

The Status of Camel Feed Resources, and Its Management in Ethiopia Somali Region

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Abstract

Camel production is the dominant livelihood option for pastoralist, and also very important livelihood option for agro-pastoralists in Somali region.

This study was conducted in five administrative zones of Ethiopian Somali Regional State to assess the current status of camel feed resources, and its management practices. A key informant interview, focus group discussion (FGD), household survey (HH) with structured questionnaire, and field observation were employed as data collection tool. With purposive sampling design for this cross-sectional study, a total of 150 sample household heads were selected.

The result indicated that there is variation in camel feed quality and rangeland conditions between the study districts. Despite of this, mismanagement of feed resources coupled with intrinsic camel feed resources shortage and quality deterioration at different seasons is putting the camel production vulnerable to changing climate throughout the region. Although it is not satisfactory to overcome the camel feed shortage in districts, traditional feed managements such as area enclosure (34%), camel migration during drought seasons (90%) browsing land resting (45.3%), and table salt provision to supplement the camel mineral deficiency are implemented but with different status between districts.

However, the efforts made do not indicate as it ensures sustainability. Hence, awareness creation on rangeland management to integrate traditional with modern approaches, and capacity building on camel feed resource development, and conservation skills of the existing brows species in the rangelands of pastoral and agropastoral camel herders is highly required.

Keywords: Brows lands; Camel; Feed resource; Pastoralist

Introduction

Ethiopia Somali region has dominantly pastoral and agro-pastoral production system that is a generation long traditional resources management for livestock production by utilizing the available scarce range resources. Besides, the production system has its own goals, and traditional management strategies to adapt unpredicted environmental variability [1]. The pastoral areas are characterized by arid and semi-arid climate with extensive traditional mobile livestock management on fragile environment. Whereas, agro-pastoral production system includes crop farming to improve food security along with animal production, and maintaining ownership rights over the use of land. Almost all of the camel population of the country is located at pastoral and agro-pastoral areas. Ethiopia Somali region takes the big share of camel population in the country. Camel takes the line-share of livelihood since the survival and productivity of other agricultural production is constrained by the hot agro-climatic nature of the area.

The major animal feed resources of in Ethiopia include natural pasture, crop residue, agro-industrial by-products, stubble grazing and browse species; which are used at the site of production or conserved for use during season of shortage [2]. Though the use of natural pasture as a source of feed is restricted to the wet season [3], while their contribution to the total feed resources base is very high [4]. Rangelands play a significant role in camel feeding in Ethiopia Somali region. The rangeland consists of a diverse range of trees shrubs, grasses, and legumes, nevertheless feed quality and availability is poor during the dry season. The availability and quality of natural pastures vary with altitude, rainfall (RF), soil type and nutrient status, and water availability. The amount and quality of feed obtainable from natural pasture declines as the dry season progress. The total area of grazing

and browsing in pastoral areas of Ethiopia is 55 million hectares, which is 82% of the country's grazing land. However, the productivity of grazing land is poor due to lack of appropriate management [5]. As a result of the dependency on range feed resources that fluctuate with season, camel performance in semiarid areas is limited by insufficiency of feed in terms of quantity and quality.

Overgrazing, invasive plants encroachment and anthropogenic disturbances have heavily threatened camel feed resources in rangelands. A typical example could be abundance and luxuriant growth of the *Parthenium hysterophorus* invading the rangelands and in most sites replacing the native palatable and preferred herbaceous species. As indicated by the pastoralists in most sampled sites the climax species, "Serdii" *Cenchrus ciliaris* was under the stress of heavy grazing, and recurrent drought has reduced its vigor and regeneration ability. The few shrub or small tree species that occurred in abundance, such as *Xanthium spinosa* and *Acacia etbaica*, suggest a change from the primary to the secondary vegetation type of growth [6].

The contribution of browse species as camel feed sources is

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influenced by a number of factors such as the natural distribution within the agro-ecological zones, type, and availability of alternative camel fodder species in the area. The importance of foliage of browse species becomes prominent in camel feeding towards the end of the dry season [7].

Traditionally, the pastoralists had a rich indigenous knowledge, which enabled them to adapt successfully to the highly variable natural resources [8,9]. Pastoral strategies of grazing were flexible and grazing management was based on a cumulative knowledge of resources, assessment of range condition and distribution of rainfall. The herders being in close contact with their herds, the natural environment and other herds; know exactly where to move their animals in order to find available forage and water resources [8]. The people living in the lowlands of Ethiopia differ in their social organization, herding composition and coping strategies [10]. The traditional grazing land management practices provide the basis and opportunity for the development of range management plan and conservation of rangeland biodiversity [11].

Reports by Amaha [12], Belaynesh [6] have indicated the condition of rangeland species composition and diversity, and biomass production in some parts of Ethiopia Somali region. However, there was insufficient research data with regards to the current condition and management practices of camel feed resources in rangelands of large portion of the pastoral and agro-pastoral areas in the region. Therefore, the current research was conducted assess constraints of camel feed resources and existing management practices to cope up with the challenges in Ethiopia Somali Region.

Methodology

Study site description

The study was conducted at selected five districts of Ethiopia Somali Region (East and South-Eastern part of Ethiopia between 4° to 11° N Latitude and 40° to 48° E Longitude). About 80% the topography of the region is dominated by lowland plains; with an altitudinal range of 900 to 1600 meters above sea level. The region's climate is dominantly arid and semi-arid while bi-modal distribution of extremely variable and low rainfall (200 to 700 mm in average). The mean annual temperature ranges from 20 to 45°C. The prevailing soil and climatic conditions naturally influence the vegetation in the region. Vegetation in the region is sparse and composed mainly of grass, bushes and scrub. The natural vegetation contains a high proportion of endemic plants of Ethiopia. As water is rare in the region, the highest proportion of domestic animals is camels and goats, and that mainly depend on the rangelands in the communal land use system.

Sampling design and sample size

This study was conducted in five zones of Ethiopian Somali regional state (Jarar, Nogob, Korahey, Dollo and Liban Zone). From each zone, one district was purposively selected. Based on the criteria such as accessibility, security situation, and dominancy of camel production on livelihood, purposive sampling was used for mobile and scattered pastoral and agropastoral communities. Hence, Degehabur District from Jarar Zone, Hamaro District from Nogob Zone, Kabridahar District from Qorahey Zone, Warder District from Dollo Zone, and Dhakasuftu District from Liban Zone were selected. Then 30 households of dominant camel producers were selected from each district with the same procedure to have a total of 150 households.

Methods of data collection

On the camel feed resource challenges, and its management practices, primary data was collected through exploratory survey, key informants interview, household survey with structured questionnaire, focus group discussions and field observation.

- a. **Exploratory survey:** Exploratory survey was held with experts at different hierarchy of the Government structure to collect relevant data on major aspects of camel feed, more specifically on natural feed resource condition in the rangelands, camel feed resource challenges and feed management options.
- b. **Key informant interview:** Key informant interview was employed to assess the challenges of camel feed resource of pastoralist and agro-pastoralists. With the help of a pretested checklist, the interview was conducted to gather detailed data. In each district one key informant group interviews was held with selected eight individuals in each group. Women and youths were also included in order to ensure that their views were taken into account.
- c. **Household survey:** The structured questionnaire was designed to collect quantitative data was collected mainly on status of rangelands regarding camel feed resources, and camel feed resource management. Under close supervision of researchers, the household survey was carried out by recruited experienced enumerators that speak Somali language.
- d. **Focus group discussion:** To cross-check the data collected through other tools, and to deepen the required qualitative data for the study, one focus group discussion was made at each district. For this purpose, primary camel producers, elder pastoralists, and socially respected individuals (*Ugas*) were involved. In each group discussion 10 individuals participated, and with the help of checklist discussion were made; and
- e. **Field observation:** Throughout the data collection, field diary was used as primary observation data. On the other hand, secondary data was collected from published and unpublished sources such as district and regional agricultural bureau reports in the region.

Methods of data analysis

With the help of SPSS software (Version 20.0), quantitative data was analyzed. Descriptive statistics such as percentage, and frequency was used, and the result was interpreted by table and text while qualitative data was narrated, and explained logically.

Results and Discussion

The major constraints related to camel production in the study area

According to the respondents on quantitative data, feed shortage, water shortage, and prevalence of diseases are the major challenges of camel production with decreasing importance. Almost all respondents indicated that the production system of camels in the area was only extensive type, and there was no practice of improved forage production due to lack of awareness in the area. All pastoralists interviewed were not aware of the availability and importance of improved forages. Most pastoralist producers responded that they face difficulty of searching feed to their camels especially following long dry season. Mobility and sale of animals have been indicated as the last chance when critical feed

shortage occur (Table 1). In the dry season, pastoralists are forced to move to other areas covering up to 50 to 100 km distance. Similarly, Ahmed et al. [13] in Somali region of Afder Zone noted that during the dry season camels cover large area on the average 8-10 km from home depending on the size of the herd.

Current status of camel browse feed resources in the study area

In the study area, small number of pastoralist and agro-pastoral households had private grazing and browsing lands, rather it was owned communally (Table 2). In the Degehabur, Kebridahar, Warder, Hamaro and Dhekasuftu districts, 76.7%, 93.3%, 100%, 100% and 86.7% of the respondents, respectively replied that there was communal browsing land for camel (Table 2). All sampled pastoralists had temporary browsing land that used either by making enclosure or without enclosure during the rainy season.

About 100% of the respondents perceived that there is a declining trend of communal browsing land in all of the study districts (Table 2). About 78.7% and 18.7% of the respondents reported that rainfall variability and over-browsing, respectively considered as major reasons for communal browsing lands degradation in all study districts. Due to lack of attention and high stocking rates communal browsing land

is declining and deteriorating rapidly in pastoral areas of Ethiopia according to Alemayehu [14]. Environmental degradation due to deforestation and overgrazing have substantial impact on reducing soil fertility and further reduce land productivity [15]. However, the community does not perceive as agricultural land expansion and resettlement brought significant impact on camel feed resources in communal grazing land (Table 2).

According to the data from focus group discussion (FGD) in current study, invading species like *Barkatkattee* (local name) or (*Lantana camara*) which are not preferable by camels, rather results in skin swelling and stomach pain are leading to camel brows lands degradation. On the other hand, all the respondents and FGD participants reported that the main cause for disappearance of grazing and browsing range plants have been climatic variability (drought), deforestation and over-browsing in the study areas (Table 3). Hence, the current research suggests that the time to time degradation rangelands with camel brows species in the districts were challenging the main source of livelihood that is camel production. However, the impact of bush encroachment on the sampled districts was very few compared to the other parameters. This view contradicts the scenario in Shinille district in which *Prosopis juliflora* is major threat.

Constraints	Districts					Rank
	Degehabur	Kebridahar	Warder	Hamaro	Dhekasuftu	
	n (%)	n (%)	n (%)	n (%)	n (%)	
Feed shortage	30 (100.0)	30 (100.0)	30 (100.0)	28 (93.3)	30 (100.0)	1 st
Prevalence of diseases	26 (86.7)	26 (86.7)	28 (93.3)	23 (76.7)	20 (66.7)	3 rd
Water shortage	28 (93.3)	29 (96.7)	30 (100.0)	25 (83.3)	26 (86.7)	2 nd
Genotype constraint	0	0	0	0	1(3.3)	5 th
Marketing problem	0	2 (6.7)	5 (16.7)	5 (16.7)	6 (20.0)	4 th

Table 1: Major camel production constraints as ranked by respondents.

Land	Degehabur	Kebridahar	Warder	Hamaro	Dhekasuftu	Overall
Land availability, %						
Communal browse land	76.7	93.3	100	100	86.7	91.3
No Communal browse land	23.3	6.7	-	-	13.3	8.7
Status of communal browse land, n(%)						
Increasing	-	-	-	-	-	-
Decreasing	30 (100.0)	30 (100.0)	30 (100.0)	30 (100.0)	30 (100.0)	150 (100.0)
No change	-	-	-	-	-	-
Major reasons of communal browse land reduction, n(%)						
Rainfall variability	23 (76.7)	25 (83.3)	28 (93.3)	19 (63.3)	23 (76.7)	118 (78.7)
Over-browsing	5 (16.7)	5 (16.7)	2 (6.7)	10 (33.3)	6 (20.0)	28 (18.7)
Increased settlement	-	-	-	1 (3.3)	0	1 (0.7)
Increased farm land	2 (6.7)	-	-	-	1 (3.3)	3 (2.0)

Table 2: Communal browse land availability and its status in the study districts.

Causes	Districts										Overall	
	Degehabur		Kebridahar		Warder		Hamaro		Dhekasuftu		Index	Rank
	Index	Rank	Index	Rank	Index	Rank	Index	Rank	Index	Rank		
Drought	0.50	1 st	0.49	1 st	0.46	1 st	0.56	1 st	0.52	1 st	0.507	1 st
Deforestation	0.13	3 rd	0.15	3 rd	0.06	4 th	0.27	2 nd	0.19	3 rd	0.160	3 rd
Over-browsing	0.30	2 nd	0.24	2 nd	0.23	2 nd	0.13	3 rd	0.23	2 nd	0.227	2 nd
Increased settlement	0.00	-	0.00	-	0.01	7 th	0.00	-	0.06	4 th	0.013	5 th
Limited knowledge	0.00	-	0.02	5 th	0.02	6 th	0.00	-	0.00	-	0.007	7 th
Bush encroachment	0.00	-	0.00	-	0.03	5 th	0.00	-	0.00	-	0.006	8 th
Urbanization	0.00	-	0.00	-	0.00	-	0.04	4 th	0.00	-	0.009	6 th
Flooding	0.07	4 th	0.10	4 th	0.19	3 rd	0.00	-	0.00	-	0.072	4 th

Table 3: Causes of range and degradation as ranked by the respondents.

Rangeland management practices for camel browse

Pastoralists and agro-pastoralists in the study districts have rich indigenous knowledge about their environment, camel brows resources management. The result of present study revealed that some of the respondents in all districts practices clearing of unwanted woody species, range enclosures and land resting on their privately owned plots. The common traditional management practices of browsing resource in the rangelands in the districts were migration during the dry and drought seasons (90%), browsing land resting (45.3%), and use of enclosure during the dry season (34%). Migration was the first and commonly used measure taken to cope up with shortage of feed and water during the dry season in all of the sampled districts (Table 4). Due to the degradation of rangelands with camel brows species, there is serious feed shortage to support the camel population in the districts. Similar findings were reported by Gemedo [16], Admasu [17] in Hamar and Bena-Tsemay districts in Ethiopia.

Respondents indicated that modern browse land management systems have not been practiced in all districts; rather traditional management practices are implemented. Hence, about 90% in Degehabur, 86.7% in Kebridahar, 96.7% in Warder, 83.3% in Hamaro and 93.3% in Dhekasuftu districts revealed that division of wet and dry season browsing areas have been practiced as traditional range management practices (Table 4). Browse land enclosures implemented on privately owned rangelands in agro-pastoral areas, probably due to the reason that it might need strict management to enhance immediate restoration of the land and keep the brows resource for dry season. Enclosures were usually located around the homestead and farmlands and were mainly used for dry season feeding of lactating camels, calves and sick camels. This finding is in line with that reported by Abule [18] where the utilization of rangeland areas by establishing enclosures was practiced in the part of middle Awash in Ethiopia.

Mineral supplementation

The results of current status of rangelands indicated that, the feed

resource shortage might have negative impact on the camel nutrition. This problem may be alleviated with supplementary minerals for sustainable camel production. In the study districts, 76% of respondents provided salt for their camel as a supplementary mineral (Table 5). In over all, these minerals were mainly supplemented in the form of table salts (76%). Specifically, Kebridahar (90%), Warder (100%), and Dhekasuftu (100%) supply table salts as supplemental minerals to camel. Next to table salt, natural mineral lick use supplied as mineral for camel (69.3%). The percentage of respondents supplying natural mineral lick in each district was 86.7%, 66.7%, 90.0%, 53.3% and 50.0% in Degehabur, Kebridahar, Hamaro, Warder and Dhekasuftu districts, respectively. Majority of the respondents (70%) provide supplementary minerals sources at home. About 87.3% of respondents provide adequate mineral supplementation to their camels (Table 5). However, the amount provided needs further investigation for appropriate ration formulation.

Strategies to overcome feed shortage during dry season

Recurrent drought has been the most important natural threat that constrained the livelihood of camel producer pastoralists and agro-pastoralists, and has made this group of people to depend largely on food aid. Pastoralism is becoming less and less possible and a riskier business in the state of mismanagement of animal feed resources as it has creates severe problems on the grazing lands; and indigenous people who are adapted to live in it [5]. As there were feed scarcity in the study areas, there was some seasons in which the camel feed available in excess quantity (Source: Focus Group Discussion). For feed scarcity seasons in the area, the pastoralists and agro-pastoralists adopt variety of coping up mechanisms in their respective districts (Table 6).

About 84.7% of respondents replied that they used migration as cope up mechanism to alleviate feed shortage encountered during dry seasons. Selling aged camels, buying concentrated feed (reported only in Degehabur) and assistance from the Government, Non-government organizations and relatives were some of the mechanisms reported to overcome feed shortages (Source: Focus Group Discussion) (Table 6).

Management systems	Degehabur	Kebridahar	Warder	Hamaro	Dhekasuftu	Overall
	%	%	%	%	%	%
Movement by dividing season	90.0	86.7	96.7	83.3	93.3	90.0
Clearing of unwanted species	3.3	6.7	0.0	10.0	0.0	4.0
Browse land enclosures	53.3	10.0	0.0	53.3	53.3	34.0
Browsing land resting	40.0	50.0	33.3	53.3	50.0	45.3

Table 4: Indigenous browse land management practices in the study districts.

Parameter	Districts					Overall
	Degehabur	Kebridahar	Warder	Hamaro	Dhekasuftu	
Supplementation of minerals to the camel, n (%)						
Supplementation	30 (100)	30 (100)	30 (100)	30 (100)	30 (100)	150 (100)
No supplementation	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Sources of minerals, n (%)						
Natural mineral lick	26 (86.7)	20 (66.7)	27 (90.0)	16 (53.3)	15 (50.0)	104 (69.3)
Table salts	18 (60.0)	27 (90.0)	30 (100)	9 (30.0)	30 (100.0)	114 (76.0)
Mineral water	6 (20.0)	2 (6.7)	0 (0.0)	21 (70.0)	0 (0.0)	29 (19.3)
Methods of mineral supplementation, n (%)						
Taken to sources	20 (66.7)	4 (13.3)	2 (1.33)	24 (80.0)	25 (83.3)	75 (50.0)
Supplied at home	15 (50.0)	27 (90.0)	30 (100)	13 (43.3)	20 (66.7)	105 (70.0)
Level of supplementation, n (%)						
Adequate	27 (90.0)	21 (70.0)	27 (90.0)	30 (100)	26 (86.7)	131 (87.3)
Not adequate	2 (6.7)	9 (30.0)	3 (10.0)	0 (0.0)	0 (0.0)	14 (9.3)
Unknown	1 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	4 (13.3)	5 (3.3)

Table 5: Mineral supplementation practices for camel in the study districts.

Mechanisms	Districts					Overall
	Degehabur	Kebridahar	Warder	Hamaro	Dhekasuftu	
	%	%	%	%	%	
Sale of camels (old aged)	16.7	16.7	6.7	-	33.3	14.7
Moving animals/migration	80.0	83.3	93.3	100.0	66.7	84.7
Use of improved fodder trees	-	-	-	-	-	-
Use of conserved feeds	-	-	-	-	-	-
Buying concentrate feed	3.3	-	-	-	-	0.7

Table 6: Coping strategies to alleviate feed shortage in the study districts in terms of percentage.

On the other hand, there is no effort made to enhance the availability of camel feed through improved fodder trees development; and there was lack of feed resource conservation practices in all districts. Consequently, many of the mobility of the camel producers may occupy large areas including crossing borders of the region and neighboring countries while some movements were restricted to their nearby surroundings. These coping strategies were similar to those reported from the different pastoral areas of Ethiopia [19]. In contrary to some reported mechanisms in different areas, there is no use of supplementation of feed (browse tree and conserve feed) in the present study districts. This might be due to unavailability of improved fodder tree seeds, lack of knowledge and skill to plant and manage these fodder trees and conserved feed resources for scares times in the districts.

Conclusion

The current study revealed that, the status of camel feed resources in the rangelands of the study districts are in poor condition, and being deteriorated from time to time due to repeated drought occurrence and deforestation as a result of over-browsing with highly populated camels. The camel production system in the study districts was mainly extensive type, and made it difficult to attract the attention of pastoral and agro-pastoral people to improve camel feed resources in terms of quantity and quality. Most pastoralist camel producers face difficulty of searching feed to their camels especially following long drought events. Hence, migrations to long distance sometimes cross border, and sale of aged camels have been used as the last option when critical feed shortage occur. To alleviate the mineral nutrient deficiency, table salt is provided to camels as a supplementary mineral source at home. On the other hand, there is no effort made to improve the utilization of the available feed resources through conservation of surplice camel feed at on season, and lack of development of fodder trees/any woody brows species in all districts of the study area. Hence, the introduction of new technologies on rangeland browse resource management and integrate it with the existing traditional knowledge pool is needed to optimize the utilization of camel feed resources in pastoral and agropastoral areas for sustainable livelihood.

Recommendation

Based on the results and conclusions given, the following recommendations are drawn for implementation by all concerned bodies to bring back the challenges of camel feed shortage and quality problem to ensure sustainable camel production based livelihood in Ethiopia Somali region.

- Sustainable utilization practices must be implemented on the natural rangelands for camel brows plant species through the integration of modern rangeland management approach with the traditional knowledge.
- Development of high quality and nutrient rich woody brows species has to be the prior focus to reduce long distance

movement and seasonal migration of camel in agropastoral areas fist.

- There is a need of buildup of local people's skill on conservation of surplice camel feed resources during oversupply to remove wet season feed wastage, and solve dry season scarcity.

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