ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF SOCIAL SCIENCES

INDIGENOUS PRACTICES OF RANGELAND MANAGEMENT: CONSTRAINTS AND PROSPECTS IN BORANA PASTORALISTS OF SOUTHERN ETHIOPIA, OROMIA REGIONAL STATE

BY: JARSO DOYO

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Glossary of Local Terms

Abbaa herregaa-a responsible person to facilitate water use

Abuuruu-the person or persons sent to search for grass and water in the area towards which people want to move.

Adaadii- shallow and unreliable water wells

Bisaan-water

Cirriqquu- small opening created at the side of the pond to remove excess water accumulated in the pond

Dambala- natural water pool

Dheeda- a group of village sharing pasture land

Duula-campaign

Eela-any water hole

Foora-satellite grazing camp

Gada- Indigenous socio cultural institution of Oromo in general and Borana in particular.

Ganna- The main rainy season from March to May.

Gu'eessa- Non lactating cows

Haawwicha- Home based lactating cows

Hagayya- Secondary rainy season from September to November

Hara/*haroo*- Pond

Kaloo-Enclosure or reserved forage bank

Konfii-The owner of a particular well or pond

Kora-Meeting held to discuss on a certain issue

Laagaa-The second position of watering animal

Loon-Cattle

Marra-grass

Olla-village

Qara-the first position of watering livestock

Reera- Adjacent groups of villages

Seera-rules and regulations underlying something

Tulaa-deep wells

Waaqeffannaa-Indigenous belief system of Oromo

Waaqeffataa-the followers of this traditional religion

Waaree-the practice of grazing livestock at night

Warra- homestead area that people live permanently.

Wayaama- the land with red soil and scattered short bush; the majority of the eastern part of Borana land.

Abstract

Degradation of range resources has recently been a serious problem due to multiple causative factors such as climate change (increased CO2 concentration in the atmosphere), surge in human and cattle population, and range resource management regimes. The aims of this research are to investigate Borana pastoralists' indigenous range resources management techniques and to describe the adaptation strategies of Borana pastoral community during frequent and extended drought.

Data were collected by employing in-depth interviews, observations, Focus Group Discussions (FGD) and informal discussions. The study results reveal that Borana pastoralists indigenous knowledge and experiences play a great role in pasture and water resources management. The regulatory role of water in managing grazing land is a very key factor for range resource management, especially during recurrent drought.

In addition, various adaptive strategies such as hay making and herd division are used by Borana pastoralists to cope with drought stress. Borana pastoralists are currently facing mounting challenges such as bush encroachment, shrinking of rangelands and frequent drought incidents. Consequently, these have put a great strain in the pastoral production system and eventually may even undermine the pastoral livelihoods in drought stressed semi-arid ecosystems of the Borana lowlands.

In general, indigenous range resource management system is more or less efficient and environmentally sustainable though the external interactive factors put the resource base under stress. Development interventions were made to improve the Borana rangeland condition but could not bring lasting solution. Therefore, development interventions should work on improving their weak sides.

CHAPTER ONE

INTRODUCTION

1.1. Statement of the Problem

Pastoralism is the main production system in the dry lands. Pastoralists inhabit in a marginal environment in which livelihood options are limited by the natural environmental factors, mainly unreliability of rainfall. This holds true for Borana pastoralists of Southern Ethiopia which is characterized by frequent drought and rainfall variability. Degradation of range resources is a serious problem due to multiple causative factors such as climate change (caused by CO2 concentration in the atmosphere) bush encroachment, surge in human and cattle population, and range resource management regimes. In recent decades, pastoralists' resource management is typically considered as the main cause for the degradation of range resources in the arid and semi-arid ecosystems of Ethiopia. This underscores the role of indigenous resource management techniques of the Borana pastoral communities. In addition, the adaptation strategies of the pastoralists to the challenging environmental conditions such as inadequate rainfall and fodder scarcity should also be taken into consideration to study the effectiveness of indigenous resource management system. This research is therefore, intended to study indigenous range resources management techniques and adaptive strategies to cope with ecological uncertainties.

1.2. Objectives

1.2.1. General Objective

The general objective of this research is to investigate Borana pastoralists' indigenous range resources management techniques and to describe the adaptation strategies of Borana pastoral community during frequent and extended drought periods in which range resources become scarce.

1.2.2. Specific Objectives

The specific objectives of this research are:

- To study Borana pastoralists indigenous range resource management techniques.

- To investigate the role of traditional institutions in range resource management.
- To assess the impacts of development interventions on Borana rangelands.
- To identify the challenges Borana pastoralists face in managing and utilizing range resources.
- To investigate adaptation strategies of Borana pastoralists to the variable ecological setting in which they live.
- To provide recommendations based on the findings of the study.

1.3. Research Questions

- How do Borana pastoralists manage their range resources?
- What are the role of traditional institutions in pasture and water resources management?
- How development interventions impact on range resource management of Borana pastoralists?
- What are the challenges that Borana pastoralists face in managing their rangeland?
- Which adaptation strategies are used to cope with variable environmental conditions?

1.4. Methodology

1) Data Sources

Primary and secondary sources were consulted to carry out this research. The primary data used in this research were obtained during field work by employing various methods described in the subsequent section.

Besides, secondary sources were used to supplement the data obtained from primary sources. The secondary sources include reports, archives and official documents from various organizations which were relevant to the problem under study.

2) Data Collection Techniques

The data collection methods employed in this research include in-depth interview, observations, focus group discussions (FGD) and informal discussions. This research is conducted in Arero

Woreda of Borana zone. From the 21 total *kebeles* three sample *kebeles* namely Fuldowa, Renji and Weeb were purposely selected by considering knowledge of these areas and transportation service. A brief description of each of the methods is provided below.

In-depth Interview: was carried out with key informants. In-depth interview, according to Lisa (2009), is an open ended, discovery oriented and unstructured interview which is conducted to understand person's insight, feeling, thought and opinion about the topic of interest. It assists to elicit the individual perception about Borana traditional range resources management system. In depth interview has been conducted with eleven individuals. Those who participated in the in-depth interview were largely pastoralists and some of them were workers of development agencies. For the profile of the participants, see the tables at the appendix of this paper.

Personal Observation: is another method of data gathering tool that used in this research. During the data collection period, the researcher made observations at different sites and practices of natural resources management. Direct personal observations, for instance, were made to various grazing sites, different water points and their maintenance activities, utilization and management system. This method is used to grasp an understanding about the features that the researcher has exposure to.

Focus Group Discussions (FGD): has been employed in data gathering process during the time of data collection. Participants were divided into four groups and discussions were conducted. The first two groups comprise 6 persons each and the third and fourth groups comprise 7 and 8 individuals respectively. The variation in number of discussants across groups is due to availability problem of participants during group discussions. The employment of this method is time and place specific in a sense that the time and place was arranged before the discussion started. This method is used for the purpose of checking whether the views forwarded by individual participants are shared among community members. Those who were involved in the group discussions were pastoralists who are believed to have long time experience in resource management.

Informal Discussion: is used with some informants. The informants involved in this method were few in number compared with those participated in Focus Group Discussions. That is five individuals were participated in informal discussion. Unlike FGD, informal discussions were

conducted at the time and place where people come together for different reasons (to water their livestock and summoned to discuss resource management for example).

3). Data Analysis

In this research, qualitative data analysis method was used. Qualitative data analysis or qualitative description of different aspects of the data has principally been employed. That data collected by different data gathering tools were analyzed using qualitative narration.

1.5. Significance of the Study

This research has several important contributions. It is very important in that it is aimed at studying the effectiveness of indigenous range resources management and identifying the causes for natural resources depletion. It also tries to assess the impact of development interventions on natural resource management and therefore, the finding of this research can serve as important input for development agencies and policy makers. In addition, this research paper can assist other researchers as a starting point for those who want to conduct further research on this topic

1.6. Limitations

Limitations are obstacles or constraining factors that happen and has adverse impacts on the research procedure and eventually degrade research quality. Some of these problems are obviously known and expected to happen while others are encountered unpredictably and situational. Likewise, there are many limitations that happened in the course of this research and these limitations can be explained as follow:

- Shortage of time and resources. As the time given for this research work is fairly low, it has its own negative consequence on the achievement of the objective of the research. Similarly, the budget allocated for this research is not adequate to afford all the necessary equipment needed for the accomplishment of the research work. Logistic problem was also one of the serious hindering factors. The inhabitants of the study area are sparsely, scattered over a wider geographical area and consequently it is very difficult to reach all intended areas without availability of transportation service. I sometimes used to travel by lorry and sometimes on foot to reach the site I want to visit or to conduct interview. As a result of this problem, I could not visit all the sites I had planned to do so. Had the

additional time and resource been given for this research, I hope that it adds value to the quality and achievement of the objective of this research.

- Data gathering process of the research is, unfortunately, coincided with a prolonged dry season as a result of failure of *hagayya* (the rainy season that covers from September to November) rain in the research area. This consequently, resulted in a shortage of fodder and water both for animals and human use. Due to the above mentioned problem, all residents of the area, especially adult males whom I want to include in sample in large number, are very busy in search of water and fodder for their animals and consequently are not available for interview and group discussion. This has reduced the sample size than is intended amount.

- Security issue-there were a rumor of ethnic conflict between Borana and Garri ethnic groups and therefore, some of the adult males were hiding away around the border area between the two antagonists to protect their boundary against enemy and are not available for participation.

1.7. Organization of the Thesis

The thesis constitutes of seven chapters and they are organized in the following way. The first chapter deals with the introductory part of the thesis such as statement of the problem, objectives of the study, research questions, methodology, significance of the study and limitations of the study. The second chapter focuses on theoretical framework, and the review of related literatures. Whereas, the third chapter provides details about the background of the study area such as physical settings including location, climatic and socio-economic conditions and means of livelihood.

The fourth chapter deals with access to range resources and rules and regulations governing these resources.

This is followed by the discussion on indigenous range resources management techniques with their limitations.

Challenges facing range resources management and utilization are presented in chapter six. Finally, summary, conclusion and recommendations are provided in chapter seven.

CHAPTER TWO

LITERATURE REVIEW

2.1. Conceptual Framework

Definition of Rangeland

According to Fikre (2010:21), “Rangelands are those areas of the world which by reason of physical limitations-low and erratic precipitation, rough topography, poor drainage, and/or cold temperatures-are unsuited to cultivation and which are source of forage for free roaming native and domestic animals, as as well as source of wood products, water and wildlife” (Fikre et al. 2010). They include grass lands, shrub-steppe, desert shrub, savanna and open woodland. Any areas of the world which is not barren desert, farmed, bare soil, rock and ice can be classified as rangelands (ibid). Ludwig and Bastin (2008), on the other hand, define rangeland as “dry areas unsuitable for broad-acre farming but fertile and wet enough for pastoralism” (Ludwig and Bastin, 2008:1).

2.2. Theoretical Framework

2.2.1. Theory of Common- Pool Resources

There are many different theoretical models that can be applied to the natural resource management such as the theory of common pool resource, tragedy of the commons, cattle complex theory and others (Halake 2010:9).

The theory of common pool resource deals with the common property management such as forests, pastureland, irrigation system and fisheries. As Ostrom *et al*., 1994 (cited in Halake, 2010), indicated that common property resource find out the problem of resource appropriation and provision. As to this view, an appropriation problem can results in over consumption of natural resources where an individual benefits at the expense of the large community and the condition of the resource (ibid).

According to Hardin (1968) theory of “The tragedy of the Commons”, a set of pastoralists inevitably trapped in the overuse of their pasture. This concept was thought for many years to be

typical for common-pool resources not owned privately or by a government. Since Hardin thought the users would be trapped in their over use of a resource, he recommended two solutions to prevent future tragedies: state control and individual ownership (Hardin 1968). Based on these assumptions, the common property resource issue was ignored until the mid-1980s and the resource property regimes deduced into state control and individual ownership in different parts of the world (Halake 2010). Dietz *et al*,(2006) contrary to this, argued that Hardin has oversimplified common property regime. He ignored the fact that social groups including herders on the commons have strived successfully to avoid resource degradation by developing and maintaining self-governing institutions (Dietz *et al.*, 2006:126-7).

The proposition that protecting natural resources from damage is commonly agreed upon and the community have shown cooperative effort, both in the past and the present, to manage resource in the long run (Pretty 2006:142). Yet common property resource remains immensely valuable for many people and exclusion can be costly for them and the community can work together collectively to use natural resources sustainably over the long term (ibid: 144). Meizen et al., (2001) argued that co-operation is acknowledged due to the fact that it plays crucial role within the process of common property development and management (cited in Homann 2004:19).

The other theory that deals with the range resource management is the Cattle Complex Theory (Herskovits 1926, cited in Ayalew 2001b) which argue that herders make irrational economic decision. The central argument of this theory is that pastoralists tend to maximize their herd size on communal grazing territory that adversely affects the whole group sharing the commons. That is they increase the number of their livestock by disregarding the range's carrying capacity with the aim of keeping large number of animals for prestige rather than for utilitarian values (ibid). The argument of this theory revolves around the ideological conceptions of livestock than its economic values. Like the "Tragedy of the Commons", it mainly concerned with negative impacts cattle keeping on communal grazing land without taking into account the social resource management system in place. Tadesse stated that Cattle Complex Theory has been particularly focusing on the notion that pastoralists are conservatives and irrationally keep cattle for prestige and cultural choice (Tadesse 2006). Livingstone *et al.*, (1997), contrary to this, argued that pastoralists build the size of their herd both for economic and non-economic purposes (social values).

The theory of common pool resource is preferred to other above mentioned theories because of the fact that the tragedy of the commons and the Cattle complex theories have some defects in their argument of resource governance and their respective limitations can be briefly explained as follow.

The concept of the Tragedy of the Commons is principally emphasizes on the over exploitation of the range resource by pastoralists- that is individual ownership of livestock is the main threat to the communally owned range resources. It ignores the social principles that governs range resources management and utilization and criticized common resource management system. The proponents of this view exaggerate the impacts of common property resource. Gordon (1956), one of the advocates of this view argued that “Every body’s property is nobody’s property” that is as if range resource management remains nobody’s responsibility. The other limitation of this theory is that it recommends the state control of resource-that leads to the application of *top-down approach* where there is state control over the resource at the top and resource users, the community, at the bottom. This obviously brings management gap between resource administrators and users.

Ayalew (2001b) pointed out that Cattle Complex Theory blames the pastoralists for accumulating excessive number of animals beyond ranges resource capacity. It also argued that pastoralists are unresponsive to the market price and they do not sell their livestock even if the market price is raised to the desired level.

It is undeniable fact that keeping high number of animal regardless of available resource base has its own adverse impact on the resource. But it is important to identify whether there is any management system in place to mitigate or to counter balance the problem and this theory fail to consider this fact. Furthermore, it is crucial to consider whether pastoral production system is market oriented or price sensitive one. Both these two theories gave more emphasis on the one aspect of resource management by ignoring other aspects.

From compared theories, therefore, the theory of common pool resource is used as a theoretical model for this research. Because Borana pastoralists manage their natural resources by the collective community decision as these resources belongs to the entire Borana and therefore, common pool resource management is more applicable than the rest theories.

2.3. Review of Related Literature

This sub-section deals with the comparison between Borana pastoralists range resource management system with that of other pastoral groups such as Somali, Karayyu and Afar pastoralists all of whom reside eastern part of Ethiopia to see whether the resources management practices of these groups is similar or different from that of Borana pastoralists.

Ayalew stated that access to grazing land in Karrayu is traditionally regulated on communal basis-that is all members of the Karrayu society have equal chance to pasture resources. Being a member of Karrayu automatically guarantees a person to have free access to available resources in the areas (Ayalew 2001b:109). Grass and grazing land in the Karrayu society is regarded as a free gift from God and the underlying concept is that denying any karrayu person access to a particular grazing area is regarded as denying God (ibid).

Similarly, Boku and Helland stated that Borana land is a collective property of entire Borana, not to any specific clan, interest group or individual person and therefore, any Borana person can graze his herd wherever he want without any restriction (Boku 2000:77 and Helland 1997:65).

Hogg pointed out that most Somali clan have the concept of a home-area in which their respective clan or sub-clan live and move. This area is considered to be dominated by a particular clan along with available pasture and water resources (Hogg 1997:112). Contrary to this, however, in Borana pastoral area, there is no area inhabited by a particular clan or sub-clan and likewise all the available resources are managed and utilized on the communal basis and all residents have equal right to use available resources (Boku 2000:77). As far as resource management is concerned, only *tulaa* wells are owned and run with respect to clan lineage (ibdi).

In Somali pastoral areas, the right to water resource depends on its scarcity and labor expended to obtain it. Surface water such as river and natural depression are regarded as gift of God and free to everyone whereas water accumulated in dam, cistern or anthropogenic ponds and wells dug by human is regarded as a personal property of individual or his sub-clan. Water point ownership in Somali again depends on the depth of water points-that is shallower wells are the property of extended family while deep wells are commonly considered to be the property of sub-clan (Hogg 1997:114).

According to Hogg, in Somali pastoral areas it is only at clan and to some extent sub-clan level where there is a marked association between lineage and territory and this association is related with customary usage of the land and family ownership of wells (ibid:113). Hogg insisted that it is only in time of war or grazing pressure that prescriptive right of grazing territory is claimed and if this right is challenged this can be maintained by force (ibid). This is, however, not the case in Borana pastoral area. If there is disagreement among individuals or groups sharing pasture and water resources, the dispute is resolved by elders' mediation but no use of force.

In Afar pastoralists (Boku 2000:77) pasture and water resources management practices, as opposed to Borana indigenous range resource management system, are carried out on the basis of clan-lineage controlling a specific territory. Getachew stated that mobility is one of the crucial strategies used by Afar pastoralists to avoid or to minimize the risk of stock loss that possibly may happen and to access seasonally variable grazing resources (Getachew 2001:39). This seasonal mobility is a common feature of different pastoral communities such as Borana and Karrayu.

2.4. Indigenous Borana Rangeland Management Institutions

Borana pastoralists have managed their pasture and water resources by using their own knowledge and experiences without any external support and interference for about hundreds of years. This indigenous range resource management system is based on interaction between plants, grazing animals and the local communities with non- living elements of rainfall and soil playing a key role. In this system, the role of herders is to manipulate herd's mobility in accordance with available fodder and water resources (Oba 1998:3). Watson stated that Borana have strong set of range resources governing indigenous institutions that is said to provide them with a coherent internal governance (Watson, 2003). Access to and use of resources is shaped by a variety of overlapping institutions, regularized practices, set of rules and organizations and decision-making practices (ibid).

The Borana social structure provides a framework within which pasture and water resources management is carried out at two broad levels of traditional administrative structure (Boku 2000:34). These two levels are namely "administration from above" and "administration from within"-the former by gada system(the supreme administrative body not only in resource

management but also in all other social affairs as far as Borana social structure is concerned) and the latter is the management of *tula*, deep wells by clan arrangement(ibid:34). Boku argued that ownership right and administrative responsibility for running the wells is based on clan while that of the pond is based on territorial units such as *olla* (village), the compound villages occupying a particular geographic unit (*ardaa*) or adjacent geographic unit known as *reera.* The people who reside in the same *madda* usually meet at different water sources to discuss how to share pasture and water resources among the inhabitants using these resources together (Halake 2010:32).

Contrary to this, however, Helland argued that there is no evidence available indicating that *madda* is a resource management unit at all. As opposed to Halake argument, Helland stated that the people who reside within the same *madda* come together as a unit only in the annual *dhibaayyu* rite-celebration to ensure continued good yields from the wells and the fertility of people and animals (Helland 1997:73). Similarly, Hogg stated that the term *madda* is misinterpreted by development agencies as a fixed resource management unit (Hogg 1997:19).

2.5. Development Intervention in Resource Management in Borana Rangeland

Development programs have tried to introduce the new concepts such as ranches, permanent water points and settlement for mobile pastoralists but with little success. Pastoralists come in to contact with a series of development activities and consequences of which they have little understanding and control (Keya 1991:75). The first projects for Borana pastoral development were organized in the mid-1970s. The SORDU (Southern Rangeland Development Unit) project was part of Ethiopia's Third Livestock Development Project that mainly focuses on improving rangeland condition and herd for the purpose of taking animals out of pastoral areas (Helland 2001:68).

Before SORDU the pastoral system of Borana relied on a system of split-herd management with clear seasonal mobility of herds and Borana was famous in the context of East African pastoral societies for exceptionally rich pasture without the usual sign of over utilization and degradation found elsewhere(ibid). Despite its effort, SORDU failed in bringing desired change mainly because of its non-participatory approach and disregard of the indigenous range management practices (Ayyana and Adugna 2006:112). Similarly, other authors (Agrawal and Gibson, 1999, Leach et al., 1999), argued that different development agencies such as SOS-Sahel, GTZ and

Save the Children have been working in Borana rangelands for decades. In doing so, however, the degree to which these agencies tried to integrate indigenous institutions in to development process was limited. As a result, they could not win much support from the community side (cited in Watson 2003). The impact of development intervention as Helland argued is quoted as:

> "*…the altered management regime is probably the most direct cause for the resource degradation taking place in Borana, but factors like loss of large land areas to pastoral competitors and continued encroachment from agriculture in to the best part of Borana must also be mentioned" (Helland 2001:68*).

Helland and others argued that development interventions are made for Borana but by outsiders on behalf of 'beneficiaries' without participation or involvement of Borana. Investments in pastoral development remain unsuccessful or fail to achieve their objectives principally because of the outsiders' insufficient understanding about pastoral resource management system (Jahnke, 1982, Sandford 1983, and Salih 1992, cited in Homann, 2004). To indicate emphasis put on understanding local context the following statement is quoted;

> *"While resource management with a view to maintain the productivity of Borana pastoralism is an important objective of several development projects in the area, it is argued that institutions created for this purpose will fail unless the existing organizational and societal feature of the Borana are taken more fully in to account". "…If overexploitation of the pasture, deterioration of the vegetation resources, bush encroachment and so on are real problems in Borana, the solution must be sought in a management system which is operated by the Borana themselves according to the modalities of the Borana way of organizing public affairs" (Helland, 1997).*

2.6. Development and Expansion of Ranches in Borana Rangeland

Ranch establishment is brought to the Borana rangeland as a result of development interventions. The current rush towards ranching by individuals or a group of businessmen may be viewed a recent development of the last decade. But ranch establishment is not new in Borana and it was through the active engagement of the state that considerably wider tracts of pastureland were alienated from Borana pastoralists. The study carried out in Kenya by George A. Keya indicates that many commercial ranches in Kenya were established in high potential grazing area following the alienation of land from pastoralists (Keya 1991:82).

The establishment of ranches is one of the major contributing factors to the loss of Borana pastoral land area which is the backbone of Borana economy and 60% of Borana reported that they lost substantial portion of their land as a result of ranch establishment (Skinner 2010). Many of the current conflicts over ranches in Borana are therefore actually associated with sites initially expropriated by the state in the name of livestock development (Boku 2000:93). There are different ranches still operational in Borana rangeland. They occupy a very vast area of land which accounts for about 33805ha. Some of these ranches such as Dida liban and Surupa ranches are owned by a private company known as ELFORA while Dida tuyura ranch is owned and run by the state. Community access to these ranches, except Sarite community ranch, is denied (Skinner 2010). Oba (1998) reported that one of the most worrying changes in Borana rangeland is expansion ranches for privatization of communal grazing land. This land expropriation is by the people who have relation with administration and urban business community. Alienation of range resources puts the Borana pastoral system under increasing pressure and undermines efforts to improve pastoral production (Oba 1998b:8).

Ranching was started in Borana rangelands when SORDU demarcated special ranch for the purpose livestock fattening and thereby integrating the pastoralists to the highland market (ibid). Ranch development (Tadesse 2006) in the Borana rangeland has principally pay attention to the benefits of government and individual investors but less attention to the pastoralists' need. These ranches lack profitability for their objectives and remain unpopular with Borana pastoralists. It was pointed out that ranch strategy in SORDU ran counter to the survival tactics of Borana (Coppock 1994:35).Borana, Guji and Gabra population have complained bitterly about the occupation of their good grazing sites and water points by ranch without their consent. Generally, the deterioration of rangelands due to development interventions such as resettlement and ranches has resulted in several adverse impacts in the Borana pastoral area.

CHAPTER THREE

BACKGROUND OF THE STUDY AREA

3.1. The Physical Settings

3.1.1. Location

Borana rangeland is located between 4-6˚N and 36-42˚E (Ayyana and Adugna 2006:111).

Borana rangeland is bordered by Guji administrative zone in the north and north east, Somali regional state in the east, Kenya in the south and Southern Nations, Nationality and peoples region in the west. But there is no clear boundary between the study area and surrounding areas as many of these areas are inhabited by pastoralists who constantly move with their livestock from place to place. Arero, woreda in terms of its relative location, is bordered by Odo shakisso woreda of Guji administrative zone in the north, Dugda dawa Woreda of the same zone in the north-west, Yabello Woreda in the west, Dirre woreda in the south-west, Dhaasi woreda in the south and Solima regional state in the east. From the 21 total kebeles in the Woreda, three sample *kebeles* namely Fuldowa, Renji and Weeb were selected.

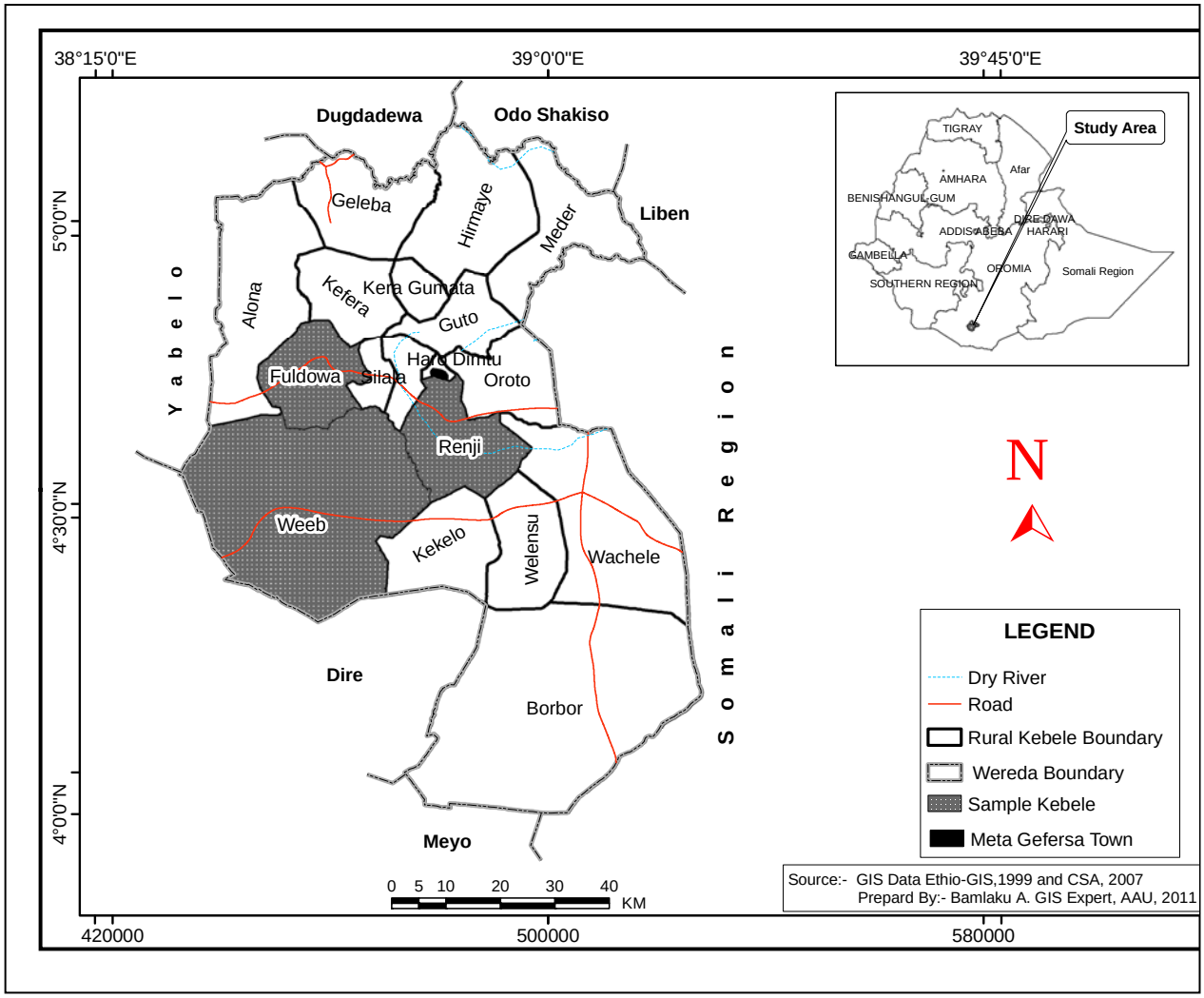

Fig. 3.1 Map of the study Area

According to the joint report of Oromia Agricultural Bureau and GTZ, southern Borana rangeland accounts for 7.6-12.3% of the total land area of Ethiopia. Kamara *et al.*, 2002) stated that the aerial extent of Borana rangeland in southern Ethiopia is approximately about 95,000km^2.

3.1.2. Topography

The Borana landscape, according to Coppock 1994, is mainly undulating plane with a few scattered volcanic cones. Among these cone-shaped hills, Dallona, Ensi and Yadan, found at the south west of Arero town, are few of them. The landscape slopes gently from the north-west to the south-east, between altitudes of 1500 and 1000m above sea level. In Borana land, as

elsewhere in Ethiopia, altitude is an important modifier of climate and rainfall seem to be directly affected by altitude (Helland 1983). Further more, the study area is characterized by the existence of some escarpments. Generally, Borana lowland is characterized by more or less an even slope with no much ups and downs.

3.1.3. Climatic Condition

The Borana rangeland is principally characterized by arid and semi-arid climatic conditions except some pocket areas with relatively humid climatic condition.

According to the (1999) joint report of Oromia Agricultural Bureau and GTZ, the mean annual temperature varies from 18-25 degree Celsius with slight seasonal variation depending on the location of different meteorological stations.

Regarding the amount of rainfall, different sources put different figures and this is probably due to the variation in annual rainfall over space and time. According to the 1999 report of Oromia Agricultural Bureau, for instance, the Borana rangeland receives the total annual rainfall of 440-1100mm. Watson stated that Borana rangeland receives the total annual rainfall ranging from 400-700mm (Watson 2003). (See fig 3.2 below).

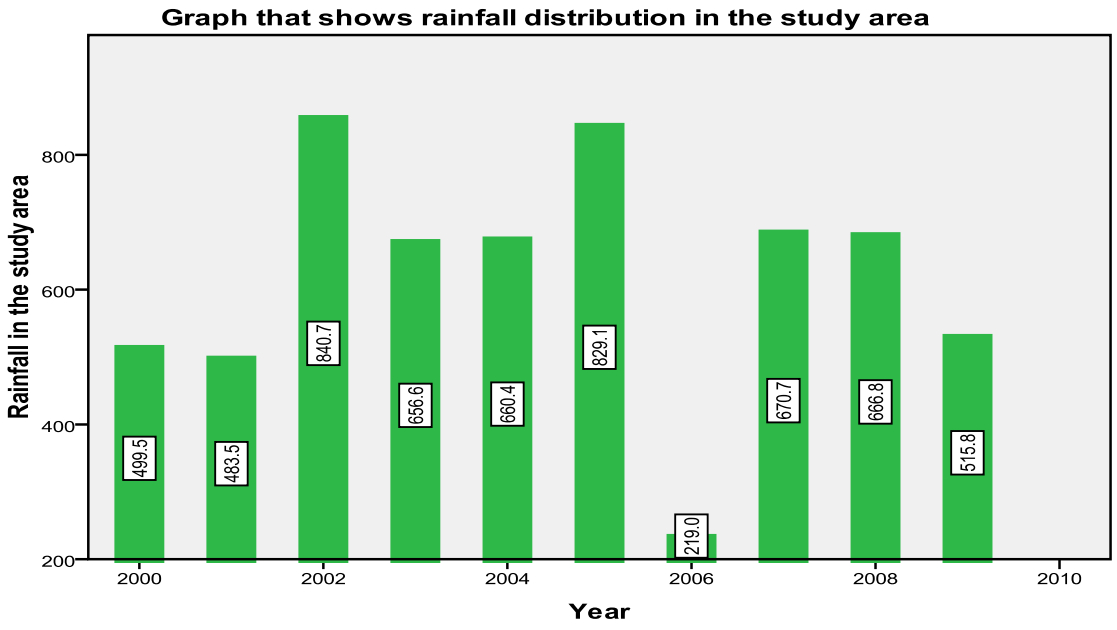

Fig. 3.2 Rainfall Distribution in Arero town Meteorological station (2000-2009).

Borana rangeland receives bimodal rainfall distribution. That is *ganna* (the "main" rainy season from March to May) and *hagayya* (small rainy season from September to November) are the two important rainy seasons. More than half of the rainfall in Borana rangeland is received in *ganna.*

Borana rangelands are characterized by the spatiotemporal variation in annual rainfall. Even sometimes the rain may absent at expected time or fall below average. In general, rainfall in Borana rangeland is very much unreliable both in amount, space and time of arrival as well.

3.1.4. Vegetation Types and Patterns of Distribution

In terms of vegetation cover and patterns of distribution, the majority of Borana land is covered by savanna vegetation with short and scattered thorny bush. According to Dalle et al. (2006), Borana range lands constitute deciduous woodland vegetation such as genera Combretum and Terminalia, whereas, the bush lands and thickets, which cover major parts of Borana land, are dominated by acacia and commiphora species. This scattered bush is inter-mixed with some perennial herbaceous and woody plants. From among growing vegetation types, various species of acacia predominates. Fulleessa *(Acacia derpanolobium*), Waaccuu (*Acacia seyal*), Saphansa (*Acacia mellifera*) and Ammeessa (*Commiphora africana*) are the dominant plant species in the area (PARIMA, 2008).

Some of the above mentioned species are very expansive and are rapidly encroaching on to the large part of Borana rangeland and eventually creating accessibility problems. It has been observed that *Acacia mellifera* and *Acacia derpanolobium* are a few of them currently creating this problem.

Larger part of Borana rangeland is covered by the short, scattered and thorny vegetations. But some evergreen pocket areas that are covered with a very dense forest known as *baddaa* in Borana were observed. For instance, Guuto, Ooblo, Boobella and Hirmayye are some of such areas found to the north east of Arero town and have this kind of vegetations. SOS-Sahel Ethiopia reported that Arero forest is one of the dense forests in Ethiopia that covers 2389ha of land. *Juniper procera* (known as *hindheessa* in local language) is the dominant plant species (SOS-Sahel Ethiopia 2008).

3.2. Economic Activities and Livelihoods

Animal husbandry is the commonly practiced old age economic system as ecological settings of Borana rangeland is more suitable for animal rearing than for crop cultivation (Ayana and Adugna 2006:111). Borana pastoralists keep various stock types such as cattle, goats, sheep, camel, and equines. Cattle keeping is the most favored one as cattle, beside serving as a source of livelihood, is associated with some social values as well.

Homann (2005) reported that Borana cattle are large East African Zebu breed. In the early period, Borana did not keep camel and it was introduced later than other stock types; that is, camel husbandry has began during the *gada* of Abbayi Oroo (1552-1560) (Oba 1998). Still some of the Borana families such as Karrayu beerree and Odituu warra qaalluu sub-clans do not consume any camel product. But the Gabra group principally keeps camel and goat and small number of cattle.

The inhabitants of the Borana rangeland, who were pure pastoralists in the past, are currently combining crop farming with animal husbandry and practicing agro-pastoral economic system.

According to the 2002 E.C report of Pastoral Development Bureau of Arero Woreda, the land that is potentially productive for agriculture is about 17% from the total land area of the Woreda (See fig. 3.3 below).

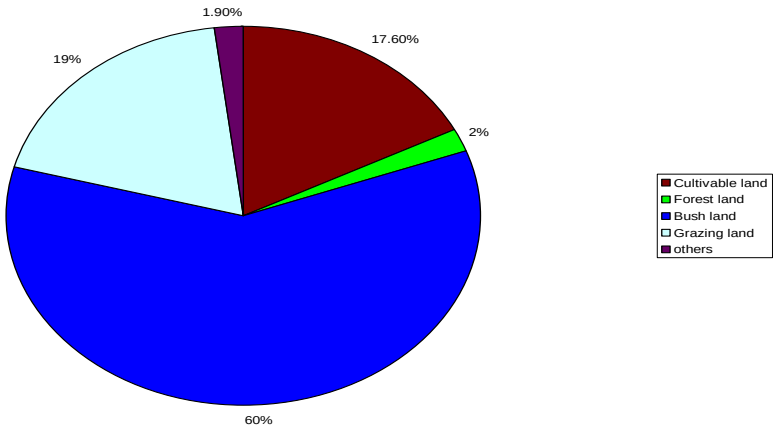

Figure 3.3: Land use and land cover in Arero Woreda (source: Arero Woreda Pastoral Development Bureau).

Crop production is intermittent in a sense that it is rain fed one and consequently the people abandon their farm if the problem of rainfall shortage occurs. As a result, the potential of agriculture on a regular basis is limited and is confined to some pocket areas. Arid and semi-arid nature of the Borana rangeland makes the people choice of economic system subject to "environmental determinism."

Borana people have less experience in urban based economic activities including commercial activities. This is probably due to the low rate of urbanization and poor infrastructure development. Borana depends on various means of livelihood such as animal product (mainly milk) and food grain though purchase, food relief or from farm if condition allow them. But the total reliance on milk is currently changed and the people began to seek for additional means of livelihood subsistence as milk yield decreases with decrease in range land productivity.

The people of study area earn their income from different sources. In the past they depended on the sale of livestock and livestock products like milk and butter as a main means of income earning. But recently, there are various additional sources from which people earn income. These are:

- Some of them get money from the sale of forest products such as charcoal, firewood, gum and others. This is the main source of income for those who are relatively lower in economic status or lead a destitute life.
- Gold mining area found at the northern part of Arero Woreda is also another source of income. People engage in this gold mining activity by the time their animals are too weak to sell as a result of failure in rainfall and consequent failure in crop production.

As I mentioned above Borana are less commercially oriented and as a result, the cash income per household is relatively low. Even if they have a number of animals, they never sell them except in a critical condition. It is therefore, easy to understand that lower cash income does not mean that a given household is poor. It is not cash income that serves as an indicator of people's economic status but instead the number of animals a given person possesses is the measure of his or her wealth.

3.3. Demographic Background

This sub-section deals with demographic aspects such as population size, growth rate and density in study area. According to the report of Central Statistical Agency (CSA, 2007) the total population of Arero Woreda is about 48,108 of which 93.7% live in rural area and the remaining 6.3% are urban dwellers. The total population of the three selected kebeles namely Fuuldowa, Reenjii and Weeb according to the report of Arero Woreda pastoral Development Bureau (2002 E.C) is about 5750, 5589 and 7923, respectively.

The annual human Population of Borana is most probably growing between 2 to 3 percent. Population density per area is very low; that is about 4persons/Km^2. That is the population density over a given place is not constant because majority of them are mobile pastoralist who frequently move from place to place following the availability of water and pasture.

CHAPTER FOUR

RULES AND REGULATIONS GOVERNING WATER RESOURCES MANAGEMENT

4.1. Important Water Sources in Borana

Water and pasture are the two most important resources in Borana pastoral system of production. They are the two sides of the same coin that cannot be treated separately. In most cases Borana call the two resources as one together by the name *marra- bisaan* which means grass and water. They also say *marra bisaaniin dheedan* which means the utilization of pasture depends on the availability of water. This indicates that the two resources are inseparable or they are complimentary resources. In other words, pasture land cannot be used if water is not available in the area. Different written sources confirm the complementary nature of the two resources. In addition to being considered as important resource for pastoralists (Ayana and Adugna 2006:113), water plays a central role in regulating pasture land exploitation. Access to water, according to the World Bank report, determines the utilization of the surrounding pasture (World Bank 2005).

Boku (2000 and Halake 2010) reported that Borana pastoralists use different water sources. It is principally from rain water (harvested in ponds and natural pool known as *dambala*) and ground water that they extract by digging wells. The water wells are known as *eela.* These water wells or *eela* can be divided into two groups called *eela tulaa* and *eela adaadii* which means deep *tulaa* wells and shallow wells respectively. The difference between the two can be explained as shown in Table 4.1

Table 4.1: Comparison of *tulaa* and *adaadii* wells in Borana.

Tulla wells	Adaadii wells
Are relatively deeper	Are relatively shallower
Reliable water sources	Non reliable water sources
Clustered at various places	Scattered over the area
There is watering order	No watering order
Excavation and maintenance needs more resources and time	Excavation and maintenance needs less time and resources
Used by all stock types	Mostly used by small ruminants
Can support several animals	Can support small number of livestock

Source: Field survey Dec. 2010.

4.2. Water Points Control and Ownership

Like water points development and maintenance, water points ownership and control varies across water points and these variations are explained in the following section.

Ponds can be developed or excavated or improved either by the society or by development agencies. If a given pond is initially excavated by development agencies, there is no single person or clan that assumes the ownership. It belongs to the whole community and run by selected individuals instead. If the pond is excavated by an individual, that person automatically entitles the ownership of that pond[1].

Helland argued that the main principle for establishing ownership rights to water points is by investing labor through excavation, re-excavation or maintenance (Helland 2002). Whatever the improvement or re-excavation is made to a given pond, the owner of the pond is the one that scratch the ground for first time. Investing labor or participating in re-excavation or improvement does not guarantee a person to become the owner of a given water source but are the means of ensuring temporary right to access because of the very fact that clan affiliation is also one of the decisive factors to get access to particular well.

[1] In depth interview was conducted with Liban Dida in environs of Fuldowa in December 2010.

The owner of the pond is *Konfii.* This title of ownership inalienable one and cannot be removed from him in any circumstance. It is inherited and passes from father to son and then to grandson. Even if the owner died having no children, the ownership right would go to his close relatives[2].

Apart from *Konfii* (the owner of the pond), Liban insisted that there is a man known as *Abbaa herregaa* which means a person who is in charge of controlling water point. They are assigned by the decision of the community who use that particular water point[3]. Homann and others argued that institutional arrangement and networking within and between pastoral groups were used to enforce decisions among multiple resource users (Homann *et al*., 2007).The person assigned is the one who is well-skilled in resource management, good decision making, have good inter-personal relations, treat everyone fairly and who cherish respect from the community members.

His responsibility is to facilitate water use and set the order of animal watering day for all herders sharing that water point. They are also responsible for preventing violation of rules and regulations governing water use. These people who are in charge of facilitating water use are expected to come to water point on every watering day or send their representative in case they face problem and could not come[4].

The herders, who want to use that particular water source, must contact *Abbaa herregaa* before taking their livestock to the water source to get admission of watering their livestock there. The owner of the pond himself, if for instance he move with his animals to other and wants to comeback and use the pond, must contact *abbaa herregaa.*

Unlike the title of *Konfii,* the title of *abbaa herregaa* can not be inherited and it can be transferred from person to person either by the decision of himself or by the decision of the community. It can be transferred if he:

- Unfairly admit livestock to the pond (for personal benefit for example).
- Could not facilitate the pond use or make decision effectively
- Gets too old or sick and as a result could not come to the pond on each watering day.
- Voluntarily wants to be replaced.

[2] In depth interview with Liban Dida in Fuldowa area in December 2010.
[3] Ibid.
[4] In depth interview with Halake Wako in Fuldowa area in December 2010.

If a given *abbaa herregaa* wants to be replaced by another person, he cannot simply "resign" any time he wants without informing the community. This is so because he carries the responsibility of facilitating water use on behalf of the whole community. If he needs to be replaced he must inform the elders. Then the community arranges a meeting for the assignment of new person who replace him. Even if he inform the people, they do not leave him immediately and he must stay on duty until the one who replace him is assigned as the replacement takes time; that is the person who replace him may not be found quickly or the people may not agree on the person to replace him[5]. This indicates that resource management is carried out communally and therefore, the Theory of Common pool is relevant for this research.

Incase of the pond excavated by development agencies such as government and non-government organization, it is communal property and assignment of *Abbaa herregaa* takes place in the same way.

Adaadii wells (shallower wells) are another important water sources in Borana rangeland. *Adaadii* wells control and ownership is more or less similar with that ponds. Here there is disagreement among informants. The owner of the *Adaadii* well can claim priority right and even can exclude others from use if there is a problem of water shortage[6]. Contrary to this, *adaadii* well is equal for all users as long as there is water to use and *konfi* do not claim priority right[7]. Again this ensures communality of range management.

Tulla deep wells are the most important water source whose management is relatively complex than other above mentioned water sources. *Tulla* wells ownership and control is a sub-clan based phenomena. Like the case of pond, the owner of the specific well, *konfii,* is a person who digs the ground for the first time and the well is a property of that particular sub-clan to which a man belongs. Oba stated that property right of the wells is in the konfii (who initiated the digging) that is genealogically inherited through the paternal line (Oba 1998a). Primary right to well is with the individuals or direct descendants of individuals who initially excavated it (Watson 2003). As for me this sub-clan ownership of the well has disadvantage. That is if a certain clan has no their own well from the area in which they live they suffer when there is a water shortage or no enough

[5] In depth interview with Walensu Haro in Weeb in December 2010.
[6] In depth interview with Halake Wako in Fuldowa area in December 2010.
[7] In depth interview with Gufu Liban in Balli in December 2010.

surface water to use. As a result, they cannot graze their livestock in this area which in turn force them to leave their residential area (see Table 4.2).

Table 4.2: Weeb *tulaa* well Complex and Ownership

No	Wells	Owner sub-clan	Konfii family
1	Daraato	Maliyyuu	Liiban Seendee
2	Daaccituu	Maccituu	Liiban Galgaloo
3	Harboora	Karrayyuu raasaa	Boruu Galgaloo
4	Eela Halake waraaba	Digaluu eemajii	Halakee Waraaba
5	Dooranticha	Maxxarrii	**
6	Waticha	Warjiddaa	Waticha Guyyo
7	Soraa	Warjiddaa	Soraa Dhaddachaa
8	Koonicha	Koonnituu	Jaldeessa Iloo
9	Eela yabbii	Karrayyuu	Gufuu Liiban
10	Noonicha	Noonituu	**
11	Galaanticha	Galaantuu	Morowa Abbay
12	Saddeeti	Digaluu nuurtuu	Gobba Allaa
13	Ginda	Maxxaarrii gaadullaa	Diida Soraa
14	Baabboo qodhaa	Maxxaarrii meettaa	Kusse Banjuu
15	Dambicha	Dambituu	Halakee Baalla
16	Odicha	Odituu	**
17	Goolota	Karrayyuu ajeeji	Boruu Galgaloo

**conflict of ownership among different families (Source: Field survey Dec. 2010).

As indicated in Table 4.2, *abbaa herregaa* is assigned by the community decision from any clan randomly whereas in case of *tulla* well, *abbaa herregaa* is assigned by the owner of the well himself and is selected from a well owning clan. Watson reported that the day to day running of well is carried out by *abbaa herrega*, who is appointed by *abbaa konfi* in consultation with other clan members (Watson 2003). This reveals that the Theory of Common pool resource is more relevant and appropriate for this research.

Borana say *Tulaan warraa adaadiin foora* which means that *tulaa* well is the homestead or the base area while *adaadii* well is a seasonal temporary camp that used during satellite grazing and abandoned after short period of time. The underlying concept is that tulla wells are reliable water source and used permanently whereas *adaadii* wells are not[8]. This indicates how much *tulaa* wells are the focal point in Borana range resource management system and due attention is given.

[8] In depth interview with Halake Wako in Fuldowa area in December 2010.

4.3. Water Points Development and Maintenance

Borana pastoralists, as mentioned above, use multiple water sources found naturally or developed by the community themselves or by development agencies. Some water points are found naturally and later improved by human. They carried out different water point maintenance activities. These maintenance activities vary as to who participate and the way the maintenance is carried out. Group three discussants reported the following information. Pond, known as *hara* or *haroo,* is one kind of water sources commonly used by Borana pastoralists and their maintenance is conducted as follow.

- After the pond has been filled by the flood or rain water the people fence it with thorny bushes and keep the water for later use as other surface water is available for animals. Livestock are not allowed to drink pond water as long as there is alternative temporary surface water. Fencing is therefore, to exclude animals from entering the pond. That temporary surface water (of natural pool for example) is used first before it dry up due to evaporation and/or percolation. The fence around the pond is renewed from time to time.

- The rain water in the form of flash flood harvested in a pond in different rainy season carries a large amount of sediment into the pond and finally makes it shallower and shallower. The sediment deposition in turn reduces pond's water storing capacity. To overcome this problem the users remove siltation or sediment deposition from the pond. In doing so all pond user are equally responsible.

- In the rainy season there may be a heavy rain and consequent excessive flood. The flood discharged in to the pond may exceeds its water carrying capacity and finally destroy the pond. To avoid such problem, the pond users come together and construct a trench. This is done in order to divert the main water channel leading to the pond that carries a large volume of water which potentially can threaten the pond.

- If the pond is filled by rain water the users come together and create a small opening known as *cirriqquu* at the side of the pond. This opening serves as a passage via which excessive amount of water that possibly destroys the pond is removed or leaked out. These pond maintenance activities are initiated by the elders from pond users and they

present the problem for discussion. That is they arrange a meeting and call all pond users to attend the meeting. All people may not necessarily attend the meeting, that is one or two persons can attend the meeting on behalf of their respective village and inform their co-villagers what has been decided at the meeting. Following the decision, the silt removal from the pond is carried out by the joint effort of all users. People sometimes receive food aid either from government or from donors and this time engaging in a certain developmental activity is set as prerequisite to get the aid. In such case the beneficiaries are expected to work on improving a specific infrastructure such as school, water point and road. In such occasions pond rehabilitation can be conducted as a result of its integration with food aid program. During field observations, it was observed that people were working on well rehabilitation at weeb well complex sponsored by Save the Children, which is United States based NGO.

- The other method of pond maintenance, as group three discussants said, is conducted by the pond users on each watering day. That is the herders that water their livestock are responsible to collect all animal dung from the fringe of the water to avoid water contamination. Unlike the above mentioned maintenance measures done by all pond users, this one is done on daily basis[9].

Adaadii (shallow) wells are other important water points used and managed by Borana pastoralists. These wells maintenance is more or less similar with that of the ponds. Like the case of pond, *adaadii* wells are encircled by the fence and the fence is renewed frequently. Fencing of pond avoids misuse or untimely use of water by animals while that of the wells is to avoid the problem of sudden animals falling into the pond.

The problem of sedimentation commonly happens to the *adaadii* wells as well. It is even more serious in this case because *adaadii* wells in most cases are dug in water channel or along seasonal river banks and consequently sedimentation or siltation is more problematic than in case of a pond. As the dry rivers carry a large volume of water during rainy season the diversion seems impossible and the only measure taken in this respect is re-excavating at the end of rainy season.

[9] Discussion conducted with Group three

Development and maintenance of *tulaa* (deep) wells is a little bit differs and is more complex than that of ponds and *adaadii* wells. Waktole and others, stated that lack of surface water and variability in rainfall in the Borana rangelands forced the pastoralists to develop unique water system and management rules (Waktole et al. (2010). Although it is not known when and who initially excavated the wells, it is believed that wells excavation was carried out earlier than thirteen century by Oromo community used to live in the area (ibid). Tulla wells excavation, according to Gufu Liban, took place a long time ago by Wardaa- the ancestors of Borana pastoralists. They use sharpened stick, called *konfii,* to excavate the wells[10]. It has been observed that some of these wells such as Weeb and Irdar were excavated by penetrating a rock outcrop which is very difficult task to penetrate. What is not clear, however, is that how these deep wells were excavated by using simple hand tools at the time when modern technology and sophisticated drilling machines were unavailable.

Many written sources confirm that Borana pastoralists manage their range resource by community decision in which common interest is promoted. This in turn enables the entire members to develop the sense of ownership and protect the resource with joint effort. Commonly agreed rules and norms sometimes called the rule of the game give individuals the confidence to invest in collective activities hoping that others will also do the same (Pretty, 2006). Maintenance or improvement of *tulaa* wells is primarily the responsibility of sub-clan of *konfii* family to whom the well belongs (Oba 1998a). It needs substantial resources (including human resource or labor) and time. The well owning clan members are summoned and the meeting is held to discuss the issue of well improvement. The Hayyu is primarily responsible for calling clan assembly for allocation of resources for well re-excavation and maintenance (ibid). The participants of the meeting decide the amount of resources needed for well rehabilitation. These resources include live animal to be slaughtered, financial resource to buy ration, tools, labor force and the like. Those clan members who fail to attend the meeting have also responsibility to contribute and accept what has been decided at the meeting[11]. Homann stated that the users of wells join in assembly and request contributions to cleaning, maintenance and rehabilitation under the leadership of water manager (Homann, 2005). *Konfii (*the owner of the well) is expected to

[10] In depth interview conducted with Gufu Liban in Balli area in January 2011.
[11] In depth interview with Roba Tadhicha in Funan biressa in December 2010

slaught a bull at the well site to confirm well ownership[12]. Some number of bulls to be slaughtered and milking cows which are necessary for labors are determined to begin well excavation (Oba 1998a). Every clan member, except those who are destitute, must contribute but the amount to be contributed varies from person to person based on their economic status. The amount each individual invest depends on their respective property. Even those who are not using the well at that particular time, due to distance for example, are also responsible to contribute because if they come to the area around the well they can water their herd without any restriction[13]. Watson (2003) argued that the entire well users have responsibility to contribute during well excavation (Watson 2003). This implies the relevance of Common Pool resource theory to this research. Being a member of particular clan does not guarantee a person to use the well of his clan unless he contributes for well improvement or maintenance. If he fails to do so his accessibility to that particular water point is ceased from that time onwards[14].

Huka insisted that those who are not members of well owning clan can voluntarily invest in well improvement to safeguard their interest of watering their livestock temporarily but cannot claim ownership right[15]. Watson (2003), similarly, reported that member of other clan or those who have not contributed to the construction of well can use the well but cannot rely on it on regular basis (Watson 2003). Later on, however, they could be denied the access to use. In some cases, those who do not contribute to well maintenance can use the well on the following grounds:

- If there is social bond (marriage for example) between a person and the owner of the well.
- If a person has no well of his respective clan in that area.
- If a person is in charge of dealing with social problems and maintain law and order in Borana social life (gada councilors for example).

4.4. Rules and Regulations Governing Range Resources Management and Utilization

The rules that determine who can use resources and how they can use them help shape the way that people use resources and manage their livestock (Luseno *et al.*, 1998). Borana pastoralists

[12] In depth interview with Huka Jatani in in Didimtu area in December 2010.
[13] ibid
[14] In depth interview with Huka Jatani in Didimtu area in December 2010.
[15] ibid

have their own customary rules, though not written, that govern range resources management. According to Oba, the rules and regulation governing natural resource management in Borana was formulated by Borana prophet (*raaga*) known as Moro Uchuma (Oba 1996a). These rules and regulations are called *seera marraa bisaanii* which means the law regulating pasture and grass resources management. Those who break these rules face punishment. If for instance, a given person is seen watering his livestock at a particular water point without informing *abba herregaa* or without keeping his watering day, *abba herregaa* present the case to the community and the meeting is held as usual and make decision[16]. Pretty argued that mutually agreed sanctions ensure that if someone breaks the rules he/she know that there will be punishment as a result (Pretty 2006).

4.5. Development Interventions and Local People's Attitude

Based on the assumption of the tragedy of the commons, development interventions wanted to modernize the pastoral production system which is not compatible with traditional Borana communal grazing land ownership system (Tafesse 2000:). Sinclair and Fryxell pointed out that development projects are based on the assumption that changes in the grazing system and in patterns of pastoral land use will improve rangeland productivity (Sinclair and Fryxell 1985 cited in Ayana and Adugna 2006:). This indicates that development interventions primarily focus on the transforming pastoral indigenous resource management regime rather than encouraging it and it is possible to conclude that is why they fail in bringing desired change and winning much support from pastoralists' side.

Interview has been carried out both with pastoralists and the workers of development agencies to investigate the impacts of development interventions on range resources management and utilization. Different works of development agencies (government and non-government organizations) such as construction of water cistern and selective bush clearing have been observed (see fig. 4.1).

[16] Informal discussion with Jirma Duba in Omacho area in December 2010.

Figure 4.1: Water cistern constructed by Arero Woreda Water Development Bureau in 2000 E.C (Source: Photo taken during field observation).

Local people have different attitude towards the development agencies operating in the area. That is 86% (36 out of 42 informants) of them complain that development interventions have adverse impacts on range resources management while the remaining 14% argued that interventions to some extent solve the problem. Those who argue against development interventions reported that development agencies engaged in development of water point at various sites that have negative impacts on the range land management. They criticize this involvement of development agencies for various reasons stated below.

1. Construction of water points has caused rangeland degradation. That is proliferation of water points in rainy season grazing area impairs seasonal mobility of pastoralists. This in turn, causes simultaneous grazing of rainy and dry seasons pasture. Rangeland degradation in Borana range land is intensified by unsound water development policy which in turn is responsible for breakdown of indigenous pattern of land use (Oba 1998a). Water development was identified as one of the factors that disturb indigenous-knowledge based range resource management (Homann et al. 2007). That is Borana pastoralists traditionally use seasonal grazing pattern. Some of the grazing land is used during rainy season, other reserved for dry season grazing. The area that used during dry

season is the area around permanent water wells or the area in which surface water is scarce whereas rainy season grazing is in the area with enough surface water. By the time rainy season grazing area is used, the dry season grazing area is left to recover and vice versa. Proliferation of water points at many places in all grazing areas makes both dry and rainy season grazing land to be exploited at the same time and this in turn impairs seasonal grazing pattern.

2. Informants complain that water projects are developed at the expense of traditional ponds and wells. Waktole and others similarly, reported that interventions, instead of strengthening indigenous water management system, have introduced less laborious alternative water points (Waktole, et al.,2010). This makes many users reliant on engine-pumped water and depriving the well of the regular maintenance (ibid). In the past Borana pastoralists frequently conduct water points maintenance activities which are very laborious and time consuming. Similarly, drawing water from deep wells is also very difficult task.

Following the expansion of water points people began to abandon using traditional wells and ponds and their maintenance as well. As a result, many of the traditional wells and ponds are becoming out of use.

3. Many of the water projects constructed by development agents are power based one and their functioning depends on the availability of fuel whose cost is increasing from time to time and sometimes not available.

4. The generator that pumps water most of the time, suddenly fail while operating by the time many of the herds are there and waiting for their turns. If this problem occurs people are forced to go to the town in search of technician to resume it or instead take their livestock to other water points which is very serious problem.

The counter argument is that development interventions, to some extent, could solve the problem water shortage in Borana rangeland. They said that water shortage is very critical problem particularly during the dry season except in some area where people has access to the *tulaa* wells, the only reliable water source in Borana rangeland. Those who argue in this respect do not deny

the above mentioned adverse impacts of development interventions on rangeland but give priority for water.

The reality is, however, that the impact of this water project (figure 4.1), for instance, is double edged one. The area in which it was constructed is previously used by the inhabitants of the area as a main grazing area; that it is relatively better than adjacent area in terms of grass coverage. The construction of this water project attracted a very high number of livestock to the area and consequently, the area is overgrazed. Now a day, it has been observed that the area around this water point is totally devoid of grass.

Besides, it also has positive impact for inhabitants of the area. In addition to this water point, there was one important water point known as Dambi pond in this area up to April 2010 which the herders use for watering their livestock from one rainy season to the next. This pond was destroyed in April 2010 as a result of heavy rain in the area at that time. Since then, people began to use funnaan birreessa water cistern, which is the only water source people have access to at present. As people have no access to other alternative water sources, they are forced to water their livestock both day and night. Had not it been constructed, people of this area have no other option but to abandon this area and move somewhere. Generally, though it has some adverse impact on the grass resource, it could, to some extent, able to solve a very serious problem that the residents possibly face.

But what all informants agree is that there is communication gap between development agencies and local people. It is obvious that lack of consultation with local community has its own negative consequences on the local people and on the achievement of organizational goal. It also causes the people to develop resentment towards development efforts which in turn resulted in lack of cooperation from community side.

The other intervention area is bush clearing activity as a means of improving rangeland productivity (see fig 4.2).

Figure 4.2: Bush clearing activity (Source: own photo Dec. 20101).

Many sites at which bush clearing is underway are observed and the researcher had tried to get information from those who engaged in bush clearing activity. This activity is initiated and conducted by the government and non-government organizations operating in the area with the aim of improve rangeland condition. The above picture (fig.4.2), for instance, is the site from which bush is cleared funded by Save the Children/ United States. Bush clearing practice on the government side is integrated with safety net food aid program and on the side of non-government organizations it is reinforced by cash income. Bush clearing is carried out either on the communal grazing land or in the group owned *kaloo* (reserved fodder bank). It is practiced primarily with the purpose of controlling bush encroachment. One of the people engage in bush clearing, who was not volunteer to tell me his name, told me that they do not hope that bush clearing does not solve the problem of bush expansion and they work only for the sake of payment and food aid.

In practice, this does not seem to tackle the problem because of the following reasons. Firstly, the information from almost all informants and field observations confirm that currently, the larger parts of Borana land is converted to the bush land and this degrade the productivity of pasture land. People use a simple hand tools for bush clearing and it is from a very small area that the bush is cleared. In other words, there is imbalance between bush expansion rate and clearing rate that bush is expanding at faster rate than the clearing does. Even the bush re-growth can happen and again it re-occupies the cleared area. Secondly, bush clearing goes on only if there is reinforcement such as food grain and payment but stopped otherwise. It has the implication of

'Food for Work' and/or 'Cash for Work'. Furthermore, such sites should be fenced to exclude livestock from grazing. This enables to see whether the cleared sites are recovered as a result. However, it has been observed that many of these sites are left open without being fenced and as a result, animals graze daily and it is impossible to know whether it brings the desired changes.

For the purpose of analysis, it is necessary to compare the current bush clearing activity with the old age use of range fire for the same purpose (See table 4.3 below).

Table 4.3: Comparison Between Range Fire and Bush Clearing.

No	Range fire	Bush clearing
1	Indigenous to local people	Introduced as a result of development intervention
2	Less laborious and takes less time	More laborious and time consuming
3	Introduced a long time ago	A recent phenomena
4	Season based	Conducted any time needed
5	Indiscriminately remove plants	Species selective
6	May expand undesirably	Confined to the limited area

Source: In depth interview with Walensu Haro in Weeb.

Bilala Kana, who is 45, one the workers of Action for Development, told to the researcher that the works of their organization lack formal Impact Assessment[17]. According to the principle of environmental protection, any designed project should be preceded by impact assessment to assess its social, economic and environmental impacts. It is obvious that absence of Impact Assessment produces undesirable social and environmental consequences and also can have adverse impacts on achievement of the intended goal.

In addition, he reported that the organization faces various problems while engaging in development activities. Seasonal mobility of the people and interference from administrative body are some of the challenges. The workers of non-government organizations cannot consult pastoralists directly unless they come with somebody either from the woreda or kebele administration[18]. The establishment of PAs by the government since 1970s becomes threat to the indigenous institutions because it is run by those who have less experience and give less attention to rangeland (Homann *et al*., 2007). As to me, interference from Woreda administration weakens

[17] Informal discussion with Bilala Kana in Weeb in January 2011.
[18] Ibid

indigenous resource management system unless it works in collaboration with indigenous institution. It is pastoralists themselves who know what they need, where and when they need. Therefore, everything (so long as improving pastoralists' livelihood is concerned) should be done based on the interest and choice of the local people. Therefore, everybody who wants to participate in resource management issue should consult local people as long as resource management is concerned. Helland (1997) argued that:

> *"…It is therefore, a complete mystery why development agencies must fabricate their own structures for popular participation instead of using the leadership, the organizational skills and societal structures already in place in Borana to come to grips with the various development issues at hand, particularly since development declare support for genuine local participation" (Helland 1997).*

In general, the Borana pastoralists have long established customs and traditions that govern range resources management and utilization. Though there is a slight variation between the rule that govern pasture and the one that governs water points they are interrelated. Access to these resources is also governed by these rules and it depends on the adherence to them.

CHAPTER FIVE

BORANA PASTORALISTS INDIGENOUS RANGE RESOURCES MANAGEMENT TECHNIQUES AND ADAPTIVE STRATEGIES

Borana pastoralists have long established traditional range resources management systems in Ethiopia. These indigenous practices of rangeland resources management systems are discussed in the following sections. Under this section the indigenous-knowledge based range resources management practices by which Borana pastoralists manage their rangeland is discussed in detail along with its limitation.

5.1. Waaree

Waaree is a unique kind of grazing practice, particularly cattle, which takes place at night. This grazing system is practiced only in the rainy season when there is adequate rain and consequently sufficient grass. During *waaree* herd is taken to the grazing site approximately around 4:30 am or half an hour later[19].

Halake continued that the herd is taken back to home at about 8:00 am in the morning. This is so because lactating cows were taken to the grazing field without being milked by the time they were sent for grazing. Therefore, milking lactating cows takes place when the herd come back home. After this the herd rest for about an hour or half an hour and then again taken to grazing sites for normal day grazing[20].

Waaree grazing system is practiced for the purpose of grazing animals the grass with dew because Borana pastoralists believe that the grass with dew is very much suitable for fattening the cattle. Consequently, *waaree* grazing is conducted to graze the livestock before the dew evaporates off from grasses in the morning. Such grazing system continues up to the late rainy season; that is the time availability of the dew began to decline and finally cease off as a subsequent dry season approaches. Following the decline in availability of the dew, *waaree* grazing is abandoned and the normal grazing from morning to evening is resumed. *Waaree* grazing system, as I noted above, is associated with availability of abundant grass and it is

[19] Indepth interview with Halake Molu in Cira in January 2011.
[20] Ibid

currently almost abandoned. This is one of the indicators of decrease in Borana rangeland productivity. The distance animals cover during *waaree* grazing is relatively shorter than the distance they cover during normal day grazing. Indeed, this can be disadvantageous in that the animals graze the area adjacent to their settlement which is normal grazing area for calves and overgrazing possibly takes place. Furthermore, it increases gazing pressure over pasture land than the normal and depletion of grass resource may occur.

5.2. Herd Split: an Adaptive Strategy to Declining Range Resource

Utilization of natural resources in arid lands requires herd mobility and tracking strategies. This could create a balance by way of adjusting stock size to the available livestock fodder and it is by considering this condition that various development interventions were undertaken (Bahnke and Scoones 1991 cited in Tadesse 2006:7). Here Tadesse argued that development interventions were made to facilitate herd mobility. Contrary to this argument, the World Bank reported that livestock mobility is restricted by the development interventions in pastoral areas (World Bank 2005).

The number of livestock that graze over a given grazing area may exceed range resource capacity; imbalance between livestock size and available resources. This problem can happen due to various reasons such as: natural increase of livestock number, migration of animals from other areas of scarce resources; and decrease in range resources caused by natural factors while livestock number remains the same.

Pastoralists use different adaptive strategies of which herd split is one to counter balance the problem. From ecological point of view, division of herd is a crucial strategy for the distribution of livestock over range and minimizes loss and environmental degradation (Oba, 1996b). Borana pastoralists divide their herd in to two groups known as *loon warraa or loon haawwichaa and loon fooraa*. The first group, *haawwicha*, which means lactating cows, or *loon warraa*, stays around and grazes in their usual residential home area. This herd group mainly comprises lactating cows, young calves and one or two bulls for mating the cows[21].

[21] Informal discussion with Dalacha Huka in Omacho area in December 2010.

The second group is called '*loon fooraa'* or *loon gu'eessaa*'. The two terms are used interchangeably which means that the former is the herd that graze in a mobile camp know as *foora* while the latter means non-lactating cows that constitutes the larger percent of this herd group. In addition, this group comprises bulls and few lactating cows upon which those who take care of animals depend for their subsistence[22].

The *foora* herd leaves the usual homestead area and move to graze over new grazing area. This group is the most mobile one and this can be explained by Borana famous saying *foori duula* which means campaign. This term is used to indicate the degree of mobility of this herd group.

Fooraa herd cannot share pasture and water resources with *haawwicha* unless there is abundant resource. Borana pastoralists flexible natural resource use strategies and stratified herd management used by Borana pastoralists matched the livestock with available pasture and water resources during time of scarcity (Watson, 2003 and Homann *et al.,* 2007). The strategy of dividing up livestock herd has some important labor, security and ecological implications (Oba, 1996b). If the resource is in short supply, the priority is given for *haawwicha* herd because the *foora* herd can easily move to the new area and access the distant resource that *haawwicha* cannot. The *fooraa* herds that move from their home area are not allowed to encamp in the area close to other settlement and this restriction is imposed to prevent sharing pasture and water resources[23]. As we can understand from here, livestock mobility is a key strategy in dealing with range resources and it is a good mechanism of adjusting livestock size to the scarce range resources. This is the best method of avoiding degradation of rangeland ecology and ensuring sustainability.

This herd splitting practice is affected by several factors. Some of these include:

1. Labor availability is one of the factors. Similarly, Oba pointed out that labor for herding and watering is a major constraint of each pastoral family (Oba, 1996b). Labor is needed both for *haawwicha* and *fooraa* herd. If the herders have no enough labor, they keep all their livestock at home area. Sometimes those who have no enough labor to look after their cattle at *fooraa* give their livestock for their co-villagers who take the responsibility of taking care of animals.

[22] Ibid
[23] Ibid

2. Pasture and water availability is also another affecting factors. According to Oba, scout is sent to assess the current grazing pressure and accessibility to water for both human and livestock (Oba 1998a). Before moving their livestock the herders send a scout, known as *abuuruu* for ensuring the availability of grass and water. Hendy and Morton pointed out that the degree to which herds are split and dispersed widely vary with grazing availability and access to water (Hendy and Morton, 2001). If it is in the rainy season and surface water is freely available, the main thing is searching for the area with a good quality of grass. If, however, it is in the dry season and as a result the herd must depend on the permanent wells or pond, the herders must ensure the availability of water as well. Watson evidently reported that access to grazing land without access to water is insufficient to sustain livelihood especially in dry season (Watson 2003). In this case, the herders must contact *abba herregaa* (the person who is in charge of facilitating water utilization) and ensure their admission in to that particular water point before moving their herd in to the new area. Water rights are more limiting factor to herd mobility than grazing land right (ibid).
3. Security of the area is also another decisive factor to be taken in to consideration while practicing this grazing pattern. This grazing system always takes place in the peripheral or outskirt areas that people do not live in permanently because of insecurity and consequently resources in those areas are left without being exploited. Oba in his study in Kenya stated that, the occurrence of insecurity exacerbated by the spread of firearms has restricted access to several grazing areas in Western Marsabit (Oba 1996b). *Fooraa* grazing system is thus practiced in such areas partly because of relatively sufficient resource and partly because of the fact that they can easily retreat in time of inter-ethnic conflict.

The *fooraa* grazing system is now a day in its declining state, as majority of the informants reported, because of decreasing availability of range resources and recurrent inter-ethnic conflict which in turn causes insecurity of the areas previously used for this purpose. Oba stated that in Borana rangelands conflict over grazing land and ecological degradation are putting range resources under severe pressure (Oba 1998a).

In addition to the above mentioned herd split method, there is another measure used by Borana pastoralists as a response to the shortage of range resources. When pastoralists face resource scarcity problem, they divide their herd and send a portion of the herd to their respective relatives

or friend, living in the area with relatively better resource, who take the full responsibility of taking care of animals. If the area in which they live is severely degraded or water resource is scarce and not enough to support their livestock, the whole village moves to the new area[24].

This indicates that this system plays a key role in reducing pressure over natural resources and the application of this method is facilitated by social relation which has significant contribution in resource management and utilization.

5.3. Hay Making: an Adaptive Strategy to Fodder Shortage

Hay making is another indigenous practice of feeding animals on the fodder cut and collected for later use. It is one of the important adaptation strategies of coping with shortage of fodder. Borana pastoralists cut and store the grass near their respective house at the turn of rainy season or in the early period of dry season. Oba (1998b) reported that cutting and collecting is mainly the task of women and it should take place at the right stage of plant growth because dry hay has less nutritional value for animals. Luseno *et al.,* argued that the traditional feeding practice of cutting grass and feeding animal is very laborious task and highly inefficient with regard to time management (Luseno *et al,*1998 cited in Mulugeta, 1990 and Coppock, 1992). Hay making is conducted when the shortage of forage is expected to happen in the subsequent dry season. In addition, it is intended to feed sick animals that can not move and graze on communal grazing land and calves which are very young to be released to communal grazing land (see the fig. 5.1 below).

[24] In depth interview with Ali Sora in Afura area in December 2010.

Figure 5.1: Grass cut and collected for cattle feeding (Source: own photo Dec. 2010).

Cutting grass and collecting hay may not necessarily carried out at one time. If it is intended to feed young calves, cutting the grass is conducted on daily basis.

In some cases, the stored grass is used to feed the whole herd mostly on the watering day known as *obaa.* This is so because the area around the route connecting water point and settlement is most of the time devoid of grass as it is grazed by animals daily. Furthermore, the cattle has limited time to graze as they spend some hours around water point waiting for their turn particularly when many herds use the same water point and hence have lesser time to graze. Feeding the whole herd is, however, possible only for those who have limited number of livestock otherwise weak animals are fed selectively. Had every herder kept a limited number of livestock, they could save cattle from the danger of animal death as a result of fodder shortage in such critical condition[25].

The grass is cut from various sites such as *kaloo* –reserved forage bank and from the fringe of farm land but is mostly from the area that animals have no access to because of uneven topography and/or dense and thorny thicket concentration (field observation). Here we can conclude that this is good practice in that pastoralists extract the grass that remains idle without being used by animals because of accessibility problem.

[25] In formal discussion with Doyo Agarsu in Mudhi dununu area in December 2010.

Kamara *et al* reported that ILCA (International Livestock Center for Africa) -currently known as ILRI (International Livestock Research Institute) and CARE have introduced hay making in the late 1980s and as a result improved animal feeding and reduced mobility. Hay making either by local people or by development agencies is a measure taken as a response to the shortage of fodder during the time of hardship. Provision of hay is for the sake of keeping animal alive and I doubt that it can improve animals feeding situation and change seasonal grazing pattern.

5.4. Livestock Watering Order

The order of watering livestock is one of the important elements in indigenous water resource management system of Borana pastoralists. It concerns for watering day and the order by which animals are watered on a given day. Like other management systems, livestock watering at tulla deep wells and the rest of water sources has some differences.

In tulla wells there are three watering day in dry season (Oba 1998a). Tari Sora reported that the cycle of watering day depends on the number of livestock using a given water point and availability of water. If there is enough water and moderate or small number of animal, livestock can be watered at two day cycle and three days otherwise. Even if there is enough water but large number of livestock three day cycle is used. This is so to avoid the problem of congestion at water point on a given day[26].

The watering order is set by the joint decision of stakeholders such as *konfi*, *abbaa herregaa* and other clan members. The first position is called *qara*. This position is for the senior clan members to water their livestock. *Abbaa herregaa* takes the second position which is known as *laagaa.* The third position is for those who are relatives of the well owning clan or related to them in other way. The fourth position is for those who do not belong to that particular clan. The next priority is for those who come first; that is on the first-come first-served basis[27]. Watson stated that animal watering follows a strict rota; that is *abbaa konfi*, *abbaa herrega* and other clan members based on their seniority (Watson 2003). Setting the watering order is thus, the best method to avoid conflict that may possibly arise. That is all herders take their livestock by

[26] Informal discussion with Tari Sora in Fuldowa area in December 2010.
[27] Ibid

keeping their respective watering position. But it is preferable when the time at which each herd watered is fixed for proper time management.

Watson reported that watering position can be obtained by somebody outside the well owning clan if he has good relation with *aba konfi* (ibid). Watson extended her argument that there is a complex web that affect an individual access to water from any particular well and determine the place in rota of watering animal (ibid). The latter argument contradicts the former. As to me, establishing relation with *konfi* alone does not enable a person to get special watering position as there is a set of criteria of which clan membership is the first and very important one.

In case of the rest of water sources such as pond and *adaadii* wells, there is no such set order of watering. The herds that arrive first drink and leave and hence water order depends on the arrival of the livestock.

The other important aspect is the watering order on the basis of stock type. Watering animals at various water points has been observed. That is if different stock types arrive at the same time or if the water is not enough for all animals using given water point the priority is given based on the animals' resistance to the thirst. In such conditions the first priority is given for equines which are less resistant. Watson, similarly, reported that some animals particularly horses are watered before other stock types (Watson 2003). Next cattle and sheep and goat get priority. The last order is for camels as they are thirst resistant and can stay for several days without water. It has been observed that this stock type-based priority of watering is applicable at any water point. Stock type based watering order is also efficient system. Some animals are thirst resistant while others are not or less resistant. Camel, for instance can stay for a long time without water whereas equines cannot stay even for a short period of time when they need water. I have witnessed that mare (female horse) aborted because it could not get water at a critical time it needed and therefore, this kind of problem can be avoided by giving priority for those less resistant.

5.5. Weakness of Indigenous Range Resource Management System

Indigenous range resources management system is believed to be efficient and environmentally sustainable in many respects. But it has some limitations or drawbacks. There are no formal and written rules and regulations governing range resources management and utilization. The absence

of written rules sometimes makes resource management decision controversial and consequently the process of decision making is protracted[28].

Moreover, some influential personalities with political and/or economic power can influence resource management decisions. For instance, some individuals in authority can influence resource management and utilization decision in an unusual way. If, for instance, the decision made by the whole or at least by majority affects their interest they refuse to accept it. And therefore, the decision is delayed or left without being implemented at all. According to Kotola Godana, some individuals occupied a very vast pasture land and monopolize it as their private property (*kaloo*) that others have no access to it. Though many of these enclosures or forage banks are decided by community meeting to be restored as a communal grazing land, the 'owners' keep on monopolizing[29] (See chapter six for more information) .

In the past Borana pastoralists use fire as a tool to control bush encroachment over rangeland. In doing so there was no mechanism of limiting fire to a certain area and consequently fire can undesirably expand[30]. The range fire can be effective method for intended purpose but it has disadvantages that it destroys different flora and fauna species found in the burnt area. There may also be a danger of causing damage to property and life.

In sum, Borana pastoralists have their own traditional range resources management system by which they govern the two most important resources (pasture and water) though it has some drawbacks. External pressures have weakened the traditional resource use management. But changes in the system are inevitable because of changes in socioeconomic and ecological setting in climate change.

[28] Indepth interview with Mallich Adi in Diriba adama in January 2011.
[29] In depth interview with Kotola Godana in Arero in December 2010.
[30] In depth interview with Walensu Haro in Weeb in December 2010.

CHAPTER SIX

CHALLENGES OF RANGE LAND MANAGEMENT

All informants reported that range resources management and utilization has encountered multidimensional and mounting problems such as shrinking of range land, inter-ethnic conflict, bush encroachment and shortage of rainfall. These problems are partly human induced and partly naturally occurring ones. Each of these challenges is discussed briefly in the subsequent sections.

6.1. Shrinking of Rangelands

All informants said that shrinking of rangeland is one of the challenges that Borana pastoralists encountered. Fekadu 2004 reported that Borana land has been shrinking from the east since mid-seventeenth century (cited in Halake 2010). According to Borana oral history, Borana rangeland was very much vaster than its present extent and later on, it gradually began to decrease because of different reasons. Different written sources confirm this view. Bassi and Boku argued that "common property and indigenous land rights are not recognized in Ethiopia, Borana territory has been treated as "no man's land"; to be assigned to whoever claimed it (Bassi and Boku 2008:111)". Helland similarly stated that persistent pressure from Somali groups along the eastern border of Borana land and adept political dealing in a confused political situation resulted in the formal recognition of Somali claims to areas historically controlled by the Borana (Helland 2002:58).

All informants reported that population pressure from neighboring ethnic groups is the main cause for Borana rangeland shrinkage. Borana land is surrounded by many ethnic groups such as Garri, Gujii, Konso and Arbore. These groups (Hogg, 1997) gradually began to occupy Borana territory either through invasion or through peaceful settlement. Many of these ethnic groups are pastoralists and they went in to conflict with Borana pastoralists over scarce resources mainly pasture and water. Expanded occupation of land by competing groups of pastoralists has created greater insecurity is grazing zone of overlap and intensified by political disruption (Gibbs and Bromley, 1989; Hendy and Morton, 2001). Ayalew (2001), has reported similar situation Karrayu pastoral area who also went into such conflict with neighboring pastoral groups such as Arsi Oromo, Afar, Ittu and Argoba over scarce resources (Ayalew, 2001a:81).

The armed conflict between Borana and Garri group is the most frequent and serious one than the conflict with other ethnic groups. According to Hogg, Garri is one of the camels herding pastoral group that border Borana land in the east and claim that they are descended from Hawiyya clan of Somali (Hogg, 1997).

The conflict between Borana and Garri in its earlier phase was caused by the competition over the scarce range resources. Later on, however, the dispute is changed in to the territorial claim. Resource based inter-ethnic conflict in Borana land is intermittent but was more intensified since 2000 (Watson, 2003).

During the period of Transitional Government of Ethiopia, serious armed conflict took place between Borana on one side and Garri, Gabra and Guji on the other side. The joint force of these groups had displaced Borana and occupied a larger portion of Borana territory. As a result, all Borana were pushed westward and forced to cross Addis Ababa-Moyale asphalt road. After the war has been ceased, Borana could not regain their lost grazing land[31]. The formal alienation of important range resources by the regionalization policy was direct denial of Borana pastoralists' right to fodder and water (Homann et al., 2007). Consequently, Borana lost substantial part of their land i.e. about one-third of Borana land with two important well complexes were transferred to Somali (ibid).

According to Boku, the lost part of Borana land (eastern part) known as *wayyaama*, the area with red soil and scattered bush, is very suitable one for Borana multi species livestock (Boku 2000). It is very productive one in terms of grass coverage and availability of valuable fodder for livestock. In addition to pasture land (Hogg 1997), some important permanent water points such as Goofa and Laye deep wells complexes also became under the control of Garri and as a result, Borana have been denied the access to these water points with the adjacent grazing land.

Gufu Liban, 61 years old Borana man who lives in Afura, has explained the problem of rangeland loss as follow:

> "*In the past we have a very vast land that we can use it for grazing as we want. We could take our livestock wherever we want but now our land is taken away by other ethnic groups who encroached to Borana land; as a result, our land is now reduced to the size of hand palm.*"

[31] Informal discussion with Dalacha Huka in Omacho area in December 2010.

Furthermore, beside the land over taken by Garri ethnic group, the border area between the two protagonist remains subject to conflict and its accessibility for grazing purpose is questioned due to frequent armed conflict. Unregulated use of rangeland by competing pastoral groups finally degrades the productivity of the range and depletion of valuable forage species (Gibbs and Bromley, 1989).

The other factor that contributes to the decrease in rangeland is expansion of farm land that takes place at the expense of grazing land. Ayalneh and Korf reported that similar problem took place in the Yerer and Daketa valleys of Eastern Ethiopia and threat to livestock seasonal mobility (Ayalneh and Korf, 2005).

Agriculture was introduced to Borana land recently by resettlers from other areas and gradually began to expand. Borana, as discussed in chapter three, were pure pastoralists in the past but later on started crop farming. Waktole and others said that traditionally the Borana considered tilling of land as the work of evil and violation of sacred rule of land use (Waktole et al., 20101). As the reliance of people on animal products has decreased due to the decrease in animal productivity, the number of people involved in the farming activity began to increase[32]. Ayalew (2001) reported similar change took place in production system among Karrayu pastoralists of Eastern Ethiopia (Ayalew, 2001a:83).

This crop farming activity initially confined to the sub-humid pocket areas and in the mean time began to expand to the semi-arid areas that used for grazing purpose. In such a way, crop production began to expand from its initial grass root level. The expansion of farm land negatively affects range land management in different ways.

Firstly, it prohibits seasonal mobility of pastoralists between different climatic zones. That is pastoralists move to semi-arid areas during rainy season and move back to the pocket sub-humid areas during dry season. Similarly, Ayalneh and Korf reported that the inhabitants of Yerer and Daketa valleys follow similar grazing pattern (Ayalneh and Korf 2005).

Secondly, it has been observed that in semi- arid areas farming practice developed along the dry river banks, which is more or less better in moisture availability and preferred for grazing purpose during dry season. Hendy and Morton, similarly, stated that in the early dry season lowlands, riverine areas, flood plain and depressions provide persistent green forage resources

[32] Group discussion with group two discussants

(Hendy and Morton, 2001). Crop cultivation is expanded principally in the low-lying areas which previously were the most important grazing area (ibid).

Thirdly, it has been observed that those who are involved in crop farming fences extra land in addition to the cultivated land, which in some cases is more than the cultivated land for grazing their calves. Homann and others indicated that there has been fencing-off communal pasture in the name of crop cultivation (Homann et al., 2005).

According to the 2002 report of Arero Woreda Pastoral Development Bureau, the contribution of agricultural land to the shrinkage of range land is minimal; that is the land under crop cultivation is only 0.5% of total land area. This contradicts with the view of group two participants of the FGD, who showed no comfort with expansion of farmland. Even those who complained against farm land expansion practise both crop cultivation and livestock husbandry. This is probably due to the fact that they give priority for livestock than for crop production.

Hogg, in his study, argued that pastoralism and farming do not represent a polar opposition, but rather ideal type of economic activity that can be practiced simultaneously (Hogg 1997). This may be possible in the area where people keep a few number of animals that even can feed on the crop residue or where there is abundant fodder for animals but not possible in the context of Borana where pastoralists keep a number of animals and there is fodder scarcity which is currently the case.

6.2. Privatization of the Communal Grazing Land

Currently, in much of Sub Saharan Africa (SSA), grazing lands are mainly governed by common property regimes, which allows people to pool and reduce the risks associated with variable forage production (Luseno *et al*,1998). In Borana pastoral area, range resources are believed to be a common property that every one has equal access to available resources even though there are some restrictions. Borana fence a certain area to reserve it for grazing of calves. Such reserved area is known as *kaloo*. This reserved area may not necessarily be fenced and sometimes demarked by different physical features such as road, mountain, escarpments and so on. It is in principle, not allowed to establish *kaloo* individually but at the village level or used by a group of adjacent villages known as *ardaa*[33]. Huqqa (1999), reported that the private appropriation of

[33] Indepth interview with Kotola Godana in Arero

rangeland by fencing-off and individual ownership of forage bank is prohibited but collective grazing reserve is accepted (cited in Homann *et al.*, 2005). This communal resource ownership is the best resource management system that it ensures equal right of everyone to use available resources and it promotes collective interest than individual interest.

Despite this general agreement, Kotola continued, some individuals ignore this agreement and fence their private *kaloo* or fodder reserve which is even larger than that of the village. These individuals are those who have economic or political power. They fence a very vast area and monopolize it. But some of these enclosures are restored as communal grazing area while some of the "owners" keep on monopolizing the area. The name of the individuals with their respective private *kaloo*, the approximate area of those *kaloos* (ha) and their location are given in Table 6.1.

Table 6.1: Private kaloos

Name	Status	Approximate area (ha)	Location
Guyyo Dida	Kebele administ.	50	Weeb
Liban Jaldessa	Ex-abba gada	80	Dallona
Jarso Boru	Former gada councilor	200*	Qaqallo
Jatani Molu	Wealthy and kebele administ.	120	Hallona

*- 140 hectare of this enclosure is restored as communal grazing land.

(Source: Discussion with Kotola Godana, one of the worker of Arero Woreda Pastoral Development Bureau).

Bassi and Boku reported that management and access of natural resources in Borana are strictly regulated through practice and customary norms which is built on the indigenous governance of highly complex gada system (Legesse, 1973 cited in Bassi and Boku, 2008). Indeed, the gada system is not an institution organized for natural resource management; but is an ultimate authority to deal with any rules and regulations (including governance of natural resources) in Borana social life. Gada officials are expected to punish those who violate the rules governing resources management. Paradoxically, however, as indicated in table 6.1, some of the people who illegally use private enclosure (*kaloo*), which is against common property regime, are gada officials. This indicates that the indigenous natural resources management system is weakening.

6.3. Bush Encroachment

Bush encroachment is one of the mounting problems in Borana rangeland. Heitschmidt and others argued that invasion and expansion of noxious plants is one of the main threats to the integrity of rangeland ecosystem and diminishes the functionality of rangelands (Heitschmidt et al., 2004). The majority of the informants reported that bush encroachment on to rangeland is not a new phenomenon but currently reaches its climax stage. In addition, bushes grow very close to each other and make the grass inaccessible for livestock. Borana pastoralists used to apply fire as a measure of controlling bush expansion in the past[34]. Walensu said that pastoralists use fire for different purposes. Firstly, it serves as a means of mitigating bush expansion problem and growth of non-palatable plants. Secondly, using range fire enhances the growth of fresh grass. Thirdly, it eliminates the parasites which are harmful to the animals. Later on, however, fire use was officially banned during the Dergue regime and this intensified the problem of bush expansion (interview with Walensu Haro). The World Bank, similarly, reported that official ban on fire use exacerbates the problem of bush encroachment on to the grazing land and resulted in disruption of Borana traditional resource use system (World Bank 2005). According to the Arero Woreda Pastoral Development Bureau report of 2002, 60 percent of the land area of the Woreda is converted to bush land. It seems that by considering this problem that government and different non-government organizations such as Action for Development (AFD), Save the Children/United States and SOS-Sahel Ethiopia were engaged in bush clearing activity but they could not solve the problem.

The coordinator of SOS-Sahel Ethiopia at Yabello field Office, reported that their organization started selective bush clearing; that is some plants such as some acacia species are left not cut. The stems from which branches are removed are peeled in order to prevent bushes' re-growth. Actually, this is the best method of avoiding bush re-growth after cutting.

6.4. Shortage or Absence of Rainfall

All informants said that scarcity of rainfall is one of the main challenges in the Borana rangelands. The area receives low annual rainfall which is not sufficient and the problem is increasing from time to time. Group three participants of FGD stated different ways in which this affects resource management.

[34] In depth interview with Walensu Haro in Weeb in December 2010.

Firstly, fodder availability depends on adequate amount of rainfall and resource depletion takes place when rainfall is below the expected amount. Similarly, water for animals becomes inadequate.

Secondly, pasture land exploitation depends on availability of water. Hendy and Morton pointed out that availability of additional surface water allows more dispersion pattern of grazing from permanent water sources (Hendy and Morton, 2001). Some of the areas are used only in the rainy season due to absence of permanent or reliable water sources. In the time of absence or shortage of rainfall, such areas are left being not used for grazing purpose.

Thirdly, in most cases the rainfall received is unevenly distributed or not uniform over space and time. Some areas receive sufficient amount of rainfall while others receive less or no rainfall at all. In such occasion, the people who live in the area with inadequate rainfall are forced to move with their livestock to the area with relatively better rainfall (discussion with group three participants). It is clear that this results in undesirable consequences both on the pastoralists and the environment. It impairs seasonal mobility of pastoralists which is a key aspect of natural resources management. Moreover, it brought about concentration of large number of animals that exceeds carrying capacity of the range. The final outcome is over grazing and subsequent environmental degradation.

Generally, it is undeniable fact that, climate change is currently one of the global pressing problems in general and for pastoralists in particular. Because of the fact that pastoral life is vulnerable to climate related problems as they depend on the environmental natural resources of which rainfall or water and pasture are the two most important one. This leads to the conclusion that shortage or absence of rainfall for consecutive years can resulted in drought that puts pastoralists' wellbeing at risk.

6.5. Livestock Population

Livestock population over a given area is one of the decisive factors affecting rangeland productivity. If a number of livestock or livestock population density in a given area is imbalance with available resources, it obviously causes rangeland degradation. The problem of rangeland degradation is one of the challenges Borana pastoralists currently facing. This is so partly because of increase in number of livestock and partly because of decrease in rangelands which in turn increases number of animals per area. According to Sample survey conducted in 2003, Arero

Woreda has 46036 cattle, 5218 sheep, 15179 goats, 1470 equines, and 6412 camel (CSA, 2003). According to Arero Woreda Pastoral Development Bureau report of 2010, the total grazing and bush land area of the Woreda is about 860310ha. Therefore, it is necessary to calculate livestock density over area as follow:

Total number of livestock/landarea=74315/860310ha= 0.086livestock/ha, which is very difficult to believe. This stock density is not constant over a given area because of frequent livestock mobility caused by variation in resource availability. But what is important here is that, Borana pastoralists keep multi-species livestock type of which some are grazers and others are browsers. This, to some extent, can minimize pressure over grazing land.

6.6. The Current Condition of Borana Rangeland

Bromley (1985) argued that currently the process of resource depletion is underway in different parts of the world (cited in Gibbs and Bromley, 1989). Similarly, all informants said that Borana rangeland is in its deteriorating state or its productivity is declining from time to time. But the respondents attributed this to different factors such as bush encroachment, rainfall scarcity, increase in the number of livestock and consequent overgrazing, expansion of farmland, proliferation of water point and the like. Helland (2000), in his study indicated that Borana pastoralists were in favorable position to develop efficient system of natural resource management but now in transition state in which external influences have started to shape their strategies (cited in Homann 2005). Scoones 1999, reported that the Borana rangelands are considered highly productive for a dry land area (cited in Watson 2003:293). Contrary to this however, it has been observed that many places in Borana rangelands, particularly the area adjacent to the semi-sedentary settlement, are devoid of grass and changed into bare land. It can be productive at some time in the past but now the situation seems changed and the reverse is true (Figure 6.2).

Figure 6.1: An area devoid of grass (Source: own photo Dec. 2010).

Source: photo taken during field observation.

Group one discussants reported different indicators of decrease in rangeland productivity as follow:

- Increased frequency of animal death. The death of animals is not a recent phenomena; it is as old as the rearing of cattle in the area. In the past animals death was less frequent and a few numbers of animals used to die because of cattle diseases or because of severe dry season. But many others were resistant even to very harsh condition because of availability of sufficient fodder. Even in extreme cases animals' death occur in the late dry season. Currently, however, the death of animals is more frequent and takes places in the early period of dry season.
- Decrease in milk yield is another indicator of decline in rangeland productivity. Hendy and Morton reported that on the natural rangelands performance of livestock depends on the quantity and quality of forage available for animals (Hendy and Morton, 2001). According to the participants, milk yield per lactating cow is a good measure of rangeland productivity. Borana used to subsist on the animals products, mainly milk, only without having other supplementary means of livelihoods. In the past if a given family has two lactating cows for example, the milk yield from these two cows is enough to feed the entire family members. But now, whatsoever the number of lactating cows possessed, the milk obtained from them cannot support the owner household and they need additional

means of subsistence either from farm or through purchase which is the common feature of almost all Borana.

- Decrease in reproduction rate is another measuring factor of range productivity. Participants reported that livestock reproduction rate is declining form time to time and is currently taking place at a very lower rate than it was in the past. In the past animal breeding took place at faster rate and even sometimes faster than needed as a result of high range resources availability. Even herders separate female and male animals to avoid mating. Now a day, however, the situation is reverse as animals breeding rate is decreasing with decline in rangeland productivity.

Generally, rangeland management is currently facing several challenges partly human induced and partly naturally occurring problems. Consequently, the productivity of Borana range land has been deteriorating from time to time as a result of the combined effect of the above noted challenges. These make range resources management and utilization difficult and put Borana livestock at risk in the long run.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1. Summary

Pastoralists' indigenous knowledge and experiences play a great role in pasture and water resources management. Borana pastoralists used to manage range resources for a long period of time. The regulatory role of water in managing grazing land is a very key strategy. But now a day, they are facing mounting and multidimensional challenges that put its sustainability in question. As a result, rangeland productivity is deteriorating from time to time. Decline in rangeland productivity is due to several interacting factors such as bush encroachment, the recent climate change and loss of grazing land due to recurrent enter-ethnic conflict.

Development intervention also was not able to bring about lasting solutions. Even though it has some positive impacts but unable to improve the overall rangelands condition or productivity as compared to what indigenous management system could done. This is so because development interventions are made without taking into account the indigenous knowledge of the local people and try to implement different projects without active participation of beneficiaries. Such development interventions are carried out without conducting impact assessments. In general, the range resources are going to face more critical problem in the long run. Because some of the current challenges such as bush expansion and recurrent drought are forced by the recent climate change.

7.2. Conclusion

Borana pastoralists have more or less efficient range resources management technique. However, this does not mean that this management system has no limitations or drawbacks. Though it is not possible to say it is 100% percent perfect, its contribution to rangelands degradation is minimal. Adaptive mechanisms such as hay making and herd division are best strategies in place to cope with uncertain or variable environmental conditions.

Water, in addition to being important resource, plays central role in managing and utilizing adjacent grazing land. That is the number of livestock graze over a given area is controlled by the

available water sources and the number of animals they can support. This regulative function of water in turn serves as a means of adjusting the number of livestock to the surrounding pasture.

Currently however, the efforts made to manage these resources effectively and sustainably are facing several challenges whose cumulative effects can be a potential threat to the persistence of pastoralism.

A series of development interventions is made with the goal of improving range resource management but with no much success because of the fact that they fail to work in collaboration with indigenous institutions. As a result, they could not win much support from local community side.

7.3. Recommendations

The following recommendations are provided, based on the findings of the study

- The concerned body such as government, non government organizations and community elders should work on mitigating inter-ethnic conflict that adversely affects not only range resources management but also the overall wellbeing of the inhabitants of the area.
- Bush controlling measures should be taken to tackle bush expansion problem. This is one of the important measures needed to be taken to reverse rapidly expanding bush which is the direct threat to the productivity of Borana rangelands.
- Pastoralists' active participation in designing and implementing various projects aimed at improving rangeland condition or productivity should be promoted. It is only with active involvement or participation of local community that development efforts can be successful. Because the more the local people participated the more they co-operate with development agencies as participation causes the people to develop the sense of ownership.
- Development of water points should be site selective. That is, it should be conducted at the place where the people want them to be though the feasibility of water availability is regulating factor. If, for instance, water projects are constructed in the main grazing area, they attract high number of livestock to that specific area which in turn causes overgrazing.

- Different water projects established in pastoral area should be preceded by the Impacts Assessment to avoid its negative impacts both on the local people and the environment. This is very important in that Impact Assessment enables to avoid undesirable social and environmental impacts of such water projects.
- Rules and regulations governing range resources management should be written by the range users to avoid its subjectivity to the individual interest.

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Appendix 1

Background of Informants

List of Interviewees

Name	Age	Sex	Place of residence	Occupation	Date of interview
Liban Dida	51	M	Fuldowa	Pastoralists	11/04/2003
Halake Wako	65	M	Afura	Pastoralists	11/04/2003
Jirma Duba	70	M	Omacho	Pastoralists	12/04/2003
Halake Molu	62	M	Afura	Pastoralists	13/04/2003
Tari Sora	56	M	Fuldowa	Pastoralists	16/04/2003
Guyo Dida	66	M	Renji	Pastoralists	17/04/2003
Mallicha Adi	53	M	Diriba Adama	Pastoralists	20/04/2003
Gufu Liban	61	M	Balli	Pastoralists	20/04/2003
Walensu Haro	59	M	Weeb	Pastoralists	21/04/2003
Katelo Godana	47	M	Bosaro	Pastoralists	23/04/2003
Dalacha Huka	51	M	Omacho	Pastoralists	25/04/2003
Bilala Kana	45	M	Weeb	AFD worker	28/04/2003
Roba Tadicha	66	M	Funnan bireesa	Pastoralists	29/04/2003
Ali Sora	56	M	Afura	Pastoralists	01/05/2003
Doyo Agarsu	69	M	Mudhi dununu	Pastoralists	02/05/2003
Kotola Godana	47	M	Arero	Government worker	08/05/2003

List of Group One Participants

Name	Age	Sex	Place of residence	Occupation	Date
Sara Boru	57	M	Afura	Pastoralists	15/04/2003
Liban Kana	56	M	Mudhi dununu	Pastoralists	
Huka Duba	64	M	Omacho	Pastoralists	
Duba Gababa	70	M	Fuldowa	Pastoralists	
Tari Dika	69	M	Dambii	Pastoralists	
Garbicha Sora	61	M	Fuldowa	Pastoralists	

List of Group Two Participants

Name	Age	Sex	Place of residence	Occupation	Date
Gurracha Huka	56	M	Gara ejersa	Pastoralists	19/04/2003
Adi Guyo	48	M	Omacho	Pastoralists	
Guyo Boru	53	M	Afura	Pastoralists	
Liban Halake	66	M	Sangota	Pastoralists	
Jaba Boru	62	M	Tille	Pastoralists	
Kanchora Boru	55	M	Didimtu	Pastoralists	

List of Group Three Participants

Name	Age	Sex	Place of residence	Occupation	Date
Galma Jarso	49	M	Funan biressa	Pastoralists	27/04/2003
Wario Jarso	60	M	Renji	Pastoralists	
Molu Guyo	72	M	Balli	Pastoralists	
Galma Bule	50	M	Renji	Pastoralists	
Boru Gurracha	47	M	Diriba adama	Pastoralists	
Huka Jatani	73	M	Warkatte	Pastoralists	
Duba Jilo	51	M	Sangota	Pastoralists	

List of Group Four Participants

Name	Age	Sex	Place of residence	Occupation	Date
Boru Dida	64	M	Ciraa	Pastoralists	06/05/2003
Molu Huka	71	M	Gara ejersa	Pastoralists	
Jatani Sora	55	M	Weeb	Pastoralists	
Dhenge Dabbaso	62	M	Dallona	Pastoralists	
Kanu Wako	57	M	Bosaro	Pastoralists	
Wario Halake	60	M	Dhaka lake	Pastoralists	
Godana Sara	52	M	Sora dhera	Pastoralists	
Jaldessa Anna	49	M	Ciraa	Pastoralists	

NB. The name assigned for each informant is not their original name the new name is assigned in order not to mention their original name

Appendices 2

Interview Guidelines

Good morning or good afternoon? My name is …..and I am from Addis Ababa University Department of Geography and Environmental Studies. I am currently conducting research on Borana pastoralists' Indigenous Range resources management system. I want you to participate in group discussion or interview. Are you volunteer? Your name is not mentioned in relation to the information you provide. The information you give me is used only for the purpose of this academic research. You have right not to answer the question/questions if you do not want to do.

Name _____

Sex _____

Age _____

Place of residence _____

1. How do Borana pastoralists manage their range resources?
   1.1. Who is the responsible body in managing range resources?
   1.2. Is/Are there institution/s responsible for range resources management?
   1.3. If yes, are they indigenous institutions or other?
2. Do Borana pastoralists have rules and regulations governing range resources management and utilization?
   2.1. Do these rules vary over space and time?
   2.2. If yes, what cause this variation?
   2.3. How these rules and regulations are enforced?
   2.4. Are the rules governing pasture differ from the one that govern water resource?
   2.5. If there is difference between the two, at what point they differ?

3. Are there development interventions in range resources management?

   3.1. If yes, do the development agencies work in collaboration with indigenous institutions or independently?

   3.2. Are they successful than customary institutions?

   3.3. Is there any improvement in range resources management as a result of interventions?

   3.4. In what areas they fail to bring desired change?

   3.5. Is the way they work compatible with that of local people?

4. Are range resources owned individually or on communal basis?

   4.1. Are all community members have equal chance and access to the available range resources?

   4.2. Can individuals claim exclusive right over range resources?

   4.3. If yes, on what grounds they can claim?

   4.4. If no, why?

5. Are there challenges Borana pastoralists face in managing range resources?

   5.1. If yes, what are these challenges?

   5.2. Are these challenges human induced or naturally occurring ones?

   5.3. Are these challenges from outside or from the customary management itself?

   5.4. How do these challenges affect rangeland management?

   5.5. Is/Are there measure/s taken to solve these problems?

   5.6. If yes, what are these measures?

   5.7. Is there any improvement as a result of the taken measures?

2.1. Points of discussion for Focus Group Discussion

1. Do you think that range land degradation is currently a problem to the Borana rangeland?

   1.1. If yes, what do you think is/are the factors cause this problem?

   1.2. What do you think is the solution?

2. Do you think that the number of animals is in balance with available range resources?

3. What do you think is the problem if a high number of animals graze over a small area of grazing land?

4. Do you think that Borana indigenous range management system is efficient?

5. What is/are the limitations or drawback of indigenous range management practices?

6. Is/Are the any fundamental change or improvement that development interventions brought about?

7. In what area they fail to improve range management?

8. Do you think that pastoralism survive in the future?

9. If yes, what are favorable condition or hope to do so?

10. If no, what do you think is the reason?

2.2. Interview Guidelines for Development Agencies

1. Is there any thing your organization did or is doing to improve or facilitate range resources management?

   1.1. If yes, what are actions taken?

   1.2. Is there a change or improvement as a result of action taken?

   1.3. What are indicators of improvement?

   1.4. Is there problem/s that remains unsolved?

2. Does your organization appreciate indigenous natural resources management system?

3. Do you think that indigenous range resources management system has defect?

4. What is range resource management gap that your organization is trying to fill?

5. Does your organization encourage indigenous range resources management practices?

6. Does your organization invite the community to participate in designing development projects?

7. Does your organization Conduct Impact Assessment before implementing development projects?

   7.1. If no, what is the reason?

7.2. If yes, is there any designed project that left without being implemented due to its possible threat to the environment?

8. Is/Are there challenges you face while working on improving resource management and utilization?

8.1. What are these challenges?

DECLARATION

I declare that this thesis is my original work and has not been presented for a degree in any university and all materials used for the thesis are duly acknowledged.

Declared by:	Confirmed by:
Jarso Doyo	Desalegn Wana(Ph.D)
_____	_____
Candidate	**Advisor**