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Effect of range land vegetation degradation on livestock and socio-economics status of the pastoralists, Afar regional state, Northern Ethiopia

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The objectives of the study were to assess current vegetation diversity in the rangeland and its effect on the livestock and socio-economics of the pastoralists. Vegetation data were collected from 72 sample plots laid on the four transects. The size of the main plot was 20 m x 20 m for tree species. Socio-economic data were analyzed using SPSS version 21 software packages. A total of 75 species of vascular plants belonging to 60 genera and 26 Families were identified from 72 plots. Fabaceae and Poaceae were found to be the dominant families. The Shannon diversity index of the vegetation was 2.10, and evenness index was 0.50, total basal area calculated was 3.25 m^2/ha for tree plants species. These studies indicated that most tree species were identified to have poor regeneration status, while shrub species had good regeneration status; which means expansion of unpalatable shrub species and the indicator of bush encroachment in the study area. In the study area, rangeland vegetation composition dramatically changed from grassland to bush land within the past two decades. Due to this, pastoralists tend to change their livestock herd structure into small ruminant. This small ruminant economically has low amount with many return and pastoralists were economically distributed.

Key words: Rangeland, species diversity, pastoralist, herd structure.

INTRODUCTION

Rangelands are among the most important resources of the world's arid and semi-arid ecosystems. Low and erratic precipitation, rough topography, poor drainage, and warm temperatures are considered as unsuited for cultivation (Holechek, 2011). Rangelands provide multiple functions as a habitat for a wide array of wild life species and for diverse as well as wide range of native plant species (Lishan, 2007).

In Ethiopia, rangelands cover about 61 to 65% of the total area of the country, which are characterized by arid and semi-arid agro-ecologies; ecosystems to the home is about 12%-15% of the human population, and 26% of the

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total livestock population of the country (Mohammed, 2009). Pastoralism and agro-pastoralism are the dominant types ofland use systems in these areas (Teshome et al., 2009; Adefires et al., 2012). However, reduction of the natural rangeland ecosystem through theexpansion of non-pastoral land uses, encroachment of bushes and other invasive plant species, as well as emergence of agro-pastoralism are the main challenges facing the rangelands (Alemayehu, 2004; Lishan, 2007; Semere, 2010).

In the study area most of these grass species, however, are subjected to continuous threat of genetic erosion due to overgrazing, rangeland degradation, invasion and encroachment by undesirable species (like *Prosopis juliflora, Parthenium hysterophorus, Tribulis terrestris, Sida ovata, Cryptostegia grandiflora* etc.), in addition to weakening of the indigenous rangeland resource management practices of the pastoralists (Mohammed and Abule, 2014).In Ewa (study area), no previous work has been done on this research except very few assessments regarding the potential and constraints on the production system (WARC and APARI, 2007). Therefore, these gaps need to be filled by studying the existing floristic composition of rangeland and its effect on the livestock and socio-economics of the pastoralists in the study area. This in turn helps to pave the way for designing different rangeland interventions to be undertaken in the Ewa district. Therefore the objectives of the study were to assess current vegetation diversity in the rangeland and its effect on the livestock and socio-economics of the pastoralists in the study area.

MATERIALS AND METHODS

Description of the study area

Ewa is one of the districts (*woreda,* the smallest planning unit in Ethiopia) in Zone 4 Administrative *(Fantena Rasu)* of the Afar Regional State. It is situated about 650 km north of Addis Ababa (Capital of Ethiopia) and about 188 km south of Semera (capital of the Afar).

It is geographically located between latitude and longitude 11º49'20" N and 39º55'08" E respectively and the altitude range of the area is between >550-1080 m above sea level and most of the rangelands of the study district falls below 850 meter above sea level. The mean minimum and maximum temperature of the study area are 22.5 and 37.55°C respectively, and the rainfall is bimodal with erratic distribution (Figure 1).

Sampling and data collection methods

Reconnaissance survey was conducted. Vegetation data collections were carried out between August and September 2016 to collect visual information on the study area. Stratified sampling design was used for this study to collect vegetation data. Stratification was made based on the different land cover (habitats) namely woodlands, bush lands and grassland, which are the prominent vegetation types of the study area. A total of three representative sites were selected by visual observation based on homogeneity in floristic composition, and each site were sampled systematically.

In these three selected sites, four transect lines were used. The comprehensive vegetation data were collected from 72 sample plots laid on the four transects. The size of the main plot was 20 x 20 m, as recommended by Kent and Coker (1992) for tree species. The plots measuring 20x20m (400 m^2) were established along the line transects approximately at 400 m intervals along north-south directions. Five sub-plots of 5 x 5 m were set-up within each 400m^2 of the main plot, four at each corner and one at the center, to collect data on shrubs. Then the mean values of these five sub-plots were used in the analysis. Within each 5mx5m sub-plots, another 1 x 1 m sub-plots were set up to collect data on the herbs and grass species and the mean value was used in the analysis.

Plant species scientific name were identified at the field. The remaining plant species were recorded and voucher specimens of plant species were collected and deposited at the National Herbarium of Addis Ababa University for further identification and nomenclature. The nomenclature of plant names in this study followed the published volumes of Flora of Ethiopia and Eritrea (Hedberg and Edwards, 1989, 1995; Edwards et al., 1995, 1997, 2000; Hedberg et al., 2006).

Socio-economic data collection survey

There are ten kebeles in Ewa district. The study involved a total of 3 kebeles that were purposively selected based on their importance of the rangeland in Ewa district, namely *Badula I*, *Duba,* and *Bolotomo.* The selected residents who had spent their entire lives in the area and are totally depended on pastoralism for their livelihood. The research used the simplified formula developed by Yamane (1967) and reviewed by Israel (2012). A total of 70 respondents (because the pastoralist household are not easily accessed due to the scattered settlements and no access of transport to assess much number of household) were randomly selected for the questionnaire interview with a precision level of ±7%.

$$n = \frac{N}{1+N(e)^2}$$

Where 'n' is the sample size, 'N' is the population size and 'e' is the level of precision.

Interview and questionnaire were conducted, using simple random sampling method to collect data on the current herd structure as compared to 10-20 years back, to analyses herd structural dynamic in the study area. In the sampling method, age and gender representation were considered. Key informants (elderly pastoralist spent their life herding) were identified as the major informant to evaluate the current herd structural change as compared to the previous time in relation to vegetation types.

Data analysis

Vegetation data analysis

The comprehensive vegetation plant species data were used to compute species richness, diversity, evenness, density, frequency, basal area, Importance Value Index (IVI), and population structure of woody species in the study area using the following formula:

Shannon Diversity Index=$H' = -\sum_{i=1}^{s} pilnpi$ (1)

Where, H' = Diversity of species, S = the number of species, Pi = the proportion of individuals abundance of the i^{th} species and *ln =log base$_e$*

Equitability or species evenness was calculated using the

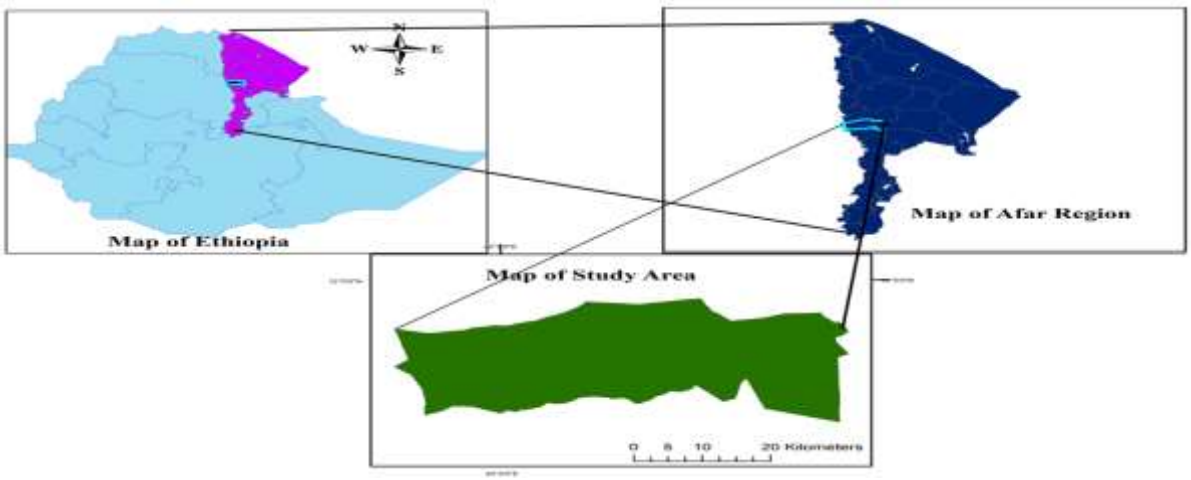

Figure 1. Map of Study area, Ewa district.

Shannon Evenness index following the equation:

Equitability or evenness (E) = H'/H $_{Max}$ = H'/ln(S) = $\frac{-\sum_{i=1}^{s} pilnpi'}{lnS}$ (2)

Where, H'$_{max}$=lnS, H' = Shannon diversity index, Ln$_S$ = the natural logarithm of the total number of species in each community, S= number of species in each community (Shannon and Weiner, 1949).

Basal area =$\Sigma\pi(d/2)^2$ (3)

Where, d is diameter at breast-height and

$\pi = 3.14$ (4)

Relative Dominance = $\left(\frac{\text{Dominance* of tree species}}{\text{dominance of all species}}\right) \times 100$ (5)

Where, Dominance* is mean basal area per tree times the number of tree species.

Density = $\frac{\text{Total number of stems of all trees}}{\text{Sample size in hectare}}$ (6)

Relative density= $\left(\frac{\text{Number of individuals of tree species}}{\text{total number of individuals}}\right) \times 100$ (7)

Frequency is the frequency of quadrats occupied by a given species. It is calculated with the formula:

$$\text{Frequency}=\left(\frac{\text{number of plants in which a species occur}}{\text{total number of plots}}\right) x100 \quad (8)$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species}}{\text{Sum frequency of all species}} \text{x } 100 \quad (9)$$

Importance value = Relative density + relative frequency + relative dominance.

Socio-economic data analysis

Socio-economic data were analyzed using descriptive statistics by Statistical package for social science (SPSS, 21) to summarize the socio-economic data referring to the current and past herd structural dynamics of the different pastoral groups in comparison with vegetation types and potential socio-economic effects. The results were presented using tables, charts and frequency distributions.

RESULTS AND DISCUSSION

Floristic composition and diversity

A total of 75 species of vascular plants belonging to 60 genera and 26 Families were identified from the 72 plots examined in the study area. Out of these plant species, 25 (33.33%) were herbs; shrubs species, 23 (30.67%); trees,15 (20%); and grasses, 12 (16%) (Figure 2). Fabaceae and Poaceae were found to be dominant in the study area in which each Family have 11 (14.7%) plant species, followed by Asteraceae with 8 (10.7%) species, Euphorbiaceae and Malvaceae the same number of species each 5(6.7%) species, and Amaranthaceae with 4 (5.3%) species. The three species (Fabaceae, Poaceae and Asteraceae) constitute 38.7% of the total vegetation in the study area (Figure 2).

The domination of Fabaceae and Poaceae in the vegetation stands could be the peculiar feature of the rangelands in Africa. The family Fabaceae contains drought tolerant, deciduous and spiny species that are well adapted to the prevailing drought conditions of the study area.Similar reports were given by Semere (2010), Anteneh et al. (2011) and Abeje (2013) for arid and semi-arid environments.

The Shannon diversity index of the woody and herbaceous species was 2.10, species richness was 75, and evenness index was 0.50 in the study area. Adefires et al. (2012) reported that the diversity and evenness value of vegetation in borana were 2.9 diversity index and 0.8 evenness.Also, Teshome (2006) reported that Shannon diversity index and evenness of vegetation in borana range land vegetation were 2.100 and 0.661

Figure 2. Growth types of species.

respectively. Vegetation in Yangudi-Rassa National Park in Afar was 2.9 diversity index and 0.8 evenness (semere, 2010); but in the study area the diversity and evenness of the vegetation were very low relatively to other range land vegetation.

Vegetation structure of woody and Herbaceous plant species composition

Woody and Herbaceous plant species density

The numbers of individuals, which had DBH > 2.5cm were 149 per hectare for tree and 173 per ha for shrub species. *Acacia tortilis* occupied 22.68% of the total density and followed by *Balanites aegyptica* (15.04%) and *Acacia nilotica* (13.89%). The density of the shrub species were *Acacia oerfota* (22.56%), *Grewia ferugine a*(20.80%) and *Salvadora persica* (13.45%). The density of woody species on the study site was relatively much lesser than the Borona lowlands (3149 individuals per hectare) (Gemedo, 2004); the Range land of Afar Yangudi-Rassa National Park vegetation (427 individuals per hectare) (Semere, 2010) and Babile Elephant Sanctuary (19,991 individuals per ha) (Anteneh et al., 2011). Therefore, this indicated how the range land of Ewa district was diminished through time as well as seriously affected by the El Nino phenomenon of the 2015/16.

The densities of the herbaceous species, especially the grass, were *Andropogon canaliculatus* (59.79%), *Pennisetum polystachion* (39.79 %) and *Enteropogon* species (33.72%). The herb species were *Parthenium hysterophorus* (33.96%),*Tribulis terrestris* (26.91%), and *Celosia trigyna* (11.94%) which is highly abundant in the study area.

Woody and Herbaceous plant species frequency

The most frequent tree species in the study area was *A. tortilis,* with 43% frequency of occurrence; followed by Acacia *nilotica* with 30.5%; *Doberaglabra*, 29%; and *Balanites aegyptica,* 26.4% frequency of occurrence. The less frequent tree species were *Balanitesrox burghii* (4.2%), *Acacia asak* (4.2%), and *Euphorbia candelabrum* (1.4 %). The frequencies of shrub species were *Grewia feruginea*(54.2%), Acacia *oerfota* (44.4%), and *Salvadora persica* (30.5%). Lampricht (1989) pointed out that high value in higher frequency and low value in lower frequency classes indicate constant or similar species composition; whereas high value in lower frequency classes and low values in higher frequency indicate high degree of floristic heterogeneity. For convenience, the study area woody species had been classified into four frequency classes (Table 1).

From the above table, the result showed that there was high value in lower frequency classes and low values in higher frequency. Therefore, it indicates that the Ewa District rangeland woody species had heterogeneous species composition and high degree of floristic heterogeneity.

The most frequently grass species that occurred in the rangeland were *Andropogon canaliculatus* having 58.3% frequency of occurrence; followed by *Pennisetum polystachion,* 52.8%; and *Enteropogon* species, 42.7%. For herb species,the most common (frequent) herbaceous species in many sample plots in the study area were *Celosia trigyna* with 55.6% frequency of occurrence followed by, *Parthenium hysterophorus* with

Table 1. Species frequency class of study area woody species.

Parameter	A	B	C	D
Frequency class	31-45	21-30	11-20	1-10
Sp. Frequency(shrub)	2	1	6	14
Sp. Frequency(tree)	2	3	2	8

Table 2. Basal area (BA) value of some woody species.

S/N	Botanical name	Spp. No	Habit	DBH m	BA/ha
1	*Acacia nilotica*	60	T	4.47	0.28
2	*Acacia seyal*	45	T	4.00	0.28
3	*Acacia tortilis*	98	T	9.22	0.91
4	*Balanites aegyptica*	65	T	4.41	0.30
5	*Doberaglabra*	47	T	7.31	0.78
6	*Acacia oerfota*	113.4	SH	1.21	0.05
7	*Grewia feruginea*	104.6	SH	1.71	0.03
8	*Salvadora persica*	67.6	SH	1.17	0.04

52.8% and Trianthema *portulacastrum* having 41.7%.

Basal area (BA) for woody plant species

Basal area is the cross-sectional area of all stems in a stand at breast height (1.3 m above ground level). Basal area is used to explain the crowdedness of a stand of woody plants. A stand of large trees is more stocked with the same number of trees of smaller diameter (Shambel, 2010 and Abeje, 2013).

The total basal area calculated for the study area was about 3.25 m^2/ha for tree plants species > 2.5 cm in DBH and shrub plant species were 0.12 m^2/ha (Tables 2 to 4). It is closer to the figures reported for Yangudi-Rassa national park in Afar, (Semere, 2010) with 3.12 m^2/ha for tree plants. *A. tortilis, Doberaglabra, Balanitesa egyptica, Acacia nilotica* and *Acacia seyal* for tree and *Acacia oerfota*, *Salvadora persica* and *Grewia feruginea* for shrub species were among the high basal area in decreasing order. The normal value of basal area (BA) for virgin tropical rain forest in Africa is 23 - 37 m^2/ha (Dawkins, 1959 cited in Lamprecht, 1989). Although the vegetation of the study area was dominated with desert and semi-desert vegetation, it was different from virgin tropical rain forest and one could expect that the basal area (BA) coverage was the least one.

Importance value index (IVI) of woody plant species

The relative ecological importance of the woody species is expressed by IVI. High IVI is attributed to their high basal area, high relative frequency and high relative density. The greatest IVI reflects the degree of dominancy and abundance of a given species in relation to the other species in the area. It is also used for setting priority/ranking species management and conservation practices and helps to identify their sociological status (structure) in a certain plant community as dominant or rare species (Kent and Coker, 1992). Importance Value Index (IVI) of woody species in the study area was calculated. Important Value Index gives a more realistic figure of dominance from the structure standpoints (Curtis and McIntosh, 1951) and it is also useful to compare the ecological significance of species (Lamprecht, 1989).

The lower value of IVI may be due to either adverse environmental conditions, increased use of woody species by the local people from time to time for their daily income or random distribution of available resources in the Range land (Semere, 2010).

Livestock structure and its effect on the livelihood of pastoralists

Respondent's profile

The average family size in Ewa district was 4.9 persons/household with a range of 2 to 14 persons/household. The respondents ranged from age 18 to 69 years old, where the majority of the respondents age ranged from 41-69 (50%). All respondents were Muslim (100%) in the religion and almost all the respondent were married. The gender distributions of the respondents were 70% male and 30% female. The respondents make 76% of the sampled household inthe

Table 3. IVI value of some woody species.

S/N	Scientific name	Species No.	R. frequency	R. dominancy	R. density	IVI
1	*Acacia tortilis*	98	18.88	11.56	22.63	53.07
2	*Acacia nilotica,*	60	13.60	3.09	13.86	30.54
3	*Doberaglabra*	47	12.72	7.03	10.85	30.60
4	*Balanites aegyptica*	65	11.40	4.08	15.01	30.49
5	*Acacia seyal*	45	10.96	2.79	10.39	24.15
6	*Grewia ferugina***	104.6	17.41	38.36	20.47	76.25
7	*Acacia oerfota***	113.4	14.29	27.29	22.20	63.77
8	*Salvadora persica***	67.6	9.82	31.61	13.23	54.66
9	*Balanites roxburghii*	7	1.75	0.23	1.62	3.60
10	*Acacia asak*	11	1.83	0.41	2.54	4.78
11	*Grewia villosa*	11	3.51	0.62	2.54	6.67
12	*Tamarindus indica*	13	3.07	0.68	3.00	6.75
13	*E. candelabrum*	3	0.44	0.20	0.69	1.34

**=the Important Value Index of the shrub plant.

Table 4. Major livestock feed in the study area.

Major feed resources	Respondents (frequency and percentage)	
	Frequency	Percentage (N=70)
Nature pasture	70	100
Browser plant	70	100
Cropr esidue	42	60
Other	32	45.7

family members had not attained formal education and 14% of household member attained formal education. This represented a serious limitation to the transfer of technology and emphasized the importance of education that might need improvement. The main occupations of the households were identified as accounted to the 71% pastoralist and 29% were agropastoralist respondents. This was indicated that in the pastoral systems, livestock contributes to 50% of gross household income and was also in line with the former findings from the different pastoral areas of Ethiopia (Abule, 2003; Ahmed, 2003; Admasu, 2006; Belaynesh, 2006; Mohammed and Abule, 2015).

Feed resources

The major feed resources in the study district were from the communal grazing land use system. This holds true also for the pastoral production system in the Ethiopian dry land area where communal grazing and browsing plants of the rangelands had been the only technique for livestock production (Table 3). To some extent, crop residues, standing hay (enclosure) and improved cultivated forages (Panicum, Buffle, Cowpea and Lablab) were the other feed resources available for livestock, but they vary in terms of the extent of availability.

In addition, these (Nature pasture and Browser plant) feed sources are used mainly during the critical feed shortage period (Figure 3).

The feed source in the communal grazing area was available to their livestock for about four months, starting from June to September (main rainy season) but there source decline in the remaining month especially in the months of February to May. There was critical feed shortage that means there was no rainfall. Browser tree and shrub were used as sources of feed for their livestock in the study area.

Diversity of herd composition

The major livestock reared by the community arecattle, goats, sheep, camel, and donkey. According to the opinion of the pastoralists in the group discussions, keeping diverse species of livestock was giving them advantage to mitigate the harsh climatic condition, as well as feed and water shortages. The pastoralists also explained that composition and diversity of livestock

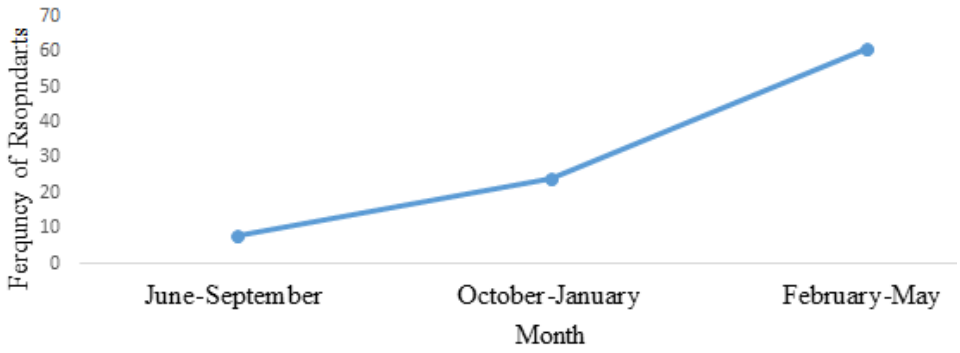

Figure 3. Critical feed shortage period.

primarily depend on the climate and types of feed. The type and quantity of the existing feed (proportion of browse to grass), availability of water and the sensitivity of animals to drought and diseases mostly decide the type of livestock reared in the area. This strategy of maintaining herd diversity has been common practice in most arid and semi-arid areas of East Africa (Ndikumana et al., 2001; Alemayehu et al., 2004; Mohammed and Abule, 2015).

Major constraint o f livestock production

The major constraints for livestock production in the study district were recurrent drought, diseases, shortage of feed, and water shortage. Others such as conflict on rangelands resources and lack of appropriate livestock management/handling system were also mentioned by different pastoral areas in Ethiopia (Beruk, 2003; Alemayehu et al., 2004) (Table 5).

The perceptions of pastoralists' towards vegetation composition versus herd structure

Most of the pastoralists in the study district believed that the rangeland vegetation composition dramatically changed within the past two decades, particularly for the most important perennial grasses. As stated by most of the respondents, the most important perennial grasses of the Ewa rangelands were replaced by less palatable annual grasses and unpalatable woody vegetation. The most important perennial grasses like *Cenchrusciliaris, Cynodon dactylon, Panicum coloratum*, and *Chrysopogon plumolosus* as mentioned were threatened to the level of local extinction. The majority of the respondents in the study districts reported that the vegetation composition has been moved from desirable/more palatable to less desirable and unpalatable plant species of both herbaceous and woody layers (Figure 4).

Due to this major reason, the pastoralist tended to change their livestock herd structure into small ruminant predominantly of female animals, especially goats which is adaptable to their environment and feed (Gemedo, 2004; Lishan, 2007), and also reported similar opinion of pastoralists for Borana and Somali rangelands. Currently, the relative population size of cattle and camel decreased as compared to the past two deceases that could be related with the decline of feed source from time to time, as well as an increased level of rangeland resource degradation and vegetation composition change.

Livestock population structure change and its effect on the livelihood

An interview conducted with the pastoral community indicates that there was considerable livestock population structural change within the past 20 years. They listed out various reasons for the structural change of livestock populations (Figure 5).

Due to change of livestock population (herd structure), the pastoralist livelihood has also changed. Previously, the pastoral community had a lot of livestock especially cattle and camel; yet, currently they have been lost. Therefore, the pastoralist livelihood's is affected due to change in the herd structure, which is dominated by shoats.

The economic return from shoats became much less than that of the cattle and camel products. That is why, the pastoralist started a new mitigation strategy of selling small ruminant animals to compensate the economic return, while previously the pastoralist sale of the live animals were not the common practice. From the pastoralist point of view, the current livestock economic value became dominated by the small ruminants (goats and sheep) because the shoat were adapted to the recurrent drought and their feeding habit is more suitable for the current rangeland condition of the study area (Figure 6).

Table 5. Top three ranked livestock production constraints.

List of problem	No. of respondents	Percentage (%)	Rank
Feed shortage	70	100	1
Disease	70	100	1
Recurrent drought	70	100	1
Shortage of water	31	44	2
Conflict	12	17	3

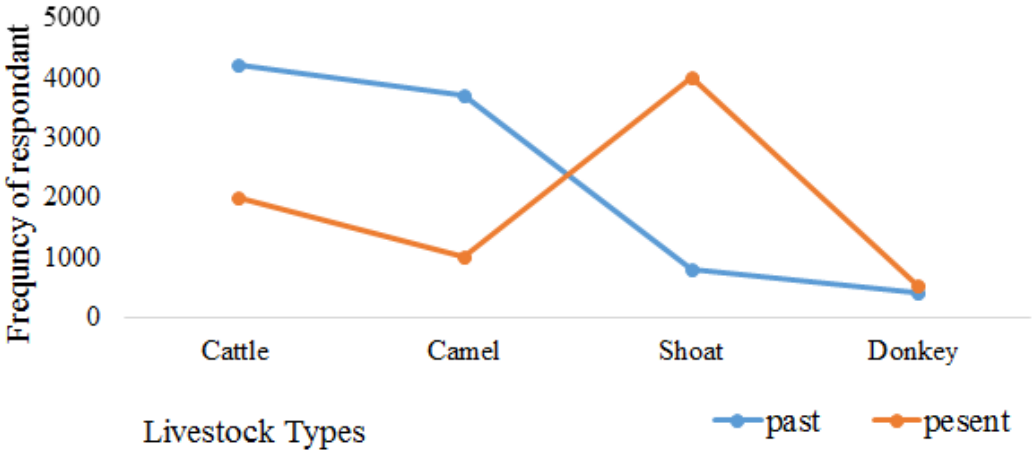

Figure 4. The past and present population trends of livestock.

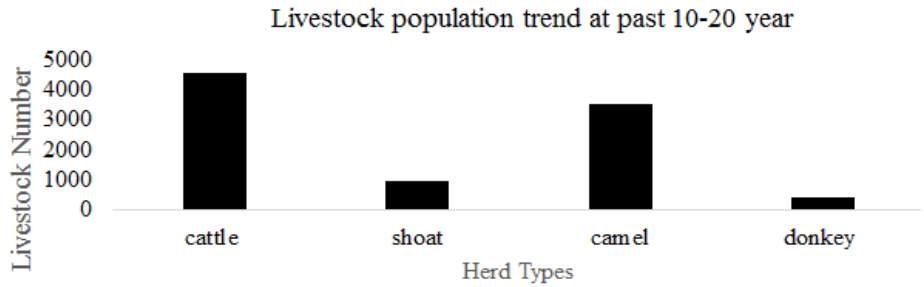

Figure 5. Livestock population trend estimate in past 10-20 years range by the respondent.

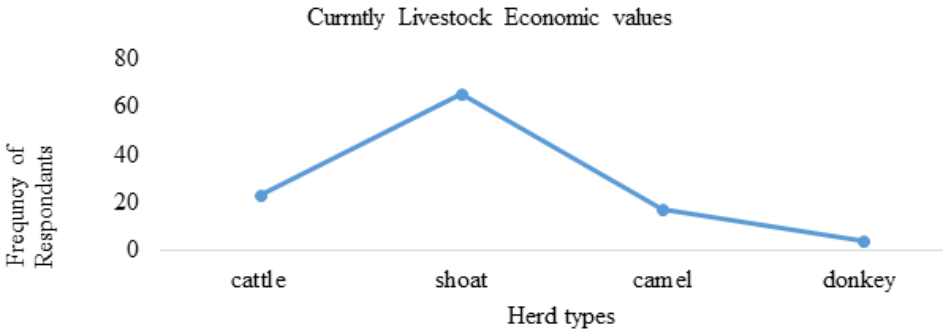

Figure 6. Responses on the currently economic values from the livestock.

DISCUSSION

The result of the vegetation analysis showed that the study area had considerable species richness with the dominant families of Fabaceae and Poaceae that make the area suitable for livestock grazing and browsing. The dominant family was Fabaceae, which contains drought tolerant, deciduous and spiny species that are well adapted to the prevailing drought conditions of the study area (Semere, 2010; Abeje, 2013). The Shannon diversity and evenness indexes of the vegetation species were found relatively low due to different factors like overgrazing, overutilization of woody species by local people for charcoal making, construction, firewood, expansion of invasives pecies (Solomon et al., 2007; Shackleton et al., 2008; Belaynesh, 2006; Markos and Simon, 2015).

The density of woody species(tree and shrub) in the study area has been found to possess scattered tree individuals dominated by grasses, herbs and also shrubs with decreases; with increasing DBH (high density especially shrubs in the lower classes DBH) (Gemedo et al., 2005; Demeke, 2007; Abrha, 2008; Feyera, 2010). From the view point of population structure analysis, most woody species were in poor regeneration status except shrub species. The main causative agent to degradation of rangeland were anthropological activities such as clearing of woody species for construction , charcoal, overgrazing and over browsing by domestic stock especially camel and goat; thus, should be prioritized for conservation plan to promote sustainability of the woody vegetation resources. However, shrub plant species had good regeneration status that means there is expansion of low desirable (unpalatable) shrub plant species (Amaha, 2006; Dinkissa, 2011; Mohammed and Abule, 2015).

The species composition of the vegetation layer of the Ewa rangeland revealed that frequency of annual herbaceous vegetation was greater than perennial vegetation and it was an indication of perennial vegetation species being replaced with annual herbaceous species on the rangeland due to heavily grazing, recurrent drought and encroachment of invasive species these result same as reported by Mohammed (2014). These have been creating conditions for invasive species to spread and dominate the rangeland. The most common herbaceous vegetation in the study area were *P. hysterophorus, Tribulis terrestris Celosiatrigyna, T. portulacastrum, A. canaliculatus, P. polystachion* and Enteropogon species had the highest dominance and frequencies of all herbaceous vegetation. It was also reported in the work of Yvan and Tessema (2005), Solomon et al. (2006) and Mohammed and Abule (2015).

The study areas were invaded by less desirable and undesirable species which indicates the low grazing value and the deteriorating range condition of the study area. Finally the pastoralists tend to change their livestock herd structure into small ruminant (goats and sheep) that require affordable feed resource and browser animal (camel). Due to the change of livestock population (herd structure) which had been affected by the vegetation trend, the pastoralist livelihood has been changed; that means, economically very poor and socially disturbed (Alemayehu et al., 2004; Lishan, 2007).

Generally from this finding, it can be concluded that the range vegetation of the study area was subjected to continuous threat of genetic erosion and extinction due to overgrazing, recurrent drought and rangeland degradation. Vegetation changes overtime clearly affect the level of biodiversity, conservation status and productivity of rangelands as well as livestock production. The frequency and intensity of utilization has significantly influenced the vegetation structure, composition, quality and productivity.

The most important and highly desirable herbaceous species were endangered in most of the grazing areas. Rangeland resource in the study areas were invaded by less desirable and undesirable species which indicates the low grazing value and the deteriorating range condition of the study area. This significantly affects the livestock sustainable productivity in the study areas well as the pastoralist livelihood, which means economically poor and socially disturbed (in the pastoralist community livestock were used as prestige level and highly dependence in social life).

Recommendation

Therefore, conservation of endangered and promising species, especially grass species by making seed collection and multiplication are crucial for future rangeland restoration purposes; also making enclosure is another option to revive the endangered species. Continuous awareness rising through training is to play vital roles so as to enhance the traditional knowledge of the pastoralists and also to know modern rangeland management; thereby improving the livelihood of the community.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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