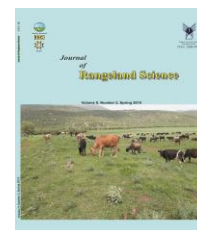


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**Research and Full Length Article:**

## **Causes and Effects of Rangeland Degradation in the Lowland Districts of the Bale Eco-Region, Southeastern Ethiopia**

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**Abstract.** This study was carried out in Bale Eco-Region (BER) which is located in Southeastern Ethiopia with the objective of addressing the cause and effect of ecological damage, particularly rangeland degradation. Both purposive and stratified random sampling approaches were used to select HouseHolds (HH). Individual interview, key informants and Focus Group Discussion (FGD) were the main sources of data for this study. The livelihood activity in BER lowland area was pastoralism before 1965 and it was based on highly productive, vast and free Rangeland with unlimited movement of the pastoralists. In the low land of BER, migration has a destination, pattern and objective to meet. These destinations are sources of mineral, a breeding site, feed and water. Migration is used as strong seasonal disease, water and feed shortage escaping mechanism. However, this is currently changed to Agro-pastoral or some of them to crop production do different disturbances. The change was mainly aggravated by expansion of agricultural investment, high population growth, illegal settlement and cultivation and banning of migration to Forest. Utilization of grazing land is communal and rangeland around homestead and watering points are overgrazed and resulted in bare land and encroached by unpalatable and thorny species. The vegetation cleaning and cultivation of drought prone area under rain-fed regimes have accelerated bare land expansion and unpalatable vegetation encroachment. The overall rangeland condition has deteriorated and the livelihoods were jeopardized. The people get in trouble, then moving from degraded area to protected and moist source forest land in Bale Mountain National Park and now causing serious deforestation.

**Key Words:** Eco-region, Pastoralism, Rangeland, Agro-pastoral, Livelihoods

## Introduction

Livestock population has reached more than 88 million in Ethiopia which is the largest in Africa (MoA, 2010). African Intergovernmental Authority on Development's estimated that pastoralist livestock population makes up 30% of the nation's cattle, 70% of the goats and sheep and all camels in the country (IGAD, 2010). In Ethiopia, despite a strong subsistence orientation, pastoralists provide about 90% of the legal livestock exports in live animals, and 20% of the draught animals for the highlands (Sandford and Habtu, 2000).

Rangelands in Ethiopia occupy about 61% of the national land mass and largely dominate the lowland areas (Coppock, 1994). Of the total land mass of the country, about 12-15% and 12% are pastoral and agro-pastoral, respectively. Bale Eco region comprises 12 districts of Bale and 2 districts of West Arsi zones of the Oromia regional state. According to Bale zone finance and economic development office (BZFEDO, 2001), out of the total area of Bale zone, 63.5% included under lowland and 39.1% is under rangeland. These areas are characterized by arid and semi-arid environments, diversified vegetation types, livestock and wild animal species as well as untapped mineral.

Rangelands in Ethiopia are in danger of becoming seriously degraded owing to natural and human-induced factors (Coppock, 1994; Amaha *et al.*, 2008). In Ethiopia, about 20, 24 and 51% of the rangelands are in good, medium and poor condition classes respectively implying a steady decrease in rangeland production and productivity. As a result, dry matter feed production is between 1.0 and 0.53 tons/ha/annum, with carrying capacity varying from 8 to 15 ha per Tropical livestock Unit (Amaha *et al.*, 2008). Different studies and reports have indicated that rangeland degradation has increasingly become a threat to the pastoral production systems and has

resulted in substantial declines in rangeland condition. Water potential, soil status, and animal performance decline were obviously observed in livestock holding at the household level which in turn leads to food insecurity and widespread poverty to the extent of food aid and the need for alternative livelihood income and diversification. Nowadays, the Bale lowland eco-region is seriously challenged by low livestock productivity which results in declining the number of livestock holding per household, severe livestock death during dry periods, increase of cultivated land, and increase of number of people vulnerable to food insecurity as well as considerably higher reliance on food aid.

However, the detailed causes and effects of the depreciating rangeland condition forcing the pastoralists to change their livelihood activity and putting pressure on conserved Bale eco-region have not been studied yet. Therefore, this study was carried out in Collaboration with Bale zone Pastoral Area Development office to address the cause and effect of ecological damage particularly rangeland degradation currently affecting the whole system in the Bale low land eco-region, southeastern Ethiopia.

## Materials and Methods

### Study area Description

This study was carried out in Bale Eco-Region (BER) located in the Bale administrative zone of the Oromia regional state of Ethiopia some 400km southeast of the national capital Addis Ababa. The Eco-Region lies between 05°22'-08°08'N and 38°41'-40°44'E. Three Low land districts located in Bale eco region: Dalo Mana, Mada Wolabu and Harana Buluk were included in this study. The rainfall pattern in the study area is bimodal March to June which is called "Gana" and September to November called "Hagaya" with erratic distribution. The main production system (livelihood) in the district is pastoral and agro-pastoral. Description of the study area is indicated in Table 1.

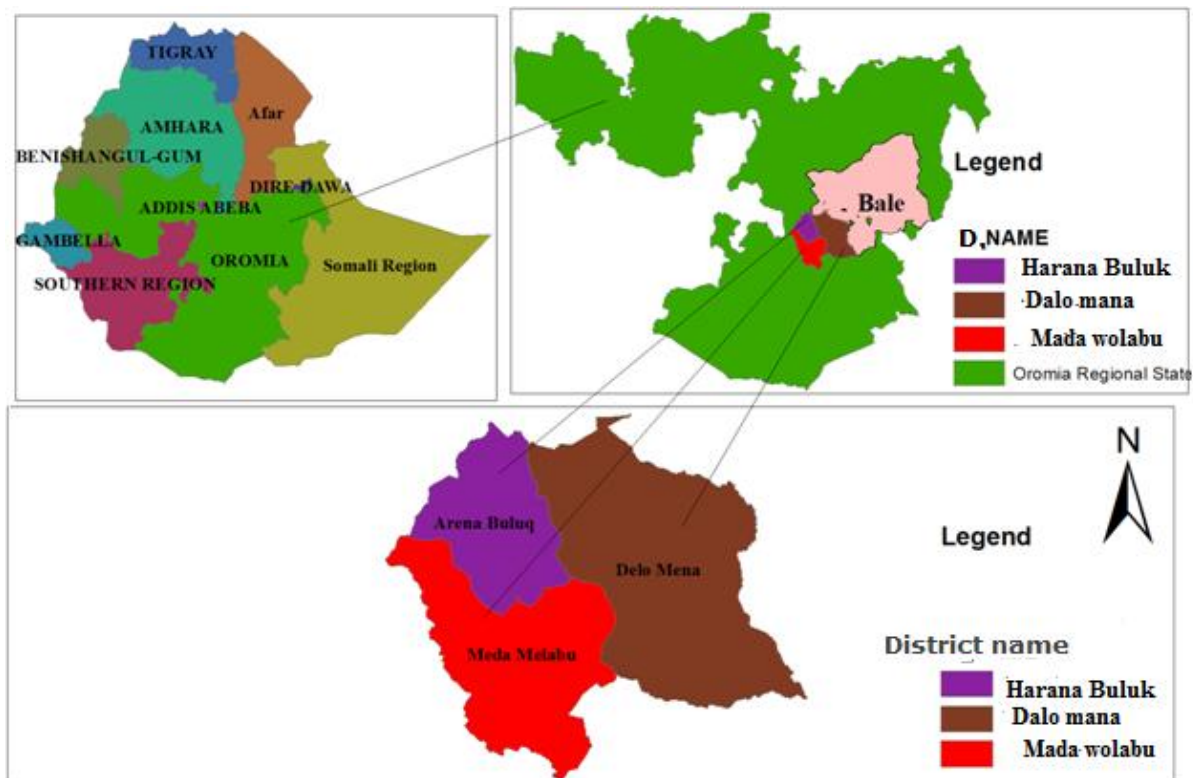
**Table 1.** Descriptions of the study environments

No	District	Population	Altitude (m asl.)	Temperature(°C)		Rainfall (mm)		District area (km <sup>2</sup> )	Forest and woodland (%)	Grazing land (%)	Cultivated land (%)	Arable land (%)	Degraded land (%)	Other (%)
				Min	Max.	Min.	Max							
1.	Dalo mana	114,742	1200-500	21	38	628	775	4,834	43	21	3	7	23	3
2.	Mada Wolabu	122,277	500-500	20	40	400	800	8,871	38	15	3.24	3.12	36.23	4.41
3.	Harana Buluk	102,872	1500-3000	13	23	900	1,000	1,934	64	12	5	1.5	15.45	2.05

	Cattle	Goats	Sheep	Camels	Donkeys	Horses	Mules
1. Dalo mana	322,626	90,902	14,912	44,672	13,994	1,275	2,511
2. Mada Wolabu	213,962	233,020	11,901	19,446	7,873	1,541	4,775
3. Harana Buluk	156,975	47,135	7,782	750	8,706	5,753	5,277

Source: BZFEO, (2000) and BZPADO, (2016)



**Fig. 1.** Map of the study area

**Data collection**

The study was based on primary and secondary data. Primary data related to the socio-economic characteristics of the pastoralists such as educational level, land size, livestock owned, and livelihood activities were collected using semi-structured questionnaires. The data on causes and effects of range degradation, perception of communities on rangeland

condition trend and overall livelihood activity were collected using Focus Group Discussion (FGD) and key informants, respectively. Secondary data about livestock development activities and information on rangeland management and utilization were collected from concerned organizations. The status of rangeland condition was judged using field observation focused on major grazing

areas and types of grazing using easily understandable methods like resource mapping and constraint listing by the local dweller.

### Sampling Method

In this study, both purposive and stratified random sampling approaches were used to identify study subjects and collect primary data. In the first stage, out of nine Lowland districts (Woredas) found in the Lowland of Bale eco region, three districts (Mada Wolabu, Harana Buluk and Dalo Mana) were purposively selected. The main criteria used to select the three Districts were livelihood activity (pastoral and Agro. Pastoral), proximity to Bale highland forest, representativeness of the Districts to major land use/land cover types, land management practices, trends in land use and land management interventions, and natural resources use interdependence and inter-links, environmental degradations and local livelihoods.

In the second stage, the sample size of the study in each livelihood activity (keeping the three Districts selected) was determined by adopting Green (1991) rule of thumb sampling approach as:  $N \geq 50 + 8m$

Where: N=the sample size of the study from each Livelihood activity and  
M=the number of key research variables of the study for the livelihood activity ( $X_i$ ),  $m=1, 2...n$ . The sample size from the Agro-Pastoral area where a total of 3(three) key variables were assessed for the three research

topics covered were determined as:

$$N \geq 50 + 8m; N \geq 50 + 8(3), N = 148 \text{ HHs}$$

In the third stage, 2 representative Kebeles (A *kebele* is the smallest administrative unit of Ethiopia, similar to a ward, a neighborhood or a localized and delimited group of people) (one for each livelihood activity) from each Woreda, accounting to a total of 6 Kebeles from the 3 Districts were purposively selected by adopting the criteria used to select the study Districts above. The aim was to distribute the sample size determined for each livelihood activity to the respective Districts selected in the livelihood activity and cascade the sample size determined to the 6 Kebeles selected. The Probability Proportional sample size distribution technique was used to allocate the sample size determined for each agro-ecology to the respective Districts and Kebeles proportional to the total HHs size of each District and Kebele (Village Association) selected, respectively (Table 2).

In the fourth stage, stratified-random sampling technique was used to select sample HHs in each Kebele proportional to the sample size determined for each Kebele above. The listing of the total number of the HHs in each Kebele was carried out with the help of Kebele administrators and local experts. Finally, random selection of sample HHs from each respondent category was carried out in each Kebele through random lottery method and data collection and field assessment was carried out at household farm level through applying various data collection methods and tools.

**Table 2.** Summary of studied Kebeles and sampled households by Livelihood activity

No	Livelihood Activity	Study Woreda	Sample Kebeles	No of sample households		Total
				Male	Female	
1	Pastoral	Dalo Mana	Barak	18	1	19
		Haran Buluk	Melka Arba	21	4	25
		Mada Wolabu	Hora kore	28	2	30
		Sub-total		67	7	74
2	Agro. Pastoral	Dalo Mana	Haya Oda	22	3	25
		Harana Buluk	Shawe	24	0	24
		Mada Wolabu	Karjul	23	2	25
		Sub-total		69	5	74
Over all sample size				136	12	148

Household (HH) survey, Key Informants Interview (KII) and Focus Group Discussions (FGD)

Survey of a total of 148 agro-pastoral HH units was carried out to collect primary data in the 6 studied Kebeles. To that effect, a semi-structured questionnaire was prepared for all the research topics separately and translated into Afan Oromo (local language). The questionnaire was first tested in one Kebeles during the scouting survey, modified and administered to the sampled respondents.

In-depth interview with key informants from Bale zone and District pastoral

community area development offices and livestock and fisher resource development office, local elders, administrators and experts carried out to supplement and enrich the data collected from the HH survey. The representative individuals of different government organizations, experts and local elders (24 males and 1 female) were also interviewed on issues of cause and effects of rangeland degradation of BER (Table 3).

**Table 3.** List of stakeholder participants on the study

S/N	Kebele/Organization	Informants		
		Male	Female	Total
1.	Districts & Kebele administrations	6	1	7
	District Land resource management office experts	3	0	3
2.	District Investment offices	2	0	2
3.	Local Elders in three Districts & Kebele administrations	7	0	7
4.	District Range land development experts	3	0	3
5.	Rang land experts	3	0	3
6.	Total	24	1	25

In this study, Focus Group Discussion (FGD) was particularly important to bring together pastoralists and other individuals to debate mainly on cause of rangeland degradation and its effects on all

ecosystems in the area. In each studied districts, 2 FGDs were conducted with selected participants from the community (Table 4 and Fig. 2).

**Table 4.** Pastoral and Agro-pastoral FGD Participants

No	Livelihood Activity	Study	Sample	No of sample households		Total
		Woreda	Kebeles	Male	Female	
1	Pastoral	Dalo Mana	Barak	12	3	15
		Haran Buluk	Melka Arba	14	2	16
		Mada Wolabu	Hora kore	15	3	18
		Sub-total		41	8	49
2	Agro. Pastoral	Dalo Mana	Haya Oda	16	2	18
		Haran Buluk	Shawe	17	2	19
		Mada Wolabu	Karjul	12	4	16
		Sub-total		45	8	53
Over all sample size				86	16	102

As much as possible efforts were made to form homogenous groups for each FGD. Females’ representation in the FGDs was

low because it was hardly possible to balance the number of males and females house hold heads



Shawe



Barak



Hora kore



Karjul

**Fig. 2.** Photos during FGD in selected village association (VA)

**Data analysis**

Descriptive statistics were used to analyze data collected using Statistical Package Software for Social Science (SPSS) Computer software program. Data collected from FGD and key informants were summarized using prioritization matrix and response percent of the participants.

**Results and Discussion**

**Household Characteristics**

Household characteristics of the respondents in the study area are presented in Table 5. There was no

significant difference ( $P>0.05$ ) with respect to sex, educational status and age of the respondents across the study area. Out of the total households involved in the study, 8.1% were headed by females. Concerning educational status, more than 60.8% of the respondents had completed primary education while about 32.4% were illiterate. More than 46.0% of the respondents were aged greater than 40 years while 17 to 25 year aged participants were less than 4.1%. Out of the total participants, 70.3% of them are using both livestock and Crop production as income source.

**Table 5.** Household characteristics of the respondents in the study area

Sources of variation		Districts of the study								P-Value
		Mada wolabu		Dalo mana		Harana Buluk		Total		
		N	N %	N	N %	N	N %	N	N %	
Production system	Pastoral	25	48.1%	15	35.7%	26	48.1%	66	44.6%	>0.392ns
	Agro. Pastoral	27	51.9%	27	64.3%	28	51.9%	82	55.4%	
Household head age	17-25	2	3.8%	3	7.1%	1	1.9%	6	4.1%	>0.113ns
	25-31	8	15.4%	11	26.2%	8	14.8%	27	18.2%	
	32-40	21	40.4%	15	35.7%	11	20.4%	47	31.8%	
	41-48	11	21.2%	7	16.7%	16	29.6%	34	23.0%	
	49-56	4	7.7%	0	0.0%	6	11.1%	10	6.8%	
	>56	6	11.5%	6	14.3%	12	22.2%	24	16.2%	
Participant sex	Male	49	94.2%	38	90.5%	49	90.7%	136	91.9%	>0.744ns
	Female	3	5.8%	4	9.5%	5	9.3%	12	8.1%	
Educational Status	Illiterate	18	34.6%	12	28.6%	18	33.3%	48	32.4%	>0.814ns
	Primary	31	59.6%	27	64.3%	32	59.3%	90	60.8%	
	Secondary	2	3.8%	3	7.1%	2	3.7%	7	4.7%	
	College	0	0.0%	0	0.0%	0	0.0%	0	0.0%	
	Religious	1	1.9%	0	0.0%	2	3.7%	3	2.0%	
Income sources of household	crop production	8	15.4%	7	16.7%	5	9.3%	20	13.5%	<0.017**
	Livestock production	15	28.8%	5	11.9%	3	5.6%	23	15.5%	
	Both	29	55.8%	30	71.4%	45	83.3%	104	70.3%	
	Others	0	0.0%	0	0.0%	1	1.9%	1	0.7%	
Total		52	100.0%	42	100.0%	54	100.0%	148	100.0%	

\*\* Frequency variation is significant at 1% probability level, Source: The field survey

**Causes of ecological change and Trends of livelihood Responses of households on Causes of Ecological Change**

Ecological disturbance is one of the strongest challenges that have been scientists and all human beings are currently worried about. In this study, participants

were highly concerned about ecological degradation around their area. Based on their experience and their current personal observation of population growth 26%, climate change 50% and land use policy 24% were listed as first causes of range land degradation in the area (Fig. 3).

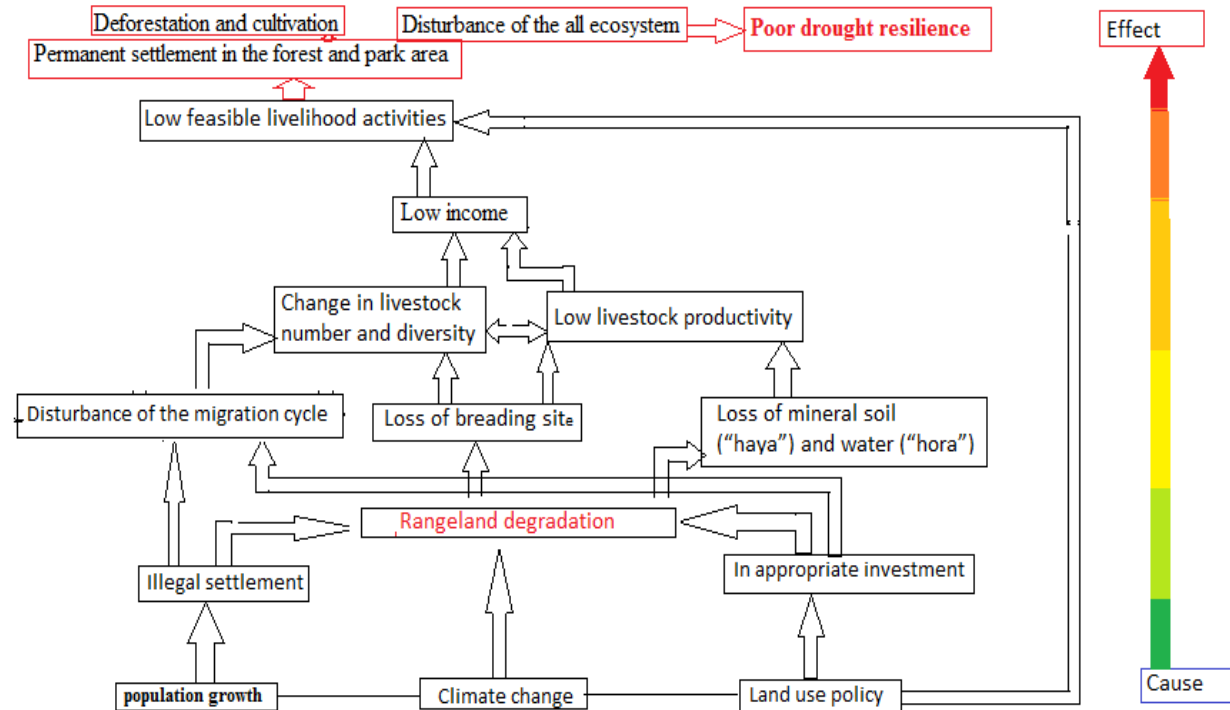


Fig. 3. Responses of households on Cause and effects of range land degradation in BER

Population growth described as illegal settlement and internal growth is regarded as one of the main contributors of the rangeland degradation in the area. This illegal settlement was highly related to migrants from highland area and other settlers from near border Somali region. Related to climate change, 52% of the respondents were related the issue to God. Their personal observation was obvious on the decrease and change in rain pattern. In addition, increase of average temperature and range of its fluctuation was highly bolded by the participants.

The idea on inappropriate Agricultural investments was supported by 100%

respondents as the main cause of ecological damage disturbing the eco-system. Participants related this to pushing of the pastoralists by government to produce food crops and expansion of the irrelevant agricultural investments in potential rangeland areas like Barak Rangeland.

The aggregate effects of the main causes of the rangeland degradation were disturbance of the migration cycle, loss of breeding site and loss of mineral sources for animals. This forced a change in livestock number, diversity and low productivity. This highly limited household income which forced them to participate on low feasible



livelihood activities such as crop production in drought prone area.

The households unable to tolerate this problem forced to migrate to unsusceptible areas like protected forest and national park areas like Harena forest and Bale mountain national park. This finally disturbed the roof of the ecosystem through deforestation and cultivation of food crop. In this regard, the current overall ecosystem disturbance was through challenges and the household in the area exposed to poor drought resiliency.

### Trends of livelihood activity in the study area

Agro pastoralist has lost its share of livestock income due to many factors

affecting livestock production. This loss has been exacerbated by the reluctance of state entities to acknowledge and respect pastoralists' rights to land and disregard to pastoralism. Pastoralists also mentioned that banning of migration to forest during dry season and expansion of crop production investments in the area particularly in Berak Kebele of Dalo mana have highly disturbed pastoralism activity carried out in the area.

In this study, the number of livestock per HH has decreased dramatically in the recent four decades (Fig. 4). The respondents have tried to relate this issue with climate change, high human population and conflict over conversion of rangeland to cropland and inequitable investment expenditure.

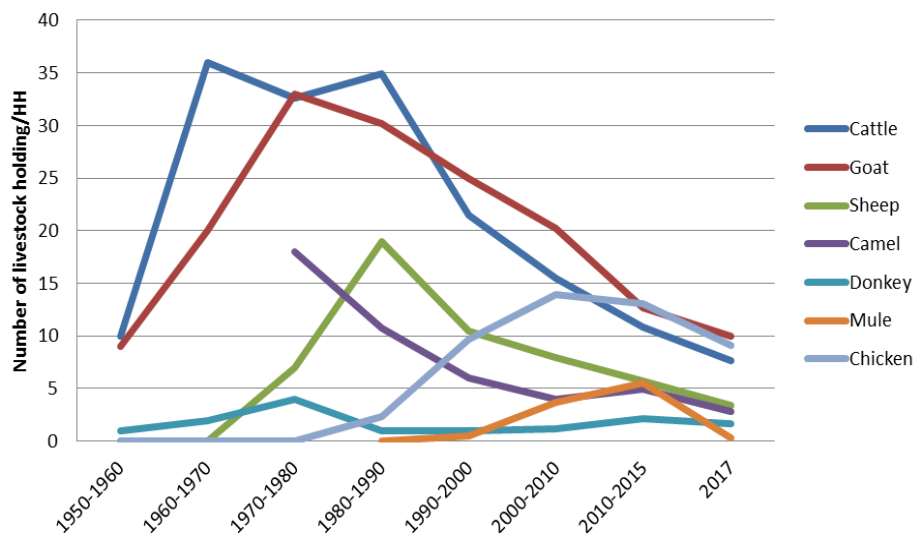


Fig. 4. Responses of the participants on Trend of livestock holding per household

The participants of FGD mainly stressed that the change in productivity and the number of livestock were mainly aggravated by occupying vast area of rangeland by investors and smallholders. In Bale Eco-Region pastoralism, migration movement had been following grass and water availability cycle in the year. To keep moving the normal activity of pastoralism, this full cycle has to be maintained without interference of any livelihood activity affecting it. In this study, all respondents

have indicated that vast rangeland areas like Barak and Forest areas like Harana forest play a crucial role in reproduction and productivity of livestock particularly cattle.

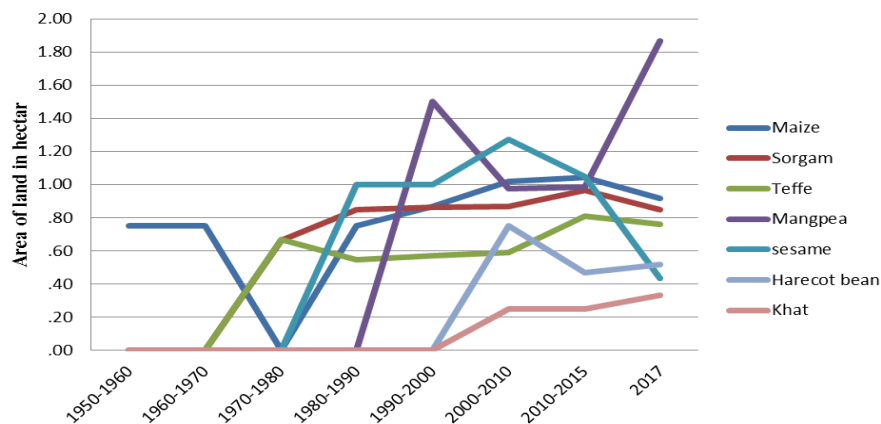
In the low land eco-region of Bale Eco-Region, migration has a pattern, Destination and objectives. Barak Rangeland and Harana Forest are the main migration sites targeted during different seasons. During wet season (April to June), pastoralists in this area migrate to Barak Rangeland from more than twelve districts surrounding Dalo mana

Districts. It is a place where livestock get Mineral water “Hora”, mineral soil “Haya” and mineral soil dissolved in water “Duba”. In addition, it is the most important cattle breeding site and the place to share bull with good production traits.

After wet season was passed, Barak is highly affected by highly feed and water shortage and serious livestock disease. To escape this, pastoralists migrate to Harana forest which is another breeding place for none pregnant cows and calving place for those conceived last year at Barak during wet time (July to September). In addition, Harana forest is also endowed by mineral water springs and “Hora” contributes a lot to cattle production and reproduction improvement. After end of the dry season in the forest, the pastoralists must leave the forest immediately and go to Barak Rangeland again to escape the season of Tsetse fly bite and different disease outbreaks. This season (October to November) has short rainfall and limited feed in the area. After staying for a maximum of two months, migration will be made back to Harana Forest and stay for at most three months (December to February) and must leave the forest immediately to escape disease outbreak. To finish full migration cycle throughout the year, Pastoralists stay at least for one month

(March) in a place between Harana forest and Barak rangeland and move back again to Barak Range land.

In Bale Eco-Region, this important cycle of migration that has strong contribution to livestock production and livelihood of the community has disturbed by expansion of cultivated land, agricultural investments and banning of forest migration. The present results are in line with previous studies such as Abate *et al.* (2011) and Mohammed *et al.* (2017) and demographic expansion and consequent agricultural expansion are the major driving forces of land use cover changes. This caused serious loss of livestock and forced pastoralists to partially shift their livelihood activity to crop production. In response to this in recent years, sesame (*Azadirachta indica*) has been one of the most important cash crops in Bale Eco-Region. However, all participants have indicated that the yield from this crop was severely affected by disease and short rain period and currently replaced by another cash crop Mung bean (*Vigna radiata L*). The response of the participants indicated that the area of cultivated land for other crops production is slightly decreasing except some highly demanded cash crops such as Mung bean, Haricot bean and Khat (*Catha edulis*)(Fig. 5).



**Fig. 5.** Responses of the participants on Trends of average of land used to produce different crops/ha in Bale low land eco-region

**Constraints to livestock production**

Based on the result of the group discussions and responses of the sampled individual households, inadequate quantity and quality

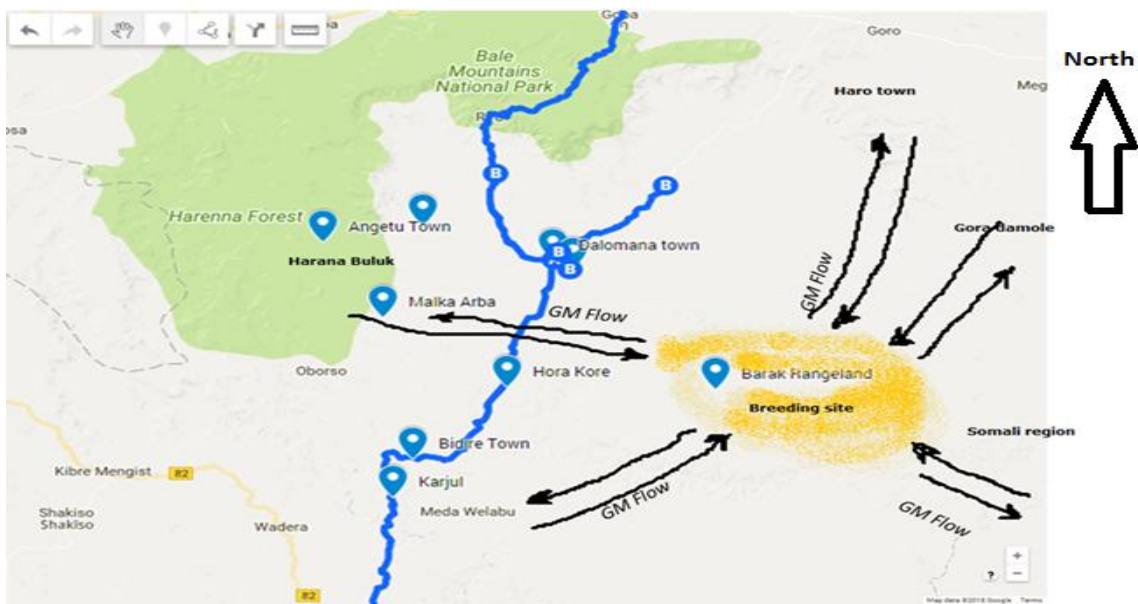
of feed resources are ranked as the primary constraints to livestock production followed by livestock health, shortage of water and poor livestock breed (Table 6).

**Table 6.** Major constraints of livestock production ranked by pastoralists and agro-pastoralists

Constraints	Number of respondents		Rank
	N	N%	
Feed	98	66.22	1
Disease	20	13.51	2
Water	10	6.76	3
Breed	8	5.41	4
Market	6	4.05	5
Theft	4	2.70	6
Conflicts	2	1.35	7

Low productivity of grazing land due to recurrent drought, bush encroachment and expansion of cultivation are the main reasons for inadequate availability of feed resource in the study area. The incidence of disease and parasites and poor genetic potential of the indigenous cattle are also among the major constraint that contributes to the low production and productivity. It is clear that Barak Rangeland was the main breeding site for their livestock particularly

for their cattle. In this case, since the site was visited by thousands of cattle from other districts surrounding this rangeland and from nearby districts of Somali regional state, the flow of genetic material created a good opportunity for breed improvement. Currently, the previous pastoralists practice and opportunity to select good breeding animal was halted to decrease the number of cattle and their diversity coming to that traditional breeding ground. (Fig.6)



**Fig. 6.** Flow of livestock Genetic Material (GM) related to seasonal migration in rangelands of lowland BER districts

In addition to livestock breeding improvement, the most important contribution of seasonal migration (Godansa) to rangeland improvement was addition of the organic matter through their feces, remained litter and soil structure improvement through animal trampling. Currently, the number of livestock coming to this area was limited due to agricultural investment and sedentarization and inflow of farmers from other areas.

**Feed resources and feeding practices**

Crop residue is the major feed resource in Haya Oda “kebele” of “Dalo mana” districts whereas grazing of natural pasture was the main form of feed utilization at the rest kebeles where the study was conducted. At Karjul VA of Mada wolabu district, 69.2% of the respondents indicated that crop residue was the major feed resource followed by grazing land. Crop residues such as stalk of maize, sorghum and teff straw were mainly during the dry season. Utilization of grazing lands is mostly communal and it is continuous throughout the year. Communal pasture land around homestead and watering point is usually overgrazed and resulted in bare land and mostly dominated by unpalatable species. Hence, they usually move their animals far from homestead. In some areas of the selected districts, pasturelands are reserved for grazing of draught animals where

cultivation is a primary means of livelihood. These lands are protected from animals during the wet season mainly from July to November to allow rejuvenation of the existing grass cover and are opened for grazing at the end of rainy season. In areas where more of the land was covered with woody vegetation, trees and shrubs are important sources of livestock feed throughout the year.

Agro-pastoralists in area of Dalomena districts also utilize weeds from crop field for feeding of lactating and draught oxen. During the dry period, standing hay is also used as an important feed resources. All the households responded that there was a critical feed shortage during the dry seasons. To cope with feed shortages, migration and use of feed sources like browse trees, enclosures and crop residue are used as alternative. In Dalomana town, 15-20kg of teff (*Eragrostis tef*) straw is sold 30-45 birr (1.1-1.67 USD) and a bell of straw 24kg is sold 55-60 birr (2.02-2.2 USD). Agro-industrial by-products were not adequately available and known in the area.

On the other hand, forage crops were not widely cultivated because of scarcity of forage seeds, lack of knowledge of production and feeding techniques and poor extension services in the area. Only 2.1% of the respondents at Shawe kebele of Harana Buluk are producing improved forage crops mainly Elephant grass.

**Table 7.** Responses of Major feed resources used by pastoralists and agro-pastoralist

Parameters	Percent Respondent		
	Meda wolabu	Delomena	Harana Buluk
Crop residues	69.2	18.3	19.3
Grazing land	13.3	55	57.8
Haymaking	2.2	0	2.2
Stubble grazing	6.4	16	12.4
Fodder trees (indigenous)	4.4	11.1	8.2
Cultivated forage crops	0	0	2.1

Feeding systems in the study area were based on the purpose of livestock rearing. In

most cases, animals of different species irrespective of their age and sex are allowed

to graze together. However, lactating animal especially cattle receive special attention. Cattle in the Village association (VA) like Barak, Malkarb a and Kerjul are spending extra time and energy looking for drinking water especially during the dry season when there is no surface water.

Pastoralists and Agro-pastoralists in the studied district previously supplemented livestock with mineral soil called locally 'Haya' and Mineral soil dissolved in water called "Duba". *Haya* a black or gray colored soil is usually fed during the wet season for all classes of livestock, particularly for cattle. This activity is currently limited due to more of these mineral soil places controlled by private individuals. The most serious problem currently increasing in the area is the heavy influx of settlers in almost every area previously considered as communal grazing land in both pastoral and Agro pastoral areas. Mineral water locally called "Hora" is the most important livestock mineral supplement previously used in the area. Though the potential of minerals on livestock productivity is indisputable nowadays' pastoralists are limited supplying their animal. A number of "hora" (mineral springs) are located in the forest where the movement of pastoralists are partially banned or the area is controlled by local individuals. Many different scientific articles have explained that minerals are important for good production and reproductive performance as deficiency limits all performances. Proper herd management should be designed to optimize the production of the highest quality product while minimizing any adverse effects on the health and welfare of the animals. Adequate and balance of major and minor trace mineral play important roles in health as well as reproductive efficiency.

## Trends of Government policy and their effects on Range land Degradation

**Table 8.** Major policy issues, events and their effects on rangeland in low land Bale eco-region

No.	Year/ regime	Main events on rangeland and pastoralism	Effects on rangeland and local community	Response to the effects by community, NGO's and gov't
1	Haile Selassie 1928-1974	<ul style="list-style-type: none"> <li>• Vast area of land Locally called “Gofare” was used for grazing</li> <li>• Free grazing and pastoralism was implemented</li> <li>• Ample amount of river and shallow hole water (“Eela”) source were available</li> <li>• Burning of rangeland was not restricted</li> <li>• Number of livestock owned per HH was very high as compared to current</li> <li>• Bale mountain National park was established</li> </ul>	<ul style="list-style-type: none"> <li>• Any pastoralist how want to utilize the grazing land can use it by only paying a few payment called “Gofare” payment</li> <li>• Rangeland was well managed</li> </ul>	<ul style="list-style-type: none"> <li>• Development and food aid programs like to day was not common</li> </ul>
2	Provisional Military Administrative Council (PMAC) “Derg” 1974-1991	<ul style="list-style-type: none"> <li>• Villagezation was launched</li> <li>• Vast area of grazing land used by herders during dry season in mid and high altitude area was controlled by crop producers and state farmer</li> <li>• Few small Scale irrigation was established</li> </ul>	<ul style="list-style-type: none"> <li>• The place where to migrate during dry season was lost/limited and conflict was frequent</li> <li>• High number of herders evacuated from mid and highland area for state farm establishment was migrated to lowland areas and introduced different crop cultivation activities in low land area</li> <li>• Over utilization of Biodiversity was started</li> </ul>	<ul style="list-style-type: none"> <li>• Few small Scale irrigation was established</li> </ul>
3	EPRDF 1991 to present	<ul style="list-style-type: none"> <li>• High issues of conflicts on watering point and grazing land was emerged</li> <li>• Little care for natural resource were come out particularly on communal grazing land</li> <li>• crop producing investors and privet farmers</li> <li>• None feasible Agricultural investment has taken a large area of rangeland</li> </ul>	<ul style="list-style-type: none"> <li>• Fencing locally called “Kalo” for grazing and crop land was started</li> <li>• The previous communal range land was shared by local pastoralists and the remained fragile land was seriously degraded</li> <li>• Migration and free grazing was halted and conflicts was increased</li> <li>• Drought resilience of the community was seriously affected and high food aid dependency was developed</li> <li>• Serous pesticide application was started and bee keeping activity was highly decreased</li> <li>• A large area of potential grazing land covered by woody plants savanna was cleared for crop production and this was disturbed normal migration cycle in the area</li> </ul>	<ul style="list-style-type: none"> <li>• A number of Food aid delivering activities by government and NGOS was started</li> <li>• Water shade development programs such as work for food was started</li> </ul>

## Perceptions of Pastoralists and Agro pastoralists on Rangeland Degradation indicators and the current status of low land BER

Pastoral communities' indigenous ecological knowledge and its outcomes can make an important contribution to the development of local policies.

Comparison and ranking of the rangeland degradation indices from pastoral and agro-pastoral points view are crucial. Pastoralists and herders often have different perceptions on the rangelands degradation problems compared to the scholars and the experts (Reed and Dougill, 2002).

**Table 9.** Perception of the participants on indicators of range land degradation

No.	Criteria	Indices	Perception of the participants (5-point Likert scale)		
			Pastoral N=74	Agro pastoral N=74	Combined N=148
1.	Vegetation	Reduction of plant production	3.00	3.05	3.0
		Loss of biodiversity	4.00	3.72	3.9
		Loss of palatable plants	2.99	2.83	2.9
		Increasing the number of non-palatable and poisonous plants	3.76	3.53	3.6
		Reduction of shrubs and perennials	3.47	3.29	3.4
		Reduction of annual plants and forbs	2.33	2.4	2.4
		Reduction of vegetation cover	2.33	4.23	3.3
		Increasing of plants intervals	3.33	3.42	3.4
2.	Soil	Loss of litter	3.23	3.25	3.2
		Soil salination	2.21	2.95	2.6
		Reduction of soil infiltration	2.68	3.42	3.1
		Increase of bare soil	3.13	2.76	2.9
		Clayey soil	3.06	3.14	3.1
		Loss of soil darkness	3.78	3.22	3.5
		The sandiness of the soil	1.2	1.2	1.2
		Reduction of rain fall	2.68	3.46	3.1
3.	Climate	High and low temperatures	3.14	3.62	3.4
		Reduction of water resources	3.67	5.00	4.3
		Increase of water resources spacing	4.50	5.26	4.9
3.	Others	Increased risk of wildfires	2.30	2.12	2.2
		Increased risk of pest damage (such as rats and grasshoppers)	1.25	1.35	1.3
		Overall average	2.82	3.06	2.9

Variation in perception between experts and rangeland users leads to restrictions on the successful implementation of range management plans.

Due to a long history and experience, pastoralists have a comprehensive and accurate body of knowledge about their own pastoral systems and rangelands condition. Therefore, it is recommended that sustainable range management systems are based on a combination of indigenous ecological knowledge of local Communities and scientific knowledge to prevent degradation of rangelands (Khwarae, 2006). In this regard, pastoralists and herders have better and unique knowledge on the trends of their range land. Based on the pastoralists'

indigenous knowledge of rangeland degradation estimation (5-point Likert scale), it is possible to estimate and talk about the range land degradation trend and their effort made to improve it so far (Table 9). In this study, the rangeland users were highly considered "Loss of biodiversity", "reducing production plants" and "reducing of water resource potential" as the first priorities for assessing rangeland degradation. Study by Ahmad *et al.* (2012) confirmed that the rangeland degradation indicators vary from region to region, but reduction of plants production is one of the main symptoms of rangeland degradation. Using these main symptoms as indicators, 93% of the respondents have

indicated that their rangeland is under severe risk in both pastoral and agro-pastoral areas.

### **Conclusion and Recommendation**

Before three decades, the livelihood activities of the local communities in this area were totally pastoralism and the potential of this ecosystem was tremendous with high biodiversity, good water resources and sufficient grassland for browsing. In addition to livestock production, only few activities like bee keeping and maize cultivation for family consumption have been practiced. During that time, the community was stable and income from Pastoralism activity was sufficient for family need in the area despite the unexpected conflicts between government and between clan that frequently occurred in the area.

However, the recent deforestation, expansion of cultivated land and settlement, conflict (on water, grazing land and border dispute) and administration change brought a lot of negative changes in the area. Herding patterns were seriously affected by expansion of crop production, high human population growth and establishment of the Bale Mountains National Park. Due to these factors, different destinations with high sources of mineral water and soil, grazing area for different seasons and good breeding niche for livestock were lost. In addition, this pressure also hindered pastoralists migration.

The ecosystem of pastoralists in the area was disturbed and pastoralism was replaced by drought susceptible crop farming. This caused severe livestock losses due to shortages of feed, water, licking mineral and disturbed animal breeding niche. The overall disturbance of ecosystem was highly influenced livelihood of the dwellers and poor drought resilience in the area has exposed residents to the need for frequent food aid.

Therefore, to limit the current crises of BER in particular and southeastern Ethiopia in general, the following points have to be considered by community and all stakeholders:

The feasibility of investment activities planned in low land area has to be seriously studied in relation to social and environmental importance.

In low land of BER, the influx of settlers and illegal settlement and agricultural land expansion is the main bottle neck to range land rehabilitation. There must be a clear policy of land uses and livestock development.

The current running soil and water conservation activities by the government lacks coordination or involvement of stakeholders, skilled human power and integration of biological materials in the developed conservation structure.

Migration is a purposive movement which supports pastoralists to fulfill the requirement of their livestock through the year. In numerous kebeles of BER, currently migration of pastoralists is hindered by influx of settlers, expansion of crop land, expansion of private occupation "kalo". A number of Mineral water and Mineral soil places are now controlled by private individuals and National parks. This has hindered the activity of mineral supplementation of pastoralists for their animal. Lack of micro minerals in animals feed affects the production and reproduction activity of livestock through many directions. To fill this gap, the exact minerals that pastoralists utilizing have to be identified and the way to supply these minerals has to be devised.

During this study, the elders have indicated that a number of indigenous spp of grasses, forage trees, shrubs and herbaceous legumes have endangered. To sustain the existence of this material and further conduct study for further utilization, the collection of the material has to be held and tested on experiment site.



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## علل و اثرات تجزیه مراتع در مناطق فقیرنشین منطقه اکو بالی، جنوب شرقی اتیوپی

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چکیده. این مطالعه در منطقه اقتصادی باله در جنوب شرقی اتیوپی انجام شد. هدف آن شناسایی علت و معلول آسیب‌های زیست محیطی، خصوصاً تخریب مراتع است. برای انتخاب خانوارها از روش‌های نمونه‌گیری تصادفی هدفمند و طبقه‌بندی شده استفاده شد. مصاحبه فردی، خبرنگاران کلیدی و بحث گروه‌تمرکز منابع اصلی داده‌ها برای این مطالعه بودند. فعالیت امرار معاش در منطقه دشتی BER قبل از سال ۱۹۶۵ چوپانی بود و بر اساس مراتع حاصلخیز، وسیع و آزاد، حرکت گله در آن نامحدود بود. در زمین‌های پایین BER مهاجرت دارای الگو، مقصد و هدف خاصی است. این مقاصد منبع مواد معدنی، محل پرورش و آب و غذا است. مهاجرت به عنوان یک مکانیسم رهایی هنگام شیوع بیماری فصلی، و کمبود آب و غذا استفاده می‌شود. با این حال، در حال حاضر منطقه به کشاورزی یا تولید برخی از محصولات کشاورزی تغییر کرده که باعث اختلالات مختلفی شده است. این تغییر به طور عمده توسط گسترش سرمایه‌گذاری کشاورزی، رشد جمعیت بالا، سکونت و کشت غیرقانونی و ممنوعیت مهاجرت به جنگل تشدید شده است. بهره‌برداری و چرای بیش از حد از چراگاه‌های اشتراکی و مراتع اطراف زمین‌های رعیتی و نقاط بهره‌برداری آب منجر به زمین لخت و تجاوز گونه‌های ناپسند و خاردار شده است. برداشت و کشت گیاهان در مناطق مستعد خشک‌سالی تحت رژیم‌های رطوبتی، گسترش زمین‌های لخت و نابودی پوشش گیاهی را افزایش داده است. شرایط کلی مرتع رو به وخامت گذاشته و معیشت افراد به خطر افتاده است. در این حالت مردم در معرض دشواری قرار می‌گیرند و سپس از منطقه تخریب شده به زمین‌های حفاظت شده و مرطوب زمین جنگلی در پارک ملی کوه بیل حرکت می‌کنند و در حال حاضر باعث جنگل‌زدایی جدی می‌شوند.

کلمات کلیدی: اقتصاد منطقه ای، چوپانی، مرتع، کشاورزی-دامداری، معیشت