

Traditional Rangeland Resource Utilization Practices and Pastoralists' Perceptions on Land degradation in Madda Walabu district, South-east Ethiopia

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Abstract

A study was conducted to examine rangeland resource utilization practices of pastoralists and rangeland degradation in Madda Walabu district, south-east Ethiopia. A single-visit survey method was used to gather data through a structured questioner (130 households), group discussions and direct observations. Free grazing of communal land (100%), use of enclosures (89%), division of herds based on species and class of animal (59%), migration (79%) and seasonal assessments of the condition of rangeland were the basic traditional rangeland management practices. About 91% of pastoralists indicated that the condition of their rangelands was poor. The most dominant use for woody plants was for construction (91%), followed by browse (68%) and medicinal purposes (25%). More than 86% of the respondents considered that their grazing lands now carried more bushes and shrubs than they did 30 years ago. Feed and water shortages and drought were identified as current challenges for pastoralists, with migration the main coping strategy, in spite of the hardships it entails. Rejuvenating the existing rangelands requires the development of a range-land management strategy involving pastoralists and other stakeholders, with all participants fully committed to a successful outcome. A reduction in livestock numbers must be an essential component of any future strategy.

Keywords: Pastoral perception, Rangeland degradation, Resource utilization, South-east Ethiopia

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INTRODUCTION

Background

Rangelands are defined as uncultivated land that provides the necessity of life for grazing and browsing animals (Holechek *et al.*, 2005) and occupy about 50% of the World's landmass (Friedel *et al.*, 2000). Rangelands covers about 65% of Africa (Friedel *et al.*, 2000), and 62% of the total landmass in Ethiopia (Alemayehu, 1998). A Large part of the rangeland in Ethiopia is located in lowland arid and semi-arid regions with unreliable and erratic rainfall, and high temperature (Alemayehu, 1998).

Worldwide, rangeland contributes about 70% of the feed needs of domestic ruminants and about 85% of the total feed needs of ruminants (cattle, sheep and goats) in African and South American countries (Holechek *et al.*, 2005). In Ethiopia, it represents a valuable resource to the pastoralists and to the nation (Oba and Kotile, 2001). According to Hogg (1997), about 40% of the cattle, 50% of the small ruminants, and almost all camels are found in the pastoral areas. Furthermore, 12-15% of the country's total populations live in these dry areas. In the country, livestock resources are important in the Ethiopian economy. In the rangeland areas, livestock are important possessions as they provide all the consumable outputs and insurance against disasters (Alemayehu, 2004). The pastoral and agro pastoral production system represent approximately 45-55% of the cattle, 75% of the small ruminants, 20% of the equines and 100% of the camels of the total national livestock population. Accordingly, they contribute about 50% to the national agricultural Gross Domestic Product (GDP) and 90% of the annual hard currency earnings from live animal exports (EARO, 2002).

Pastoral communities usually have a detailed knowledge of their grazing lands, acquired through extensive observation and continuous herding practice (Oba and Kotile 2001; Mapinduzi *et al.* 2003). Despite the existence of such knowledge, researchers and development policy experts have previously overlooked community-based knowledge when evaluating rangelands. Turner *et al.* (2000) concluded that traditional knowledge of indigenous people was fundamentally important in the management of local resources. Other studies (*e.g.* Fernandez-Gimenez 2000; Ayana and Fekadu 2003; Amaha 2006; Ayana and Oba 2008) also showed that documenting indigenous knowledge of rangeland resources can provide useful information for the development, sustainable utilization and conservation of natural resources. Additionally, community-based knowledge may provide new insights for improving existing scientific knowledge and a basis for designing appropriate research and development policies. In most parts of Ethiopia, the indigenous knowledge of pastoralists is not adequately documented (Gemedo 2004; Amaha 2006).

Statement of problem

Community-based knowledge plays a significant role in rangeland resource management (Angassa et al., 2012). The traditional practices of rangeland management are based on meticulous and wise use of community's knowledge (Farm Africa, 2009). In recent years, a growing body of literatures (Angassa and Oba 2008; Angassa et al., 2012) has tried to inform policy-makers and development practitioners to recognize community's knowledge for sustainable management of their environment. Previous Studies (Angassa et al., 2012; Sulieman and Ahmed, 2013) have also shown that communities' knowledge has a role to play in the advancement of scientific research and attainment of sustainable development goals. Similar to trends in other parts of Africa, the Oromo pastoralists of Ethiopia are experiencing considerable erosion of their traditional lifestyle during the last five decades (James et al., 2014). This is due to confiscation of their prime grazing lands for establishment of large-scale commercial farms and ranches, Game Park, urban settlement with increasing trends of human and livestock populations (Mohammed, 2010).

Despite the vital role of pastoralism as way of life in food production for its inhabitants in arid environment for millennia, pastoral societies are poorly recognized by national policies. National policies and development agenda in East African pastoral systems often overlooked pastoralism only focusing on modernization of the agricultural sector as engine of economic development and poverty reduction (Mohammed, 2010). Successive governments of Ethiopia have been promoting large-scale agricultural intervention in pastoral areas (James et al. 2014; Mohammed et al., 2017). Development in pastoral areas has long been a contested concept (James et al. 2014), which is arguably the case in the context of Oromo pastoralists. Previous studies (Flinton and Chibsa, 2016; Mohammed et al., 2017) have indicated that the unsuitable development intervention such as promotion of agriculture and private investors has often contributed to the continued marginalization and resource depletion rather than improvement of communities' livelihood in Bale pastoral areas. According to the same authors, the view that pastoralism is an inefficient way of life, which should be replaced by sedentary agriculture, and as a result ignorance of local communities' participation in development interventions contributed to the unfavorable effects facing them today's number of studies (Stringer and Reed, 2007; Teshome et al., 2010; Sulieman and Ahmed, 2013) have suggested that recognizing pastoralists' perception and their goals could provide useful information for designing effective management and development programs. It further helps in ensuring sustainable management of rangeland thereby improving the livelihood of pastoralists. Although IK may provide a basis for developing alternative ways of managing resources at the grass root level, such knowledge has overlooked in different zones of Oromia. Since the last few decades, the expansion of large-scale agricultural farms, park reservation, and settlement has been given more emphasis than the traditional practices of rangeland management. Madda Walabu district is located in the lowlands of Bale, where pastoralism and agro-pastoralism are the main land use systems and livestock are the main assets of the community. The knowledge of traditional rangeland resource utilization and pastoralists' perception on land degradation has not been documented. Therefore, it is very crucial to fill the existing information gap that is crucial for the managements of invasive alien plant species.

Objectives of the study

General objectives

- To assess traditional rangeland resource utilization practices and pastoralists' perceptions on land degradation in Madda Walabu district, south-east Ethiopia

Specific objectives

- To examine traditional rangeland resource utilization practices in Madda Walabu district, south-east Ethiopia
- To examine pastoralists' perceptions on land degradation in Madda Walabu district, south-east Ethiopia

MATERIALS AND METHODS

Description of the study area

The study was conducted at Madda Walabu district in the lowlands of Bale zone, Oromia national regional state, Ethiopia. The district was selected in terms of the nature of vegetation, climate, soil type and slope to represent the lowlands of Bale. In addition, these areas are among the worst affected areas by rangeland degradation and are the one among four districts the government and non-government subsidizes with feed for their livestock for the last four years (Personal communication with pastoral area development office range expert, 2016).

Madda walabu district covers about 9,543 km². The rainfall pattern is bimodal (March - June and September - October) with mean annual rainfall about 600 mm and mean annual temperature ranges between 26-42°C (BZFDO, 2016). According to CSA (2013), the human population of the district is about 79,137 (Male=49.98% and Female = 50.02%) of which 6.7% live in urban areas, while the rest 93.3% are rural dwellers. According to the statistical information of the zonal pastoral area development office, in the district, there are about 52,740 cattle; 62,000 goats; 30,000 sheep; 10,640 equine; 19,000 camels. The vegetation is devoid of dense woodland. There is

no detailed information regarding the soils of the district. However, the major types are clay, sandy and black soils (MDEDO, 2016). The production system in the district is pastoral (PADS, 2004). Bee keeping has been practiced in the area for a long time mainly in the forest where water and feed are readily available. Generally, the study area was known for its livestock population in the past and the inhabitants were totally nomads. Sedentary crop cultivation in the area is a recent phenomenon, not more than three decades' history (Tekale, 2007).

Sampling procedures

A single-visit formal survey method (ILCA, 1990) was followed to gather the necessary information. Prior to the actual survey, visits were made to the district and secondary information relevant to the study was gathered from all possible sources. Informal survey and group discussions was made to gather information about the district and to get insights from community members who are directly or indirectly involved in the production system. Madda Walabu district contains 20 Kebeles, seven (7) Kebeles was selected purposely based on their importance to livestock, accessibility, problems of rangelands and representativeness grazing land potential. The sample sizes of HHs were determined using the formula recommended by Arsham (2007) for survey studies.

$$N=0.25/ (SE)^2$$

Where: N= sample size

SE= standard error of the proportion

Assuming the standard error of 4.4% at a precision level of 5%, and the confidence interval of 95%, 130 HHs was selected by a simple random sampling technique for the interview. The numbers of HHs selected per Kebele was fixed based on the proportion of HHs in each kebeles. Randomly selected pastoral HHs from the seven kebeles was used for information related to this study. The interview was undergone following complete lists of pastoral HHs from the selected kebeles.

Data collection

Focus group discussions (FGDs) and key informant interviews (KIIs) were conducted using a Participatory Rural Appraisal (PRA) tools (Tilahun et al., 2016). An open ended, discovery-oriented, and semi-structured questionnaire was used to understand a person's insight, feeling, thought, and opinion about traditional rangeland resource utilization and rangeland degradation. Different groups of the society who have the knowledge about what Madda Walabu rangelands look like, i.e., elders, experts in rangeland management, and administrative staffs of the study area was participated in FGDs and KIIs. For the questionnaire, a household was taken as a unit of analysis. To undertake the interview, enumerators was recruited and training is given. Pre-testing of the questionnaires was made before the actual data collection, and appropriate modifications and corrections are made. The questionnaire consists of both close- and open-ended questions. Prior to conducting the actual survey, the questionnaire was translated to the local language "Afaan Oromo", and objectives of the survey was explained and discussed with the informants in order to ensure their cooperation. Data was collected between the months of June and August 2017.

Data Analysis

Completed questionnaires were first checked and coded. After careful scrutiny, the data was entered into a computer and analyzed using Statistical Package for Social Sciences (SPSS) software (version 20.0). Specifically, statistics like percentages, mean, standard deviation, cross-tabulation, and projections was employed during analysis and interpretation of data.

RESULT AND DISCUSSION

Household profile

The household survey showed an average family size of 9.45 ± 5.94 (\pm SD). All respondents were male and Muslim, as males were the head of the family and strong cultural practice prevented females responding on behalf of the family. The age range was 27–77 years (mean 48 ± 9.56). About one-third of the respondents had no formal education with only 2% being educated past 6th grade.

Evolution of agro-pastoralism

Historically (30 years earlier), livestock production was practiced by 94% of families and the inhabitants were totally pastoralists. Livestock and livestock products played a major role and the rangelands were used mainly for grazing. Currently, only 36% are purely livestock producers, with 63% combining livestock and crop production (agro-pastoralists). Most of the families (73%), who commenced growing crops, did so during the period 1974–1991, with 13% doing so before that time. Reasons for adopting an agro-pastoral lifestyle included the need to diversify household income (81%); human population pressure (49%); expansion of settlements (19%); and a decline in livestock numbers per household owing to drought (12%). Consequently, pastoralists started to cultivate small plots of land to grow cereal crops in situations, which were marginal for cropping. About 94% of the

respondents had increased the area of land devoted to cultivation at the expense of grazing area. Maize, sorghum and Teff (*Eragrostis tef*) were the major crops grown. *Livestock production systems* Livestock have been the main assets of pastoralists, with an average livestock holding per household of 10.3 Tropical Livestock Units (TLU = 250 kg non-lactating animal; ILCA 1991) (Table 1), of which 5.9 TLUs were cattle. Most households indicated that livestock management was traditional with a free-ranging, extensive system. Ninety-eight percent of respondents derived income from livestock, selling small ruminants and dairy products, with some selling crops (46%), honey (17%) and timber products (3%) to cover expenses.

Livestock were also used as sources of food (mainly milk from cattle, goats and camels, and occasionally meat), as well as for social functions and transportation and to supply draught power. Camels and cattle have been used in society as a ‘savings account’, while small ruminants constitute liquid assets, often being sold during emergencies and at the time of crop failure.

Table 1. Mean livestock holdings per household in Madda Walabu district (n = 90)

Livestock class	Herd size (TLU1)	SD
Cattle	5.9	2.50
Sheep	0.5	0.44
Goat	1.1	0.57
Camel	2.4	4.25
Equines	0.4	0.27
Total	10.3	0.62

In the study area, manure was rarely used for fuel and crop production. Based on the results of the group discussions and responses of the sampled households, drought (86%) ranked as the primary constraint to livestock production, followed by shortage of feed (62%), availability of water (53%), health problems (45%) and wild animal attack (12%).

Feed resources and traditional rangeland management

Feed resources. Natural pastures, woody plants and crop residues were the major feed resources for livestock in the study area (Table 2). Although the availability of crop residues was low, straw from maize, sorghum and Teff was fed mainly during the dry season. As most of the land was covered with woody vegetation, trees and shrubs were important sources of livestock feed throughout the year. Some of the most important browse species mentioned by pastoralists were: *Acacia busier*, *A. mellifera*, *A. Senegal*, *Commiphora collinum*, *Commiphora erythraea*, *C. kua*, *Grewia arborea* and *G. tenax*. Grazing was the main form of feed utilization, and grazing lands were communal and grazed continuously throughout the year. Natural pasture was available to animals for about 6 months, mainly from March to June (main rainy season) and September to October (short rainy season). During the dry season, natural pasture, browse plants and standing hay were important (Table 2). All households experienced a critical feed shortage during both the short and long dry seasons. Strategies for coping with feed shortages included: migration (December–February); and use of alternative feed sources like browse trees, enclosures and crop residues. Pastoralists supplement all classes of livestock, especially cattle, with mineral soil called Haya, usually during the wet season. The supplement was considered to make livestock fat and stimulate cows for reproduction, as well as having medicinal value.

Traditional rangeland and herd management practices

Clan leaders in madda walabu had no control over communal rangeland management practices. About 88% of respondents conserved feed as standing.

Table 2. Ranking of feed resources during the wet and dry seasons. Values are the percentage of respondents who rated that feed type as the 1st, 2nd, 3rd or 4th most common type.

Feed Type	Wet season				Dry season			
	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
Natural Pasture	89	11	3	-	56	27	16	6
Browse	11	73	28	9	31	32	15	28
Crop residues	-	9	44	91	6	30	30	18
Standing Hay	-	7	25	-	8	11	39	49

hay by establishing enclosures called Hogga, where standing hay was surrounded by thorny bush fences. About 98% of these enclosures were owned privately, while the rest were communal enclosures, accessible to all members of the community. Private enclosures provide greater control by the individual in managing that piece of rangeland to ensure conservation of forage for his animals and for the cultivation of more land. Enclosures were usually located around the homestead and farmlands and were used mainly for dry season feeding of lactating cows, calves, draught oxen and weak and sick animals. This rangeland management practice was a recent innovation. Drought (*i.e.*, shortage of rainfall), bush encroachment, poor productivity and lack of proper

management of enclosures were considered major constraints to production. Splitting of livestock species was common. Fifty-eight percent of respondents split their herd into village-based and satellite herds. Village-based herds such as calves and small ruminants were kept around the homestead, as were animals under production (lactating cows), sick animals and calves during the dry season. Satellite herds (bulls, heifers, dry cows and camels) utilized pasture and water remote from the homestead. Of the respondents, 71% were transhumance, moving their livestock seasonally in order to exploit areas remote from their permanent settlement sites.

The entire villages rarely moved with the herd and only 6% (5) of the respondents were nomadic, while the remaining 23% were sed entry. The extent and direction of movements depended on the availability of rainfall, water, feed and security. In the dry season (December– February), livestock, mostly cows, bulls, heifers, goats, sheep and camels, were moved to a remote location where water and feed were abundant and stayed as godaantu (migrants). House- hold heads and boys above the age of 15 years were responsible for migration. According to 63% of respondents, the frequency of migration has decreased over time, owing to settlement, decline in livestock ownership per household, human population pressure, conflict and government policy (encourages settlement, education and water points). The remaining 37% indicated that the intensity of migration has increased in the study district because of shortage of rainfall (*i.e.*, drought conditions), feed and water. Problems associated with migration were: wild animal attack 88%; death of livestock 73%; water short- ages 46%; feed shortages 14%; conflict 12%; theft 4%; and human disease 2%.

Rangeland condition and degradation

There were differing opinions on the current condition of the rangeland as compared with 30 years ago. Ninety-one percent of respondents indicated that the condition of rangelands was poor with drought, overgrazing and bush encroachment being the major constraints (Table 3). The com- munities were well aware of the extent of degradation that has been occurring in the rangelands and listed bush encroachment (83%), reduction of livestock numbers (90%), reduction of livestock output (90%), change in the proportion of perennial to annual species (81%), change in vegetation cover (93%) and soil erosion (93%) as indicators of rangeland degradation. Periodically, pastoralists assessed the condition of the range- lands, either individually or on a group basis, using mainly the following criteria: availability of grasses and water, freedom from animal and human disease, suitability to the different live- stock species and security of the herders. In the past, when grasses were abundant, pastoralists used fire as a management tool, but recently the use of fire has been banned.

Table 3 . Possible causes of poor range condition and rangeland degradation as ranked by the responses of the sampled households in Madda Walabu district

Causes	Current range condition (%)	Rangeland degradation (%)
Drought	90	87
Overgrazing	49	45
Bush encroachment	34	25
Population pressure	52	36
Increased settlement	11	27
Decrease in livestock mobility	-	33
Limited knowledge of rangeland management	37	27
Soil erosion	-	18
Lack of burning	1	7

Use of woody plant species. Pastoralists used woody plant species for a wide range of services, the primary use being for construction purposes (91%), followed by use as livestock feed (68%), for medicinal purposes (25%) and to some extent for timber (14%), food (30%), shelter (6%) and fragrance (3%). *Acacia busier* and *Combretum collinum* were important for use for house and fence construction. Some trees and shrubs were commonly used as traditional medicines for live- stock and humans.

Some tree species were also used as indicators of potential locations for wells during drought. Respondents perceived that *F. sycomorus* probably required large amounts of moisture and usually grew near underground streams, where the water table was shallow. While fuel wood was the major source of household energy, only dry and dead wood was used for fuel, as living trees were not cut as a fuel source. Charcoal making and marketing was rare in the area owing to government controls, prohibition of marketing char- coal and poor access to market.

Bush encroachment. About 86% of the respondents indicated their grazing land carried more bushes and shrubs than 30 years ago, while 83% of households perceived bush encroachment to be an indicator of rangeland degradation and blamed drought (56%), overgrazing (44%), uncontrolled livestock movement (42%) and lack of burning (9%) for triggering bush encroachment in the area. However, 17% of the respondents failed to give any reason for bush encroachment. According to the respondents, reduced production of herbaceous vegetation, mainly the grass layer (84%), difficulty in herding (54%), damage by wildlife (50%) and bloating (3%) were the

major problems associated with an abundance of trees and shrubs. *Acacia busier* and *Commiphora* species were the major encroaching bushes.

Poisonous plants. Poisonous plants were increasing in abundance but were not a major problem for livestock production in the district. In the pastoral areas, livestock were traditionally kept under free-ranging conditions on rangeland that was frequently denuded by drought, overgrazing and bush encroachment, so that animals could eat poisonous plants, which they would normally avoid. Ninety-three percent of respondents knew poisonous plants, both herbaceous and woody, which affected their livestock. The most common was *Tribulus terrestris* (kumudu), an herbaceous plant found during the wet season. Pastoralists considered it caused bloating in cattle at early growth stages and indicated that it was introduced from other areas. Grass species such as *Cynodon nlemfuensis* (kecha) were also reported to be poisonous for cattle, along with *Achyranthus aspera*.

Water resources. Availability of water resources has been a major threat and key determinant for the movement and migration of pastoralists in the study district, with 96% of households indicating that both Quality and Quantity of water were major problems. Intermittent rivers (26%) (Calcal, Jaban and Laantaa), ponds (63%) and rainwater (96%) were the major sources of water for livestock during the wet season, while ponds (27%) and permanent rivers (99%) (Wayib and Waabee) were the main ones during the dry season. However, these rivers flow on the southern border of the district, so were of limited benefit for the whole district.

In the Madda Walabu district, traditionally shallow ponds and wells were dug, with most belonging to the community, while some were owned individually. Strict rules applied to usage of water from the ponds, and ponds and wells were regulated, fenced and guarded by elders in the village. Some ponds were utilized only during the dry season and remained closed until this time. Pond water was used mainly for humans, calves and weak animals. About 54% of respondents reported that animals and humans might use the same sources of water. About 59% of respondents travelled more than 20 km in a round trip during the dry season to provide water for their animals, while a further 23% travelled 6–10 km.

Watering frequency of livestock depended on season, type of livestock species and distance from watering points. During the dry season, 10% of respondents watered cattle daily and 87% every second day, while 80 and 88% of pastoralists watered sheep and goats, respectively, every second or third day. Most (91%) watered camels every 4–7 days. To cope with water shortages, 52% of respondents would migrate to watering points, 6% used conserved water by digging ponds and 42% used a combination of the two. During the dry season, pastoralists dug shallow wells called eela at the side of intermittent rivers. The other form of water supply in the district was ground water, which was dug by a non-government organization (NGO) called Water-aid.

Rangeland use conflict

The term ‘conflict’ in the context of this study refers to the ongoing disputes between various groups over access to scarce range resources (Table 4). As far as rangeland use was concerned, 58% of respondents recognized that there was conflict between pastoralists over utilization and ownership of territory. About 96% of respondents considered that the conflict was between the Oromo and Somali ethnic groups.

There were different opinions as to whether the intensity of conflict over rangeland resources has increased over the last 3–4 years or not. Many pastoralists (85%) suggested a decrease in intensity, mainly due to an increase in conflict between the Somali ethnic groups such as Ogaden and Shiekal (Shekistan) around the border of Oromia and Somali National Regional State (SNRS), which reduced the tension between Oromo and Somali ethnic groups. A further reason for reduction in conflict was government interference. In contrast, 15% of respondents suggested that the intensity of conflict escalated during this period, mainly as a result of livestock feed shortages during the dry season. During the time of feed shortage, Somali pastoralists from the neighboring SNRS created pressure on rangeland resources and were a cause for conflict. However, most respondents agreed that conflicts were managed and mediated by clan leaders, community elders, religious leaders, respected individuals (Jarssa biya) and government and non-government bodies.

Droughts

Frequent and prolonged drought has been the most important natural threat that impact cause of famine in Madda Walabu district for many years. Respondents differed in their perception of the on the livelihood of pastoralists, remaining a major cause of famine in Madda Walabu district for many years. Respondents differed in the perception of the frequency of drought, 43% suggesting drought occurred every year, 32% every 2 years and 10%.

Table 4. Conflict situations in survey area.

Conflict		Percent
Ethnic group	Oromo-Somali	96
	Oromo-Oromo	4
Intensity over the last 3-4 yr	Decreased	85
	Increased	15
Cause for conflict	Grazing land utilization	2
	Grazing land ownership right	15
	Grazing land and water utilization	37
	Grazing land, water utilization and settlement	31
	Grazing land, water utilization, settlement and ownership	15

Values are the percentages of respondents in the study district who gave that every 3 years. Pastoralists have become largely dependent on food aid.

During drought years, pastoralists migrated to localities where resources were relatively more available. Moreover, they adopted strategies such as supplementary feeding (browse trees and conserved feed), herd management (maintenance of female-dominated herd structure, herd diversification), use of wild fruits, destocking and accepting assistance from various sources such as government bodies and NGOs.

This study has provided a wealth of information on current management systems in the madda Walabu district of Ethiopia, which will be invaluable in developing sustainable management strategies for use by pastoralists. The development of agro-pastoralism resembled that in other pastoral areas in Ethiopia (Ayana and Gufu 2008), reflecting a change from the traditional pastoral lifestyle of much of the 20th century.

Like many pastoral and agro-pastoral communities in other pastoral areas of Ethiopia and east Africa (Coppock 1994; Ndikumana *et al.* 2001), households kept more than one species of livestock to secure their livelihood, with a pre-dominance of female animals. Retaining two or more species with different feeding habits can make more effective use of vegetation and often be more profitable. In addition, different livestock species can serve different roles (Scoones 1995; Amaha 2006), with sale of livestock and livestock products providing the main source of income (Ndikumana *et al.* 2001; Abule *et al.* 2005). As elsewhere in Ethiopia and other pastoral areas in east Africa, communal grazing was the main traditional land-use management system in the study area. Establishment of additional enclosures in the study area could provide an opportunity to develop a more intensive grazing land management and could help in reducing grazing pressure on communal lands, creating access to fodder banks and improving restoration of soil for successful rangeland development. The problems associated with enclosures in the study area were similar to those reported by Oba (1998) and Gemedo (2004) in southern Ethiopia Borena. In contrast, Admasu (2006) reported that enclosures in Hamer and Bena-Tsemay districts were found to be in good condition with no bush encroachment. The allocation of grazing lands for wet and dry season use in the study area was not as well developed. The traditional range and livestock management practices observed in this study of splitting livestock herds based on species, type and productivity, migration and free ranging of communal land were similar to those reported from other east African countries (Oba and Kotile 2001) and for Borena pastoralists (Gemedo 2004). Mobility and opportunistic resource utilisation characterized the pastoral production system. It was a very important strategy of pastoralists to exploit scarce vegetation and water resources in dry lands and was in harmony with the harsh environment. The extent and directions of movements, trends of migrations and the problems facing pastoralists in the current study were similar to those reported by Scoones (1995), Abule *et al.* (2005) and Amaha (2006). Pastoralists associated the spatial diversity and abundance of bush and shrub vegetation with free movement of livestock in the communal grazing land, resulting in dispersal of seeds of different plant species.

In semi-arid ecosystems, these issues are some of the major factors that cause conversion of grasslands to woodlands (Archer 2003). There is also ample evidence in the literature that bush encroachment causes a decline in rangeland condition and the respondents in this study supported this view. The control of bush encroachment will require a proper understanding of invasive species, the degree of encroachment, the mechanisms leading to their increase and the population dynamics of the invasive species, which would be used to develop a long-term community-based control program.

Prolonged droughts have been the most important natural threat to the livelihood of the pastoralists, as found in many other studies (Ndikumana *et al.* 2001) and were ranked as the major factor responsible for degradation of rangeland in the study area. In meteorological terms, Pratt *et al.* (1997) suggested that drought occurred when rainfall was below half the long-term average or when rainfall in two successive years fell 75% below average. According to Coppock (1994), drought can be defined as 'when two or more consecutive dry years occur in which the length of the growing period (LGP) is less than 75% of the mean, i.e., a drought is driven by several consecutive rainy seasons in which deficient rainfall has a determinant effect on the production system.' Historical evidence indicates that natural climatic patterns produce cycles of drought, followed by periods of relatively higher rainfall. However, Snyman (1999) reported that the effects of low rainfall can be intensified by injudicious grazing

practices or overgrazing, which can lead to ‘man-made droughts’. Degradation of the rangeland ecosystem, accompanied by soil loss, can be the case in the study district. Even in normal years the intensity of management-induced droughts, which are usually localized, as was the case in the study district. Even in normal rainfall years, parts of the grazing lands could suffer from localized drought, which could have been the underlying reason for the responses of some participants regarding the frequency of drought. People with degraded rangelands create their own droughts and increase the intensity and frequency of climatic droughts (Snyman 1999). Pastoralists have developed comprehensive knowledge and skills to cope with drought in its various forms, resorting to strategies such as migration, supplementary feeding (browse trees and conserved feed), herd management (maintenance of female-dominated herd structure, herd diversification), use of wild fruits, destocking and assistance from the government, non-government organizations and relatives. With predicted patterns of climate change as a result of global warming, the frequency and severity of drought periods are forecast to increase and more drastic measures will be required to prevent an increase in the rate of rangeland degradation. Reduction in livestock numbers will be an integral part of any coping strategy.

Studies conducted in parts of Ethiopia and the horn of Africa have indicated that pastoralists are challenged with multi-dimensional conflicts (Hogg 1997) as a result of competition for resources, changing patterns of resource use and the weakening of traditional mechanisms governing resource management and conflict resolution (Hussein *et al.* 1999). In our study, the main reason for the escalating conflict was perceived to be livestock feed shortages during the dry season. Mohammed (2003) reported that inter clan conflicts have often been resolved using traditional social organization and suggested that traditional social institutions could have a key role to play in resolving conflicts regarding management of natural resources, bringing sustainable development to pastoral areas. Hence, a strengthening of the traditional institutions and formulation of a conflict management policy would be crucial for successful development programs.

CONCLUSION

One of the major conclusions to be drawn from this study is that the current communal grazing system for rangelands is not sustainable. Since the problems facing pastoralists have emerged over many years, the solutions will also require time to implement. It is essential that degradation of rangelands be halted and the current condition of communal rangeland be improved through rangeland rehabilitation, conservation and improved management. This would involve resting of communal grazing areas, controlled grazing management, strengthening of privately owned enclosures as well as establishment of community-based enclosures in some key sites. The traditional goal of almost all livestock owners using communal rangelands is to maximize their animal numbers, which can lead to overgrazing. This culture is unsustainable and pastoral communities must be educated to reduce their livestock numbers to sustainable levels. This would involve the provision of local information on the enhanced performance of livestock when stocking pressures are reduced, resulting in greater productivity from reduced numbers of livestock. Furthermore, it is essential to focus on strengthening of the traditional resource management system, and provision of both technical and technological support to pastoralists. All stakeholders must be involved in the planning and execution of management strategies with full participation of pastoralists and government and non-governmental organizations. Critical elements of any plan would include the conservation and management of desirable trees and shrubs for sustainable use. To this end, the indigenous knowledge of pastoralists about range-livestock management and their environment should be incorporated in the planning and implementation of developmental interventions.

Since drought (extended dry periods) has such an impact on pastoral production systems, minimizing its effects will have significant direct impacts on the livelihood of pastoral communities. As a result, strengthening early warning systems, and developing coping and disaster-response mechanisms incorporating both indigenous and scientific knowledge should be a matter of priority. Furthermore, establishment of community-based grazing reserves in some key range sites for use during drought periods is essential.

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