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Understanding Local forest management institutions and their role in conserving woody species biodiversity: A Case study of Alamata Woreda, southern Tigray, Northern Ethiopia.

By

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DECLARATION

This is to certify that this thesis entitled "Understanding local forest management institutions and their role in conserving woody species biodiversity: a case study of Alama Woreda, Southern Tigray, Northern Ethiopia." submitted in partial fulfillment of the requirements for the award of the degree of M.Sc., in Tropical Land Resource Management to the School of Graduate Studies, Mekelle University, through the Department of Land Resources Management and Environmental Protection, done by miss Tirhas Mebrahtu Hindeya, Id.No FDA/PS0037/98 is an authentic work carried out by her under our guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of our knowledge and belief.

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ABSTRACT

Even though many communities in Tigray have developed their own institutions and methods of environmental management that enjoy great local legitimacy, the interventions by government and numerous projects in the name of development and environmental protection have generally failed to recognize this. Hence, a study on understanding the local forest management institutions and their role in conserving biodiversity of woody plants were carried out in Alamata woreda, southern zone of Tigray Region, Northern Ethiopia. This study attempted to compare vegetation composition of three communal forests with adjacent free grazing lands. Investigation of vegetation parameters was undertaken from 84 plots with size of 20m x 20m laid systematically along transect lines. Data from group discussion and 120 household surveys was also collected in order to understand their institutional arrangements and the perception of the local community towards communal forests. A total of 30 species of woody plants of trees were recorded in the three communal forests and six in the three free grazing lands. Comparing the diversity of woody species of trees, all the 3 communal forests are significantly different ($P<0.01$) from the free grazing lands.

The local forest management institutions in the three study sites had clear boundary of forests, defined users, use rules, monitoring procedures, sanctions and conflict-resolution mechanisms among users. Ninety five of the respondents prefer the communal forests to continue under the control of the local people. All of the informants are happy about the way local institutions manage the communal forests. In addition, all agree with the rules and penalties. The Pearson chi-square test reveals that the educational level, age, sex, wealth, oxen possession and occupation of the respondents and their attitude and

perception towards the communal forests are not significant at $p<0.05$. However, the survey proved that there is difference among the female household heads and male household heads in their participation in the meetings of the forest management.

Key words: Communal forest, free grazing land, local institution and biodiversity, Alamata, Tigray, Northern Ethiopia.

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ACRONYMS

BSP	Biodiversity Support Program
CPR	Common Property Resource
EFAP	Ethiopian Forestry Action Program
FAO	Food and Agricultural Organization (of the United Nations)
Fig.	Figure
°E:	Degrees east
°C:	Degrees centigrade
°**N**:	Degrees north
IVI	Importance Value Index
IPMS	Improving Productivity and Market Success
ILRI	International Livestock Research Institution
m.a.s.l	Meter Above Sea Level
MSc	Master of Science
SPSS	Statistical Packages for Social Sciences
SSA	Sub-Saharan Africa
TLU	Total Livestock Unit
TARI	Tigray Agricultural Research Institutions

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CHAPTER 1 INTRODUCTION

1.1 Background

Ethiopia is one of the Sub- Saharan Africa (SSA) countries known for its fast population growth, accelerated environmental degradation and structural food insecurity (Tesfaye, 2003). Among others, accelerated forest resource degradation has become the major threat to rural livelihood and sustainable natural resource management in the country.

In Ethiopia, pressure of intense human activity and improper farming as well as poor management practices pose serious threats to the sustainability of the natural resources and maintenance of ecological balance. There is a widespread problem related to intensive cultivation, overgrazing, deforestation, soil erosion, soil fertility declines, water scarcity, and livestock feeds and fuelwood shortage. These factors often interact with one another resulting in a re-enforcing “cycle of poverty that is indicated as deep and structural, food insecurity and natural resource degradation trap" (Alemneh, 2003).

The long duration of human settlement together with increasing demands of the growing human and animal population, exploitative land use practice including excessive deforestation for expansion of cultivation, grazing, fuelwood and timber have resulted in reduced protective plant cover there by soil erosion induced land degradation in Tigray (REST, 2004). These problems, associated with soil moisture stress have played a significant role in reducing agricultural productivity and resulted in substantially large populations in the region facing poverty and food insecurity.

Even though, there is little documentation of history that shows communities’ traditional resource management practices in Ethiopia, it is clear that a number of communities had

traditional/indigenous resource management practices including some elements of biodiversity conservation (EFAP, 1994 cited in Domoz, 2007).

In addition, since local communities live with forests, they are primary users of forest products. They create rules that significantly affect the forest condition and their inclusion in forestry management schemes is now considered essential by many researches and policymakers (Arnold, 1992).

1.2 Statement of the problem

Even though, many communities in Tigray have developed their own institutions and methods of environmental management that enjoy great local legitimacy, the interventions by government and numerous ambitious bilateral and multilateral projects in the name of development and environmental protection have generally failed to recognize this. Instead, they have tried to introduce new organizational structures and regulations for resource protection, which they have not always been able to sustain (Yohhanes, 2007).

In the study area, there are some communally managed forests that serve as pockets of the near past representative reserves. These forests were protected and saved by the initiation of the local communities. They use their own rules and sanctions. Generally local institutions were established to manage the forests.

However, little evidence exists regarding the nature of local-level institutions and organization for resource management in the study areas, or their effectiveness. In addition, little evidence exists in their importance in conserving biodiversity.

So, this study is aimed at understanding the local indigenous forest management institutions and at assessing the importance of the communal forests in conserving

biodiversity compared with the adjacent free grazing lands. In addition, it assesses the attitude and perception of the local community towards communal forest management.

1.3 Significance of the study

Most analyses of forest exploitation lack linkages to the local level, despite a growing awareness among scholar and practitioners that the actions of local people greatly determine the success or failure of natural resource management schemes. Because the debate about the causes of deforestation and other environmental harms has been largely confined to macro analyses, it has failed "to benefit from the wealth of data generated at the micro level-data which provide rich information on the social and economic factors that mediate the relationship between population and the environment" (Arizpe *et al.*, 1994). And yet the role of people at the local level is crucial.

Scholars and practitioners often assert the need for local-level institutions in natural resource management schemes (Ostrom, 1990; Bromley *et al.,* 1992). The variation of local institutions discovered also discourages the view that template forest policies are likely to work when imposed on a country as a whole. The diversity of conditions, rules, and outcomes presented in this study, therefore, equips policymakers with an appreciation of the complexity of forest resources as well as examples of management successes and failures that should assist in the construction of the most appropriate roles to be played by local, regional, and national authorities. Information on vegetation is also required to solve ecological problems for biological conservation and management purpose (Kent and Coker, 1992).

1.4 Hypothesis

✓ The local communal forest managements play a significant role in conserving woody species biodiversity.

✓ Local communities have a positive attitude and perception towards communal forest managements.

1.5 Objectives

Over all Objectives

✓ The general objective of this study is to understand the local communal forest management institutions and assess their role in conserving woody plants biodiversity.

Specific objectives

✓ To compare the performance of managed communal forests to that of free grazing lands in terms of composition, abundance & diversity of woody species.

✓ To understand the existing local forest management institutions.

✓ To investigate perceptions of the nearby community/communities on the actual and potential socio-economic and environmental benefits of the communal forests.

1.6 Research questions

1. What is the role of the local forest management institutions in conserving woody plants biodiversity?
2. What is the regeneration status of the managed communal forest as compared to those openly grazed sites?

3. What is the tenure history of the study sites?

4. How is the local forest management institution arranged?

5. What is the attitude and perception of the local community towards communal forests?

CHAPTER 2 LITERTURE REVIEW

2.1 Managing forests as common property

‘Common property’ can be most simply defined as ‘corporate group property’ (Bromley, 1992). Common property has often been used to refer both to land or resources available to all and consequently not owned or managed by anyone, and also to situations where access is limited to a specific group that holds rights in common.

In case of open access to common resources, there is unrestricted entry and unregulated use of resources. This has often caused an overexploitation and degradation of common resources, a situation often referred to as the "tragedy of commons" (Hardin, 1968).

Commons are degraded because each individual gains by increasing their use-level as long as marginal benefit are less than average cost, in the absence of specified ownership they can not be valued in the market and competing individuals can not cooperate in a management scheme that would benefit all.

Nearly everywhere common property resources have been massively reduced in modern times. Privatization, encroachment and government appropriation have been the main processes taking resources out of common use. Increasing pressure on what’s left have frequently led to its progressive degradation. In order to regulate the use and management of a common pool forest resource, there must be institutions that authorize and secure use by a particular group of users (to the exclusion of others), and institutions that set rules to govern this use, monitor and enforce these rules. Thus, common property systems can function only if the group is organized, or can organize itself, to set and implement such rules, provide individual members with inputs and services that are more effective when

organized collectively, and provide a mechanism for negotiation and liaison with the state and other external entities (FAO, 1998). The choice of property regime may also reflect historical and conquest institutions (Bruce, 1998).

Despite these negative pressures and trends people still widely depend on common property resources, with the poor usually more heavily dependent than others. Even in the heavily reduced and degraded dryland communal areas of India, it was found that the poor obtained the bulk of their fodder and fuel wood, and from 14% to 23% of their income, from common property resources (FAO, 1998).

2.2 Indigenous knowledge

The study of indigenous forest management is often considered to belong to the domain of research on indigenous knowledge systems. Knowledge systems are concerned about the way people understand the world, interpret and apply meaning to their experiences. Such knowledge is built through the complex process of selecting, rejecting creating, and transforming information and is in extricably linked to the social, environmental and institutional contexts in which it occurs (Arce and long, 1992).

Indigenous Knowledge has been defined as a body of knowledge built up by a group of people through generations of living in close contact with nature (Johnson, 1992). It includes a system of self-management that governs resource use.

Banuri and Marglin (1993) make a useful distinction between ‘modern’ and ‘non-modern ' knowledge systems. These categories are to be seen as ‘ideal’ types: all societies employ some combination of these two knowledge systems.

Modern knowledge is based on western science and ideology, and has a powerful and dominant position in the world today. It is characterized by a belief in universalism, individualism. Other knowledge systems are not recognized in the modern knowledge system or, they are labeled inferior and viewed to be characterized by ignorance or superstition.

Modern knowledge is reductionist in the sense that elements are separated from each other for the scientist to gain an understanding; connections on economic profits are also stressed in the modern systems. Modern knowledge is therefore, recorded and transmitted through written documentation (Gombya-Ssembajjwe, 1997).

Non-modern (indigenous) knowledge on the other hand, is embedded in experience and place (Gombya-Ssembajjwe, 1997). Its actions are linked to social, political, spiritual, and moral spheres. By virtue of this embeddedness, indigenous knowledge is bounded by its context. Individuals are seen in context; culture is related to place and linked to nature. This knowledge is based on observation and experience using a holistic understanding in which all elements are interconnected, and is often transmitted orally. It is an important source of information and knowledge that can help to avoid costly mistakes, and assists traditional groups in their development within their indigenous cultural frame work (Gerden and Mtallo, 1990). We must emphasize that both modern and indigenous knowledge systems change and people generally use some combination of the two contrasting systems.

Indigenous knowledge systems are those that have evolved within local communities and have been handed down through cultural transmission methods. Over time, external information may become incorporated, and indigenous Knowledge should therefore not be considered as being isolated from external influences. Neither should it be considered to

concern only traditional knowledge dating from the past. Since it also includes local knowledge that has evolved more recently in response to changing conditions and needs. However, since indigenous knowledge emanates from specific environmental and cultural contexts, it is often unique to a specific culture or society (Warren, 1991).

2.3 Indigenous forest management institutions

Institutions are defined as rules, norms, formal hierarchies, monitoring and sanctioning which shape individuals' actions and expectation (North, 1991). They are a "set of rules actually used" (Ostrom, 1992; 19) or "rules of games in society "(North, 1990: 3). They are also considered as regularized patterns of behavior between individuals and groups in society or a segment of society (Ayres, 1962). It is now believed that institutions are humanly devised constraints that structure political, economical and social interaction (North, 1991).

According to Watson (2003), Indigenous institutions can be taken to be those institutions that emerge in a particular situation or that are practiced or constituted by people who have had a degree of continuity of living in, and using resource of an area. Indigenous institutions represent established local systems of authority and other phenomena derived from the Socio-cultural and historical processes of a given society. They originate from local cultures; have firm roots in the past and are variously referred to as informal, pre-existing or native institutions.

It has been increasingly recognized that the erosion of traditional organizations is often a major factor contributing to the decline of the strength of village-level organizations for common-property resource (CPR) management and allocation. However, in villages where

traditional social sanctions and institutions are still respected, the decline in CPR is found to be less (Baland and Pleatuea, 1996), because social norms and conventions that have often been seen to govern CPR have saved forests from degradation (Uphoff and Largholz, 1998).

2.4 Factors affecting common property forest management

During the past decade, considerable progress has been made with the design of analytical models that help us understand what factors and interactions determine the circumstances under which common property management is likely to be appropriate and successful, and under which it is not (Bromley and Cernea, 1989; NAS, 1986; Oakerson, 1986; Ostrom, 1990; Wade, 1988 cited in FAO, 1993). Key features that have emerged from these analytical models are summarized as below.

2.4.1 Physical and technical characteristics of the resource

A basic characteristic is whether the resource has definable boundaries and can be protected. Management of a CPR is more likely to be effective if the resource is close to the user group and can be readily monitored. Another basic consideration is whether the resource can be divided up or not. An area of forest that can produce multiple products only as long as its multispecies structure is maintained more or less intact is more likely to induce collective management than tree stocks that could be split up into individually managed units, such as woodlots, or that generate outputs that can be produced from farm trees.

The incentive for users to invest in collective management is likely to be greater if the resource is capable of meeting a substantial part of users' needs, and if these benefits can be obtained rapidly and regularly. By the same token, situations involving forests that are

producing already are likely to provide a greater incentive to local collective management than woodlots that will produce only after several years. Therefore, the tendency to allocate degraded forest or scrubland for collective management in many programmes has probably often weakened the incentive for users to participate. The same is true if the resource allocated is too small to meet many of the users' needs. Resources that produce outputs that are valued locally, and products that members of the user group can benefit from in an equitable manner, are also likely to provide a stronger incentive to common property management than others that do not.

2.4.2 Characteristics of the group of users

It has been widely argued that small homogeneous groups, confined to those with similar views on the use of the resource, are more likely to be successful than larger, more diverse groups. There are many instances where smaller groups do seem better able to sustain common property regimes. Although the task of dividing responsibilities and benefits may favour small and cohesive user groups, the task of managing and exercising control over the resource may call for a larger body that encompasses all those with a claim on the resource.

Migration, mobility and market integration can all affect the stability of the community, and lack of stability can undermine the possibility of voluntary collaboration. Education or exposure to knowledge and ideas from elsewhere may alter members' perceptions of what they want from the CPR or from collective action. Changing attitudes and increasing wealth may introduce opportunities to benefit from privatization, or introduce the danger that the user group will become dominated or usurped by emergent elite within the broader

community. As communities change in these ways, the composition of a user group and its objectives are likely to need to change as well.

2.4.3 Attributes of institutional arrangements

The institutional characteristics that affect the success of communal forest management which is explained by Ostrom (1990) is presented in Table1.

Table1: Institutional characteristics for successful communal / group forest management (after Ostrom, 1990).

No	**Characteristics**	**Explanation**
1	Clearly defined boundary and users	Individual or household who have rights to explore resources must be clearly identified. The boundaries of the area managed must also be clearly defined and agreed upon.
2	Appropriate rules for exploiting the resources, and maintaining it.	Rules limiting the time, place and technology used must be appropriate to the particular resource, and linked to investment in the maintenance of the resource. Rules are simple and easily understood
3	Collective choice arrangement	The people affected by the rules must be able to participate in changing them.
4	Effective monitoring producers	Monitors of the rules are either users of the resources, or accountable to them. Monitoring must be easy to carry out.
5	Graduated sanctions	Users of the resources who violate rules are likely to face graduated sanctions are assessed and imposed by fellow users, or officials accountable to them.
6	Conflict-resolution mechanisms	Users and their officials have rapid access to low-cost mechanisms to resolve conflicts among users and officials.
7	Recognition of legitimacy	The rights of users to devise their own institutions are not challenged by external authorities: in most cases they need to be actively supported by them.

2.5 Biodiversity

Biodiversity is defined as the variety of life and its process (Noss and Cooperrider, 1994; Tadesse Woldemariam, 1998). It is the totality of genes, species, and ecosystems and human culture that is closely linked to the entire process of totality. Three levels of diversity can be recognized: Genetic diversity (variation of genes within species), species diversity (variety of species within a given bioregion) and ecosystem diversity (refers to the boundary of biological communities in association with species and ecological system). According to this definition, biodiversity includes the variety of living organisms, the genetic diversity, the community and ecosystem in which they occur and the ecological and evolutionary process in which it helps them to keep functioning. Diversity helps in the functioning of ecosystems and interaction between ecosystems. Reduction of diversity will result in the instability of ecosystems. The loss of a certain fraction will result in the disruption of the whole system (BSP, 1993).

Biodiversity conservation could help in the future realization of the potential values of species. The unknown potential of genes, species, and ecosystems remains a never-ending source of biological resources of inestimable value. Wild species will be of great importance for the further advancement of agriculture, animal husbandry, medicine, industry, etc. They have a security value, option value, economic value, and cultural value. If biodiversity is not conserved, species, which have a great importance for human kind, will become extinct.

Diversity of biological resources and ecological systems, including human culture is shrinking. Forests are reservoirs of biological diversity and have a great variety of exploitable plant species for timber and non-timber forest products. The main causes of loss

of biological diversity are unwise human interaction with his environment, human population growth, and change in natural conditions and homogenization of views.

The strategies to conserve biodiversity are *in situ* conservation, reduction of deforestation, *ex situ* conservation using gene banks, botanical gardens, arboreta, planted forests and agro forestry systems. Other strategies include integrated land use and conservation, monitoring utilization and generating information on the status of overexploited species, raising public awareness especially at community level and harmonization of laws related to land use.

In addition the ownership or tenure of forested land has a potentially important impact on the likelihood of sustainable management and the conservation of biodiversity.

2.6 Values in Biodiversity Conservation

People value biological resources in different ways: spiritually, economically, aesthetically, culturally, and scientifically. Biodiversity values also differ at the international, national, and local levels. Conservation of biodiversity is directly relevant to local residents, for whom biological resources often represent their primary source of livelihood, medicine, and spiritual values. Nation-states may also express values related to biological resources, often in relation to economic benefits brought about through biological resource use, both consumptive (timber harvesting, hunting) and non consumptive (tourism). Biodiversity conservation has become an international issue as well, based on a global concern for maintaining the existing species richness on earth, expressed in terms of the common heritage of humans (Johnson, 1992).

These different values can be difficult to reconcile. It is important to be able to clarify different values that underlie positions taken on various sides of a given issue relevant to

biodiversity and to understand how values can affect willingness to adopt different patterns of resource use or to reach compromises. Many traditional societies fostered belief systems as well as social norms which encouraged or even enforced limits to exploitation of biological resources. Economic change, population growth, and other factors, however, have brought far-reaching shifts in traditional patterns (BSP, 1993).

There is a need to assess the ways in which cultural practices and value systems have fostered conservation in specific settings and to investigate how such cases can be encouraged, strengthened, and replicated. Value systems compatible with sustainable development cannot be prescribed, but must emerge through local participation, and with respect for traditional beliefs and practices that have effectively conserved biodiversity for centuries.

CHAPTER 3 MATERIALS AND METHODS

3.1 Description of the study sites

3.1.1 Location and physiography

Alamata wereda is located in the southern zone of Tigray, bordered by Raya Azebo in the North, Ofla in the west, the Amahara National Regional State in the south and the Afar National Regional State in the East at 12°15'N latitude and 39°35'E longitude. It is situated 600km north of Addis Abeba and about 180km south of the Tigray Regional capital city, Mekelle (Fig.1). It has ten *tabias*, namely: *Tumuga, Selen Wuha, Limaat, Selam Bekalsi, Kulu Gize lemlem, Gerjale, Ta`o, La`elay Dayu, Tsetsera* and *Merewa*. Topographically, Alamata is divided into western highland and eastern lowland. The western part (*Tsetsera* and *Merewa)* is categorized under the northern highlands of Ethiopia, having an altitude range of 2000 to 3000 meters above sea level (m.a.s.l). It is characterized by steep slopes, gorges and undulating terrain having scattered flat lands used for grazing livestock and farming. It covers 25% of the woreda. The topography of the area dominated by steep slopes has induced erosion.

The eastern lowland with its eight *tabias* is generally plain in topography with an altitude ranging from 1450 to 1750 m.a.s.l. The plain landscape of this area makes the area suitable for agriculture and it covers 75% of the woreda.

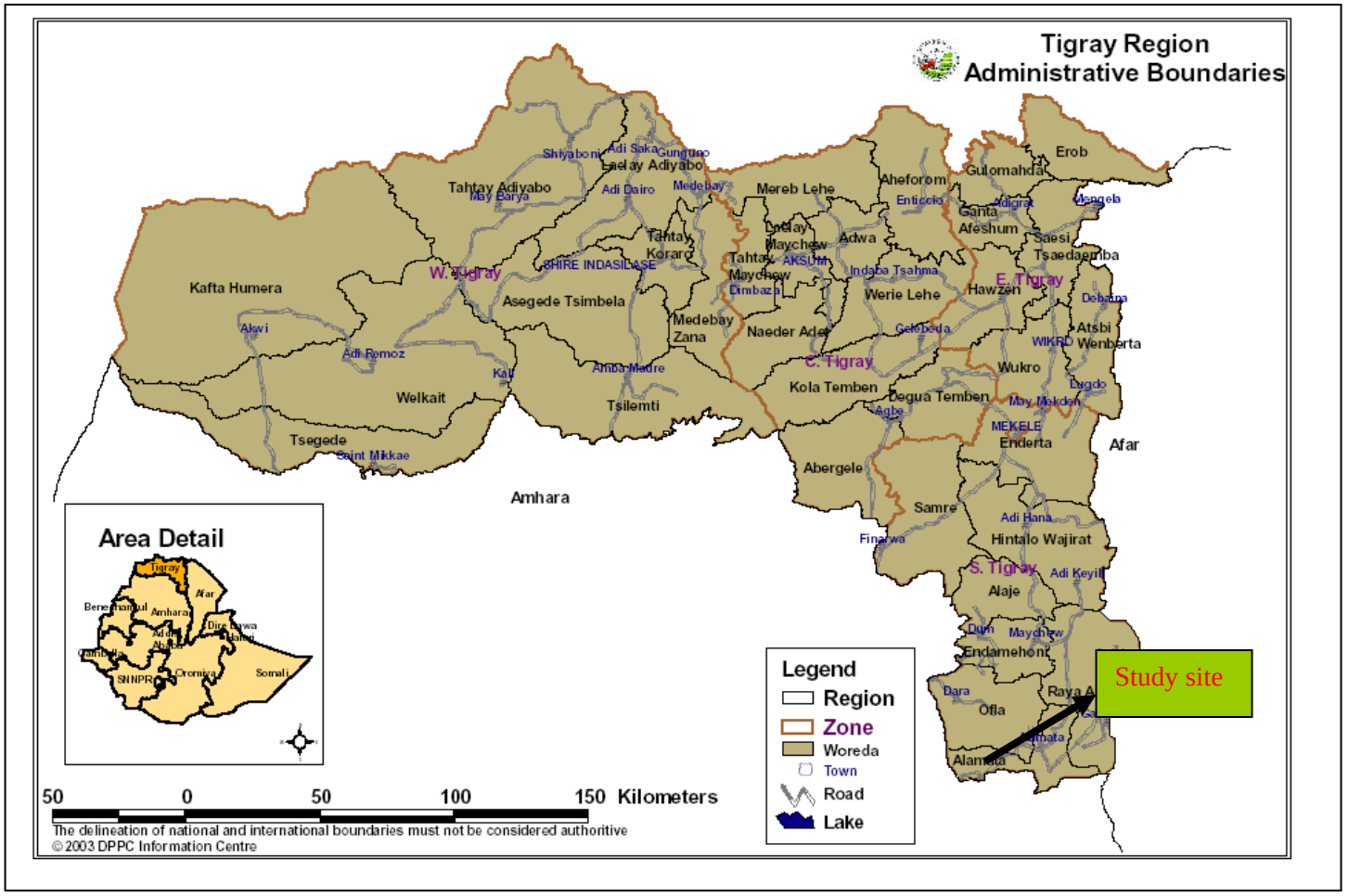


Figure 1: Location of the study area in a map

3.1.2 Soil and climate

The soil type found is Eutric Cambisols and Eutric Fluvisols (STZ, 2000). Climate differs between the lowland and highland of the area. The eastern lowland of Alamata is characterized by hot to warm sub-moist type of climate where the mean monthly rainfall is between 41 to 82 mm and the mean annual temperature is 18^0c to 27^0c. A semi-bimodal rainfall pattern with a small peak in April and maximum peak in August dominates this area. However, meteorological data of the area indicate that rainfall is highly variable and evapo-transpiration is high. The western highland is categorized under sub-moist highlands. The western highland is characterized by a mean annual temperature of 12^0C

to 18 ^{0}C and a mean monthly rainfall of 40 to 62 mm. Though the amount of rainfall is relatively low, the coefficient of variation for the area indicates that rainfall is moderately variable.

3.1.3 Population

The total human population of the study district is about 84,997. Out of the total population, 93.5% live in rural areas and 48.8% are female. There are about 16,986 households in rural areas. Accordingly, the average size of the households is 4.6 persons, (with 5 persons for male-headed households and 3 persons for female-headed households).

3.1.4 Land use and farming system

A Mixed farming system with the predomination of crop production is practiced in the district. Cultivable land, pasture and forest occupy about 67.8%, 8.5% and 8.2% of the total land area, respectively. The remaining area (15.5%) is non-usable, water body, settlement and other land use types. Of the total cultivated land (14,535 ha), annual crops occupy 97.9%. Permanent crops, grazing land, wood land, fallow land and other lands occupy 0.08%, 0.03%, 0.54%, 0.30% and 1.1% of the cultivated land, respectively. Permanent crops include fruits and stimulant plants like *chat*. The average size of land holding for the district is 0.88 hectare. The major food crops grown in the area are cereals, occupying 93.6% of the total cultivated area of temporary crops in the 2001/02 cropping season, followed by pulses covering 5.9%, oilseeds covering 0.22%, vegetables occupying 0.21% and root crops and other stimulants covering only 0.07% of the cultivated area of temporary crops. Sorghum, *teff* and maize are the major cereal crops

grown in the area. Moisture stress, weeds and invasive species (*Parthynium*, *Striga* and *Prosopis juliflora*), unavailability of improved agricultural technologies, crop pests and diseases, post-harvest losses, salinity and water-logging problems, poor water harvesting and irrigation agronomy practices, deforestation and soil erosion in the foot hills are the major production constraints in the area (TARI, 2004).

The woreda is known for livestock production. The average livestock holding of the district was 4.42 TLU (Total Livestock Unit) per household. Livestock are kept for the support of crop enterprise. Oxen are used for plowing and threshing, equines for threshing and transporting, cows for the production of replacement stock and milk for household consumption and sheep and goats are kept as assets, which can be exchanged into cash at times of need. The livestock population of the district is presented in Table 2.

Table 2: Livestock population in Alamata district, as on 2002/03

tabias	**Cattle**	**Sheep & goat**	**Camel**	**Equines**
Tumuga	7527	2009	57	589
Selen Wuha	10384	7550	181	787
Limaat	8114	2357	336	535
Selam Bekalsi	4384	1126	151	269
Kulu Gize lemlem	5359	2600	142	373
Gerjale	8177	1850	131	573
Ta`o	14419	1738	140	703
La`elay Dayu	7261	2974	309	769
Tsetsera	2362	2344	-	568
Merewa	6201	1941	-	350
Total	74188	26489	1448	5516

Source: Rural Development District Office, 2003

3.1.5 Vegetation

Available natural vegetation coverage is very small and only 8.2% of the Woreda is covered by residual and pocket forest trees found in communal forests, churches and area closures. The presence of Girat Kahsu natural forest also covers a good part of the forest cover. The lowland parts of the woreda dominated by Acacia species.

3.2 Site selection and sampling method

3.2.1 Site Selection

As one of the objectives of the study was to compare vegetation of the communal forest to that of open areas, the surrounding of Alamata Woreda was surveyed to look for suitable sites for the study. The preliminary selection of *tabias* was purposive. That is, *tabias* that have communal forest and free grazing land adjacent to each other were deliberately considered for selection as sample *tabias*. The communal forest and free grazing land needed to had similar vegetation cover in the past. In addition, the communal forest and the adjacent free grazing land should be similar in geological parent material, altitude, rainfall, aspects and drainage.

From the ten *tabias*, only three *tabias* were found to fulfill the above characteristics. Therefore, the three *tabias* were taken for the study. Then one communal forest with its adjacent free grazing land was selected purposely from each *tabias* (Table 3). The three tabias are located at different distances, but in the same direction that is in east direction from Alamata town. T1 (*Selen Wuha)* is located 18km away from the center of the

Alamata town, T2 (*Selam Bekalsi)* is located adjacent to the town and T *(Lemeat)* is located 8km away from the Alamata town. The selected tabias are found in the lowlands of Alamat Woreda.

Table 3: Distribution of study sites by tabias and villages in Alamata Woreda

Name of Tabia	**Name village**	**Name of goit**	**Name of communal Forest**
T1 (*Selen Wuha*)	Bedena Leco	Tigre mender	Alage
T2 *(Selam Bikalsi*)	Hasheya	Dima	Kern Awulie
T3 *(Limeat)*	Kutiche	Tao	Kern Tao

3.2.2 Vegetation sampling method

A systematic random sampling method was used to locate the sample plots in order to generate the woody plant inventory data, that could help to investigate species composition, diversity, abundance, dominance, similarity and population structure (Kent and Coker, 1992). The transect lines were laid in the ground starting at a randomly selected point at the edge of the forest. Keeping the north south direction with the help of a Silva compass parallel and straight transect lines were constructed (Emiru Birhane, 2002). The transect lines were spaced 50m between and with in the parallel lines (Tefera Mingstu, 2001). At this interval of spacing sample plots with 20m x 20m, 10m x10m, 5m x 5m and 4m x 4m size were established for trees, saplings, seedlings and herbs sampling

respectively until sufficient plots were taken (Abebe Gebrehaweria, 2007). The sample plots were arranged in concentric manner (Fig 2).

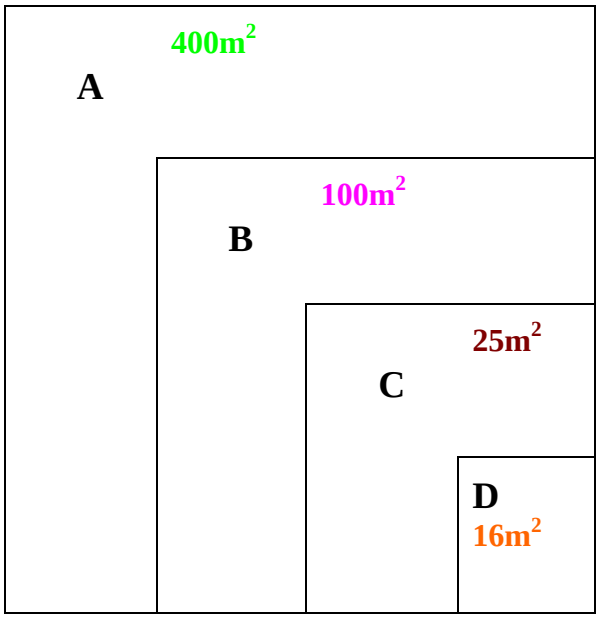


Figure 2: Arrangement of sample plots with nested compartments A, B, C and D.

Using this system, from each sample size a total of 84 plots were laid out, and the number of sample plots per sites varied according to the total area of the land uses. To assess the regeneration status of woody plants, individual woody categorisation were made as height <0.5 m and dbh<2.5 cm seedling, h >0.5 m and dbh<5 cm sapling and h >0.5 m and dbh> 5 cm tree. The categorization was made based on preliminary survey of the study sites. The measurement taken in each compartment is presented in Table 4.

Table 4: Types of vegetation measurements taken in each compartment

No	Compartment	Size	Measurement
1	Compartment A	20m*20m	-All woody plants with height >0.5m and diameter >5cm were recorded - Diameter and height of each trees were measured
2	Compartment B	10m*10m	-Saplings which have a height > 0.5m and diameter < 5cm was recorded and measured based on species.
3	Compartment C	5m*5m	-Seedlings which have height <0.5m and diameter < 5cm the number were recorded based on species.
4	Compartment D	4m*4m	-The abundance of herbaceous species was estimated visually.

3.2.3 Socio-economic sampling method

First a preliminary survey was carried out that included field observation, formal and informal discussion with professionals, administrative officers and representatives of the local people. This survey was used to identify the users of the selected communal forests. So, purposive selection of households of users, that are users of the three communal forests, was done from the three *tabias*.

Then, stratified random sampling was used to select the households. The users of the communal forest were stratified into male and female household heads in order to include female household heads. This is because male and female household heads could have different attitude and perception towards communal forests. A total of 120 household heads were sampled using the above method from the respective list of farmers in the

selected three *tabias* using proportional to size sampling. The size of the users was equivalent in each *tabias*, thus the same sample size was taken from each *tabias* as seen in table 5, forty households from each *tabia* were sampled. The informants of female household heads were 15.8 % of the total informants. A total of 120 households were selected for the study and this is 22 % of the users population.

Table 5: Distribution of sampled household heads in each study tabias in Alamata Woreda

TABIAS list	**Total users HHHs**	**%**	**Sampled HHHs**
T1 *(Selen Wuha)*	200	20	40
T2 (*Selam Bikalsi)*	185	22	40
T3 *(Limeat)*	180	22	40
Total	565	22	120

3.3 Data collection

Vegetation data: Using the above mentioned the following information (data) were colleted from constructed plots of each study land uses.

- From Compartment A, name of species (Vernacular and scientific), number of trees from each species, tree height using clinometers and diameter at 0.5m using caliper were recorded.
- From compartment B, name of species (Vernacular and scientific), number of saplings from each species and diameter above the ground using caliper were recorded.

- From compartment C, name of species (Vernacular and scientific) and number of seedlings from each species were recorded. In addition, from compartment D, herbs ground covers were visually estimated.

Species identification was done with the help of local knowledgeable elder persons and the nomenclature was done following the flora of Ethiopia, Honeybee flora of Ethiopia (Reinhard and Admasu , 1994) and Use full tree and shrubs of Ethiopia (Azene, 2007).

Socio-economic data: The survey was carried out by using;

House hold sampled survey

The household survey was conducted using a semi-structured questionnaire (Appendix II). This was done to know the attitude and perception of the users towards the communal forests. This questionnaire was developed based on literature review, preliminary survey/pre-test/(Appendix III). After being reviewed (comments and suggestions) for relevance, coverage of the intended study and validity of the information, some modifications were made to the questionnaire.

Having a refined questionnaire, enumerators were then trained on how to use it Recruitment of the enumerators was based on their familiarities with the locality and the people. In addition, key informants that organize village meetings and set convenient time for individual interviewees and provide relevant information were selected. As the result the following data were collected.

- ✓ Socio-economic setting

Population characteristics/ personal that is Age, gender, educational status, marital status, family size, occupation etc. and economic characteristic that is wealth status and land holding of the users were collected.

- ✓ Management system

Local participation (type and extent) and benefit distribution of the users were collected.

- ✓ People's attitude and perception towards communal forests were collected.

Group discussion

This group discussion was done in order to understand the local forest management institutions. So, focus group of 5-8 farmers who have detail knowledge about the communal forests and the institution setup were selected for the group discussion. These were consists of present and past leaders of the local forest institutions, elders, guards of the communal forests, young people and women. The group discussion was made in holydays so that the people could have enough time to discuss. The type of data collected were:

- ✓ Tenure arrangements

Historical perspectives, Owner ship and use right and feeling of security were collected.

- ✓ Institutional arrangements

Defined boundary and users, rules for exploiting the forest, collective choice arrangements, sanctions and conflict –resolution mechanisms of the informal institutions at local level were collected.

Finally, data were collected from Office of Agriculture and *tabias* administrative in order to know their attitude and perception through interview.

3.4 Data processing and analysis

Species area curve and basal area

The species area curves were drawn following Lamprecht (1989) with the x-axis representing each additional sample area, and the y-axis representing the number of species encountered. The basal area was calculated and converted to a per hectare basis following Akca (2000) using Excel.

$$g = \sum_{i=1}^{n} \frac{\pi D_i^2}{4}$$

Where: D_i = diameter of each tree in the sample

N= number of trees in the sample

Species composition of the land uses

The land use types are described in terms of species composition, species abundance, frequency, and importance value index (IVI). Where there were trees with diameter at 0.5m height greater than 5 cm in diameter, dominance was also calculated. Abundance is the number of individuals of a species. Frequency is the percentage of plots (or sub-plots within the plots) where the species occurs. Dominance is the rank based on the basal area of a species (Lamprecht, 1989). The IVI is a sum of relative abundance, relative frequency and relative dominance (Curtis and Mcintosh, 1951). Each species was listed, and the abundance of each species was entered in the list. A paired t-test was done to see

if there was any significant difference in the presence or absence of species, and their abundance of the two land uses (Sara, 2003).

Ground cover of herbs

To asses the ground cover of herbaceous species in the communal forest and open area, the proportions cover of all herbs in each plot were categorised into arbitrary ground cover classes (Heinz, 1972).

Indices of species diversity and evenness of species distribution

The Shannon-Wiener indices of diversity and evenness were used to look at the level of species diversity and evenness of species distribution (Kent and Coker, 1992).

Diversity: $H' = -\sum_{i=1}^{s} pi \ln pi$

Equitability or evenness: $J = \frac{H'}{H'\max} = \frac{-\sum_{i=1}^{s} pi \ln pi}{\ln s}$

Where: s = the number of species

pi = the proportion of individuals of the abundance of the i^{th} species as expressed as a proportion of the total

ln = $\log \text{base}_n$

The paired t-test was used to test if the diversity and evenness values of the different land use systems were significantly different from one another. To do this the paired list of the values $pi\ln pi$ and $pi\ln pi/\ln s$ in each land use were tested using the paired t-test.

Species richness: Species richness was analyzed by adding the number of all species encountered in the plots each land uses (Adefris, 2006).

Coefficient of similarity of the different land use types

The species of the two different land use types were compared according to Sörensen (1948). The formula used to calculate the similarity indices is as follows:

Sörensen (1948): $$Ks = \frac{2c}{a+b} * 100$$

Where: Ks= Sörensen's similarity coefficient

c = number of species common to both sites

a = number of species found in site one

b = number of species found in site two

Regeneration status

In this case distribution of individuals in terms of diameter class size that is 1= < 5cm, 2 = 5 – 10 cm, 3 = 10-15 cm, 4 = 15 - 20 cm, 5 = 20 -25 cm, and 6 > 25 cm diameter at 0.5cm. Then, histograms were drawn to see the population structure of the whole individuals and the dominant specie of the communal forests and free grazing lands.

Socio-economic analysis

Descriptive statistical data obtained from the sample households were compared and contrasted. Descriptive statistics such as percentage and frequency of occurrence were employed to assess farmers' attitude and perception on the communal forest. The data was analyzed with SPSS version 13 using software, Chi-square Test (X^2). Sex, age,

wealth, education, oxen possession and occupation of the respondents were used as independent variables. The dependent variables were attitude and participation of the local people towards communal forests. Data obtained from the group discussion was also analyzed descriptively.

CHAPTER 4 RESULTS AND DISCUSSION

4.1 Vegetation survey

4.1.1 Species area curve of the different land uses

Species area curves were drawn to judge the adequacy of sampled areas to represent the species diversity and related vegetation qualities. The levelling out of the species area curve is used to determine whether adequate samples were taken. The species area curve is a cumulative curve that relates the occurrence of species with the area sampled. Since the curves grow up and flattened at the end, this indicates that the number of plots taken is sufficient (Lamprecht, 1989). The species area curves for two land use types in the study area are given in Figures 3, 4 and 5.

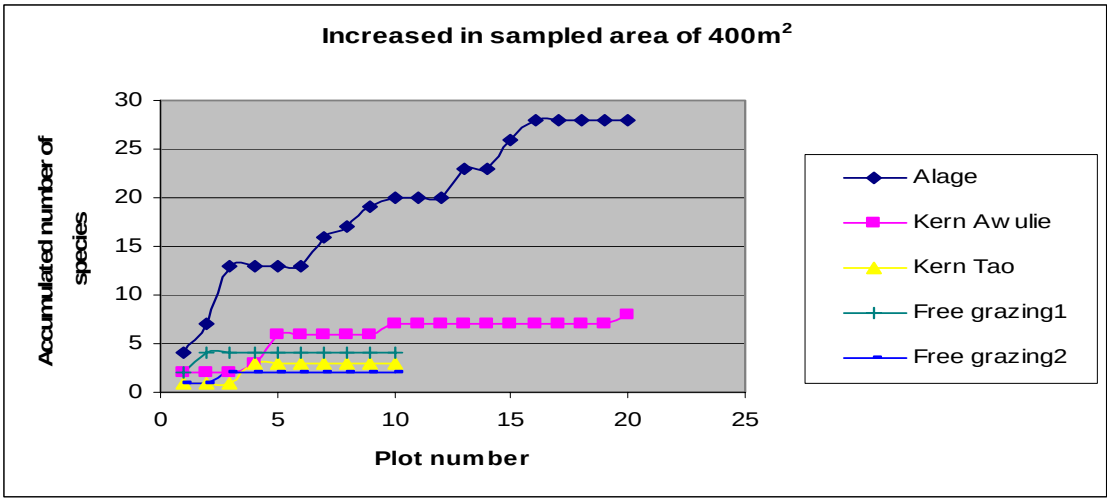


Figure 3: Species area curves of trees (all trees > 5cm at 0.5m and h > 3m) for the different land use types

In *Alage* communal forest the species area curve line increase up to the end with relatively less flattening trend. This could be as a result of high diversity of the area, which is also true from the result of Shannon-wiener diversity index (Table 8). This is

the communal forest with the highest diversity index value. The high diversity of *Alage* compare to the other communal forests could be due to nature of the original vegetation and inaccessibility of the area. As the respondents explain it was very rich in species since they have known the forest. It is also rich in wild animal too. *Kern Awulie* and *Kern Tao* had less species diversity than *Alage*. There were no trees in freegrazing3 land. Free grazing1 seems to have higher species diversity than Kern Tao. This is because the local community stopped cutting trees from their surrounding since recent times.

Alage had the highest species of sapling diversity. *Kern Awulie* and *Kern Tao* had much less species diversity of saplings than *Alage*. The free grazing lands had the lowest species diversity of sapling. The third free grazing land did not have saplings (fig.4).

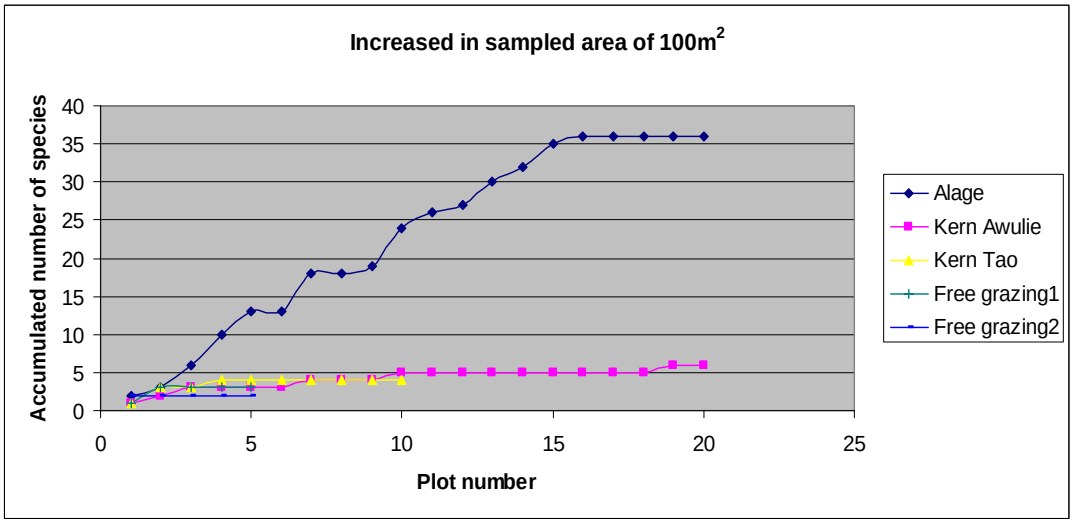


Figure 4: Species area curves of woody species saplings (> 2.5cm and < 5cm at the basal diameter) in the different land use types

Again Alage had the highest species diversity of seedlings. *Kern Awulie* and *Kern Tao* had much less than species of seedling than Alage. However, the free grazing lands had the lowest species diversity of seedlings (fig. 5).

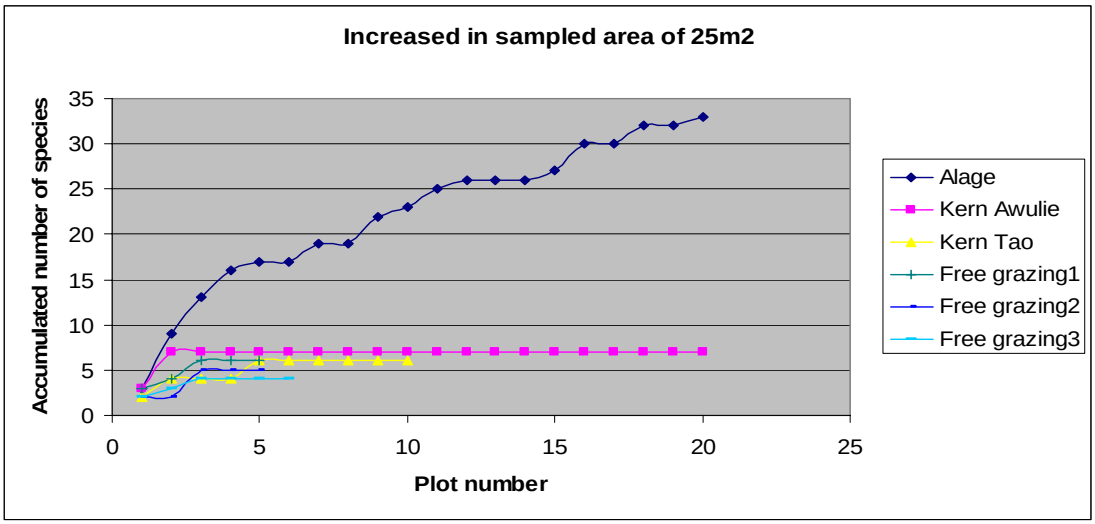


Figure 5: Species area curve of woody species seedlings ≤ 50 cm height, found in the different land use type

4.1.2 Species composition, abundance and basal area of woody plants of trees (> 5cm at 0.5m height)

A total of 30 species of woody plants of trees were recorded in the three communal forests. Seventy three percent of the species were only found in *Alage* communal forest while only six species were recorded in the freegrazing lands. A total of 29 woody species of trees were recorded in *Alage* while four were in the freegrazing land1. Similarly, *Kern Awulie* and *Kern Tao* had eight and three species of trees respectively. *Kern Tao* had the lowest species diversity of trees. The freegrazing1 and freegrazing 2 had four and two woody species respectively (Table 6).

Generally, the vegetation composition of woody species was much denser in the communal forests than the free grazing lands. This indicated that the local institution have played a role in conserving biodiversity of woody species. However, the recorded number of species in *Kern Awulie* and *Kern Tao* is much less than the species richness reported from dry forest (Daniel *et al*., 2006). As the respondents explain many species disappear from the communal forests as they compare with the original forest condition. In *Kern Awulie*, even though, the name *Kern Awulie* and the history of the site indicated that *Olea europaea* subsp. was dominant species, none was found in the standing vegetation which may indicate the possibility of local disappearance in the event of death of the existing few individuals. This indicated that high deforestation was occurred before the local communities start to protect the communal forests. In addition, since the communal forest are not completely closed from browsing animals, some species like *O. europea* could face high problem because it is highly palatable. However, if high level of protection in the communal forests continues, there may be good regeneration of these woody species since seedling survival of these species can be enhanced by preexisting early-successional shrubs that serve as nurse-plants, probably through limiting drought stress (Aerts *et al.,* 2008). Excluding livestock is an essential requirement because the shrubs do not protect seedlings efficiently enough against browsing. Therefore the communities should be closed the degraded forest land completely from any browsing animals in order to rehabilitate well. Woodland recovery has been associated with decreasing intensities of browser pressure (Walpole *et al.,* 2004).

The species composition, abundance, frequency and importance value index (IVI) were also calculated for all land use types and it is shown in Appendix I. For trees with diameter greater than 5 cm, dominance was also calculated.

According to the importance value index (IVI), the three most dominant species found in *Alage* were *Acacia asak, Acacia bussei and Dichrostachys cinerea* and in communal *Kern Awulie* the three most dominant species were *A. asak, A. etbaica* and *A. tortilis (*Appendix I). Similarly, *A. asak,* is the most dominant species in *Kern Tao*. It represented 273% of the total dominance. *A. asak* is the most dominant species for all communal forests. *A. asak* was the most dominant species in the free grazing1 too. This species is a pioneer species; such species are more dominant in disturbed sites taking advantage of primary succession (Denslow, 1987).

All the species found in all land uses were indigenous species. This is because no plantation was done in the communal forests. Being all species indigenous makes the communal forests free from the risks of exotic species in their rapid growth rate resulting in high competition for the native trees (Webster *et al.*, 2005).

Communal forest **Free grazing**

Figure 6: Showing the vegetation cover of communal forest and free grazing in Kern Awulie

In *Alage*, an abundance of 338 individuals/ha of woody species of trees were encountered. Similarly, in *Kern Awulie* and *Kern Tao*, an abundance of 350 individuals/ha and 313 individuals/ha were recorded respectively.

Except free grazing1, the rest free grazing possess the lowest abundance in the study areas. Taking all species of woody plants, even though the abundance of the communal forests are small (Table 6), they are significantly greater than the adjacent free grazing lands at ($P< 0.01$).

Basal area of all woody plants with diameter of >5cm was 1.57m^2 /ha for *Alage*, 3.82 m^2 /ha for *Kern Awulie* and 2.94 m^2 /ha for *Kern Tao*. The basal area of free grazing1 and 2 were 0.52 m^2 /ha and 0.09 m^2 /ha respectively (Table 6). The basal areas of the communal forests are too small. This is because the communities started to protect the communal forests after high destruction of the forests happened. This could be 15-18 years and it is short time to have higher diameter classes. This time was related to the time the communal forest institutions exist. However, the indigenous forest institutions were effective since the basal areas of the communal forests are significantly higher than the adjacent free grazing lands which had the same vegetation cover in the past. The difference comes from different land use management. In addition, the greater difference in basal area between the communal forest and open area could be due to the high number of multistemmed trees in the communal forest, leading to bigger diameters.

Table 6: Summary statistics of important parameters of trees

Tabias	Communal forest				Free grazing				P-Value for abundance
	N/spp	N/ha	B/ha	F/ha	N/spp	N/ha	B/ha	F/ha	Communal Forest Free grazing
Selen Wuha (T1)	29	338	1.57	460	4	192	52	666	**
S*elamBikalsi* (T2)	8	350	3.82	305	2	25	.09	558	**
Lemeat (T3)	3	313	2.94	460	0	-	--	-	**

Number of species encountered per the land uses: "N/spps" , Abundance per ha “N/ha”, Total Basal Area per ha “B/ha” total frequency per ha “ F/ha” however the in detail result is put in appendix.

** Significant different at p-value 0.01

4.1.3 Species composition, abundance and basal area of woody plants of saplings (> 2.5cm and < 5cm at the basal stem diameter)

From the 37 species of sapling found in Alage, *Dichrostachys cinerea* and *Dodonaea angustifolia* are the most dominant species of the saplings. These species grow in a variety of habitats and rapidly colonises open area of recently cleared forests. The higher number of species of woody plants in sapling stage than tree stage indicated that the forest is under active restoration. And also shows a potential to develop into good forest. In case of freegrazing1, the number of species recorded was three and *A. asak* was the most dominant saplings.

Similarly, in *Kern Awulie* eight species were recorded and the dominant species of the saplings were *A. etbaica* followed by *A. asak*, and *A. seyal*. *A. oerfota* was the most dominant shrub species of sapling in the free grazing2. Similarly, only 4 species were encountered in the *Kern Tao*. *A. asak* was the most dominant species of sapling in the two land uses in Lemeat (Appendix I).

In Alage the abundance was 3096 individuals/ha while free grazing1 had only abundance of 434 individuals/ ha. Similarly, the abundance of Kern Awulie was 314 individuals/ha respectively while its adjacent free grazing land has an abundance of 100individuals/ha. A lower proportion of saplings of Kern Awulie showed less potential for the restoration of a woody community. In Lemeat, the abundance of the Kern Tao was 615 individuals/ha (Table 7).

Table 7: Summary statistics of important parameters of sapling

Tabias	**Communal forest**			**Free grazing**		
	N/spps	**N/ha**	**F/ha**	**N/spp**	**N/ha**	**F/ha**
Selen Wuha (T1)	37	3096	487	3	434	131
S*elamBikalsi* (T2)	8	314	159	2	100	133
Lemeat (T3)	4	615	143	0	-	-

Number of species encountered per the land uses: "N/spps" , Abundance per ha “N/ha”, total frequency per ha “ F/ha” the detail result is put in appendix.

4.1.4 Species composition, abundance and basal area of woody plants of seedlings (<0.5m heights and <2.5 diameter at basal stem diameter)

In Alage, 30 species of seedlings were recorded while six species of seedlings were recorded in freegrazing land1. Similarly, Kern Awulie, seven species of seedlings of woody plants were recorded and six species of seedling were recorded in free grazing2. In Lemeat, only 5 species were recorded in Kern Tao and 4 species were in free grazing3 (Table 8).

Dodonaea angustifolia is the most dominant seedlings in Alage. In the free grazing1, *Acacia asak* was the most dominant species of seedlings. *A. asak* was the most dominant species of seedlings in Kern Awulie and Kern Tao. *A. oerfota* was the most dominant species of seedling in both the free grazing land2 and 3 (Appendix I)

The abundance of woody plants of the seedlings of Alage was 10,654individuals/ha while free grazing1 had only 806 individuals/ha. Similarly, Kern Awulie had abundance of 2727 individuals/ha while free grazing2 had 667 individuals/ha. However, all individuals found in freegrazing land2 were *A. oerfota* species of shrub. Kern Tao had possess a total of 2885 individuals /ha and free grazing3 had 133 individuals/ha (Table 8).

Table 8: Summary statistics of important variables of seedling

Tabias	Communal forest			Free grazing		
	No of Spps	**N/ha**	**F/ha**	**No of Spps**	**N/ha**	**F/ha**
Selen Wuha (T1)	30	10,654	341	6	806	298
S*elamBikalsi* (T2)	7	2727	168	5	677	233
Lemeat (T3)	5	2885	271	4	133	133

Number of species encountered per the land uses "No of Spps", Abundance per ha "N/ha" total frequency per ha " F/ha" however the in detail result is put in appendix.

4.1.5 Ground cover of herbs

As it is presented in Table 9, in Alage communal forest, 77% of the plots had good cover of herbaceous plants. In free grazing1, only 20% of the plots were under intermediate cover of herbaceous and 75% of the plots were under poor ground cover of herbaceous.

Similarly, 74% of the plots were under good cover of herbaceous in Kern Awulie. However, none of the plots were under good cover of herbaceous in free grazing 2. In Kern Tao, only 55 % of the plots were under good cover of herbaceous while no plot was under good cover in free grazing3. The better ground cover of the communal forests than the freegrazing lands is due to the restricted grazing system they use. Similar study in Tigray also proved that the use regulations were believed to contribute to a significant regeneration of grazing lands, supporting the role of communal resource management in redressing resource degradation (Gebremedhin *et al.,* 2004).

Table 9: Number of plots categorized under ground cover classes in the communal forests and open grazing areas

Tabias	**Sites**	**Ground Cover Classes**			
		1	**2**	**3**	**4**
T1	Communal forest1	0%	9%	14%	77%
	Free grazing1	75%	5%	20%	0%
T2	Communal forest2	0%	11%	15%	74%
	Free grazing2	83%	10%	7%	0%
T3	Communal forest3	25%	6%	14%	55%
	Free grazing 3	84%	11%	5%	0%

Ground Cover Class: 1 = 1-25% (poor cover), 2 = 26-50% (thin cover), 3 = 51-75% (intermediate), 4 = 76-100% (good covers)

4.1.6 Diversity, evenness and similarity of Woody Species

As it can be seen in the Table 10, the species diversity of trees of *Alage* and *Kern Awulie* were greater than their adjacent free grazing lands and they were statistically significant different at ($P<0.01$). The high diversity values of communal forests compared with open areas indicate the importance of the communal forests for the conservation of genetic resources of the woody species. Increases in the value of the indices indicate more species diversity. Grazing land 3 has no tree.

The J evenness value looks at the abundance distribution among the species occurring in a certain site. The higher the value of J, the more evenly distributed is the abundance among the species (Kent and Coker, 1992). All the diversity and evenness values in all the land use types were found to follow the normal distribution, thus

allowing the utilization of the t-test. The evenness of the species of trees values showed no significant difference among all land uses. Similarly, all the communal forests showed significant differences in species of sapling and seedlings diversity as compared to the grazing lands.

Table 10: Shannon-Wiener indices of diversity and evenness of trees in the different land use types

Life forms	**Land uses being compared**	**H'**	**J**	**P values**	
				H'	**J**
Trees	Alage vs. free grazing 1	2.61-0.91	0.77-0.66	**	NS
	Kern Awulie vs. free grazing 2	1.16 -0.63	0.60-0.38	**	NS
Saplings	Alage vs. free grazing 1	2.71-0.93	0.75-0.84	**	NS
	Kern Awulie vs. free grazing 2	1.65-0.25	0.79-0.35	**	NS
Seedlings	Alage vs. free grazing 1	2.54-0,90	0.74-0.50	**	NS
	Kern Awulie vs. free grazing 2	1.15-1.20	0.69-0.74	**	NS
	Kern Tao vs. free grazing 3	1.14-0.64	0.71-0.47	**	NS

** Significant difference observed at 0.01.

NS No significant difference observed at 0.01

Similarity

The species of the six different land use types were also compared according to Sörensen (1948) and the method considers presence/absence of species. When all species is taken, the species composition of all communal forests were different from the freegrazing lands. *Alage* was more different from their corresponding open grazing land than *Kern Awulie* and *Kern Tao*. *Kern Awulie* and *Kern Tao* had 37.5 % and 33.3 % species in common with free grazing 2 and free grazing 3 respectively (Table 11).

Table 11: Species similarity indices of the different land use types, when all species are used for comparison

Land use types compared	**Sörensen (1948)**
Alage vs. free grazing 1	29.5
Kern Awulie vs. free grazing 2	37.5
Kern Tao vs. freegrazing 3	33.3

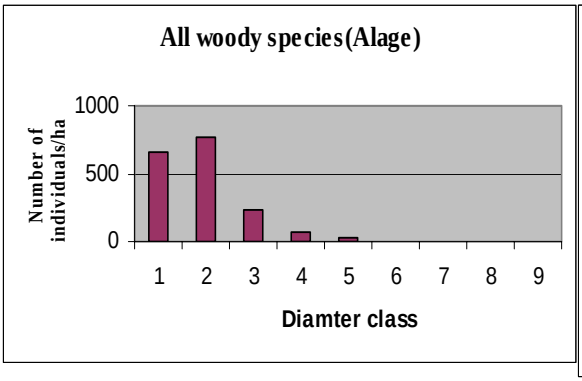
4.1.7 Population structure of woody species

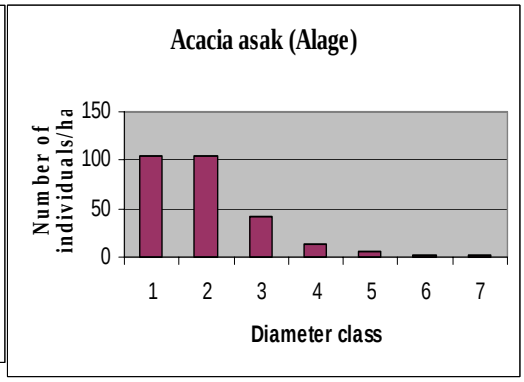
The diameter distribution of the communal forests for all woody species shows higher number of individuals in the lower diameter class than the higher diameter class. *Alage* seems to have an inverted J shape. There is relatively higher number of individuals with lower diameter class than higher diameter class in *Kern Awulie*.

Similarly, in Kern Tao, though, there is higher number of individuals with lower diameter classes, the seedlings were dominated by shrub *Leucas abyssinica* next to *A. asak.*

Though, there is relatively higher number of stem with lower diameter classes in *Kern Awulie*, this does not mean that it is in good regeneration trend. The drown graphs' shape (Fig.7) also indicates they are under insufficient number of seedlings to sustain the forest as most of the graphs did not appear to be like that of reverse "J" shape which indicates whether a given forest area is disturbed or not (Demel Teketay, 1997). In the case of the free grazing lands, even though there are high number of lower class diameter individuals than higher diameter class (Fig.8), the recorded individual are dominated by a shrub *A. oerfota* species.

The most abundant species for the three communal forests (*A. aska*) had an inverted J-distribution. The high proportion of seedlings shows a self-maintaining population structure implying the probability of being the main species in the recovery of the woody community (Emiru, 2002). More than 85% of the communal forests' population had diameter distribution of less than 5cm. *Kern Awulie* had possessed the highest number of individuals of trees than the rest all land uses (fig.7).





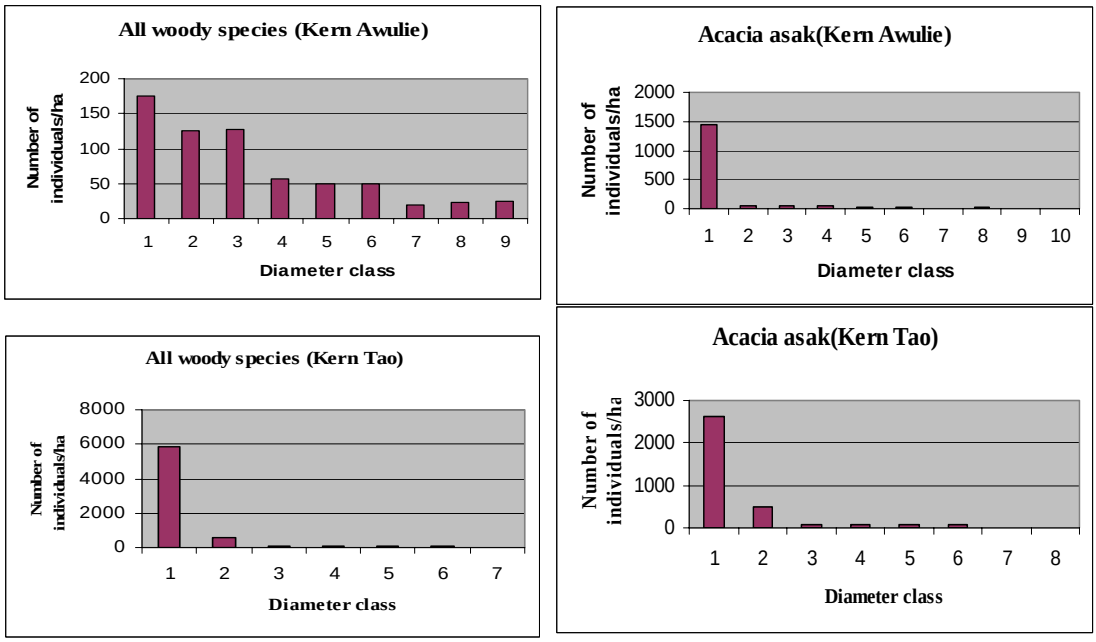
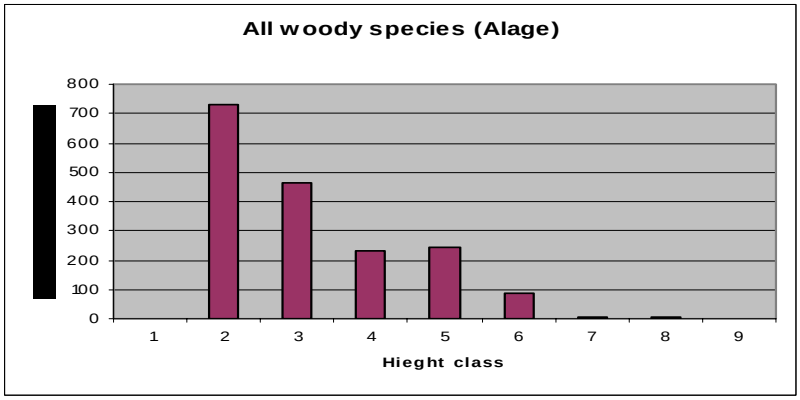


Figure 7: Diameter class (cm) distribution of all woody plants encountered in all plots of the communal forests and the dominant woody plant. Diameter class: 1< 2.5 cm, 2= 2.5-5, 3= 5-7.5, 4= 7.5-10, 5= 10-12.5, 6= 12.5-15, 7= 15-17.5, 8>17.5cm

The height class frequency distribution of woody species of the communal forests are shown in Figure 6. Woody species with height less than 3m constitutes more than 85%. Like the diameter distribution it can be seen that the height distribution follow similar trend.



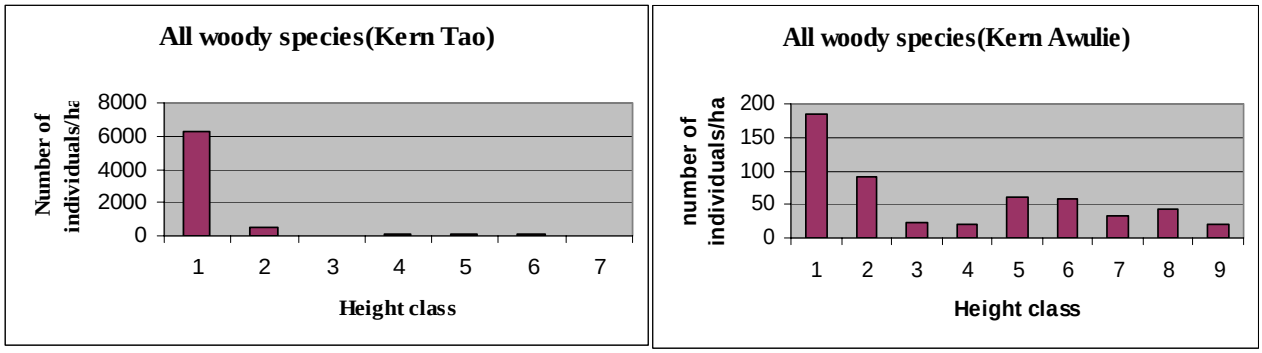


Figure 8: Frequency distribution of height classes (m) for woody species of communal forests: Height class 1<1m, 2= 1-2m, 3=2-3m, 4=3-4m, 5=4-5m, 6=5-6m, 7=6-8m, 8>8m

The diameter distribution for the open grazing land also shows an inverted J shape. The percent of seedlings, saplings and trees for free grazing land1 was 40%, 16% and 44% respectively. For free grazing land 2, the percent of seedlings, saplings and trees was 34%, 60% and 6% respectively. There were no trees for grazing land3.

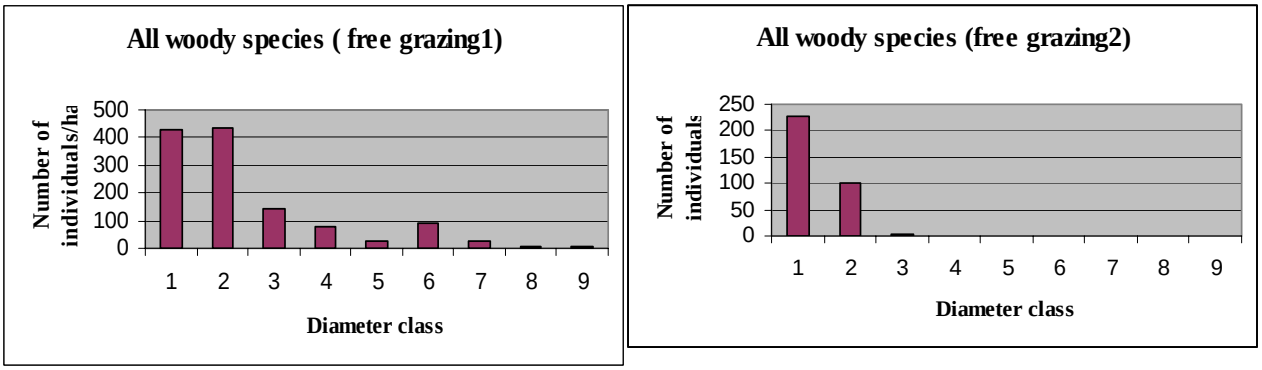


Figure 9: Diameter class (cm) distribution of all woody plants encountered in all plots of the free grazing land. Diameter class: 1< 2.5 cm, 2= 2.5-5, 3= 5-7.5, 4= 7.5-10, 5= 10-12.5, 6= 12.5-15, 7= 15-17.5, 8>17.5cm

In freegrazing 1 the height class distribution showed that irregular pattern. It seems to have higher number of lower class height than the higher height class. However, the same to diameter distribution it is dominated by some shrub. Similarly, the freegrazing2 showed that higher number of height class which is dominated by a shrub *A. oerfota* species

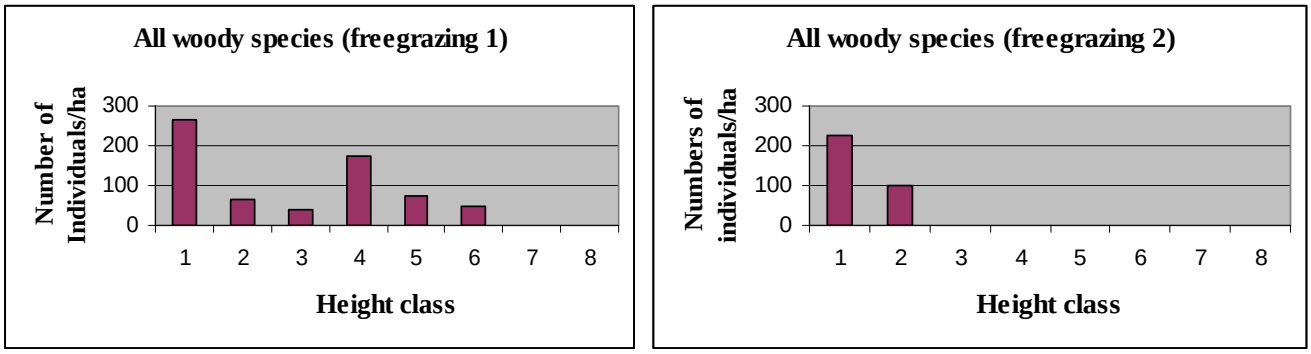


Figure 10: Frequency distribution of height classes (m) for woody species of freegrazing lands: Height class 1<1m, 2= 1-2m, 3=2-3m, 4=3-4m, 5=4-5m, 6=5-6m, 7=6-8m, 8>8m

4.2 Socio-economic

4.2.1 Socio-economic conditions of the sample individuals

Regarding most of the population characteristics such as male to female ratio, age distribution, martial status, educational status, family size and wealth status, there is no significant difference among the three *tabias.* Thus, it is reasonable to treat all samples as one when necessary. However, farm size and most of the domestic animals showed significant difference among the *tabias.* Oxen and goat showed no significant difference.

Table 12: Mean comparison of farm size and livestock number among Tabias in Alamata Woreda

Dependent variable	***Tabias***			**Significant**
	Selen wuha	**Selam Bekalsi**	**Lemeat**	
Farm size	0.99	0.58	0.72	**
Cattle	3.30	1.30	1.50	**
Oxen	1.50	2.00	1.70	NS
Sheep	0.55	0.50	1.90	*
Goat	0.37	1.60	0.57	NS
Camel	0.22	1.02	0.37	**
Donkey	0.50	0.36	0.57	**

* Significant different at P= 0.05
* * Significant difference at P= 0.01

More than half of the respondents had family size 5-9. In addition, more than half of the respondents had age of 30-50 years.

Table 13: Distribution of sampled household heads by type, age and family size in Alamata Woreda

HH head type	**No respondents**	**HH head age**	**No respondents**	**Family size**	**No respondents**
male	101(84.2%)	<30 years	18(15%)	<3	16(13.3%)
female	19(15.8%)	30-50 years	67(55.8%)	3-4	24(20%)
		> 50 years	45(34.9%)	5-9	76(63.3%)
				>9	4(3%)

As it is shown in Table 14, majority of the respondents were married and illiterate. Except one person all the informants were dealing with farming only. They did not have additional sources of income.

Table 14: Distribution of sampled household by Martial status, Education status and occupation in Alamata Woreda

Tabias	**Martial status**						**Education**				**Occupation**			
	Single		**Married**		**Divorced**		**Literate**		**Illiterate**		**Farm only**		**Off farm**	
	N0	%	No	%	No	%	No	%	No	%	No	%	No	%
Selen wuha	5	12.5	30	75	5	12.5	9	22.5	31	77.5	40	100	-	-
Selam Bekalsi	1	2.5	32	80	7	17.5	10	25	30	75	40	100	-	-
Lemeat	2	5	33	82.5	5	12.5	16	40	24	60	39	97.5	1	2.5
Total	8	20	95	79.2	17	14.2	35	29.2	85	70.8	119	99.2	1	.08

The settlement pattern of the people in the study area is cluster and the homes were located around the bottom of the hills of the communal forests and area closures (Fig. 11). Regarding, the ethnicity of the informants, 82.5% were Tigraway and the rest were Amhara. Eventhough, there are two ethnic groups especially in Selen Wuha, almost all were original inhabitants of the place, the difference comes from the border effect of the Tigray and Amhara National regions. These relate to the homogeneity of

the local communities and they contribute to the users to organize easily and have successful indigenous resource management (Ostrom, 1990).

Figure 11: The settlement pattern of the users in Kern Awulie and Kern Tao are in a cluster way

Economic status and landholding

The main economic means of the people in the study area was crop production and animal rearing with the higher reliance on the former. The classification of wealth was done based on local classification methods. Land holding and oxen possession were used as indicators of wealth. A farmer who does not possess land and an ox was considered as very poor, a farmer who owns < 0.5 ha and one ox was consider as poor, a farmer who owns 0.5-1ha and two oxen was considered as rich and a farmer who owns > 1ha and more than two oxen was considered to be very rich.

Accordingly, 2.5 % of the respondents were very rich, 57.5% of the respondents fell in the rich category, 35.8 % of the respondents were considered as poor and 4.5% of the respondents were very poor (Fig.12). 83.3 % of the female respondents were poor.

Similarly, 10.8% of the informants were landless, 69.2 % possess <1ha, 17.5% possess 1-2ha and 2.5 % possess > 2ha. Most of the landless were the young people (Fig.13).

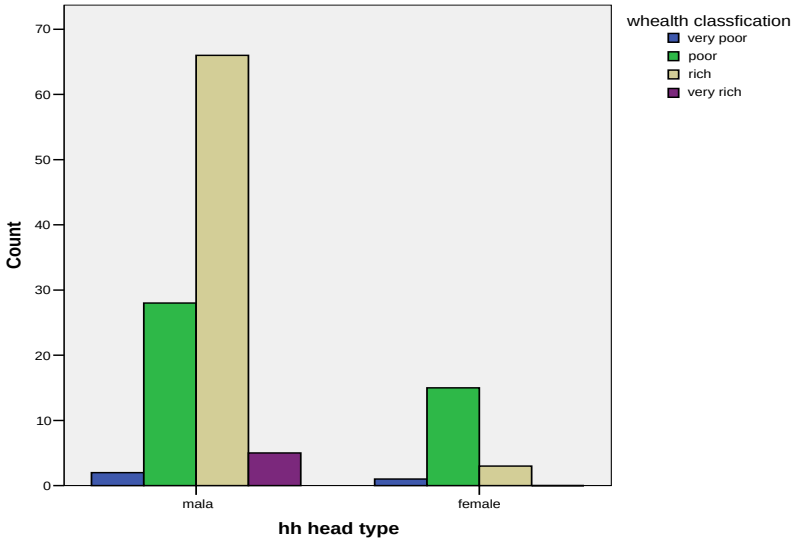


Figure 12: Distribution of sampled household by Wealth status by gender in Alamata Woreda

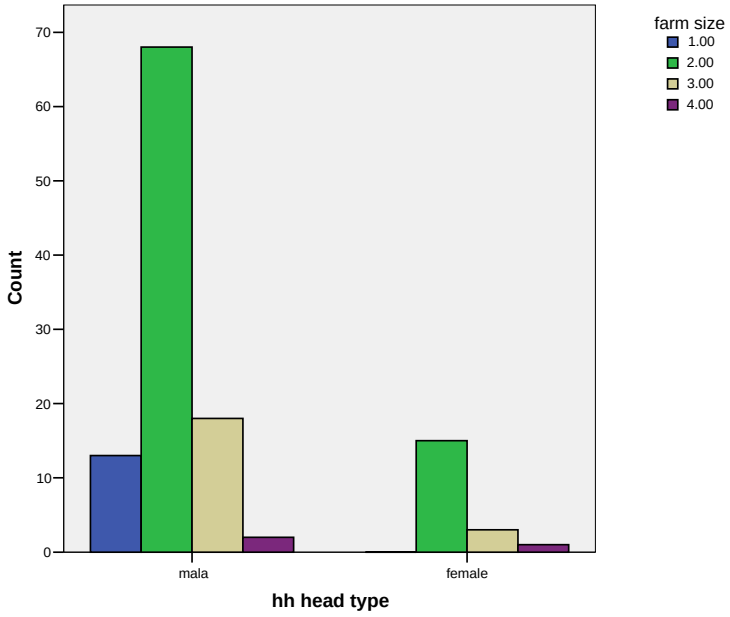


Figure 13: Distribution of sampled household by Land holdings by gender in Alamata Woreda; 1=>no farm land 2=<1ha.3=1-2ha,4>2ha.

4.2.2 Tenure history of the study sites

"Tenure" is the set of rights which a person or some private entity holds in land or trees" (Bruce, 1989). As it is indicated in Table 15, in Hileselasie's regime, in the three *tabias* the communal forests were under the control of the communities. As the respondents reported in the group discussion, it was believed the communal forests belong to the village landlord. However, access to the forests was free. There was no restricted use of the trees. The farmers could use the forest products as much as they want. However, the forest resources were plenty. As the respondents explain, even though the forests were open access, there was not high degradation because there were less people.

All the present communal forests and grazing lands were covered by trees. Even the dead/fell trees were remained on the ground. As the respondents mentioned, there was no need to worry about deforestation. So, they did not have restricted use of trees. However, they used to practice restricted grazing locally called '*Sera'* that indicates only oxen is allowed to graze after rainy season begins. They had been guarding the forest from grazing animals turn by turn when it is closed. They had punished one Birr per person for illegal grazing. This indicated that the local people have long tradition of managing natural resource. There were also institutions eventhogh their rules were only limited to the grazing. This is because as respondents explain forest resources were plenty and it is true that there is no need for property rights when a resource is plentiful. Such resources are exploited as open access resources (Bruce J W, 1999).

Table 15: Tenure history of the study sites in the Imperial Haileselase Regime (Pre-1974) in Alamata Woreda

No	Characteristics	Forests		
		Alage	**Kern Awulie**	**Kern Tao**
1	Under community control	Yes	Yes	Yes
2	Restricted grazing in side the forest	Yes	Yes	Yes
3	Guards hired by the community	Yes	Yes	Yes
4	Local bylaw	Yes	Yes	Yes
5	Institutions for the forests	Yes	Yes	Yes
6	Access for forest products	Free	Free	Free
7	Forest condition	Good	Good	Good

In the Derg regime, the ownership and access for forests were different for the three sites. In *Alage* forest, it continued as open access for trees as it was in the imperial regime. And the restricted grazing was also continued. There were no guards hired by the government or by the community. As a result, in 1985, when there is high drought in the whole parts of the country, many people used to come from out side the village and the *tabia* and cut trees for sale. There was charcoal making inside the forest too. As a result the forest was highly exploited. This is due to undetermined property right of the forests. The government did not give legitimacy to the communities. This indicates that tenure determines whether local people are willing to participate in the management and protection of forests (Bromley, 1991/92).

In case of *Kern Awulie*, the forest was under the control of the government. However, the community continued to practice restricted grazing in side the forest. The resource becomes more highly valued as population grows (Bruce J W, 1999). The local community was restricted from using the forest products. There were guards hired by

the government although, as the respondents explain, there was no strong guarding. As a result especially, in 1985 when there was high drought a big destruction of the forest had occurred.. In the group discussion it was explained that, the main destruction was done by the government. The government cut trees for fire wood for the military that settled in Alamata town. As the elders explain, they begged them not to destroy the forest. But, they gave them a deaf ear. At the end of the 1990's G.C, the forest became degraded.

Similarly, *Kern Tao* was completely under the control of the Government (Here, the forest included the present adjacent area closure too). It was considered as state forest. It was completely closed from human and animal interference. The surrounding community was not allowed to use restricted grazing. There were guards hired by the government. The protection was strong, as a result the forest was in a good condition. However, the community benefited nothing. Even the income that was gained from the sale of grass belonged to the local military camp (Table 16).

Table 16: Tenure history of the study sites in Derg regime (1974-1991) in Alamata Woreda

No	**Characteristics**	**Forests**		
		Alage	**Kern Awulie**	**Kern Tao**
1	Under community control	Yes	No	No
2	Restricted grazing in side the forest	Yes	Yes	No
3	Guards hired by the community	No	No	No
	Guards hired by the government	No	Yes	yes
4	Local bylaw	Yes	No	No
5	Institutions for the forests	Yes	No	No
6	Access for forest products	Free	No	No
7	Forest condition	Degraded	Degraded	Good

Post-1991, in *Alage*, four *'goits'* which are settled near the forest decide to exclude outsiders from any benefit gained from the forest. They also decided to use the forest in a restricted way and prevent it from future degradation. While the other villages in the *tabia* disagreed with this agreement. They wanted to use it as free access. They raised conflict. The reason for exclusion of the other villages was because they had their own communal forest in their village and the *tabia* administration support the four *'goits'* agreement. The local government gave the ownership right to the four '*goits'*.

Similarly, in *Kern Awulie,* after the big destruction happened in the *Derg* regimes, realizing that they are the first sufferers of the forest degradation, the community decided to protect the forests from further deforestation. They formulate local rules and regulations for managing the forests. They selected leaders who can enforce the rules. They also defined the users. As the respondents explain the local government supports their organization for the forest management.

Similarly, in *Kern Tao*, the forest return back to the community, the community restarted restricted grazing arrangement inside the forest as it was in the Imperial regimes. As the respondents explain, they were very happy to restart the communal management because in the *Derg* regime they did not benefit from the communal forests. In addition, the communities were interested to use the restricted grazing management in side the forest as it was in the Imperial regimes. As a result, when the *Derg* fell the forest was given to the communities and the communities rearranged their institution in order to manage the forests. The community started also protecting the forest from free access use of trees. Each household contributed two Birr per

month for a guard. The guard's salary was 120 Birr. Here the forest included the adjacent area closure too. Eventhough, the community tries to protect the forest from exploitation, people came from other villages to cut trees (most of the time for wedding and mourning). The community could not stop them since they had license from the local *tabia* administration. However, as the respondents and Woreda office of agriculture explain, the *tabia* administration was wrong in giving license to cut trees, because it was not the *tabias* that owned the forest. The forest belonged to the surrounding communities. As the farmers explained those people destroy the forest. They cut more trees than they should cut. Because there was nobody that controls the amount of the wood they should take. In addition, the *tabia* administration only give license. They did not limit the amount they should take. They had also conflict with two neighboring *'goits'*. The neighbors wanted the forest to be free access and free grazing. However, the Tao *'goit'* did not want to be free access. They tried to stop the other *'goits'*. However, the *'goits'* did not come to agreement. Finally, in 1992, the conflict got worst and the *tabia* administration told the Tao *'goit'* that they do not have the authority to prevent them. As a result three people were accused and went to prison. Since then the *Tao* community kept some hectare which is closer to them. The rest were left as open access. As a result, the open access land became bare. In 2005, the area was closed for rehabilitation as area closure with the agreement of the office of agriculture and the three *'goits'(*Table 17) .

Table 17: Tenure history of the sites in EPRDF regime in Alamata Woreda

No	Characteristics	Forests		
		Alage	**Kern Awulie**	**Kern Tao**
1	Under community control	Yes	Yes	Yes
2	Restricted grazing in side the forest	Yes	Yes	Yes
3	Guards hired by the community	Yes	Yes	Yes
	Guards hired by the government	No	No	No
4	Local bylaw	Yes	Yes	Yes
5	Institutions for the forests	Yes	Yes	Yes
6	Access for forest products	No	No	No
7	Forest condition	Better than before	Better than before	Degraded at the beginning now better

Generally, after the high deforestation occurred, realizing that they are the first suffers of the forest degradation, the local communities decided to protect the forests from further degradation. As rightly pointed out by Ostrom (1990), where individuals live in such area situations for substantial periods of time, they tend to develop share norms and patterns of reciprocity and can build institutional arrangements for resolving CPR dilemmas.

In all the study areas, the local communities organize them selves and formulate local rules and sanctions. This was done by their initiation and was referred to the indigenous forest institutions. Of course, the indigenous institution for the common property was already existed for the grazing arrangement in side the forest. The communities add restricted use rules for trees to the existing institution. The

institutions referred to as informal, pre-existing, or native institutions. In addition, the institutions are viewed to be indigenous institution as they are occurred at the local or community level, reflecting the knowledge and experiences of the local people.

In addition from the group discussion, the farmers have big awareness of land degradation. There words were as follow, “forest is our life. A farmer cannot live with out tree. If forests destroyed, the land will exposed to erosion and at the end our land can change to desert. Rain can also go far from us".

4.2.3 Institutional arrangements

Boundaries and size of the user group

The group of users is restricted to *‘goits’* which are smaller than village. In case of Alage, the users live in four *‘goits’*. Each *‘goit’* has its own two leaders called *‘Aba haga’* and five assistances who are responsible for the forest management. The assistances are responsible for managing financial related activities. In addition, the leaders and the assistances are also responsible for managing the social activities of the *‘goits’*. Each *‘goit’* has around 200 household users. The list of the users is known and is put with the leaders. However, the forest is not divided up to the four *‘goits’*. They manage the forest as a whole.

Similarly, in Kern Awulie, the users are limited to one *‘goit’* called *Dima Giyorigis*. The users divided themselves in to three *‘keyes’*. They are *Gdagudi*, *Maehelot* and *Kocha*. The users of the three *‘keye’* are known. The users live close to the one direction of the bottom of the forest (Fig. 11). The forest is located on the undulating hills of the village rounding the settlement of the users and covers a long distance in length. The forest is divided into three parts so that the people who live near the forest

will be responsible for protecting and use the nearby part of the forest. So each *'keye'* is responsible for protecting its part.

Similarly, in Kern Tao, the users are found to be in one *'goit'* called *'Tao'*. Furthermore the *'goits'* is divided into two *'keyes'*. The two *'keyes'* have their own two leaders for the forest management. The list of the users is known and it is put with the selected leaders.

Defining the extent of forest boundaries or the number of users in a group clearly in the study sites, allowed less opportunistic individuals to encroach upon forested land. Giving the right to use forest products to the nearby '*goits'* also makes management easier. This concords with the suggestion that groups emerge to manage common property when the user population lives close to the resource and is relatively small (Ostrom, 1995). As it is explained by the group discussion, the reason of dividing the users into smaller groups is that for the ease of the management. Many studies of the indigenous common property systems that have survived through considerable periods of change also identify small size, internal homogeneity have great contribution to the effectiveness of the communal forest management (Arnold, 1998). Study done in Tigray in the collective management of wood lots also proved that the effectiveness of the management is greater in lower level than higher level (Gebremedhin *et al.,* 2003). However, there are also studies which prove effective forest management institution with large size of users in case of the Van Panchayats in India (Agrawal, 1996).

Use rules and access to forests

In *Kern Tao* and *Alage,* the use rules forbid the users cutting trees for any purpose. The only access the users were allowed collection of dry fuel wood and grazing of oxen.

The users of *Alage* used to also get benefit from some naturally grown fruits like cactus. The reason for forbidding using non-dry woods in *Alage* and *Kern Tao* is because the community believed that the forests did not have sufficient amount to satisfy the need of the community. They left the forests for natural regeneration.

Similarly, in *Kern Awulie*, the users are allowed to get access from nondry woods in addition to dry wood and grazing. However, the users should ask first to the leaders and they should also explain for what purpose they need the wood. They are restricted to ask for wedding, mourning and farm implementation only. Asking wood for house construction is forbidden. The community with the leaders will decide the amount of wood they take and the leaders will select the tree or trees to be cut. The amount is decided based on the wideness of the ceremony. The leader with the community will determine the wideness. Most of the time 2-3 trees are allowed for wedding and mourning. First dead and fell trees are selected for firewood of wedding and mourning. One tree is most of the time allowed for farm implementation. This indicates that the local communities have clear and environmental protection rules. Similarly, being the use rules clear and environmental conservative would help the institution to have successful communal forest management (Ostrom, 1990; McKean, 1992b; and Ostrom, Gardner, and Walker, 1994). In addition, giving priority for the forests rehabilitation in the case of the *Kern Tao* than and *Alage* indicate that the local communities are well aware of land degradation. The clear enforceable rules make also life easier for resource users and for monitors representing the user group, and reduce misunderstandings and conflict.

Monitoring and Sanctions

In *Kern Tao,* the monitoring procedure is done by the selected two leaders and the users. There is no guard hired. The community guards the forest turn by turn. The leader will tell the users whose turn it is. As the respondents explain there is no need of hired guards because the forest is small and it is near to the residence of the community so it is easy to protect the forest from illegal cutters.

In *Alage* and *Kern Awulie,* the monitoring procedure is done by the selected leaders, guards and the whole users. The guards are hired when the forest is closed from grazing. The main purpose of the guards is to keep the forest for grazing of any animal. However, the guards are forced to guard the forest from illegal cutters, too. The guards are paid in cash by the community. Each user is needed to contribute one birr per ox. Most of the time the guards in both forests are paid 120 Birr per month. When there is no guard, the community keep the forest turn by turn. The leaders will tell whose turn it is. In *Kern Awulie,* if the person did not guard the forest, 10-15 birr will be fined. The leader in *Alage* stayed in power for a minimum of a year and maximum of five years. In the rest two forests, the leaders stayed in power as far as they are strong leaders. There is a meeting every Sunday in a month. If there is a need for discussion, the leader can call for a meeting any time.

The sanctions are different for all the community forests. The illegal cutters will be punished 10 Birr for first time and 50 Birr for second time in Kern Tao. If the person cut trees repeatedly, he will be sent to local courts. The sanctions are not permanent. They can be changed any time according the situation. Similarly, in *Alage* and *Kern Awlie,* the illegal cutters are punished 50 birr and 100 birr respectively. Lastly, if he

cuts trees repeatedly, he will be sent to the local courts. The penalty is sever for these who repeatedly offense. There is also evidence that penalties need not be draconian: graduated penalties, mild for first offenses and severe only for repeated infractions, are adequate (McKean, 1992b; Ostrom, 1990).

Even though, McKean, (1992b) and Ostrom, (1990) argue that the communities with healthy common forests were those that recycled the fines and penalties they collected into providing for their guards. In the study sites, the money is used for buying barrels which is used for making '*tella*'. The guards are paid from the collected money from each user one birr per ox. But, the collected money can not cover the payment of more than one guard. However, one guard is not enough for the large forests of *Alage* and *Kern Awulie.* So, it is better the collected money to be for the conservation purpose rather than for social activities.

Figure 14: Group discussion with the local farmers in Selen Wuha

Participation

As the informants explained most of the users participate in selection of the leaders, formulating the bylaws and in any meeting regarding the forest. They also participate in contributing cash or labour for protecting the forests. The contribution is related to the rules and regulation of the local community. In Kern Tao, the forest is protected by the local people turn by turn. So they did not contribute cash for guards. All the respondents response that they contribute labors for the protection of the communal forest (Table 18). In case of Alage, the users sometimes hired guards or they guard themselves. So, 30% of the respondents contribute in cash only, 30 % labour only and 40 % contribute in both cash and labour. In Kern Awulie, 90 % of the informants response that they contribute both cash and labour (Table 18). This shows that the communities are activily participating in monitoring producers. They also have good participation in the forest meetings and in contribution of labour and money for the management of the communal forests. This finding follows a study by Agrawal and Yadama (1997) who, in their sample of 279 communities, found that the most important form of user participation was the level of investment by the user group in monitoring and protecting activities. The good Participation of the users can be seen primarily as a means to achieve specific goals such as building a better management structure and getting natural resources into a ‘good condition’ .

Table 18: Contribution of the respondents for the practice of the communal forest managements in Alamta Woreda

Contribution	Tabias						Total	
	Lemeat		Selen Wuha		Selam Bekalsi			
	No	%	No	%	No	%	No	%
Cash	-	-	12	30	1	2.5	13	10.8
Labour	40	100	12	30	1	2.5	53	44.17
Kind	-	-	-	-	-	-	-	-
Cash & labour	-	-	16	40	36	90	52	43.3
Cash & kind	-	-	-	-	-	-	-	-
Labour & kind	-	-	-	-	-	-	-	-
Cash, labour &kind	-	-	-	-	-	-	-	-
None	-	-	-	-	2	5	7	5.83

Concerning the three forests together, 84.2 % of the respondents explained that they participated in the forest management meeting they had. Regarding the participation in a meetings they have, the Pearson chi-square value (0.99) revealed that participation and gender shows significant difference at $p<0.05$ (Table 19). This is because women did not participate in forest meetings. They believe that woman should not go to meetings. So, most of the female household heads did not participate in the meetings. However, they can send their sons if they are adult enough. However, the week participation of women in the meetings is critical since most women rely upon forests for their livelihoods. It seems unlikely that the system is likely to be any more effective (McLain, 1993a). Therefore, efforts by the state or the non-governmental bodies to promote empowerment for women would lead to full participation of the group in forest management decisions.

Table 19: Relation between local participation and community structure

No	Independent factor	Significant
1	Age	NS
2	Gender	*
3	Economic status	NS
4	Educational status	NS
5	Oxen possession	NS
6	Occupation	NS

NS=non-significant

- = significant, at $p < 0.05$;

Conflict resolution and Recognition of legitimacy

The major conflict raised in the study areas were with non users from other villages. In *Kern Tao*, the major conflict raised was with the neighboring *'goits'* in 1992. The cause of the conflict was the Tao *'goit'* residents needed to use the forest in restricted use but the neighboring *'goits'* needed to use the forest as free access . The local administration permitted the neighboring *'goits'* to use the large part of the forest as free access. As a result the *Tao goit* remain with the present communal forest. Eventhogh, the Tao community were not happy in the *tabia* administration's decision, they accepted as it is. Similarly, in *Alage*, the nearby villages needed to use the forest as free access. However, the *tabia* administration did not permit them. Because the people of other villages had their own communal forest in their village. The only thing they want was to get additional benefit.

As the respondents explain, conflict among the users is rare. If there is, it is easily solved by discussion. This can be due to the every meeting of the users in every Sunday in month. The small disagreement among the users implies successful common-property regimes. But the conflict with non users is about the benefit sharing

and property right and usually solved with the help of the *tabia* administration or t*abia* agriculture office. The respondents also explain that the government and the *tabia* administration are always besides them. They gave them legitimacy to manage the communal forests.

Grazing arrangements in the communal forests

The respondents explained that since Imperial Haillesielasse I, they have used to practice restricted grazing locally called *'sera'*. It was also a long tradition of developing and enforcing use regulation of grazing areas in Tigray (Gebremedhin et al., 2004). The free grazing time for *Alage* and *Kern Awulie* is half June- September and February –May respectively.

In both *Alage* and *Kern Awulie* forests, the users use cash penalties for violations. In *Alage*, the fine for Oxen or cattle illegal grazing was 10 Birr while if cowboy is found with them, it would be 30 Birr and if it is at night 50 Birr per a person. If the fault is repeated it can be 100 Birr. In *Kern Awulie*, the punishment is 3-5 Birr for any domestic animal. In case of Kern Tao, they did not have restricted regulation. As the respondents explain the communal forest is very steep. The reason for allowing only oxen to graze is that because oxen supply draught power in the study areas.

Technical aspect

As the respondents explain in the group discussion, they do not have any technical practice they use in order to maintain, protect and regenerate the forest. The only thing they do is to leave the communal forests for natural regeneration. However, from the vegetation survey, Kern Awulie and Kern Tao need some soil and water conservation

structures as the site are highly affected by soil erosion since they are located in the hill sides. They also needed to have planting enrichment. Some gully treatments were done to protect from further expansion of the gully by the office of agriculture in Kern Awulie (Fig. 15).

Figure 15: Gully treatment done by BoARD in Kern Awulie

4.2.4 Perception of the community towards the communal forests

Perception of local people is a key issue to the successful management of communal resources (Emiru, 2002). All the respondents explained that conservation of plants is important. However, 11.7% of the respondents responded that conservation of wild animals is not good because of the increase of the wild animals like hyena, wolf and leopard become a problem.

The informants classified the forest condition in three periods. During the Haileselase regime and before when the original forests exist, there were dense forests and wild animals were also rich. Then deforestation of the forests happened in different conditions as it is mentioned in the tenure history of forests. In both *Kern Awulie* and

Alage, the deforestation was happened in *Derg* regime. In case of Kern Tao, the high deforestation was happened at the beginning of the EPRDF. As most of respondents respond, the vegetation cover of the communal forests was increasing. However, it is not the same as the original forest. The wild animals in kind and quantities are increasing (Table 20). This time is related to the time the local forest management institutions exist.

Table 20: Farmers' perception of forest covers changes and number of wild animals in the communal forests in Alamata Woreda

	Tabias			Total
	Lemeat	**Selen Wuha**	**Selam Bekalsi**	
Forest cover				
Still intact	1(2.5%)	2(5%)	9(22.5%)	12(10%)
Better than before the deforestation exist	22(55%)	26(65%)	22(55%)	70(58%)
Slightly disturbed	15(37.5%)	9(22.5%)	4(10%)	28(23.3%)
Heavily disturbed	2(5%)	3(7.5%)	5(12.5%)	10(8.3%)
Wild animal				
Increase	26(65%)	33(82.5%)	37(92.5%)	96(80%)
Decrease	14(35%)	7(17.5 %)	3(7.5%)	24(20%)

Forest dependency

Majority of the respondents mentioned that they do not sell any product of the forests. Similarly, even though 53 % of the respondents said they collect fuel wood, all explain that they collect it from elsewhere not from forests. More than ninety percent said that they have fuel wood shortage. Almost all respondents use dry woods, cow dung and crop residue as sources of energy. There is nothing done to help the poor and woman house holds heads. Regarding grazing lands, 56.7 % of respondents said that they have shortage of grazing land.

As it shown in the Table 21, from the household survey, the benefit of the users depends on the forest condition and the bylaw they had. More than half of the respondents of the users of *Kern Tao* benefit only from grazing their oxen and collecting dry woods. In the case of *Kern Awulie*, the users use non-dry woods. In addition, 67.5 % of the respondents of users of *Kern Awulie* benefit from non dry wood in addition to dry wood and grazing.

Table 21: Benefit distribution of communal forests among Tabias in Alamata Woreda.

No	**Benefit**	**Tabias**						**Wealth**	
		Lemeat		**Selen Wuha**		**Selam Bekalsi**		**Poor**	**Rich**
		No	%	No	%	No	%	No	No
1	Dry fuel wood only	4	10	2	5	2	5	7(15%)	1(1%)
2	Grass(grazing) only	5	12.5	-	-	-	-	3(6.5%)	2(2.7%
3	Non dry wood only	-	-	-	-	-	-		
4	Food from fruits only	-	-	-	-	-	-		
5	Dry fuel wood & grazing	21	52.5	23	57.5	7	17.5	13(18%)	22(29%)
6	Fuel wood & \non dry wood	-	-	-	-	3	7.5	3(6.5%)	
7	Dry fuel wood & Food	1	2.5	-	-	-	-		1(1%)
8	Dry fuel wood, Grazing & food	6	15	5	12.5	-	-	3(6.5%)	8(10%)
9	Dry fuel wood, grazing & non dry wood	1	2.5	7	17.5	27	67.5	15(36%)	36(48%)
10	All	2	5	3	7.5	1	2.5	2(4%)	4(5%)

Future ownership and tenure security

In this study, only common property tenure is concerned. Ninety five percent of the respondents prefer the communal forest to continue as it was now that is to be under the control of the individuals. only 5% prefer the communal forests to be divided up to users.

None of the respondents prefer the communal forest be manage by the government. Regarding the tenure security they feel, 70% of the respondents have a fear that the communal forest might be taken by the government (Table 22). This feeling of insecurity could affect their management decisions for the future (C Gibson *et al.*, 1998).

Table 22: Perception of the respondents towards future ownership and tenure security of the communal forests in Alamata Woreda

	Tabias					
	Lemeat		**Selen Wuha**		**Selam Bekalsi**	
	No	**%**	**No**	**%**	**No**	**%**
Future ownership						
Continue as it is now	38	95	35	87.5	39	97.5
Divide and share for users	2	5	2	5	1	2.5
Be under ministry agriculture	-	-	3	7.5	-	-
Tenure security						
Do you feel tenure secure						
Yes	18	45	9	22.5	9	22.5
No	22	55	31	77.5	31	77.5

Attitude towards the communal forest management

All of the informants are interested that the communal forest managed by the local forest institutions. In addition, all agree with the rules and penalty they have. As the respondents said the rules and penalties are formulated by themselves. There is no reason that they disagree. All the respondents need the communal forests to be expanded if there is place. Regarding attitude they have towards the communal forest management, there was no significant difference at ($P<0.05$) among age, wealth, education, oxen possession, occupation (Table23).

Table 23: Relation between altitude to wards communal forest and community structure

No	Independent factor	Significant
1	Age	NS
2	Gender	NS
3	Economic status	NS
4	Educational status	NS
5	Oxen possession	NS
6	Occupation	NS

NS=non-significant at $p<0.05$

5.2.5 Perception of Tabia administration and office of agriculture towards communal forest

As the t*abias* administration and Woreda office of agriculture responded, the communal forests were becoming better when compared to the time when the forests were deforested. They responded that the local institutions protected the forests well. They explain that the *tabia* administration and office of agriculture gave the power to protect and use the forests to the community. Because they believed that the communities are managing the forests sustainably. They also explain that it is better for the communal forests to continue under the community management.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the species area curves, it is clear that adequate samples had been taken for the study. Assuming that the vegetation of both communal forest and free grazing land was similar some years ago, the vegetation in all the communal forests have a higher woody vegetation composition, densities and basal area. This is due to the management difference of the communal forests and free grazing lands. The communal forests are protected from free access or *de facto* management. This is done by the local forest management institutions exist. Accordingly, the local forest institution is effective in protecting the forests from being degraded more and becoming open access as their adjacent open areas.

However, the number of species recorded in the communal forests except *Alage* in both *Kern Awulie* and *Kern Tao* is lower than other dry forest area. This is due to the high deforestation happen before the forest management institutions exist. These communal lands had also less number of lower diameter classes stems. The poor regeneration capacity of these forests indicates the need to apply enrichment planting with indigenous tree species so that the heritage of threatened species will be maintained.

Beside to this, the topographic location of all the study communal forests is on hilly mountainous spot, which is highly vulnerable for serious erosion, it is necessary to implement and strength of appropriate maintenance soil and water conservation structures like gully treatments. The very rich species of woody plant and wild life

diversity of *Alage* forest indicate that it has a potential to recover to a very good dense forest and home of wild animals.

From the group discussion, the forest management institutions have established after the high deforestation happened especially in the 1985 when there were high drought in the country. However, they were institutions for grazing arrangement in side the forests in the Imperial Haleselasie. The local communities were initiated to protect the communal forest by them selves by realizing that they are the first suffers of the deforestation. This indicated that the local communities are aware of land degradation. In addition, the institutions are considered indigenous forest management institutions because it is unique for the communities and it is based on the indigenous knowledge of the local communities.

Being the users of the communal forests smaller and homogenous contribute the users to have successful indigenous forest management. It will also useful to have leader who are responsible for the forest management. The monitoring producers is done by the selected leader, guards and the users. This implies that the communities are actively participate in protection. The restricted use rules of the communal forests in order to give chance the forest to rehabilitate indicates that the communities are trying to manage sustainably. The local institutions have also sanctions and conflict mechanisms which are very important in having successful communal management. However, the fines should used for forest conservation rather than for buying barrels. Thus the forest management institutions should be free from social activities.

According to the hypotheses set at the beginning of the study, the following points were proven.

1. The vegetation in the communal forest as compared to that of the grazing land has shown an increase and change in species composition with increase of woody species and grass cover. However, the number of species recorded in the communal forests especially in both *Kern Awulie* and *Kern Tao* is lower than other dry forest area.
2. Almost all the respondents prefer the communal forests to be managed by the local people as it is now. In addition, all the respondents are glad the communal forests are managed by the local institutions. These imply that the local communities have positive attitude and perception to wards the communal forests. A good attitude towards the communal forests helps in the protection of degraded communal forests for better rejuvenation of woody species.

6.2 Recommendations

Based on the results of this study, the following recommendations are made:

1. There is higher species composition in the communal forests than free grazing lands. The density, abundance and diversity also outpace the free grazing. As it has saved the forests from being degraded more. Hence, the local institutions that managed the communal forests should strengthen and supported. In addition, government policy on participatory resource management will be more successful if it is facilitative of institutional innovation and adaptation at the village level.
2. All the studies communal forests are in high threat of browsing animals though they use restriction grazing that is only oxen are grazed in the allowed time. This is because important species like Olea species and others are disappear from the standing vegetation. Therefore, these lands should be closed completely from any human and animal interference in order to rehabilitate well. They should use cut and carry system in order to use the grasses.
3. The local communities should be trained and oriented about scientific tree propagation (seed collection, storage and nursery techniques), silvicultural and forest management techniques which may enhance their level of knowledge on top of traditional conservation knowledge since they have limited knowledge in the silivicultural and tree propagation.
4. It is advisable to identify *Alage* forest as an In-situ conservation site as it is rich in species of woody plants and wild animals. In addition, it can be taken as priority forest area since it covers wide area and posses different land escape topographies. .

5. In order the communal forests be successful & sustainable, the institution should be free from social activities, the fines should be used for forest conservation rather than for buying barrels.
6. Land tenure insecurity discourages local participation in forest management and forest protection activities. So, the communities should be guarantee to the communal forests in order to feel tenure security.
7. Women house hold heads should participate in the meetings of the forest management in order to have active participation of women. There fore, the government should empower women to have active participation in any forest management activities.
8. In order the communal forests be sustainable, the government should always legitimize and assist local groups to formulate and enforce rules of group access to, and non-member exclusion from, common forest areas.

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APPENDIX

Appendix I: List of woody species and important parameters of the three sites.

1.1.1 Dominance, abundance, frequency and importance value index of the trees in the three land uses in Selen wuha

No	Species	Life form	Alage				Free grazing 1			
			Abundance (N/ha)	Frequency (%)	Dominance (m2/ha)	IVI	Abundance (N/ha)	Frequency (%)	Dominance (m2/ha)	IVI
1	*Dichrostachys cinerea*	tree	47	55	0.117	35				
2	*Carissa edulis*	Tree/shrub	8	14	0.017	7				
3	*Acacia seyal*	tree					17	33	0.065	25
4	*Acacia bussei*	tree	14	27	0.084	16	58	33	0.529	21
5	*Acacia tortilis*	tree	5	9	0.018	5				
6	*Acacia asak*	tree	64	41	0.302	48	200	100	1.889	139
7	*Acacia etbaica*	tree	31	32	0.157	27				
8	*Erthrina abyssinica*	tree	20	41	0.206	29				
9	*Askar*[a]		1	5	0.008	2				
10	*Vepris nobilis (Teclea nobilis)*	tree	5	18	0.013	7				
11	*Chlorophytum tetraphyllm*	tree	1	5	0.002	2				
12	*Dga wulekef*[a]		1	5	0.025	3				
13	*Euclea schimperi,*	tree	5	14	0.013	6				

14	*Terminalia brownii*	tree	13	18	0.092	14				
15	*Rhus natalensis,*	Tree/s hrub	8	18	0.028	9				
16	*Erikoli*[a]		1	5	0.007	2				
17	*Kertse*[a]		5	9	0.015	5				
18	*Maytenus senegalensis,*	Tree/s hrub	1	5	0.003	2				
19	*Dodonaea angustifolia,*	Tree/s	1	5	0.002	2				
20	*Zizipis spaniyacrisiti*	Tree/s	1	5	0.003	2				
21	*Sclracarya birrea*	tree	8	9	0.022	6				
22	*Strychnos henningsii*	tree	3	5	0.012	3				
23	Mwata[a]		6	14	0.011	6	17	33	0.037	75
24	*Grewia bicolor*	Tree/s	9	14	0.035	8				
25	*Acacia melits*	tree	68	23	0.334	47				
26	*Korasima*[a]		1	5	0.004	2				
27	*Weyra werete*[a]		9	5	0.031	6				
28	*Bridelia micrantha*	tree	1	5	0.006	2				
29	*Ximenia americania*	Tree/s	3	5	0.011	3				
	Total		341	405	1.57	300	292	200	2.52	300

a: local name

1.1.2 Dominance, abundance, frequency and importance value index of the trees in the three land uses in Selam Bikalsi

NO	Species	Life form	Kern Awulie				Free grazing 2			
			Abundance(N/ha)	Frequency (%)	Dominance(m2/ha)	IVI	Abundance(N/ha)	Frequency (%)	Dominance (m2/ha)	IVI
1	*Carissa edulis*	Tree/s	1	5	0	2				
2	*Acacia tortilis*	tree	35	67	0.81	56	17	33	0.295	136.5
3	*Balanites aegyptica*	tree	3	10	0.1	7	8	33	1.30	163.5
4	*Acacia bussei*	tree	6	5	0.03	4				
5	*Acacia etbaica*	tree	83	67	1.06	76				
6	*Acacia asak*	tree	206	88	1.72	136				
7	*Acacia Sieberiana*	tree	15	21	0.1	14				
8	*Acacia seyal*	tree	1	6	0	2				
9	*Acacia nilotica*	tree								
	Total		350	269	3.82	300	25	67	1.6	300

1.1.3 Dominance, abundance, frequency and importance value index of the trees in the three land uses in Lemeat

No	Species	Life form	Kern Tao			
			Abundance(N/ha)	Frequency (%)	Dominance(m2/ha)	IVI
1	*Balanites aegyptica*	tree	1	14	0.033	13
2	*Acacia tortilis*	tree	1	14	0.071	14
3	*Acacia asak*	tree	311	100	2.835	273
4	*Acacia etbaica*	tree				
	Total		313	129	2.940	300

1.2.1 Abundance, frequency and modified importance value index of saplings of the woody stems in the three land uses in Selen Wuha

NO	***Species***	**Life form**	**Alage**			**Free grazing 1**		
			abundance(N/ha)	**frequency**	**Modified *IV**	**abundance(n/ha)**	**Frequency**	**Modified *IVI**
1	*Dichrostachys cinerea*	tree	559	64	31	100	33	48
2	*ader agubudi*[a]		18	9	2			
3	*Carissa edulis,*	Tree/s	23	9	3			
4	*Agam kunichbi*[a]		68	5	3			
5	*Agobudi*[a]		5	5	1			
6	*Erthrina abyssinica*	tree	5	5	1			
7	*Vepris nobilis(Teclea nobilis)*	Tree/s	27	9	3			
8	*Chlorophytum tetraphyllm*	tree	77	14	5			
9	*Euclea schimper*	Tree/s	118	27	9			
10	*Drot*[a]		5	5	1			
11	*Terminalia brownii*	tree	9	9	2			
12	*Rhus natalensis*	Tree/s	32	23	6			
13	*Acacia bussei*	tree	41	14	4	67	33	41
14	*Kelikelisha*[a]		5	5	1			

15	*Kertse*[a]		23	9	3			
16	*Dodonaea angustifolia*	Tree/s	486	36	23			
17	*Maytenus senegalensis*	Shrub/t	9	5	1			
18	*Konitirit*[a]		14	5	1			
19	*sclracarya birrea*	tree	5	5	1			
20	*strychnos henningsii*	tree	5	5	1			
21	*Minitaro*[a]		5	5	1			
22	*Mwata*[a]		218	55	18			
23	*Nech kitel*[a]		14	5	1			
24	*Rowey*[a]		64	9	4			
25	*Grewia bicolor*	Tree/s	50	23	6			
26	*Acacia asak*	tree	105	23	8	267	67	112
27	*Cadia purpurea*	tree	355	27	17			
28	*Leucas abyssinica*	shrub	18	9	2			
29	*Justicia schimperana*	shrub	27	5	2			
30	*tinibi zaf*[a]		9	9	2			
31	*Olea europeae,*	tree	46	14	4			

32	*weyra werete*[a]		5	5	1			
33	*Prunus Africana*	tree	5	5	1			
34	*yebay tiku enchet*[a]		9	5	1			
35	*Bridelia micrantha*	tree	91	9	5			
36	*yeblay chefega*[a]		355	14	14			
37	*yedel agubudi*[a]		186	5	7			
	Total		3096	487	200	434	133	200

* modified IVI, without dominance value.
a: local name

1.2.2 Abundance, frequency and modified importance value index of saplings of the woody stems in the three land uses in Selam Bikalsi

	Species	Life form	Kern Awulie			Free grazing 2		
			Abundance(N/ha)	**Frequency (%)**	**Modified *IVI**	**Abundance(,N/ha)**	**Frequency (%)**	**Modified *IVI**
1	*Anichea*[a]		13	5	7			
2	*Acacia bussei*	tree	9	9	9			
3	*Acacia tortilis*	tree	45	27	32	67	33	32
4	*Leucas abyssinica*	tree	5	5	4			
5	*Acacia etbaica*	tree	104	45	62			
6	*Acacia asak*	tree	45	50	46			
7	*Acacia seyal*	tree	86	14	36			
8	*Euphoorbia candelabrum*	tree	5	5	4			
9	*Acacia oerfota*	tree				933	100	168
	Total		314	159	200	1000	133	200

* modified IVI, without dominance value.

a: local name

1.3.1 Abundance, frequency and modified importance value index of seedlings of the woody stems in the three land uses in Selen Wuha

No	Species	Life form	Alage			Free grazing 1		
			Abundance(N/ha)	Frequency (%)	Modified *IVI	Abundance(N/ha)	Frequency (%)	Modified *IVI
1	*Dichrostachys cinerea*	tree	345	14	7			
2	*ader agubudi*[a]		18	5	2			
4	*Carissa edulis*	Tree/s	55	5	2			
5	*Kelikelsha*[a]					113	33	14
6	*Acacia tortilisi*	tree				113	33	14
7	*Agam kunichbi*[a]		36	5	2			
8	*Kalenchoe spp*	tree	55	5	2			
9	*Vepris nobilis*	Tree/s	91	9	4			
10	*Chlorophytum tetraphyllm*	tree	73	14	5			
11	*Terminalia brownie*	tree	36	9	3			
12	*Grewia spp*	Tree/s	18	5	2			
13	*Euclea schimperi*	Tree/s	91	9	4			
14	*dunbulubul cheret*[a]		18	5	2			
15	*Rhus natalensis*	Tree/s	55	5	2			
16	*Enitoromay*[a]		181	5	3			
17	*Acacia bussei*	Tree	18	5	2	267	66	28
18	*Dodonaea angustifolia*	Tree/s	673	36	17			
19	*Euphorbia abyssinica*	Tree	36	5	2			
20	*Kunukura hado*[a]		18	5	2			
21	*sclracarya birrea*	tree	55	5	2			
22	*Mwata*[a]		1200	36	22	400	33	21
23	*nech kitel*[a]		727	5	8			
24	*Celtis Africana*	tree	1055	27	18			
25	*Grewia bicolor*	tree	236	9	5			
26	*Acacia asak*	tree	55	14	5	3200	100	110
27	*Acacia etbaica*	tree				113	33	14

28	*Cadia purpurea*	tree	1000	14	13			
29	*Leucas abyssinica*	shrub	400	27	12			
30	*Justicia schimperana*	shrub	782	14	11			
31	*Olea europeae*	tree	36	5	2			
32	*yebay tiku enchet*[a]		55	5	2			
33	*Bridelia micrantha*	tree	527	14	9			
34	*yeblay chefega*[a]		2709	27	33			
	Total		10654	341	200	4206	298	200

* modified IVI, without dominance value.
a: local name

1.3.2 Abundance, frequency and modified importance value index of seedlings of the woody stems in the three land uses in Selam Bikalsi

No	Species	Life form	Kern Awulie			Free grazing 2		
			Abundance(N/ha)	Frequency (%)	Modified *IVI	Abundance(N/ha)	Frequency (%)	Modified *IVI
1	Anichea[a]		182	18	17	667	33.3	44
2	*Acacia bussei*	tree	36	5	4			
3	Hinitin[a]		18	5	3			
4	*Leucas abyssinica*	shrub	364	41	38			
5	*Acacia etbaica*	tree	527	23	33			
6	*Acacia asak*	tree	1455	68	94	133	100	20
7	*Acacia sieberiana*	tree	145	9	11			
8	*Acacia oerfota*	Shrub				1200	100	96
10	*Rikasha*[a]					133	33.3	20
11	*Kalenchoe spp*	tree				133	33.3	20
	Total		2727	168	200	2266.7	233.2	200

* modified IVI, without dominance value.

a: local name

1.3.3 Abundance, frequency and modified importance value index of seedlings of the woody stems in the three land uses in Lemeat

No	species	Life form	Kern Tao			Free grazing 3		
			Abundance(N/ha)	Frequency (%)	Modified *IVI	Abundance(N/ha)	Frequency (%)	Modified *IVI
1	*Amam gmel*[a]		57	14	6			
2	*Acacia bussei*	tree	114	29	12			
3	*Mwata*[a]		914	71	42			
4	*Leucas abyssinica*	shrub	2171	86	69	266.7	33.3	16
5	*Acacia asak*	tree	2628	71	71			
6	*Acacia oerfota*	shrub				9867	100	124
7	*Agam kinichib*[a]					1467	66.7	41
8	*Balanites aegyptica*	tree				533.3	33.3	19
	Total		5885	271	200	12133.3	233.3	200

* modified IVI, without dominance value.
a: local name

Appendix II: Questionnaires

Part one

Individual interview

I. House hold characteristics

1. Region _____ Zone_____ Wereda _____ Tabia_____

Village_____ Giote _____

2. Ethnicity of the household 1) Tigre 2) Amhara 3) Oromo 4) other

3. Age of the household _____

4. Sex of the household _____

5. Education status of the household

1) Can't read and write 2) elementary school 3) high school 4) vocational

6. Martial status of the household 1) single 2) married 3) widowed 4) separate

7. Family size 1)<3 2) 3-4 3) 5-7 4) 4-9 5) >10

8. Family type 1) male headed 2) female headed

9. Farm size 1) no land 2) < 0.5 ha 3) 0.5-1ha 4) >1ha

10.What is your main economic activity ?

1)Farming 2)livestock production 3) trade 4)forestry 5) other

11. Livestock size at this time

No	Livestock type	Quantity	Remark
1	Cattle		
2	Oxen		
3	Sheep and goat		
4	Equine		
5	Other		

12. Is your production amount sufficient for household consumption through out the year? A) Yes b) no

13.If no what other sources do you use to supplement the deficit?

II. Management of the communal forest

14. In what way have you contribute for the practice of communal forest?

1) Cash 2) labour 3) kind 4) other

15. Who is responsible for protecting the communal forest?

1) Government 2) Community 3) Both 4) other

16. What is your initiation to protect the communal forest?

17. Is the conservation of animal and plants a good thing?

1) Yes 2) no

18. What changes have you observed since you know the place?

1) Still intact 2) better than before 3) slightly disturbed 4) heavily disturbed

19. What wild animals are found in the communal forest?

20. How are the wild animals appeared since the area is managed by the community?

1) Increase 2) decrease 3) other

21. What are the major causes for the disappearance of forests and trees around your locality?

22. Have you ever been involved in making suggestions or decisions towards forest management?

1) Yes 2) no

23. If the answer for Q.22 is no why?

24. What amendments need to be made on the community bylaw?

25. Do you sell forest products?

1) Yes 2) no

26.If yes, is there any problem in selling the forest products ?

1) Yes 2) no

27.Do you face Shortage of grazing lands due to communal forest?

1) Yes 2) no

28.If yes to, Q.27 , How do you manage then?

29. Do you collect fuel wood ?

1) Yes 2) no

30. If yes where do you collect?

31. If no for Q 30 what do you use for your source of energy?

32. Do you have shortage of fuel wood?

1) Yes 2) no

IV Benefit distribution

33. What benefits do you gained from the communal forest?

1) Dry Fuel wood

2) Grazing

3) Food

4) Timber

5) Cutting live trees for different purpose

6) Other

34. Is there any problem in sharing the benefit?

1) Yes 2) No

35. Do you believe that there is equal benefit sharing among the community?

1) Yes 2) No

36. Does the communal forest provide a satisfactory forage yield for your animals?

1) Yes 2) No

37. Is there any thing done to help poorest household ?

1) Yes 2) No

38. Is there any thing done to help women house hold?

1) Yes 2) No

V. Land tenure & land use system

39. Who owns / has the right to use the trees found on the communal forest?

1) Local community 2) local administration

3) Agricultural office 4) All

40. Does the entire community have the right to graze in the communal forest ?

1) yes 2) no

41. Do you feel tenure secure of the communal forest?

1) Yes 2) No

42. What should be the future ownership look like to protect and benefit from the site?

1. It should continue like how it is owned by now

2. It is better to divide and share for users

3. It is better to be under the ministry of agriculture

VI. Attitude to wards communal forest

43. Do you agree the communal forest manage by the local institution called *"sera "*

1) Yes 2) no

44. If the answer is yes for Q,43, Why?

45. Why you are member of the local institution (*sera)*?

46. Do you agree that only oxen graze in the communal forest in summer season?

1) Yes 2) No

47. Do you agree that the community forest manage communally?

1) Yes 2) No

48. Do you want the communal forest to be expanded?

1) Yes 2) no

49. If yes where?

50. If the answer forQ. 49 is no Why?

51. Who is responsible to set the community bylaws?

1) The leaders of the local institution

2) The community

3) Both

4) The government

53. Did the community participate on the bylaw set up?

1) Yes 2) no

54. Do you obey the rules?

1) Yes 2) no

55. Do you agree with the penalty?

1) Yes 2) no

56. If no why?

57. Who select the leaders of " sera"?

1. Baito 2. Government 3. Community 4. other

Part two

Group discussion

I. Institutional arrangement

1. When do you start the social organization called "*sera*"?

2. What are your incentives or initiations to protect the forest?

3. What are the techniques used for grazing animals in the forest?

4. Do you have guards for the communal forest?

5. Was it necessary to have the site guard?

6. Is the guard paid for doing such practice?

7. If yes to Q 6 in what way is it paid for?

8. Who is paying the salary for the site guard?

9. If the payment is in kind what kind of payment is it given?

10. Does this community forest have cultural value to you?

11. How many household or individuals are under this organization?

12. How many" Goets or menders" are mange by this organization?

13. Do you have rules for exploiting and maintaining the communal forest? If yes, explain.

14. How do you formulate the rules?

15. How do you monitor the rules?

16. How do you punish for the people who violate the rules?

17. How do you enforce them?

18. How can you resolve conflict over use resources?

19. Do you have authority to devise your own institutions?

20. Are people out side the community allowed to get benefit?

21. If the answer is yes toQ.20 explain the arrangements?

22. Does rapid population increase have any impact on the benefit of the community?

23. What is the tenure history of the communal forest?

II. Technical aspect

24. Do you know the boundary of the communal forest?

25. What kind of forest products are the users allowed to use?

26. What products are not allowed to use?

27. How much amount of products are allowed to collect explain in numbers of donkey loads ?

28. What species are valuable tree species for you?

29. What kind of protection and maintenance do you do for the valuable trees?

30. Is there any thing you do to avoid competition of non-valuable tree species?

31. How do you control or protect the forest /trees damaging agents like pests, insects, fauna, fire?

32. Is there any thing you do to propagate valuable trees (and other forest) species? If it yes what is that?

Appendix III: Informal survey

a. Do you have communal forest managed by the local community in your villege?
b. Do You have freegrazing lands which is adjacent to communal forests?
c. If the answer is yes for Q.2, do the communal forest and freegrazing land have the same vegetation cover in the past?
d. Do the communal forest and freegrazing land have defined boundary ?
e. What is the tenure history of the communal forest in the three regimes?
f. How is the local institution arranged to managed the communal forest?
g. Which goites or villege is the users of the communal forest?
h. What is the number of the users household heads?
i. What is the number of female and male household heads?
j. What is your initiation to manage the communal forest?