

## The Role of Indigenous Knowledge in Rangeland Management in Yabello Woreda, Southern Oromia, Ethiopia

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### Abstract

This study was conducted with the main objective of assessing the role of indigenous knowledge of Borana pastoralists in managing rangelands. The study hopes to contribute ideas (or methodology or facts or data) to policy makers, planners and or anyone who intends to conduct a study in the similar theme. To this end, the main data for this study were emanated from both primary and secondary sources. In order to analyze qualitative data the researcher was called for discussion of the ideas, opinion and concepts of collected data. But, for quantitative analysis of data Microsoft Excel program were applied to present the results in the form of charts, graphs, percentages and tables. The study has showed that the mobility, herd splitting, customary institutions and traditional enclosure (kaloo) are identified as the main indigenous knowledge of Borana pastoralists in rangeland management. The problems affecting the productivity of rangeland should explicitly be regarded as community and societal problems and not simply the only concern of pastoralist. Communities and concerned bodies should stand beside pastoralist in supporting and integrating indigenous and technical knowledge for sustainable management of rangeland.

**Keywords:** Indigenous; Knowledge; Indigenous knowledge; Rangeland; Dry lands

### Introduction

#### Background and justification

Complex pastoral management systems have evolved from the pastoralists' successful adaptation under the harsh conditions of arid and semi-arid rangelands [1]. Similarly Blench [2] noted that, the existing pastoral systems including their local adaptations are highly diverse, although they share common development trends. Pastoral resource management systems are influenced by natural environments with high variability in rainfall and recurrent extreme climatic conditions, associated with spatial heterogeneity. Again, the pastoralists' knowledge and strategies in rangeland and water management are disturbed by inappropriate development policies, and this leads to environmental degradation and the erosion of important social structures.

Pastoralists in Ethiopia like the other African countries have continuously suffered from a long history of political, economic, and socio-cultural marginalization. The pastoralist's problems have been exacerbated by recurrent and complex natural calamities such as drought, flood, disease etc. [3]. The environment is the basic determinant of the nature and productivity of rangeland ecosystems of pastoralists. Physical environmental factors, like climate, topography and soil determine the potential of rangeland to support certain types and levels of land use [4].

Since the 1990s, pastoral development approaches in eastern Africa have improved, due partly to increased support for livestock mobility, customary institutions, and pastoral livestock strategies, and partly to a

greater emphasis on human development and rights based approaches. The building blocks for pastoral development, notably empowerment and governance, are now better understood and addressed, but there remains a major gap in understanding, at a practical level, of how pastoralists manage their natural resource base. Development projects have enabled pastoral communities to strengthen their tenure over rangeland resources, and to restore traditional management practices, but projects often lack the capacity to help pastoralists to benefit from scientific advances in rangeland management [5,6].

Rangeland monitoring is the process of periodically assessing the condition of the natural resources, mainly vegetation, water, and soil. During the monitoring process positive and/or negative change in the pasture composition and consequently general land condition can be assessed. This information can assist in making proper land management decisions to ensure sustainable land use. Rangeland can be monitored both in traditional and modern ways. The traditional method of rangeland monitoring and evaluation follows changes in indicators of environmental health, enabling herders to adjust their forage management and conservation strategies to the long and short term availabilities of resources [4].

Indigenous or local knowledge can be defined as skills, practices and technologies that are an integral part of the production system in a specific culture. They are area-specific skills and practices concerning natural resource management, human and animal health, etc. developed by indigenous people over centuries. Therefore, it is important to take advantage of indigenous institutions, environmental knowledge and traditional management practices [7].

Borana rangelands are one of the southern Ethiopia's lowland grazing units in which pastoralists have been keeping their livestock for living. Cattle, goats, sheep, and camels are the dominant domesticated animals in these rangelands. According to Cossins and

Upton [8], the Borana pastoral production in southern Ethiopia was considered until the early 1980s as one of the few remaining productive pastoral systems in East Africa.

Since then, there is evidence that the system is experiencing decline in productivity, associated with periodic losses in cattle populations; changes in land use; and fire ban that have resulted in the proliferation of bush encroachment and a general decline in forage production.

The present crisis might be the result of the combined effects of climatic variability and increases in bush cover that may increase the risk of drought-induced herd die-offs [9].

Traditionally, the vagaries of the natural environment can be overcome through access to and management of communal rangelands, mobility of stock, and institutions for mutual assistance. However, drought induced livestock mortality is often seen as a symptom of inherent flaws in livestock production systems; barren rangelands are taken as evidence of unsustainable grazing pressure and increasing land degradation [10].

Therefore, the rationale for this study was to identify major factors that hamper the potential of rangeland productivity and to assess the role of indigenous knowledge in rangeland management.

## The Study Area and Methods

### The study area

The Borana Rangeland is found in Oromia National Regional State, southern Ethiopia. It lies between 4°0'-5°30' N latitude and 37°30'-39°20' E longitude. It covers about 95,000 km<sup>2</sup> which is estimated to be 7.6% of the national area. Yabello Woreda is found in this category covering about 5556 km<sup>2</sup> (Figure 1).

Woreda is located between latitude 4°30'55.81" and 5°24'36.39"N and longitude 37°44'14.70" and 38°36'05.35"E [11] (Figure 2).

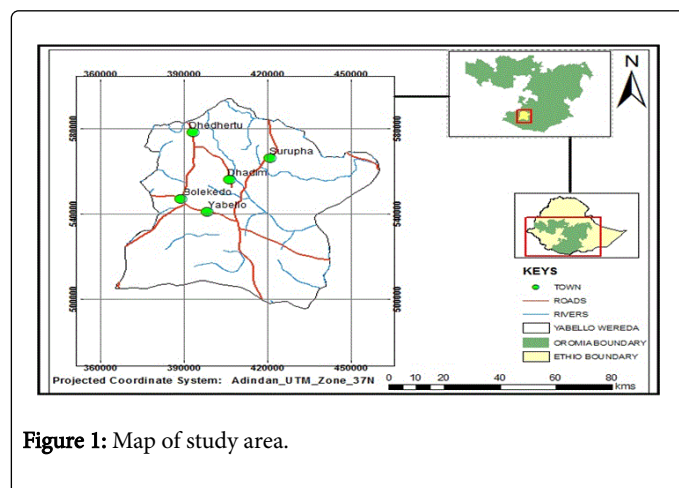


Figure 1: Map of study area.

The study area comes under the influence of a bi-modal monsoon rainfall type, where 60% of the 300-900 mm annual rainfall occurs during March to May (Ganna) and 40% between September and November (Hagaya) [12].

Adisu [13] also cited that, the rainfall of the area is distinctly bimodal pattern (Figure 3).

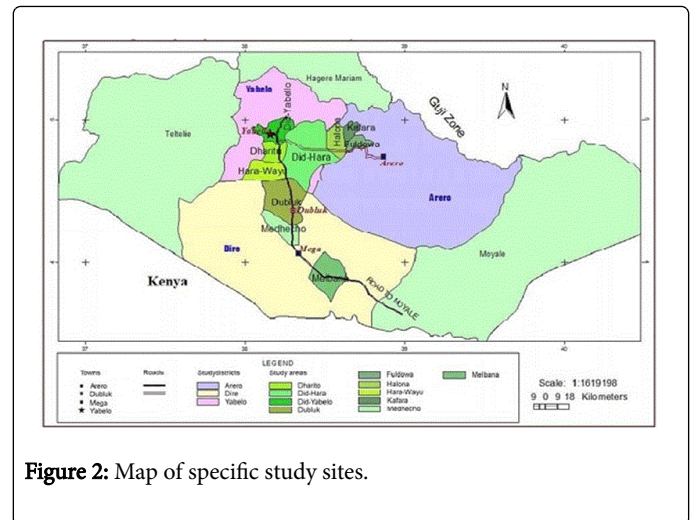


Figure 2: Map of specific study sites.

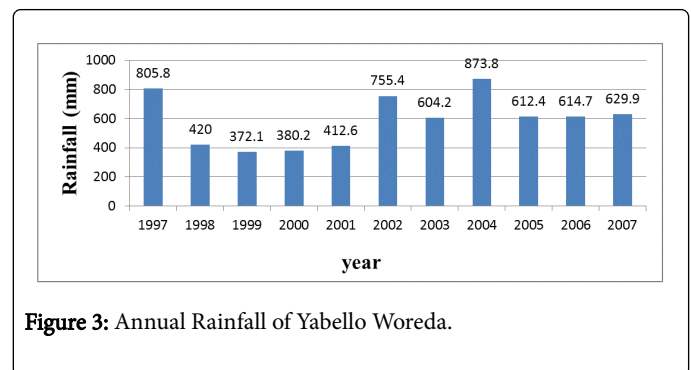


Figure 3: Annual Rainfall of Yabello Woreda.

### Research design and methods

For this study partially mixed concurrent dominant status qualitative decision research design were applied.

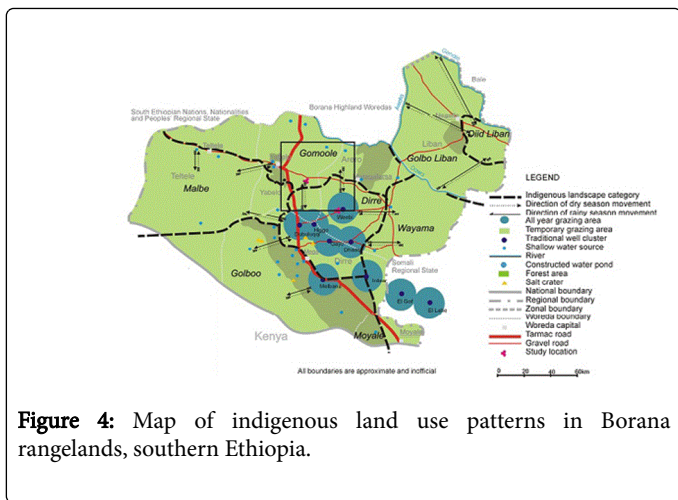
Both qualitative and quantitative methods of data analysis were considered. Qualitative data were analyzed by discussion of the ideas, opinion, and concepts of collected data. Quantitative data were analyzed by using of SPSS software and Microsoft Excel program to present the result in form of graphs, tables and percentages.

## Results

### Indigenous knowledge of borana pastoralists in rangeland management

Borana pastoralists' indigenous knowledge (IK) about range ecology, livestock resources and social organization has developed highly efficient range management strategies to deal with the high-risk environments of arid lands. Indigenous knowledge is a culture-based knowledge that is specific to certain group of peoples.

Even though some study says the utilization of indigenous rangeland management has declining, the practice is not totally lost. According to the responses of many of the respondents from study area, some of the practices of indigenous knowledge of pastoralists are discussed below (Figure 4).



**Figure 4:** Map of indigenous land use patterns in Borana rangelands, southern Ethiopia.

### Herd mobility

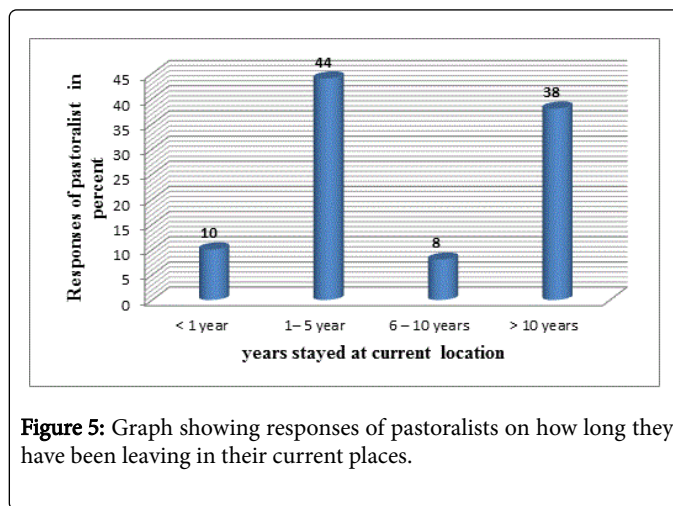
Herd mobility was traditionally practiced by the pastoralists as the key strategy to make use of the scattered rangeland resources on a large spatial scale. According to the ideas of most of the respondents from study area, they have been practicing the mobility of herds. Herd movements have been reduced considerably over time. Many years ago, Borana rangeland management was organized at a large scale of the landscape. Many of the respondents confirmed that, at present day movement by home is minimized because of pastoralist permanent settlement and mobility is by stock.

Some of the pastoralists (44%) from study area leave their previous location and move to the other reera (Figure 5). The prime reason for this movement was the decision made by Raba gadaa to arrange settlement and leave the settlement encroached into grazing area for grazing. The rangeland of Dharito and Dambala Saden was fragmented and taken by settlement and farmland. It is to leave the land for livestock/grazing. In Harweyu, bushes take the area of rangeland and some of the villages are settled in the area of grazing. Unlike that of Dharito pastoralist, some of the mobile pastoralists to Dambala Saden and Harweyu leave their previous location for grazing. This movement of pastoralist by home in study area is not by willing of them. It is because of the decision made by Raba gadaa. However now pastoralists not move by home but they send their livestock to other ardaa where there they believe forages are available. Before sending livestock to the other ardaa they send abuuru scout to that ardaa to observe the availability of forages and water sources of that ardaa and assure permission from abbaa dheeda (headman of seasonal grazing) of that ardaa. During the time in which drought is hard pastoralists from study area send their livestock to Dirree grazing zone.

As the displacement of villages was not by their will they also choose their present location as per the decision of kebele leaders. The head of each ardaa identify the villages settled in the prime grazing area and

identities the villages to be arranged with community. The decision of Raba gadaa was putted to action by kebele leader and head of each reera.

As it can be observed from the (Figure 5) some of the respondents stayed at their current location for less than one year (10%), others for one to five years (44%), about (8%) have been at their current location for 6 to 10 years and only (38%) of has lived for more than 10 years. Those who have stayed for one to five years are moved as a result of decisions made by raaba gadaa.



**Figure 5:** Graph showing responses of pastoralists on how long they have been leaving in their current places.

Many of the pastoralists (93%) have no plan to leave their present location. For instance, respondents from Dharito, if they are asked, whether they have planned to leave their current location, many of them responded they have no plan. Dharito is one of the kebeles of woreda that has been shifting from pastoralists to agro-pastoralism. Due to agro pastoralism nature of the area they cannot leave their farm land. The prime reason for them not to move is farm land and even during drought they move their livestock.

The mobility of pastoralists from Dambala Saden and Harweyu depends on the condition of rain and forage available for livestock. Dambala Saden is one of the kebeles of woreda that has been said remaining forage species are available and Harweyu is also one of the ardaa which is pastoralist, except a few introduction of farmland. Due to pastoralism nature of pastoralists they stay during the season on which forage is available for livestock at their area and otherwise they move. They move not by the home but by livestock.

The prime reason for the movement is that productivity of livestock depends on the availability of forage species which in turn depends on the rainfall availability.

The result of analytical discussion with elders and herders showed that, the most important fodder species that livestock graze during dry seasons are different grass species and leaf of different trees.

Scientific Name	Local Name	Growth form	Desirability	Life form	Frequency (%)
<i>Dychoriste hildebrandtii</i>	Gurbii gaala	Non grass	Less desirable	Perennial	11.6
<i>Cenchrus ciliaris</i>	Mata guddeesa	Grass	Highly desirable	Perennial	8.9
<i>Heteropogon contortus</i>	Seericha	Grass	Highly desirable	Perennial	8.5

<i>Dactyloctenium species</i>	Qabattee	Grass	Highly desirable	Perennial	6.9
<i>Chrysopgon aucheru</i>	Alaloo	Grass	Highly desirable	Perennial	6.2
<i>Pennisetum mezianum</i>	Ogondhichoo	Grass	desirable	Perennial	6.2
<i>Eragrostis papposa</i>	Saamphilee	Grass	Desirable	Annual	5.4
<i>Solanum sehimperianum</i>	Hiddii qixii	Non grass	Less desirable	Perennial	3.9
<i>Cynodon dactylon</i>	Sardoo	Grass	Highly desirable	Perennial	3.5
<i>Abutilon hirtum</i>	Gurbii daalattii	Non grass	Less desirable	Perennial	3.1
<i>Tagetes minuta</i>	Suunkii	Non grass	Less desirable	Annual	2.7
<i>Chloris roxburghiana</i>	Hiddo luucolee	Grass	Highly desirable	Perennial	2.7
<i>Oxygonum sinuatum</i>	Mogorree	Non grass	Desirable	Annual	2.3
<i>Digitaria naghellensis</i>	Ilmoo gorrii	Grass	Highly desirable	Perennial	2.3
<i>Sporobolus pellucidus</i>	Salaqoo	Grass	Desirable	Perennial	2.3
<i>Digitaria milanijana</i>	Hiddoo	Grass	Highly desirable	Perennial	2.3
<i>Xerophyta humilis</i>	Areedoo	Grass	Desirable	Perennial	1.9
<i>Helichrysum glumaceum</i>	Darguu	Non grass	Not desirable	Perennial	1.9
<i>Commelina Africana</i>	Qaayyoo	Non grass	Highly desirable	Annual	1.9
<i>Chlorophytum gallabatense</i>	Miirtuu	Non grass	Nor desirable	Annual	1.9
<i>Indigofera volkensisii</i>	Gurbii hoolaa	Non grass	Less desirable	Perennial	1.6
<i>Pupalia lappacea</i>	Haanqarree	Non grass	Less desirable	Annual	1.6
<i>Eragrostis capitulifera</i>	Biilaa	Grass	Desirable	Perennial	1.6
<i>Rhynchosia ferruginea</i>	Kalaalaa	Non grass	Desirable	Annual	1.2
<i>Cyperus species</i>	Saattuu	Grass	Desirable	Annual	1.2
<i>Bothriochloa insculpta</i>	Luucolee	Grass	Highly desirable	Perennial	0.8
<i>Alaku ajoo (not known)</i>	Alakuu ajoo	Non grass	Not desirable	Annual	0.4
<i>Psydax schimperiana</i>	Gaalee	Non grass	Less desirable	Perennial	0.4
<i>Abutilon species</i>	Gurbii re'ee	Non grass	Less desirable	Perennial	0.4
<i>Solanum somalense</i>	Hiddii gaagee	Non grass	Less desirable	Perennial	0.4
<i>Lantana rhodesiensis</i>	Midhan dubraa	Non grass	Less desirable	Perennial	0.4
<i>Mixixiqaa (not known)</i>	Mixixiqaa	Non grass	Desirable	Perennial	0.4
Source: Yabello woreda pastoral development office, 2013					

**Table 1:** Desirability, growth form, life form and frequency (%) of the different grass and non-grass species in the study area.

The result of (Table 1) shows those, grass species like *Cenchrus ciliaris*, *Heteropogon contortus*, *Dactyloctenium species*, *Chrysopgon aucheru* and others are highly desirable for livestock to graze. Their life forms are perennial. The frequencies of *Dychoriste hildebrandtii* (11.6) is high followed by *Cenchrus ciliaris* and *Heteropogon contortus* with frequency 8.9 and 8.5 respectively. The growth form, desirability, life form and frequencies of other species can be observed from the table.

According to the herder at foora livestock, of Gombo mountain during the period of hard drought when root of grass are lost, livestock graze leafy trees like Ejersa (*Olea europaea* subsp. *cuspidata*), Biiqqaa (*Pappea capensis*), Dhamee (*Schrebera alata*), Dhitacha (*Dodonea angustifolia*), Gaallee (*Psydax schimperiana*), Daboobesa (*Rhus species*), Qalqalcha (*Boscia mossambicensis*), Mi'eessaa (*Euclea divinorum*), harooressa (*Grewia bicolor*) and etc.

Water is a crucial resource in the lowlands of Borana. Pastoralists depend on water for household consumption and for the watering of their livestock. The mobility of livestock even depends on the availability of water for livestock. The main source of water for the pastoralist from Dharito during dry season is Dharito wells. Dharito has three wells i.e., Dambicha well, Digalticha well and Hawaticha well.

The well manager (abba herregaa) establishes watering rights for well users by fixing water rota. During rainy season livestock and people get water from nearby small ponds. Again for Dambala Saden the main source of water for livestock during dry season are Labuu wells, Digaluu and Bulee ponds. Small ponds around villages, Doloollo and haya guraacha are the main source of water during rainy season for Dambala Saden.

In Harweyu hargaasaa water pump and Yaatu well are the main water source for livestock during dry season. However, during rainy season livestock get water from Dozori, Muyatte, Madhera hidda and Didibisa ponds.

### Customary institutions for rangeland management

The result of analytical discussion with elders and survey (97%) in study area indicates that Borana has a unique system (customary institution) of managing natural resources in general and rangeland and water resources in particular. Indigenous institutions includes local cultural form of organizations, for instance locally elected, appointed, or hereditary leaders and elders, customary rules and regulations relating to access to resources, indigenous practices and knowledge. The researcher has discussed the institution for rangeland management along with institution for management of water resources as they are inseparable.

Broadly speaking, the Borana customary institutions have been categorized into two forms: micro and macro institutions. Both could be further divided into many branches. Each of them has a responsibility for natural resource management and other societal issues at various levels. Management of any resource has to start at the lower level in accordance of Borana law. According to analytical discussions with elders micro level institutions for the management of rangeland are Warra, Ollaa, Ardaa, Reera, Madda and Dheeda. Again appointed and elected individuals in the community like Jaarsa dheeda, abbaa herregaa and Jaarsa madda have their own roles and rules of managing natural resources in general and range and water resources in particular.

### Warra

Warra is a smallest unit in the village that includes family of one household (the father, mother and unmarried children). The unmarried son and daughter get their own ibida/warra after they have married with their couples. The roles of warra in rangeland management start from the advice of parents to their children who look after livestock. They told to their herders not to be out of customary law of Borana. There are area reserved and not to be allowed for grazing during rainy season. For instance, kaloo (enclosure) is not grazed during early rain to allow the growth of grasses.

Livestock and calves graze open grazing areas this time. Herders or member of warra take care of resources on their side and even reports their father when he/she sees others are exploiting the resource. Then abbaa warra pass wrong doer to the concerned body or village heads.

### Ollaa (Village)

The ollaa (village) is the collection of different warra. The coming together of many households forms ollaa. Abbaa ollaa (head of village) is the most popular man among his villagers in terms of his ability to organize, analyze and manage things according to aadaa Borana (Borana custom). One or more villages have kaloo in common. From the villages which has kaloo together pastoralists elect one person to take care of enclosure.

### Ardaa

Ardaa is a particular site that is inhabited by a village or cluster of villages. Ardaa is a small grazing territory where its residents can commonly share water, pasture and other resources within the context of aadaa seera marraa-bishaan Borana (Borana customary-laws of pasture and water). Elders from a village or villages usually hold residential meetings on how to manage and share resources in their territory.

### Reera

Reera is the cluster of villages which are found in a specified site, or two or more close sites inhabited by people who can use water from the same sources and their herds can use on the same grazing grounds. Abbaa Reeraa (head of cluster) is a famous man or who has ability of managing rangeland and water resource of reera area. He represents the members of his fellow cluster at the next larger territorial unit, madda. People in the same cluster have also regular meetings to consolidate the natural resource management systems in their unit.

### Madda

It is a wider territorial unit than reera; its concept is derived from a permanent water source. It is made up of combination of clusters, which often surround the water well at its center. A madda is administered by the council of elders drawn from different clusters of that madda. In other words, they are heads of all clusters surrounding a permanent water source. They usually meet at water point to discuss how to manage and share water and pasture among residents in their unit, or with other new comers who come from other madda in search of better resources.

### Dheeda

This is wider unit than madda. In most cases it includes in it several madda's that are managed independently by council of elders drawn from different madda's. The word dheeda literally means grazing. So, the word is sometime taken as grazing land limited to specific unit. The Borana land has two major grazing zones Liban and Dirree. Liban grazing zone (dheeda) further divided into two Golbaa and Gubbaa while Dirree is blends goomolee, Malbee, Golboo, Dirree (Tula wells grazing zone) and Wayaama grazing zone. Jaarsa dheeda are responsible for decisions about mobility; addressing social disputes and have an important role in conflict resolution.

When we come to the management of water resources of Borana in general and that of study area in particular, the most important water resource that are highly regulated by customary institutions are wells, hand-dug shallow ponds known as haroo. However generally in Borana deep tula wells and natural ponds containing water throughout the year are managed through customary laws. The grazing lands surrounding well are protected (laafa seera eela) during the wet season and used during the dry season.

According to discussion with elders, property right of wells goes to the konfi who initiates digging ceremony of wells. Konfi is abba eela (father of well) and he passes ownership title to his clan after retired. The management of wells belongs to all members of clan and Borana in general. Konfi assigns well manager (abbaa herregaa). The well manager (abbaa herregaa) establishes watering rights for well users by fixing water rota. The other small management may go to abba guyyaa (father of the day) who regulates the daily function of the well. Abbaa guyyaa can be from any of Borana clan. He is appointed only for the day on which his livestock was watered from the well. He is the coordinator of the day and supervises the activity of the other groups like obaatu (those who lift water from the well) for livestock. Their responsibilities are lifting water for livestock from well and cleaning and collecting animal dung from daargulaa (well zone).

### **Herd splitting**

Herd splitting is one of the pastoralists' indigenous rangeland management knowledge. It is the practice of dividing the livestock into separate herds depending on their age, sex and productivity. Almost most of the respondents (96%) from the study area, responded that they split their herd into different divisions. Pastoralist divides their herds on the bases of their ages. The reason why pastoralists divide their livestock is that small calves and large livestock cannot graze together. Herd diversity and splitting are techniques that can be used to maintain the long term productivity of the range, and in some cases to improve degraded rangelands.

The result of analytical discussion with pastoralist from study area indicated that, pastoralists divided livestock as waatiyyee, yabbiyyee, haawichaa, and loon foora (mobile herds). Calves of both sexes younger than 5 months (waatiyyee) were kept on open grazing around the encampment and were supplemented with forage cut and carried to them. Yabbiyyee also graze open grazing around villages and enclosure. Cows providing milk for the households (loon haawichaa), and animals younger than three years was sent to the grazing heads. However mobile herds (loon foora) were sent to other ardaa during drought. Herd splitting allows easy management of rangelands. Livestock are grazed by their ages. When asked why not they mix all age categories of livestock, they reply that waatiyyee and loon haawichaa cannot graze together. During both season of grazing waatiyyee and yabbiyyee graze around the villages and loon haawichaa (milk herds) was sent to grazing head.

### **Traditional enclosure: Reserved grazing areas**

During analytical discussion with pastoralist, all of them repeatedly raised that, the use of traditional range enclosures locally known as kaloo is widely practiced in their area for dry season grazing. Traditional range enclosures can be used as a method of rangeland restoration where rangelands are often heavily grazed to allow the herbaceous vegetation diversity to recover. Each of the study sites has their own kaloo. One site has about two to four and above reera and each reera has their own kaloo. The prime purpose for the kaloo to be designated is in order to reserve grasses for dry season grazing. Most of the time kaloo is designated for waatiyyee and yabbiyyee. However according to views of some of the elders from the study sites, beside the divisions to which the enclosure is designated for enclosure is allowed to dullacha laafaa (weak cows), qottiiyo (oxen) and livestock to be sold. This is during drought season to improve the weight of livestock.

The management of kaloo (enclosure) in the study area is by Jaarsa dheeda (elder of grazing) of that reera. It was managed according the

customary institution. Each member of the village and reera has the responsibility for the management of the enclosure. If there is the misuse of enclosure the issues has first to be resolved at the village level by elders of the villages. If the issue has to be focused in-depth, Jaarsa dheeda has to make decision.

### **Migration of ollas and demarcation of settlement and grazing areas**

As many of the pastoralists (83%) from the study area indicates, demarcation of settlement and grazing area are the recent phenomena. It was started in the Borana in general and study area in particular in 2011 by raaba gadaa. It was before some three years. This is not the indigenous knowledge that has been practicing in the past. Borana pastoralist further explained that, Borana leader at the raaba gadaa has talked on the issues of rangelands and they have reached on the decision that, the area of rangeland has been taken by expansion of cultivated land and settlement. They have reached on the decision that the area of rangeland taken by settlement and expansion of cultivated land has to be leaved for livestock for grazing.

As it was pointed out by the respondents of this study, the prime objectives of this decision were to demarcate grazing area and settlement area and to have a good grazing area by leaving out some of the farmland in strategic grazing area and migrating village settled in strategic grazing area.

Some of the pastoralists were dissatisfied with this arrangement of grazing and settlement area. They were migrated in season of bona hagaya (long dry season) which is followed by prolonged period of hot and dry season and made migration difficult to them. However, it is not totally out of benefits. They responded that, even if migration is in the long dry season (bona hagaya), during the rainy season, the area that is previously under settlement and cultivation was used for grazing.

### **Major constraints to Ik-based rangeland management**

The outcome from the focus group discussions with most of pastoralists of the study area and result of survey (68%) indicates that, this interesting system of rangeland management (IK) has been facing a serious threat from many sides. From time to time the smooth functioning of Ik on the rangeland management has been weakening. On the views of discussions with the elders and herders, the constraints to IK-based rangeland management was from external interventions like intervention of state (kebele administration) in the power of elders, inappropriate development concepts like construction of permanent water ponds, and lack of pastoral oriented extension and ban of burning of rangeland.

On the occasion of discussion and interviews with pastoralists, they strongly asserted that, the power of elders, Jaarsa dheeda (elders of grazing) and Jaarsa madda (elders of watering) has been declining. This is again further confirmed by (73%) of survey result, which indicates as power of decision on rangeland management in not in the hands of the elders. The main reason for the declining of the power of decision making of the elder is the intervention of kebele leaders and leader of each reera in the management of rangeland. Throughout the encampments in the study areas, younger community members and abbootii reera (father of each reera), in experienced in rangeland management, were appointed and given the powers of decision making at the local level. The power they were given was the power of elders. They concentrated on public security and political control, but gave

little consideration to the rangelands. The elders were excluded from decision making as if their management system is backward and hence no longer able to apply their knowledge. In all of the study sites when there is miss-management of range and water resources, reera and kebele administrations makes the decisions. This has made the networks between elders to be weakened.

As raised by many of the respondents from study area, inappropriate development concepts for instance, the construction of permanent water ponds in former rainy season grazing areas in Dambala Saden started in the early 1970s or in beginning of gadaa Gobba Bule has severely disturbed pastoralists' herd mobility and thereby reduced the variability in stocking densities. The assumptions for water developments were that the lowlands of Borana lacked surface water in general. The main water sources of study area are small hand-dug ponds and some deep and shallow wells in which livestock degrade rangeland surrounding the areas of the well. The aim of water development program was to reduce pressure on the dry season rangelands by creating watering points in the wet season rangelands.

The Ethiopian land use policy has favored sedentarization. The kebele administrations and extension services promoted crop cultivation as a means to settle the pastoralists on the permanent settlement. However pastoralist of the study area asserted that, dramatic expansion of cultivated land into the study area and increase of number of villages because of population increase is the main problem of rangeland management. Many of the respondents stated the reason of decline in mobility is expansion of farmland and that pastoralist can't move by leaving their farmland. In this development concept there is ignorance of pastoral livestock production and the lack of capacity to support pastoral rangeland management. Even though crop cultivation is base for the economy of our country, the extension messages were not appropriate to the needs of the pastoralists.

The issues of the proclamation to ban the burning of highland forests have equally applied to the pastoral rangeland. The ban to the controlled burning was introduced during Gadaa of Gobba Bule. According to the results of interviews with pastoralist, before banning of burning they control the expansion of the bushes by burning. Rangelands are burned during dry season when grasses are dried well. This can kill the species of bushes and allows for the new growth of palatable grasses. Borana pastoralist informed, after the application of this proclamation, their indigenous system of burning has weakened and even failed and since then bushes has taken rangelands at large.

## Conclusion

The study showed the role of pastoralist's indigenous knowledge in managing rangeland and major constraints to IK-based rangeland management.

There is a unique knowledge of rangeland management. In the past the strength of pastoralist IK is very good. The evidence presented in this study showed that mobility of herd, customary institutions, herd splitting and management of traditional enclosure are the main IK in rangeland management. At present day movement by home is minimized because of pastoralist permanent settlement and mobility is by stock. This is because of inappropriate development policy and expansion of crop cultivation. Customary institution of natural resource and rangeland management is not functioning well. However, the dependence on customary institution manages rangeland better. The use of traditional enclosure enables pastoralist reserve the forage

for the time of difficulty. Herd splitting into different categories and diversification were identified as a means in which pastoralists adopt to degrading environment and uses the declining rangeland resources sustainably. Indigenous knowledge is the most important system of rangeland management in Borana. The smooth functioning of IK-based rangeland management was disturbed. The severe disturbances to indigenous knowledge based rangeland management are from external intervention like inappropriate extension services and development polices. Power of elders, Jaarsa dheeda (elders of grazing) and Jaarsa madda (elders of watering) was intervened by kebele leaders. An extension service and inappropriate development message that does not go with pastoral community has considerable impacts on the well function of IK. Again the policy that has banned the burning for rangeland is against the traditional knowledge of Borana pastoralist in rangeland management.

## Recommendations

The productivity of rangeland in the study area is declining. This is because of many interrelated factors like bush encroachment, rangeland degradation, overgrazing, recurrent drought, erratic rainfall and expansion of crop cultivation. This has also considerable impacts on the livelihoods of pastoralist and rangeland productivity. The unique knowledge of community in rangeland management is also not functioning well. Therefore, the following recommendations are made for the future interventions by the researcher.

The problems affecting the productivity of rangeland should explicitly be regarded as community and societal problems and not simply the only concern of pastoralist. This mean it should be the concern of all stakeholders: government, private sectors, any local and international NGOs, pastoralists, public and etc.

The future development direction in Borana lowland should support indigenous knowledge of pastoralist in natural resource management in general and rangeland management in particular.

NGOs, Woreda and Zonal Pastoral Development Offices should stand beside pastoralist in supporting and integrating indigenous and technical knowledge for sustainable management of rangeland.

Management of traditional enclosure, mobility and herd splitting should be inextricably linked and managed in accordance to customary institution of pastoralist.

Rangeland development and extension services of the government should be built on pastoral indigenous rangelands knowledge.

Local and regional monitoring of rangelands problems should use local knowledge to focus the problem in detail.

Any rangeland development policy and programs should take into account IK of pastoralist and policies aimed to improve livelihoods of pastoralist should consider the structure of pastoralists.

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