of the period droughts lasted in the area. For instance, a majority (97.8%) reported having noticed changes in the duration of droughts within the last 10 to 20 years,

and for a large majority (72.8 %), droughts lasts for a period of six months to one year (Table 1). Therefore, pastoral communities in the area are affected by chronic water shortages. This observation is similar to that reported by ([26]) who indicated that duration is an essential characteristic of drought where it can develop quickly and become established from where it can persist for months or years. This situation is aggravated by rising average global surface temperatures ([10])). These changes according to ([27]) are likely to result in extreme weather events like prolonged droughts.

Associated with the duration of drought was the severity for which about half of the sample (48.5%) attributed to scarcity of water for livestock and availability of pasture (42.6%). This community considered water availability for livestock a more important indicator of severity of droughts than availability of pastures, which may be explained by heavy reliance of water pans for livestock in the area during the wet season and the combined effects of high evaporation rates and siltation that dry up the pans very fast at the onset of drought. ([1])) reported that ASAL areas are prone to prolonged drought which results in the drying up of seasonal water sources.

Table 1. Occurrence, Duration and Indicators of Last Severe Drought in Mailwa Sub-location.

	Frequency	Percent
When last severe droughts occurred		
2008 – 2009	47	34.6
2008- 2010	21	15.4
2009- 2010	4	2.9
2009- 2011	64	47.1
Trend in drought duration		
0 - 6 months	32	23.5
7 - 12 months	99	72.8
13 - 18 months	4	2.9
19- 24 months	1	.7
Indicator of severity of droughts		
Number of dry months	3	2.2
Number of livestock deaths	9	6.6
Availability of pasture	58	42.6
Scarcity of water for livestock	66	48.5
Total	136	100.0

Ability of the pastoralists to recall when the last major drought in the area occurred, where they moved their livestock to in coping response and the distance covered in search of pasture and water was considered important for this study. The results reflect that about half of the sample households (47.1%) remember the last major drought to have occurred during the period 2009 to 2011. Livestock is grazed within the sub-location during the wet season but when drought sets in the area, pastoralists move their livestock in search of pasture and water to neighbouring group ranches, national parks, and other parts of the country and to the neighbouring Tanzania. About half of the sampled household (44.1%) indicated moving their livestock to neighbouring locations in Tanzania, but avoid national parks which are protected areas. This observation is in line with ([17]) view that despite changes in land tenure in Kajiado, traditional herd mobility patterns were used as a coping strategy to the severe la Nina induced drought.

INFLUENCE OF DROUGHT ON LIVESTOCK FEEDING PRACTICES

The distance covered in search of pasture and water during the period of severe drought for most of the pastoralists (92.6%) was in excess of 100 Km(Table 2) from the homesteads implying that livestock movement in search of pasture and water remains the most coping strategy for drought in the study area when livestock feeding is a challenge. Results showed duration of severe droughts, distance covered during droughts and availability of water for livestock use significantly ($p < 0.05$) influenced livestock feeding practices and is attributed to prolonged drought experienced in the area which is an observation consistent with those of ([4]). The author reported that the number, distribution and productivity of permanent

pastures and water points, which are critical for livestock survival during the dry season, are on decline. In the absence of supplementary feeding, pastoralists in this area solely relied on natural pasture to feed their livestock. Therefore how long the droughts persisted impacts on the availability of pastures and water which in turn influence movement of livestock to other areas.

Kajiado County is one the most affected counties by the high rates of mortality with an overall livestock mortality rate of 25-40 per cent. The livestock economy is the most affected, since livestock body condition deteriorates due to the decline in pasture and the long distance trekking to water sources up to an average distance of 100 km during the dry spells ([6]). ([15]) confirms that the costs of the 1998/2000 drought were estimated at US$2.8 billion where in some regions, up to one third of all livestock perished due to drought. ([22]) adds that, when the probability of drought increases to once every three years, herd sizes decreases as a result of increased mortality and poorer reproductive performance. This decrease in livestock numbers affect food security and compromise the sole dependence of pastoralists on animals and their products, as well as the additional benefits they confer. Droughts in East Africa's dry lands are becoming more frequent Water is an important component of livestock feed. Availability of water for livestock is affected by the duration of drought. This is in line with ([20]) who reported that water and pastures are critical for pastoral livelihoods which are characterized by frequent movements in search of water and feed during the long periods of scarcity. ([7]) also observed that with no reliable supplies of permanent water, pastoralists adapt to an increasingly arid and unpredictable environment by moving livestock according to the shifting availability of water and pasture.

When asked to indicate sources of water for their livestock during both the drought and rainy season, all identified water pans and boreholes for livestock during the rains and dry seasons but all water pans dry up during periods of drought and use of boreholes becomes important to provide water for livestock use. However, there are only two boreholes in the area, unable to stand the pressure and now face the risks of depletion of pastures and water. ([28]) observed that ASAL areas are adversely affected by drought and the worsening effects of climate change leading to drying up of water pans. Similar view was expressed by ([8]) who reported that pastoral systems operate in dry lands, where access to water is a limiting factor when determining herd sizes for many individuals and communities in times of drought. During periods of drought, there is insufficient supply of water to meet demand resulting in the drying of water-holes, the disruption of natural water flows and siltation of pans.

In this study, sampled households indicated pasture species disappearance during periods of prolonged droughts of which a large majority (89.5%) identified *erikaru* (*digitaria macroblephara*) to have had the greatest reduction in proportion (Table 2). The disappearance of erikaru (digitaria macroblephara) show that it is a preferred pasture for livestock, but there is a trend towards altering pasture composition leading to reduction of the most palatable ones, a situation that may cause even to move frequently and longer movement of livestock. For instance, recent studies have suggested that there is likely to be an increase in browse species as a result of increased browse in the range lands ([16]). This change in range land species composition will have a significant influence on the type of animal species that can be kept by communities that rely on the range land. A similar view is held by ([18) who reported that the Maasai community had noted changes in plant species composition where some key species had declined. This is also similar to ([5]) observation that the Maasai community attributed reduction in species composition and diversity to drought variability as consecutive droughts and seasonal rains did not allow pasture to reach flowering and hence a reduction in biomass. (14) reported that in Kajiado, there was an emergence of unpalatable species that included *Ipomoea kituiensis*, *I. hildebrandtii*, *Astripomoea hyocyamoides*, *Solanum incanum*, *S. arundo*, *Gnidia latifolia* and *Acacia stuhlmannii.* This conforms to what was reported by ([25]) that due to climate change, pasture quality and quantity will be affected. Decrease in grasslands due to increases in tropical woody vegetation could reduce options for accessing dry season feeding resources. The author reported that the number, distribution and productivity of permanent pastures and water points, which are critical for livestock survival during the dry season, are on decline. In the absence of supplementary feeding, pastoralists in this area solely relied on natural pasture to feed their livestock. Therefore how long the droughts persisted impacts on the availability of pastures and water which in turn influence movement of livestock to other areas.

Table 2. Grazing Areas, Distance Covered and Pastures that Disappear During Severe Drought in Mailwa Sub-location.

	Frequency	Percent
Grazing areas moved to during severe droughts		
In other group ranches within Kajiado County	30	22.1
In national parks	14	10.3
In areas outside Kajiado County	32	23.5
Tanzania	60	44.1
Distance covered for grazing and water searching		
41 – 60 Km	1	.7
61 – 80 Km	1	.7
81 - 100 Km	8	5.9
More than 100 Km	126	92.6
Pasture species disappearing during severe drought		
Erikaru digitaria macroblephara	122	89.5
Enkopuru - chloris roxbhurgiana	14	10.3
Total	136	100.0

During periods of drought, there is insufficient supply of water to meet demand resulting in the drying of water-holes, the disruption of natural water flows and siltation of pans. This is similar to what was reported by ([23]) indicating that availability of water resources in both quantity and quality in Kenya has been decreasing over time as a result of persistent droughts and land-use patterns and the situation is expected to worsen due to rainfall variability and increased evaporation due to higher temperatures. The impacts are largely felt in the marginal rainfall areas of the country. This is view is reinforced by ([24]) who reported that the high number of emergency water trucking interventions carried out during the 2008-9 droughts in ASALs was an indicator that there was inadequate water in arid districts to meet the needs of vulnerable households and their livestock. There are still parts of the rangelands of Kenya that lack the necessary water resources for their basic needs, whether in terms of quantity or quality or both. Demographic growth is likely to increase pressures for the development of water resources and further exploitation of existing ones. ([7]) observed that with no reliable supplies of permanent water, pastoralists adapt to an increasingly arid and unpredictable environment by moving livestock according to the shifting availability of water and pasture.

This study tried to determine the influence of duration of droughts on livestock feeding practices among the pastoralists in Mailwa sub-location, Kajiado County.

4 CONCLUSIONS

Maasai community is continuing with traditional herd mobility in coping with drought effects with limited uptake of supplementary feeding practices with commercial feeds and hay. This demonstrates non uptake of planned adaptation strategies, which poses threats to livestock assets of this pastoral community and should attract attention of the development agencies in planned intervention including introduction and promotion of harvesting and storage of natural hay for drought feeding, use of drought tolerant livestock breeds, targeted livestock off-take to reduce economic losses and construction of watering facilities in the area. Regular desilting of existing water pans is a necessary accompanying intervention to increase the volume of water harvested during the rains for watering livestock during prolonged periods of drought.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

The work was a component of a wider Masters study for JMG. KSM and BOB were University supervisors of the candidate. JMG, KSM and BOB made substantial contributions to the work from conception through data collection, analysis, drafting and revising the manuscript. All authors read and approved the final manuscript.

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