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Factors Influencing Indigenous Knowledge of Rangeland Management Practices in Borana Pastoral Areas, Southern Ethiopia

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Abstract

In most pastoral areas of Ethiopia, rangelands have traditionally been managed by customary institutions, especially in Borana but with the start of various pressures, this management system is increasingly undermined and the interventions ended up with little success story but more of in favor of environmental degradations. Looking into indigenous rangeland management practices of pastoral community is a useful way to develop sustainable rangeland productivity. Rangeland plays an essential role in the livelihood activities of Ethiopian pastoralists as well as Ethiopian economy. Numerous researches have been done on rangeland management practices, but little study has been done with respect to the determinants of indigenous rangeland management in specific social, economic and ecological context. In this case, the aim of the study was to assess the determinants of the indigenous rangeland management practices of pastoral communities and assess perception of pastoral households towards the attributing causes of rangeland degradation in Borana. The study employed descriptive and inferential statistical methods to analyze the data. The findings indicated that the indigenous practice accurately reflects the productivity of the rangeland since the Borana area is unpredictable environment and victim for severe drought every year. The results of binary logit regression showed that a unit increase in age of the household head, the odds ratio in favor of practicing in traditional rangelands management increase by 1.096. Holding other variables constant, a unit increase in cultivated farm size would decrease the odds ratio in favor of practicing traditional management by a factor of 0.618. In Borana area, grazing land and water resources are jointly handled. Hence, privately owned grazing land and water points disturb patterns of mobility in a way grazing land use becomes inefficient as grazing concentrates close to the water points, leading to degradation of the rangelands. Access to communal water point was also found to be significant influence on respondents' traditional rangeland management practice at 10% significance level ($p < 0.1$). On the other hand, the result of odd-ratio indicates that, access to communal water point will increase the probability of rangeland management practice by 0.22 percent. The study recommends bases for ecologically sound and culturally appropriate indigenous rangeland management practices.

Keywords: Indigenous Knowledge, Herd Mobility, Rangeland degradation, Bushes

Introduction

In Ethiopia, rangelands cover about 61 to 65 percent of the total area of the country that are characterized by arid and semi-arid agro-ecologies. These arid and semi-arid agro-ecologies experience a relatively harsh climate with low, unreliable, and erratic rainfall. Such areas are home to 12-15 percent and 26 percent of the human and total livestock population respectively (Teshome *et al.,* 2009). In the lowlands of the country, which are predominantly pastoralists, livestock is the major source of food (meat, milk). Livestock is also the major source of cash income from the sales of live animals and livestock products like milk, butter, hides and skins (Yayneshet Tesfay and Kelemework Tafere, 2004). In addition, livestock is a measure of wealth and social status in pastoral communities Fekadu Beyene, (2008). Borana use the customarily systems and law *'Aada'* and *'Sera'* to regulate the use of pasture lands, water sources and all the goods use in homes. These customary system and laws provide the requisite social and political order which enable them to move in and to live with each other in peace (Teshome Abate *et al.,* 2009). It

is a customary practice of Borana society to differentiate dry and wet season grazing with a set of rules and regulations that residents are expected to obey and respect. Fora cattle and other animals are the biggest group; they graze rotationally away from homesteads or villages. The movement can be trans-boundary, trans-woreda and kebele (Butt, 2010).

Traditionally, Borana pastoral communities usually have a detailed knowledge to classify rangelands which is acquired through extensive observation and continuous herdin g practices. These indigenous knowledge practices provide a useful source of information for the sustainable use and conservation of natural resources (Gufu *et al.*, 2008). Combining this knowledge with scientific knowledge provides a more complete understanding of environment from the perspective of utilizing the resources (Ayana and Gufu, 2008). Hence, the need for incorporating community-based knowledge in assessing rangelands has been widely acknowledged (Gimenez and Maria, 2000). In the present day, the Borana pastoralists operate over a limited area of increasingly degraded and poor rangeland (ELSEP/RELPA, 2008). The main problems were none-functionality of indigenous rangeland categories, drought and expansion of crop production on communal grazing areas of the Borana rangeland (Ayana and Fekadu, 2003). Furthermore, the seasonal grazing system is breaking up and herd movements or rotational grazing become short-term oriented to follow scattered forage resources. This reduced and poorly coordinated mobility implies negative effects on rangeland condition (Homann et al., 2005).

The livelihoods of Borana pastoralists of southern Ethiopia are under threat from repeated cycles of drought as well as land use changes (ELSEP/RELPA, 2008). The rangeland resources have not been sustained as expected because of human and natural factors that destruct the resources. Furthermore, rangelands that have been traditionally managed as a common property resource are now being allocated as private land under some government policies (Fekadu, 2008). The private appropriation of grazing areas has also expanded, carelessly in the name of crop cultivation. These current land use dynamics are however incompatible with the Borana pastoralists' strategic choices given that the indigenous rangeland management has lost their value (Huqqa, 1999). Although the problem associated with the indigenous rangeland management practices was widely researched, much is still needed to do with respect to the indigenous knowledge of pastoral communities and factors influencing their rangeland management practices. Therefore, this background the study intended to assess the factors affecting indigenous knowledge of rangeland management practices and the households' perception respective to their range land management in the study context.

Materials And Methods

Description of the Study Area

The study was conducted in southern Ethiopia, Yabello, Dire and Taltale districts of Borena Zone purposively based on their livestock population. Population in terms of total TLU, Yabello district is the playing the leading role by about 222,008 TLU and followed by Dire, Taltale, Miyo and with total livestock population of 170,740, 145,372, and 127,014 TLU, respectively. Moyale district is ranking as the least population having only 51,076 TLU (CARE-Ethiopia, 2009).

Sample Size and Method of Sampling

The study selected three districts, all from pastoralists. Purposive sampling technique was employed to select representative districts based on their livestock holding potential. For this study in order to select a re presentative sample, a multistage sampling te chnique has been used to select sample house holds from pastoralists' kebeles.

To determine the sample households from the three districts, the following three stages were

used. In the first stage, the districts were selected purposively based on livestock potential. In the second stage, with the help of districts' pastoral development ex perts' kebeles were selected from each using lottery method. Accordingly, the researcher drew 9(nine) representative kebeles among the given districts. Finally, from the selected pastoralists' kebeles, sample household heads were selected randomly. However, the household heads sizes were varied across the nine kebeles; hence, Proportional to the Population Size (PPS) technique was used. Sample size was determined by using (Yemane, 1967) formulas at 95% confidence interval.

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

Where, n is the sample size, N is the total population of pastoralist households (2,973) and e is the margin of error (error term) at 5%. Accordingly, 352 pastoral household heads were selected.

Methods of Data Collection

Both primary and secondary types of data were collected.

To undertake the survey nine (9) enumerators were recruited and training was given. The study employed a combination of data collection techniques like semi-structured interview, focus group discussion and key informant interview. Focus group discussion has been undertaken at all the sampled kebeles. A total of fifty-four (54) household heads were participated in focus group discussion. Key informants like local elders, Abba Gada, Abba Herrega, Abba Olla, and pastoral development agents working on the sites were interviewed. A total of forty-five (45) key informants across the nine kebeles were interviewed.

Methods of Data Analysis

Both descriptive and inferential analyses were used for data analysis. Qualitative types of data were analyzed by using explanation, narration and interpretation. Econometrics model (Binary logistic regression model) was also employed.

Results and Discussion

Demographic Characteristics of the Respondents

Level of the sample household heads' rangeland management practices

The result of frequency analysis showed that the majority of respondents 252 (71.59%) belonged to high level of practicing indigenous rangeland management while the rest 100 (28.41%) of the respondents belonged to low level of practicing indigenous rangeland management practice (Table 1).

Table 1: Level of traditional rangeland management practice of the sample respondents

Level of practicing	Proportion of responses in percentages	
	Frequency (n)	Proportion %
Highly	252	71.59
Lowly	100	28.41
Total	**352**	**100**

Source: Own survey data (2017)

Age of the sample household heads

The minimum and maximum age of sample respondents in the high group are 21 and 67 years respectively whereas the minimum and maximum age of sample respondents in the low group is 18 and 66 years respectively. The mean age of the total sample respondents is 42.97. The study also analyzed the relationship between age of household heads and indigenous rangeland management practice. Based on Pearson's correlation analysis result, there is a positive relationship between age of household heads and indigenous management practices. When age increases, household heads become experienced to the area in which they live and are responsible for indigenous management practices. The results of t-test indicate that there is statistically significant difference between the ages of high and low practices at 1% (t= -5.79, p= 0.000) significant level. Similar finding was reported by Homann and Rischkowsky (2005) in their study on integrating the indigenous knowledge of Borana pastoralists into rangeland management strategies in southern Ethiopia.

Table 2: Age of the respondents

Particulars	Respondents practice	N	Max.	Min.	Mean	St.dev	Mean differ.	t-value	p value
Age	Highly	252	67	21	46.72	11.33	-14.03	5.79	.000***
	Lowly	100	66	18	32.68	12.78			
	Total	352	67	18	42.97	13.24			

Note: *** 1% level of significance, Source: Own survey data August, 2017

Education level of the sample household heads

From the result, the total sample respondents 70.83% for illiterate, 15% could read and write, and 14.17% have attained primary education (1-8). There were no household heads who attained high school and above among the selected respondents. Generally, it was found that majority of the respondents were illiterate. The chi-square test shows that there is statically significant difference between high and lowly practicing respondents of traditional rangeland management at 1% (χ^2= 20.35, p=.000) significant level. Similar Findings were reported by Tahir (1991) and Kratli (2000) in their study on education and pastoralism in Nigeria, and education provision to nomadic pastoralists in Brighton institute of development studies respectively.

Table 3: Education level of the respondents

		Respondents						
Particulars	Response	highly practicing		lowly practicing		Total		Chi-square(χ^2)
		n	%	n	%	n	%	
Education level	Illiterate	201	79.54	47	46.9	248	70.83	20.35
	Read and write	34	13.64	19	18.75	53	15	
	Elementary school (1-8)	17	6.82	34	34.4	51	14.17	
	Total	252	100	100	100	352	100	

Note: *** indicates 1% level of significance,
Source: Own survey data, 2017

Socio-economic Characteristics of the Respondents

Livestock ownership

Livestock holding is one of the main livelihood assets in pastoral area. The minimum and maximum livestock units of the sample household heads in the high group were 4.25 TLU and 49.61 TLU respectively. The minimum and maximum livestock units of sample household heads in the low group were 0 TLU and 4.18 TLU respectively. The mean livestock holding of the total sample respondents was 10.20 TLU. The mean livestock units of the respondents in the high group were 18.75 TLU and in the low group were 1.54 TLU. Even though, livestock holding of highly practicing and lowly practicing group has no statistically significant difference with traditional rangeland management practices from the survey result, it presents livestock holding is one of the important livelihood assets in pastoral area, familiar with the findings of Fikre *et al.,* (2010) in his study on community-based rangeland management in Somali region. The respondents recognize that allocation of vast area of rangeland for non-pastoral use and increase in the size of cropland was the major reasons for the poor condition of the rangeland. The overall problems have thus increased the degrees of harshness of feed shortages, and severely affect the rangeland as the same time livestock productivity consistent with the study of (Amaha, 2006).

Table 4: Livestock holdings

Particulars	Respondents	N	Max.	Min.	Mean	St.dev	Mean differ.	t-value	p-value
Livestock holding	Highly practicers	252	49.61	4.25	18.75	9.52	17.21	1.06	.029**
	Lowly practicers	100	4.18	0	1.54	0.78			
	Total	352	49.61	0	10.20	10.93			

Source: Own survey data August, 2017

Cultivated farmland size

The minimum and maximum cultivated land in hectares for the highly group 0 and 4 hectares respectively. The minimum and maximum cultivated land in hectares for the low group 0 and 10 hectares respectively. The mean cultivated land in hectares for high and lowly practicing respondents is 0.66 and 5.06 hectares respectively. The mean cultivated farmland size of the total sample respondents in the study area is 1.83 hectares. The t-test shows that there is statistically significant difference between highly and lowly practicing respondents of traditional rangeland management at 1% (t= -8.94, p= .000) significant level. It has a negative correlation with traditional rangelan d management practices. The involvement of new patterns of land use including the gradual increments of cultivated farmland size intensifies conflicts among communities and increasing competition over resources. Similar Finding was reported by Oba (1998) in his study on rangeland management in southern Ethiopia.

Table 5: Cultivated farmland sizes

Particulars	Respondents	N	Max.	Min.	Mean	St.dev	Mean d/ce	t-value	p-value
Cultivated land size	Highly practicing	252	4	0	.66	.53	4.403	-8.94	.000***
	Lowly practicing	100	10	0	5.06	3.43			
	Total	352	10	0	1.83	3.07			

Note: *** 1% level of significance respectively; Source: Own survey data, 2017

Institutional Factors

Availability and access to communal water points

In the study area, the main water sources were ponds, donors and government Bring by boats traditional hand dug wells and some of other water points (Table 6). The area is characterized by low availability of surface water. The availability of water is varying from place to place (Adisu, 2009). The sources of water that the respondents use were ponds by 34.09%, donors and government 31.66%, traditional hand dug wells 10.83%, underground water 7.5%, hand pump 5.83%, motorized deep wells or bore holes 4.16%, *siminto* (harvested water during rainy season) 3.33%, and spring water 2.5%. The supply of permanent water was limited to clusters of deep wells and access to water determined the utilization of the surrounding pastures.

From the survey result (Table 6), 65.91% of the sample respondents' highly practicing traditional rangeland management had access to communal water points respectively. Seventy five percent (75%) of the respondents' low in group access to communal water points respectively. From the result, 68.34% and 31.66% of total sample respondents access and no access to communal water points respectively. Even though access to communal water points for household heads highly and low practicing traditional rangeland management has no statistically significant differences from the survey result, it has some positive relation, because it increases the efficient use of grazing resources and to overcome the competition for space between fellow citizens trying to divert runoff to their water points (Fekadu, 2008).

Agricultural extension services

The extension services supported crop cultivation within valuable communal grazing areas and claimed key resources from the customarily rangeland production systems (Homanna *et al.,* 2005). The minimum and maximum extension service contact for the sample respondents highly practicing traditional rangeland management 0 and 6 days per month respectively. The minimum and maximum extension service contact for the sample respondents' lowly practicing traditional rangeland management 0 and 6 days in a month respectively. The mean extension service contact of highly and low practicing respondent 2.48 and 3.06 days in a month respectively. The mean extension service contact for the total sample pastoral respondents in the study area 2.64 days in a month. The t-test shows that there is statically significant difference between highly and low practicing respondent of communal pasture management at 5%(t=2.21, p=.029) significant level. Similar finding was reported by Ayana and Fekadu (2003) in their study on current range condition in southern Ethiopia in relation to traditional management strateg y. It has some negative correlation with traditional rangeland management practices, because households are faced with the challenge of developing more efficient and sustainable use of natural resources (Homann *et al.,* 2008).

Table 6: Access to water points

Particulars	Response	Respondents						Chi-Square (χ^2)	p-value
		Highly practicing		Lowly practicing		Total			
		n	%	n	%	n	%		
Access to water points	Yes	166	65.91	75	75	241	68.34	0.896	.344^{NS}
	No	86	34.09	25	25	111	31.66		
	Total	252	100	100	100	352	100		
Sources of water in the study area	n	Percent (%)							
Ponds *(Haroo)*	120	34.09							
Donors and Gov't bring	111			31.66					
Traditional hand dug Wells	38			10.83					
Underground water	26			7.5					
Hand pump	20			5.83					
Motorized deep wells *(boreholes)*	16			4.16					
Siminto *(harvested water during rainy season)*	12			3.33					
Spring water	9			2.5					
Total	352			100					

n= Frequency of the respondents, NS= Not Significan Source: Own survey data, 2017

The respondent in low group has better exposure to agricultural extension services and would give higher value to it. Hence, low practicing respondent are far more ready to seek new knowledge and information of crop production from the extension services as they need agricultural extension services to get land certification for crop production and renting the land to the prosperous households (Fekadu, 2008). The intention of the local administration has for long been to introduce formal land use plan to an unpredictable environment without considering the ground realities which could not sustain the natural resource uses (Fekadu, 2011).

Table 7: Extension service and differences by level of traditional rangeland management practices

Particulars	Respondents	n	Max.	Min.	Mean	St.dev	Mean d/c	t- value	p-value
Farm extension service	Highly practicing	252	6	0	2.48	1.17	0.57	-2.21	.029**
	Lowly practicing	100	6	0	3.06	1.45			
	Total	352	6	0	2.64	1.27			

Note: ** indicates 5% level of significance respectively; Source: Own survey data August, 2017

Strategy to overcome feed shortage in pastoral area

Currently, there is a sensitive cattle feed shortage in the Borana rangeland assumed to be caused by rangeland degradation (Anteneh and Alemayehu, 2005). It is characterized by invasion of undesirable woody species, unpalatable forbs, losses of grass layer and increased soil erosion (Oba, 1998). Moreover, degradation in the rangelands is one of the particular concerns, because rangelands cover the vast majority of the world's dry land areas and degradation is far more invasive in the rangelands than under other land uses (World Bank, 1997).

During critical feed shortage seasons in December, January, February and *Ganna* and *Hagayya* (June, July and August) livestock owners use different strategies to alleviate feed problem (Ayana, & Gufu 2008). The report is consistent with the findings of (Zewdie, 2010) on livestock production systems in relation with feed availability in the highlands and central rift valley of Ethiopia.

Table 8: Different coping mechanisms to alleviate feed shortage in the study area

		Respondents					
Particulars	Responses	Highly practicing		Lowly practicing		Total	
		n	%	n	%	n	%
Households coping mechanisms to drought	Rely on stored feed	74	29.36	47	47	121	34.37
	Rely on farm residues buying from neighbors	14	5.56	25	25	39	11.07
	Rely on natural vegetation *(woody plants)*	69	27.27	18	18	87	24.71
	Rely on market (feeding '*sooda*' during wet season and selling the old animals to buy the young one)	26	10.23	6	6	32	9.09
	Herd movement '*foora*'	69	27.27	3	3	72	20.45
	Total	252	100	100	100	352	100

Source: Own survey data August, 2017

Access to winter feed resources

Pastoralists cut the leaves and branches of trees and feed to their animals when grasses become depleted from the grazing land. Acacia pods are also used as important sources of dry season feed for goats, camels and cattle (Ayana and Fekadu, 2003). From the survey result (Table 9), 76.14% and 34% of the sample respondents highly practicing traditional rangeland management access and not access of feed resources respectively while 23.86 and 66% of the sample respondents low practicing traditional rangeland management access and not access of feed resources respectively. From the result, 64.2% and 35.51% of the total sample respondents access and not access of winter feed resources respectively. The Chi-square test shows that there is statically significant difference between sample respondents highly and low practicing traditional rangeland management at 1% (χ^2= 17.99, p= 000) significant level. This report is similar with The finding of Desta and Coppck (2004) in their study on pastoralism under pressure and tracking system change in southern Ethiopia.

The excess forage could be conserved in the form of hay or stored feed at the end of the main/long rainy season in March-May (ganna) and the short rainy season, Sept-

October (hagayya) (Oba and Kotile, 2001). They reported that different grass species such as Cenchrus ciliaris (Mata guddeessa), Eleusine intermedi (Coqorsa), Lintonia nutans, Stapf (Hiddoo (luucolee)) and Enteropogon somalensis (Alalo) are found in the area. Browses containing different Acacia species such as Acacia tortilis (Dhaddacha), Acacia seyal (Waacu), Acacia mellifera (Saphansa), and tree species like Grewia Tembensis Fresen (Dhekkaa), Commiphora (Qayyoo), Harmisia sidoides, K.Schum (Qaxxee),Grewia bicolor, A.Juss (Harooressa), Kleinia Squarrosa Cufod (Xixxiixxuu) and Acacia brevispica (Hammareessa), play a very important role as sources of feed during dry seasons primarily for the browsing species such as camels and goats as well as for sheep and cattle agreement with (Adisu, 2009).

Table 9: Access to winter feed resources

Particulars	Respons	Respondents						Chi-square (χ^2)	P-value
		Highly practicing		Low practicing		Total			
		n	%	n	%	n	%		
Access to winter feed resources	Yes	192	76.14	34	34	226	64.2	17.99	.000***
	No	60	23.86	66	66	126	35.51		
	Total	252	100	100	100	352	100		

Note: *** indicates 1% level of significance, Source: Own survey data August, 2017

Psychological Related Factors

Perception of household heads' towards the effect of herd mobility on indigenous rangeland management practices:

This study considered pastoralists perception towards the effects of herd mobility on rangeland management. To this end, 43.33% respondents recognize herd mobility reduce risks of livestock losses during drought periods, 18.33% prevent Over used (over exploitation) resources, 17.5% were flexible to changing conditions, 15.83% avoided concentration of animals at one area, 4.16% of respondents recognize uses of herd mobility as worthless and 0.85% ecological stability (conservation of biodiversity). From this result (Table 10), majority of the respondents (43.33%) believed that herd mobility as the means of reducing livestock losses during drought periods. This is due to the fact that, herd mobility is a trigger to reduce herd losses during dry seasons (Homann *et al.*, 2008).

Table 9: Perception towards the effect of herd mobility on indigenous rangeland management

Particulars	Responses	n	Total (%)
Perception towards effects of herd mobility	Reduce risks of livestock losses during drought	153	43.33
	Prevent over use (over exploitation) of resources	64	18.33
	Flexibility to changing conditions	62	17.5
	Avoids concentration of animals at one area	55	15.83
	As worthless	15	4.16
	Ecological stability (conservation of biodiversity)	3	0.85
	Total	352	100

Source: Own survey data August, 2017

Perceptions towards current condition of rangelands

Pastoralists perceived that the condition of plant growth and composition were inferred from the body condition of their animals. The poor current condition of rangelands in this study was similar to Middle Awash areas of Ethiopia (Abule *et al*., 2005) and Hamer and Bena-Tsemay districts of south-west Ethiopia. Accordingly, most of the respondents in the study area reported that compared to the past, their grazing lands are more covered with bushes, which was responsible for a decline in rangeland condition consistent with (Admasu, 2006).

Perception towards the possible attributing causes of rangeland degradation

Erratic rainfall, bush encroachment, lack of participatory endeavor or ignorance of customarily systems, decreased animal movement, high population growth and heavy grazing by livestock resulted in reduced mobility of pastoralist that in turn resulted in degradation of grasses and in invasion of unpalatable forbs, herbs and bushes (ELSEP/RELPA, 2008).

From the analysis result, respondents ranked the attributing causes for rangeland degradation, accordingly the mean and score has been calculated. The possible causes of rangeland degradation in the study area; shortage of moisture or lack of rainfall with (mean value 4.69), bush encroachment (mean value 4.48), none integration of stakeholders or lack of participatory endeavor (mean value 4.31), down ward trends of traditional management (mean value 4.01), blocked herd mobility (mean value 3.92), demarcation of settlement or promotion of crop cultivation (mean value 3.82), livestock population pressure (mean value 3.6), reserved grazing area by government (parking and sanctuaries) (mean value 2.75) and limited knowledge of rangeland management (mean value 2.51) as fist, second, third up to ninth respectively (Table 12). The possible reason respondents pointed out that erratic rainfall with mean value 4.69 shows they agreed to lack of rainfall that was the 1st rank for the causes of rangeland degradation in the study context.

Table 10: Perception of the respondents towards the current rangeland condition

Particulars	Estimation	Respondents				Total	
		Highly practicing		Lowly practicing			
		n	%	n	%	n	%
Accessibility to natural vegetation	Good	35	13.63	25	25	60	17.04
	Fair	40	15.91	22	22	62	17.50
	Poor	177	70.45	53	53	230	65.34
	Total	252	100	100	100	352	100
Current grazing pressure	Good	17	6.82	16	16	33	9.37
	Fair	37	14.77	28	28	65	18.33
	Poor	198	78.43	56	56	254	72.16
	Total	252	100	100	100	352	100
Condition of palatable plant growth	Good	14	5.68	9	9	23	6.66
	Fair	32	12.50	19	19	51	14.48
	Poor	206	81.82	72	72	278	78.97
	Total	252	100	100	100	352	100

Source: Own survey data 2017

Disappearance of some important grass species like *Cenchrus ciliaris (Mata guddeessa), Eleusine intermedia (Coqorsa), Lintonia nutans Stapf (Hiddoo)* those were useful for livestock

feeding, encroachment of unwanted tree species, restriction to bush burning and the decline of herd mobility that was practiced for a long period of time by traditional institution leaders are the main causes for rangeland degradation. This finding agrees with the finding of Desta (2009). These resulted in hold backed growth of calves, loss of resistance to disease and pests, and decreased herd size as well as rangeland productivity consistent with report of (Ayana and Fekadu, 2003).

The respondents also considered that the newly introduced practices demarcation of settlement or promotion of crop cultivation were not sustainable and damaging the communal resource base. Demarcation of settlement and livestock population pressure were resulted to rangeland degradation as well as not practicing the traditional rangeland management. Due to faulty development interventions which results in grazing area shrinkage have been the major challenges to the livelihoods of Borana pastoralists in terms of reducing forage resources for livestock rearing agreement with (Adisu, 2009). The interviewed pastoralists mentioned that the grazing lands that were not visited by livestock during wet season and reserved for dry season are now grazed at a rainy season. Some of the pastoralists say that traditional rangeland management practice (moving herds between wet and dry seasons) from areas that were used in the rainy season to unused one during dry season is also disturbed now. The environment as sedentary pastoralists to promote sedentary life were not successfully matching and balancing indigenous practices with the existing pasture condition consistent with (Ayana and Fekadu, 2003). Slightly, very recently the government allowed controlled fire in such a way that for the future, local controlled fire committee has been established at PA level and to manage bush firing. Even though prescribed fire allowed, so far in any of the study area bush burning had not yet been accomplished (*Godana*, personal communication).

Reserved grazing area by government and knowledge were not a problem for rangeland degradation and not practicing the traditiona l rangeland management.

Table 11: Perception towards the possible attributing causes of rangeland degradation

Attribute	St/ agre	Agre e	S/wh at	Dis- agree	Str/di sagree	Score	Rank
Shortage of moisture (lack of rainfall)	71.7	25.8	2.5	00	00	469.20	1st
Bush encroachment	60.8	28.3	9.2	1.7	00	448.20	2nd
Non-integration of stakeholders/lack of participatory endeavor	44.2	42.5	13.3	00	00	430.90	3rd
Down ward trends of traditional management	36.7	33.3	4.2	5.8	00	400.90	4th
Blocked herd mobility	47.5	26.7	1.7	18.3	5.8	391.80	5th
Demarcation of settlement or promotion of crop cultivation	42.5	30.0	2.5	16.7	8.3	381.70	6th
Livestock population pressure	39.2	12.5	17.5	30.8	0	360.10	7th
Reserved grazing area by government (parking and sanctuaries)	5	25.8	30.0	17.5	21.7	274.90	8th
Limited knowledge	8.3	9.2	24.2	41.7	16.7	251.00	9th

Note: Score is calculated by assigning 5 for strongly agree, 4 for Agree, 3 for somewhat agree, 2 for disagree and 1 for strongly disagree. Then, multiply % of observation by the score and finally adding the total observation.

Determinants of Indigenous Rangeland Management Practice

Binary logistic regression model was employ ed to identify factors affecting indigenous rangeland management practice in the study context. As a first step in the empirical estimation of the econometric model, multi-collinearity test for both continuous and dummy/categorical variables were conducted to check possible associations among explanatory variables. The two measures (Variance of Inflation Factor and Contingency Coefficients) were often suggested to test the existence of multicollinearity. As a rule of thumb, if the Variance of Inflation Factor (VIF) of a variable exceeds 10, there is multi-collinearity (VIF test measures the association between continues variables). To avoid such serious problems of multicollinearity, it is quite essential to omit the variable with value 10 and above from the logit analysis (Gujarati, 2004). Similarly, a contingency coefficient (CC), which measures the association between dummy/categorical variables, was computed. The values of contingency coefficients (CC) ranges between -1 and 1, with zero indicating no association between the variables and the values close to 1, indicating a high degree of association. Generally, there is no multi-colliniarity and the model fit the data set.

Different types of goodness of fit confirmed that the model fits the data well. The value of person chi-square test shows the overall goodness of fit of the model significant at less than 1 percent probability level. Another measure of goodness of fit in logistic regression analysis is measured by R^2, which works on the principle than if the predicted probability of the event is greater than 0.50 the event will occur otherwise the event will not occur (Maddala, 1989). The test of maximum likelihood estimates of the model predicted in the (Table 13).

Table 12: Estimation of binary logistic regression model

Variables	Coefficient (B)	S.E.	Wald	Significance	Odds Ratio
Age of households	.092	.033	7.62	.006***	1.096
Education of households	-.141	.870	.026	.871	1.152
Total Livestock unit	.009	.029	.098	.755	1.009
Cultivated farm size	-.481	.128	14.088	.000***	.618
Collective resource management	1.931	.704	7.521	.006***	6.894
Access to commun al water point	1.503	.815	3.399	.065*	.222
Extension service	-.257	.259	.985	.321	.773
Constant	-1.752	1.831	.916	.339	.173
Pearson Chi-square= 73.84, significance = .000***, Pseudo R^2 = 0.67					
Correctly predicted= 88.3					
-2Log likelihood= 65.33					
Sensitivity= 95.5					
Specificity= 68.8					
Number of sample respondents= 352					

Note: ***, and * significant at 1%, and 10% level of significance respectively.
-2log likelihood is the maximum likelihood of model coefficient
Source: Model output

Eight variables were entered for analysis; out of these variables four were found to be statistically significant at different levels. These variables are age of household heads,

cultivated farm size, collective resource management and access to communal water point have found to be significantly affect the respondent's traditional rangeland management practices.

Age of household head (AGEHH): As the model estimates confirm that the age of household head is found to be significantly influence traditional management practice of the respondents at 1% significance level ($p < 0.01$). This indicates that, a unit increase in age of the household head, the odds ratio in favor of practicing in traditional rangelands management increase by 1.096. This is due to the fact that, a household head with old age has accumulated customarily knowledge and skills related to traditional management activities. Hence, these household heads tend to have more experiences than the young generations in traditional managemen t put into practice. This report is consistent with the findings of Homana and Rischkows ky(2005) on integrating the indigenous knowledge of Borana pastoralists into rangel and management strategies in southern Ethiopia.

Cultivated farm size (CF Size):
This variable was significant at at 1% significance level ($p<0.01$) and negatively related with traditional rangelands management. Holding other variables constant, a unit increase in this explanatory variable would decrease the odds ratio in favor of practicing traditional management by a factor of .618. An increase in cultivated farm size decreases the traditional ways of rangeland management practices. Expansion of cultivation on communally used grazing areas flames conflicts between groups of resource users with a specific concern about the ever declining access of weaker groups such as pastoralists to productive resources. Recent studies document, for instance, that cultivation is increasingly extending into common property rangelands while pastoralism is twist somebody's arm to marginal and fragile land areas (Bassett, 1993; Kirk, 1996; Hogg, 1997).

Collective resource management (CRM):
According to the analysis result, cooperation of the sample household heads in communal resource management has significant influence on traditional management practice at 1% significance level ($p < 0.01$). From this point of view, participation in collective resource use will enable the households to maximize the use of resources. In Borana area, grazing land and water resources are jointly handled. Hence, privately owned grazing land and water points disturb patterns of mobility in a way grazing land use becomes inefficient as grazing concentrates close to the water points, leading to degradation of the rangelands. Furthermore, the odds ratio result indicates that, collaboration of the sample household heads in communally resource uses will have the probability of increasing their traditional management practices. Pastoralists are organized as resource use cooperation to take full advantage of the optimum utilization of resources. This result is consistent with the study of Roe *et al.,* (2009) on community management of natural resources in Africa.

Access to communal water point (ACWP):
This variable was also found to be significant influence on respondents' traditio nal rangeland management practice at 10% significance level ($p < 0.1$). On the other hand, the result of odd-ratio indicates that, access to communal water point will increase the probability of rangeland management practice by 0.22 percent. During dry season pastoralists are challenging with shortages of water sources. It was observed that the availability of dry season water for livestock is the most important to pastoral livestock production. In pastoral areas, make use of rangeland is partially dependent on careful preparation of water enlargement ponds, and wells (Tuullaa). This report is consistent with the findings of Yayneshet and Kelemework (2004) on indigenous rangeland resources and

conflict management by the North Afar pastoral groups in Ethiopia.

Conclusion and Recommendations

Conclusion

In traditional society, the elders are extremely familiarized with the indigenous ways of rangeland management and livestock rearing than younger pastoralists. The older age of the pastoralist the more the tendency to employ indigenous rangeland management practices. Hence, it has been indicated that Most of the interviewed household heads perceived that the traditional management of resources have relative advantages than any other systems since it is directed by experienced elders of the clan society.

Even though, education has its own positive impact on the decision making of natural resource management but, in the study case education is correlated negatively Therefore, when education level of household heads increase less emphasis for traditional management practices, and household heads practice modern patterns.

In pastoral area, livestock holding is one of the important livelihood assets. The large herds are sighted as the result of the pastoralists' with reputation and status, supposedly being their main concerns. Respondents with more number of livestock practiced traditional rangeland management practice.

Expansion of cultivated land size is a serious constraint to traditional management practices and livestock production. The more the cultivated land size the more negatively affecting the traditional rangeland management practices of the pastoral communities since priority for agricultural extension than livestock production.

In pastoralism mode of life pastoralists make a significant contribution to the flexibility of traditional management practices of rangelands but due to agricultural extension there is shrinkage of communal rangelands and this factor negatively affecting the traditional management practices of the pastoral communities. When agricultural extension increases than rangeland management in pastoral areas; the trend is that the traditional management system is becoming unstable. Then, there have been encroachments of unpalatable tree species, which in turn resulted to degradation of communal rangelands and invasion of thorn bushes. Such issue needs the attention of development planners, policy makers and government bodies to promote traditional way of rangeland resource management activities.

Recommendations

- Institutional responsibilities should be controlled by experienced elders within the indigenous knowledge and intervention among the stakeholders by sensitized pastoral representatives to identify what problems have accounted for defining rangeland degradation and promoting customarily rangeland management practices.
- In the study area, there was high illiteracy level therefore, the government should due attention to expansion of access to training/education since education level of the elders was low when compared to younger household heads.
- Utilizing indigenous strategies of management like support of herd mobility during dry and wet seasons rather than blocking herd mobility because in the area there is a problem of low and unpredictable rain fall. Mobility is used for efficient resource utilization and also it avoids the over exploitation of the range resources by reducing concentration of livestock in one area.
- Promoting communal grazing lands and protecting expansion of uncontrolled

crop production from communal rangela nds that can be leading to overgrazing and stocking. Enabling institutional conditions and promoting indigenous knowledge in management of rangeland resources and should become increasingl y recognized, as an essential means to achieve sustainable uses of rangeland resources.

- Institutional variables like extension agents needs to be giving due attention to pastoral development and be intimatel y working relationships among pastoralis ts, promote the traditional rangelands management practices, give emphasis to water sources by type, status of grazing and problems regarding resource uses.
- Expanding of forestation program by government and donors with leguminous plants and grasses species like *Saspania, gravilia, Lusinia* trees and Rhodes and Sudan grasses on communal lands.
- Unfortunately, rangelands do not receive the attention they deserve by development planners and policy makers and if man intends to live and depend upon these rangelands on a sustained basis, this degradation of rangeland resource must stop. Sustainable use and management must become the rule rather than the exception.

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Competing Interests

The author declares that they have no competing interests.

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