

Full Length Research Paper

Assessment of forest management practices and livelihood income around Arero dry Afromontane forest of Southern Oromia Region in Borana Zone, South Ethiopia

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Forest resources are often well managed by local communities either through their own initiatives using traditional institutions or being organized with assistances from development actors such as non-governmental organization (NGOs) and governmental organizations (GOs). The study was aimed to assess forest management practices, and the contribution of forest resource for communities' livelihoods of Arero forest of Oromia Regional State. Secondary and primary data was collected from household survey, forest management groups. The socio-economic importance of the forest resources was assessed by interviewing, 85 households randomly selected from three villages. A semi-structured questionnaire was used for the survey. To assess forest management practices, group discussion was used with selected key informants and local administrators. For socioeconomic survey households (HHs) were used. SPSS software was used for data analyses. Results showed that informal institutions of the Oromo 'Gadaa' systems and formal institutions like SOS Sahel Ethiopia were collaborated and played to manage the Arero forest in the region. Furthermore, the forest users' (local communities) collect various forest based products such as honey, wild fruit and medicinal plants. The annual income derived from direct forest related activities constituted 16.5% of the total household income. This figure is not including the role that the forest plays in the form of forest grazing. The contribution from the forest ranks third in terms of relative importance in household income generation after livestock and wage labor. Forest management activities like fire protection, control expansion of settlement, controlled forest grazing and enrichment planting was practiced to improve forest conditions by traditional forest management communities in collaboration with other development institutions. The observation of the population of some dominant plant species experiences poor regeneration. This also implies that current management practices are not satisfactory to sustain the forest conditions. Unless improved management interventions are made, the sustainability of the contribution to livelihoods income from the forest will be in question in the future.

Key words: Arero, Borana, community, 'Gadaa' system institution, forest, livelihood, management.

INTRODUCTION

Tropical forests are habitat of numerous species of both plants and animals, which constitute biodiversity through

a web of life. It supports various life forms including human beings who dwell in settlements in and around

forests (FAO, 2016). According to Wakshum et al. (2018), report on the state of the world's forests about 11.9% (closed forest plus woodlands) of Ethiopia's land area is covered with forests. According to FRA (2015) report, between 1990 and 2000, 141,000 ha of the forest of Ethiopia were lost every year, which equals an average annual deforestation rate of 0.93%. On the other hand, between 2000 and 2005, the rate of deforestation increased by 10.4 to 1.03% per year (or around 2,114,000 ha) of forest cover loss in the 15 years between 1990 and 2005. Estimates by Narita et al. (2018) showed that the area of closed forest declined to about 3.0 to 4.0% of the country. A recent report (FAO, 2016) showed that 124,990 km² (11.4%) of the total land area of Ethiopia (1,096,310 km²) was covered by forests. Deforestation has important local, national, and global implications. At all levels, forests are not the only assemblage of biodiversity and ecosystems but also causes loss of ecosystem goods and services like soil erosion, land degradation, water and air pollution which in turn affect the livelihoods of rural people. This is even more important in developing countries like Ethiopia where the majority of the people are dependent on natural resources (Husmann, 2015). The local households generate income from different activities like agriculture, livestock, and forestry related activities. The forest resources have input to local household economy providing timber and Non-Timber Forest Product Resources (Tugume et al., 2015). The input from Non-Timber Forest Product Resources (NTFPs) highly depends on the quality of forest resources, market availability and access situation. The quantity and quality of forest resources, in turn, depend on sound forest management and conditions of managing institutions. These can be attained when forest resources are well managed by local communities in collaboration with government and/or other development institutions (Asare et al., 2013). As used to be thought in the past, keep local households out of forest management areas is not a sufficient condition to improve the status of forests (Lalisa et al., 2018). According to Pandey et al. (2016), the only direct sustainable incentive to forest management is to secure forest use rights and revenues, through managed utilization of forest resource. That means people will only manage forest if they own rights to the resource and gain more benefits by conserving the forest than removing it, and if that benefit is directly linked to the existence of the forest and/or improvement of forest conditions¹. The Borena lowland forests are within the Somali-Masai

¹Livelihood is more than just a person's job or a way to earn a living. Livelihood has also been defined as comprising the capacities, assets (including social resources, physical, monetary assets) and activities required for a means of living (Khanal, 2007).

Regional Center of endemism (White, 1983). This forest is located in Borena zone, Southern Ethiopia near the town Meta Gafarsa capital of Arero district.

In Ethiopia where the livelihood of 83% of the population resides in rural area and dependent on natural resources particularly renewable natural resources, the pressure on forest resources are high. The depletion and deterioration of the forest resources in turn resulted in reduced agricultural productivity quality of life (Melaku, 2006). To improve the conservation of the remaining natural forests of Ethiopia, the remnant forest resources have been blocked into 58 National Forest Priority Areas (NFPA's) covering, an area of 3.6 million ha (SFCCD, 1990). These areas comprise natural forests, plantations, and non-forested land. Arero forest is one of these delineated as priority forest area in Boreana zone. Accelerated human population growth in the tropics mostly coupled with poverty has enhanced the negative human impact on the forest resources. Among the tropical forests, dry forests have been preferred for human settlement than wetter forest zones, due to different biological and ecological reasons (Tugume et al., 2015). In Ethiopia where the livelihood of 83% of the population resides in the rural area and dependent on natural resources particularly renewable natural resources, the pressure on forest resources are high. The depletion and deterioration of the forest resources, in turn, resulted in reduced agricultural productivity quality of life (Sundstrom et al., 2014). As the result the forest area of the Arero forest was declined to 29,226.39 ha.

Like most forests of the country, the Arero forest is experiencing deforestation and degradation. Several studies covering wider disciplines have been conducted in the area to contribute to the improved understanding of the ecological and socio-economic conditions for better management of the forest. Studies such as plant diversity and Ethnobotany (Kujawska et al., 2017), vegetation change (Habtamu, 2018), invasive woody plant species (Garuma and Wendawek, 2016) and socio-economic importance of Boke salt house (Wakshum et al, 2018), and population status and socio-economic importance of gum and resin bearing species (Adefris et al, 2012). However, most of these studies were made in the lowlands (rangeland and woodland) of Borana zone and only a few studies are made in the Arero forest to capture the relation between livelihoods, traditional forest management practices of communities in collaboration with formal (governmental and non-governmental) institutions and forest conditions. Therefore, the study aims to assess (1) forest management practices of the Arero district, and (2) the contribution of forest resources for communities' ¹livelihood of Oromia Regional Arero

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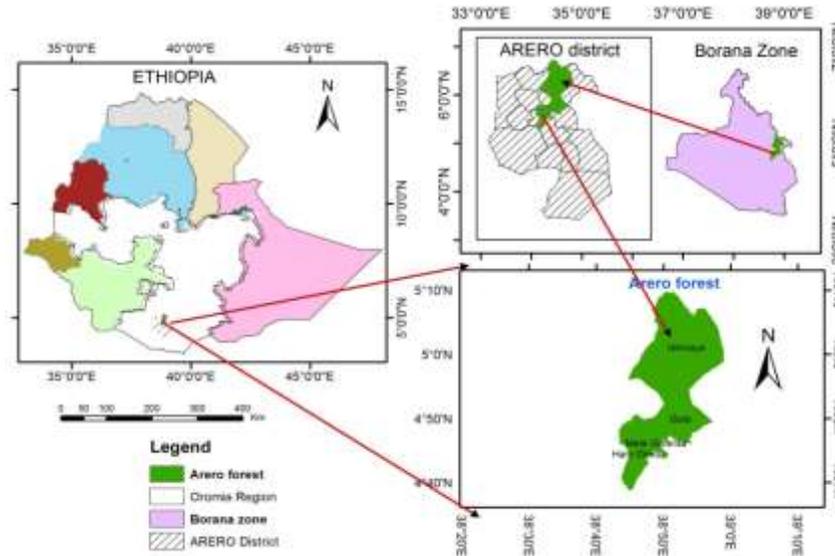


Figure 1. Map of the study area.

forest. National State and respond answers for the following questions; (1) what are the contributions of the forest to the local livelihoods, (2) What are external inputs of institutions for forest management practices for communities' participatory forest management?

MATERIALS AND METHODS

Description of the study area

This study area was carried out in Oromia Regional State, Borana zone, Arero district (Figure 1). Out of the 37 forests given priority in Oromiya 5 of them are found in Borana and Guji zones. They are Anferera-Wadera, Bore, Nagale Dawa, Galana- Abaya, and Arero-Yabalo. This study was carried out in Arero forest. The forest area is divided into three forest management units, namely Haro-Dimtiu Meta Gefersa, Guto and Guto Hirmaye forest blocks. The forest is located 670 km south of Addis Ababa on the left-hand side of the high way running to Moyale, 96 km from Yabelo town and 38 km from Wachile village. The boundary of the forest is approximately 7 km from the district town of Meta Gafarsa. The forest is located between 38°45' and 39°02' East and 4°40' and 5°09' north and at an altitude ranging from 1, 606 m up to 1, 805 m above sea level. Arero forest has a total area of 29,226.39 ha.

Population

The population of Arero district was estimated to be 74,119 out of which 11,859 or 16% are categorized as semi and sedentary farmers, while 62,260 (84%) are pastoralists and mixed farmers. There are about 12,595 households in the district of which 3,108 households are members of different forest user groups organized by SOS Sahel Ethiopia (FSDPPO, 2009). The forest user groups are Borana and Guji people.

Climate

Since there was no meteorology station at Arero district, data from

the nearest station (Mega station) was used for Arero. Hence, based on 20 (1984-2004) years meteorological data the mean monthly rainfall at the nearby station was 47.1 mm. The mean annual rainfall of the district was 532.2 mm. There is a slight variation in mean temperature throughout the year. The rainfall regime in Borana drylands is bimodal with two rainfall seasons (Figure 2). The main rainy season, known as the long rainy season is between March and May with the pick in April, and short rainy season is between September and November, with the pick in October. The mean monthly minimum and maximum temperature of Arero as taken from Mega station were 16.2 and 18.3°C, respectively. The mean annual temperature was 18.9°C.

Geology and soil

The dominant soil types found at Arero district were Chromic and Eutric Luvisol, Calcaric, and Eutric Fluvisol and Chromic, Eutric and Calcaric (OBPED, 2000). According to Gemedo et al (2005) cited in Adefris et al. (2012), bottomlands of the Borana rangeland are predominated by vertisols. The Arero forest was upland dry evergreen forest dominated by *Juniperus procera* but also consists of plant species such as *Olea europea*, *Compretum molle*, *Terminalia brownie*, *Croton macrostachyus*, *Canthium schimpeanium*, *Carissa edulis*, *Ehretia cymosa*, *Acokanthera schimperi*, *Dodonea viscosa*, *Balanites eagyptica*, *Calpurina aurea*, *Acacia tortilis*, and *Acacia mellifera* (Wakshum et al., 2018).

Sampling techniques

Socio-economic survey

Semi-structured questionnaires were developed for data collection based on the major contribution of forest resources to livelihoods of communities in the areas. Nearly 2.7% of the total households of forest user groups near or inside the forest as well as members of the households organized by SOS Sahel Ethiopia at Arero district were randomly selected. These HHs were selected based on their indigenous knowledge about the natural resources and use of the forest in the district. Sample households (HHs) were stratified into sex and age categories and selected using simple random sampling

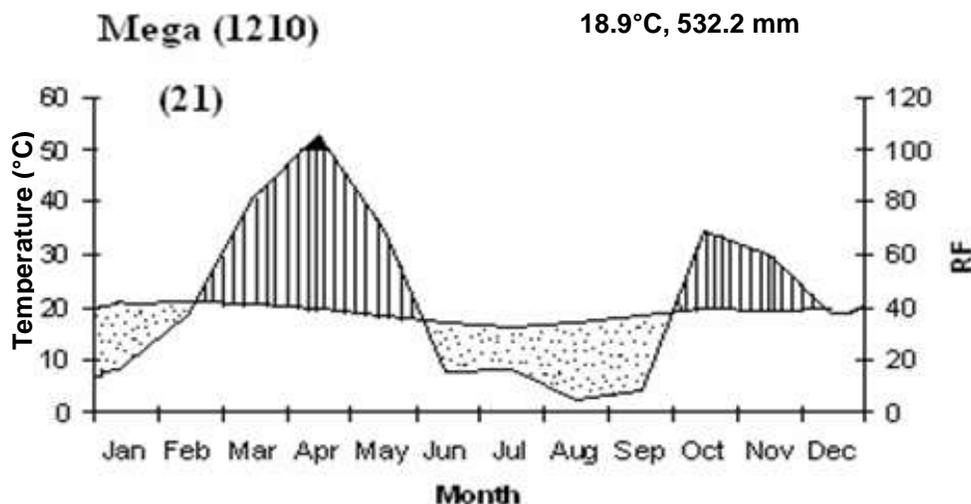


Figure 2. Climatic diagram of Mega, Borana zone, Ethiopia.
Source: Adefris et al. (2012).

technique from total HHs.

That is these were represented by about eight-five households from forest management units and interviewed for the role of forest resources to livelihoods. These sample households were only taken because Boana communities are pastoralist and mobile for grazing their cattle in the forest anywhere from Boana zone. No one in Boana zone is non-user group of this forest. During the household interview all age, sex and education were taken into consideration.

Forest management practices

Forest management practices which have been carried out by the community in collaboration with various development actors were assessed. Using district experts, key informants were selected for identifying existing institutions and the commonly used forest improvement activities in the forest. Only key informants and district experts were used for the interview because during the reconnaissance survey the result of checklist showed the same ideas. Furthermore, key informants are reflecting traditional forest management ideas of the society. Each Arero forest management units have also the objectives and are applying the same management culture. Therefore, discussions were held with six key informants from local communities, other experts and administrators. Checklists for data collection of existing institutional set-up of forest management activities were categorized into formal and informal ones.

Data processing and analyses

The socio-economic data were analyzed using descriptive statistics (SPSS version v 16.0) computer software. The results have presented in percentages, graphs and mean values.

RESULTS

Socio-economic characteristics of the sampled households

Of the sampled households, majorities (76.47%) were

male headed and (23.53%) were female-headed. The age of the respondents was mostly ranged between 15-64 years and accounted for 85.9% of the households, while only (14.1%) of the respondents' ranged above 64 years. The educational level of the majority of the respondents (69%) was unable to read and write, 4.7% were adult education, 10.6% were at 1 to 5 grade level, and 2.4% were at 9 to 12 grade levels and the remaining of the respondents (1.2%) were at the college level of education.

The role of forest resources to livelihoods

The livelihood activities in the study area include crop production, animal production, forest-related activities in terms of NTFPs, petty trade, and wage labor. Among the selected households animal production, wage labor hired in protecting the forest and other works in nearby town, and forest-related activities were ranked 1st (52.9%), 2nd (18.8%) and 3rd (16.5%) as the main source of livelihood activities. Petty trade and crop production were also ranked 4th (5.9%) each as livelihood activity (Figure 3).

Collection of honey

Honey is one of the major forest-related products used by the local communities. Summary of the amount of cash income generated by a household from the sale of this product is presented in (Table 1). As shown in this table, the total annual income generated per households is 43.35, 41.42, and 7.71 \$ at Haro Dimtu Meta Gefersa (HDMG), Guto and Guto Hirmaye forest blocks respectively. However, respondents mentioned that the annual income that can be generated from honey could

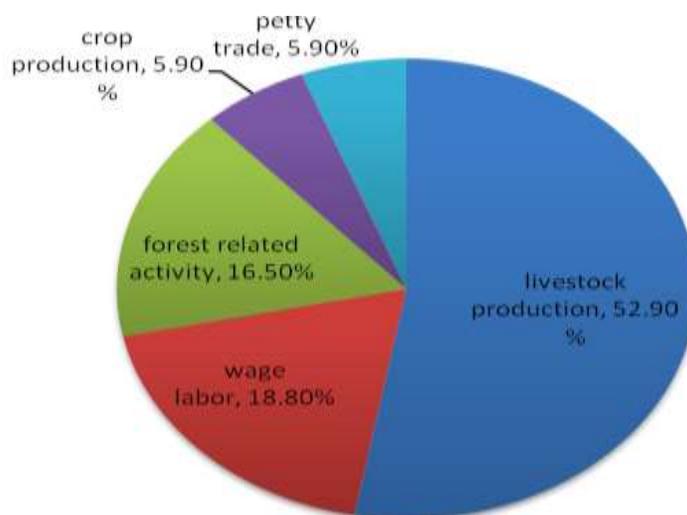


Figure 3. The contribution of different livelihood activities to household income.

Table 1. Amount of honey collected annually and Annual income generated by Arero forest user groups.

Forest Blocks	Number of households	Annual collection (kg) per total HH	Local price in birr/kg	Annual income (birr)	Annual income per household (birr)
HDMG*	19	45	20	900	47.36
Guto	42	43	20	860	20.48
Guto Hirmaye	24	8	20	160	6.66
Total	85	96	-	1536	74.50

*Haro Dimtu Meta Gefersa.

have been far more as the potential for production is very high in the area.

Collection of wild fruits and medicinal plants

Arero forest user extracts various types of wild fruits and medicinal plants for household consumption and health treatments respectively (Tables 2 and 3). About 137 kg of wild fruits and 35 kg medicinal plants are collected annually from the forest.

Forest grazing

Since Borana and Guji people are typically pastoralists, they are not used only the forest resources but animal feeds (pasture) and water without which they cannot survive. According to discussions held with key informants, water, animal feed and fuelwood were the main forest resources used in the areas. Meanwhile, they ranked water, animal feed and fuelwood one to three in order. The forests are usually dry season grazing reserve and are the only place to revert during drought periods,

and thus are essential natural resources without which the pastoralist cannot survive. Borana and Guji people are mainly driving income from their livestock which has been grazing in the forest during dry seasons directly is the main annual household income of the area.

Under current state law, local communities do not have rights to extract major forest products, but they do have rights to access NTFPs such as pasture, wild honey, firewood, medicinal plants, wild fruits, roots, aromatic plants of cosmetic value and hay at the caution of the forest development. The households' socio-economic of Arero district in terms of NTFPs were wild honey, wild fruits, and medicinal plants and were insignificant because the Boran society depends mainly on the forest largely for livestock grazing. Even if this income in terms of livestock production is not quantified directly, it has a great contribution in the local communities' livelihoods. Because as they graze in the forest in the dry season their income from livestock products and productivity increases.

Unless the Boran communities are assured of a source of water for their herds, they will not benefit from the collective pasture. To this extent, any part of the Borana land is generally inhabited by those clans and clan's

Table 2. Wild fruit and medicinal plants collection for consumption by the Arero forest user groups.

Forest resources	Annual collection (kg) per total HH	Annual collection (kg)/HH	Local price in birr	Annual income (birr)/HH
Wild fruit	137	1.6	-	-
Medicinal plant	35	0.4	-	-

***Notice:** No sell, but only for domestic uses for instance children can use it because they were a pastoralist.

Table 3. Some of the plant species used as wild fruits and medicinal plants species.

Wild fruit species	Medicinal plant species
<i>Olea europaea</i>	<i>Acacia brevispica</i>
<i>Dodonaea viscosa</i>	<i>Microchloa kunthii</i>
<i>Papea Cappensis</i>	<i>Solanum spp</i>
<i>Pavetta gardenifolia</i>	<i>Papea Cappensis</i>
<i>Ficus vasta</i>	-
<i>Rhus nathlensis</i>	-
<i>Acokanthera schimperi</i>	-
<i>Haplocoelum foliolosum</i>	-

associates who have access to the wells within it. Forests are a very important resource for the Borena. However, the 'Gadaa' rulings prohibited forest destructions; for instance the cutting of *Juniperus procera* was remains outlawed. A forest is not necessarily distinguished from pasture by the Borana because the values of forests are used as dry season grazing reserves. Before urbanization came to expand in the area, local communities living adjacent to the forest exploited for dry season grazing.

Tourist attraction (ecotourism)

Southern Ethiopia Borena and Guji zones forests particularly Arero forest is known with the home of endemic birds. Furthermore, the different sites in Borana and Guji zones attract several tourists interested in watching birds like *Ruspolia turaco*, *Salvadoria seed eater*, and *Bare eyed thrush*, *Borana cisticola*, *Banded perisoma*, *Tiny cisticola*, *Pygmy bats* and several other bird species. The revenue obtained from the income supports the livelihood of rural poor through institutionalized cost sharing which strengthening the forest management groups while managing the forest area. The local communities were benefited from tourism by securing income from tour guide and the government incurred budgets for managing the forest indirectly to sustain the forest resources in the region.

Cultural values/sacred places

The spiritual significance of the forests as ceremonial

sites is central to the cultural integrity of the Borana Oromo clans. According to oral tradition of elders, a ritual ceremony is only possible with the ritual plants found in the forests. Today, the remaining patches of the forests constitute an important part of traditional ritual practices, which is also playing key role in reducing the pressure on the forest.

Forest management institutions

The forests of the Borana lowlands have traditionally been considered by the Borana as an integral part of their pastoral land, with forest management being the responsibility of the 'Borana' 'Gadaa' system. However, they have currently gazetted reserves, registered as National or Regional Forest Priority Areas, and the Oromiya Forest and wildlife Enterprise is responsible for controlling, protecting and managing the forest resources on behalf of the Regional Government.

In the Borana traditions, all the resources in the forest like water, medicinal plants, pasture, wild fruits, and roots are used in common and managed by the traditional institutions. Borana pastoralists have their own cultural by-laws structured hierarchy. Borena traditional resource management (pasture, forest, water) institutions are:

- (1) Family = 'Abbaa Warraa' = Control resources at the family level
- (2) Neighbor = 'Abbaa Ollaa' = Manage resources at the neighbor level
- (3) Elders controlling grazing = 'Abbaa Dheedaa' = Elders controlling resources like a pasture in overall Borena

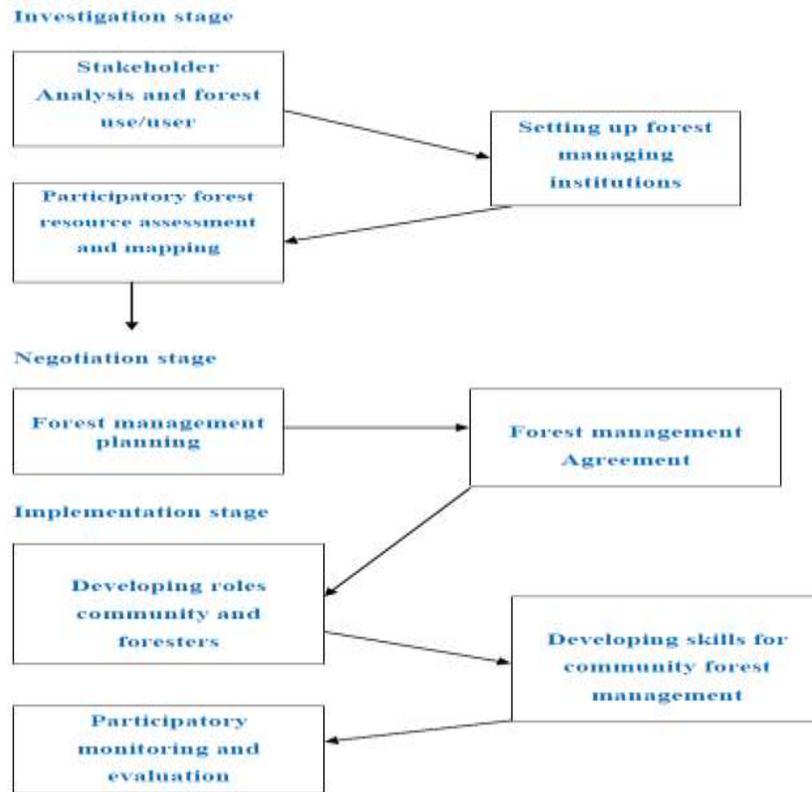


Figure 4. Key elements in a refined PFM approach model.

society

(4) Higher courts = 'Raaba Gadaa' = 'Gadaa' ruling assigned for resource governance and conflict resolution in Borena zone.

At the phase-out of this Non-Governmental Organization (NGO) or SOS Sahel Ethiopia, the management of this forest is questionable.

Traditional forest management practices

By-laws are revised and formulated every eight years during 'Gadaa' assembly. Through this hierarchy, different traditional forest management practices such as controlled grazing (browsing), fire protection and reducing expansion of settlements are practiced in this forest area. The forest areas in the Borana and Guji zones are governed traditionally by Communal resource management. Forest resources such as water and pasture are a communal property resource in Borana and Guji pastoral areas. Traditional institutions govern these resources and decide institutionally how best they could be utilized in equity.

For instance, epiphytes which are growing on *J. procera* and other old tree species is named by 'Borana'

people as 'Areeda jaarsaa' mean that elders' hair and the old tree of this species is also believed to represent elder of the people. This is an indicator of Borana people conserves traditionally forest resources. Borena society value forest resources particularly some tree species for spiritual purposes. However, conflicts between Borana people and other ethnic groups, population growth, resettlement, forest grazing, bush encroachment, farmland expansion, demand for fuelwood, drought-weakened traditional institutions, policy enforcement, and urbanization are some of the causes for the deteriorating of the forest conditions in the area.

Modern forest management institutions organized by SOS Sahel Ethiopia

To strengthen these management institutions under sub section 6.3, other management institutions were built from the smallest units ('Ollaa' and 'Maddaa' levels) up to the district and Zonal Participatory Forest Management (PFM) working groups. Forest management institutions or Borana Collaborative Forest Management Project (BCFMP) supported by SOS Sahel Ethiopia in Borana forest priority areas are shown in Figure 4. It is within this context that SOS Sahel in Ethiopia set up the BCFMP in

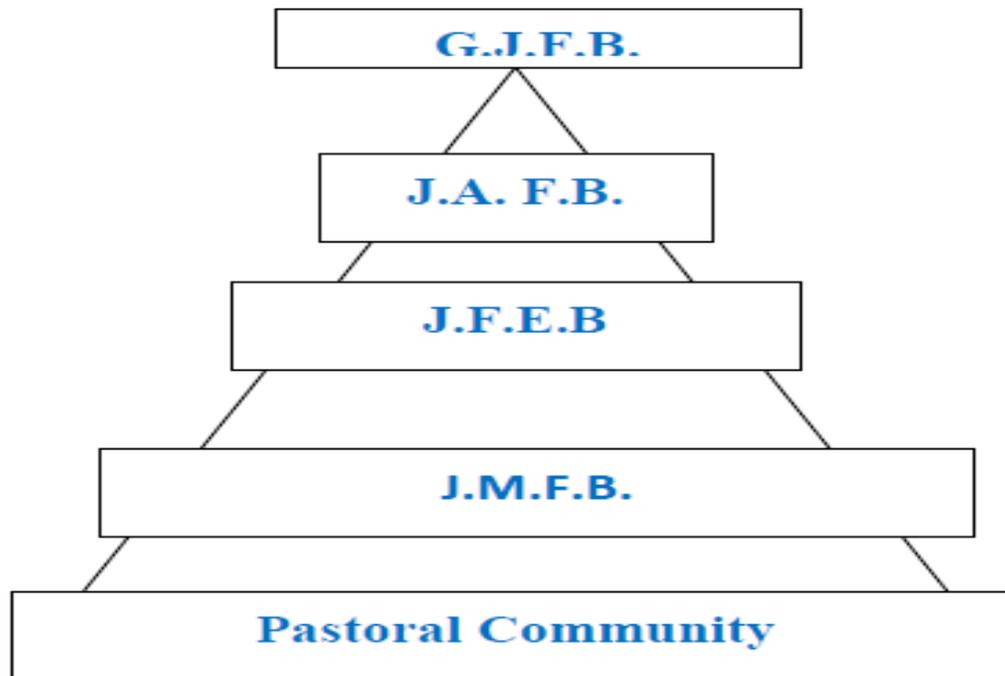


Figure 5. Participatory forest management working group structure.

* Ejja= Forest block, 'Maddaa'= Management unit (PA), 'Baddaa' =Forest.

2002 in Borena zone. The project's principle aim is to establish management systems over which local people or institutions have control and by which natural resources can be used sustainably by local communities.

Furthermore, increasing human population and urban settlement pressure has negatively impacted on forest resources mainly on *J. procera* products which are harvested for construction purposes because of its inherent property to resist termites. All these have necessitated the introduction and institutionalization of the forest management system. With better management, income could be generated from the products based on the protection and promotion of the Juniper where Juniper berries, leaves, and stems can be used for the production of different products for newly established enterprise in the Oromia Regional state.

Over the last decades, SOS Sahel Ethiopia has been working with the Borena and Guji to tackle poverty through sustainable natural resource management, and natural resources based enterprise development. Borena Collaborative Forest Development Forest Management Programme is one of such efforts that has succeeded in putting the community at the center of natural resources management particularly forests in the areas. This has become SOS Sahel Ethiopia with BCFMP/PFM as a catalytic; transform where the 'Gadaa' actively engaged. The three phases of developing a PFM plan, that is, the investigation, negotiation, and implementation phases exercised to protect the forest resources and the rangeland (Figures 4 and 5).

Roles of modern management institutions

1). 'Ummata' (Pastoral Community)

These are wider Borana and Guji people from which members of forest management groups at PA are selected.

2). 'Jaarsa Madda Finna Baddaa' (J.M.F.B.) =Managing at PA level

These are elders managing forest at PA levels like guarding, fire protection, controlled settlements, controlled grazing, control logging, and collection other live and dead trees. They were organized elders from wide pastoral communities. There are five PAs namely Haro Dimtu, Mata Gafarsa, Bokoda, Guto, and Hirmaye.

3). 'Jaarsa Ejja Finna Baddaa' (J.F.E.B.) =Managing at the forest Block level

These elders are managing forest at forest block level; in this particular forest, there are three blocks namely Haro Dimtu Mata Gafarsa, Guto and Guto Hirmaye. They were organized from elders at PA levels. Many Maddas (source of communities) have organized into J.F.E.B. They are also patrolling the delineated forest from destruction and smaller in number than management groups number 3.

4). 'Jaarsa Aanaa Finna Baddaa' (J.A.F.B.) = Combination of government and elders at district

These elders are organized from J.F.E. B., experts, administrators, and polices at the district level. They are controlling forest through the enforcement of customs, rules, and laws of institutions and the state. They can

apply sanction individuals violating rules at this level. The sanction is 5 animals per individual. If the individuals are beyond their control they report individuals to the highest court at zone level (G. J.F.B) for sanction.

5). '*Gadaa Jaarsa Finna Baddaa*'='Raaba Gadaa' (G.J.F.B.) =Higher court of elders.

These elders are organized from J.A.F.B. at zone level and this institution is the final decision of sanction that violates the rules below institutions. Note that each member in the numbers 1 through 5 has decreased up as shown in (Figure 5) from the community to G.J.F.B. at the zone level.

The *J. procera* forest which suffered from series of forest fires and destruction during 1999/2000 was able to regenerate and maintain its ecological health once again through the participatory forest management process. Traditional resource governance system within the common property regime was implemented to build upon the customary institution and to enable the full participation of different community members in resource management. The customary institution mainly the Gadaa played a vital role in the negation of rights in resource governance and use. Through the forest management institutions, the integration between the different sectors offices and the customary institution (the Gadaa) was a break through to prove the key roles of communities in the management of forest resources. The multiple use of the forest was fully recognized by the community which resulted in improved ownership and sustainability of the interventions. BCFMP was successful in working very closely with the rural communities in all forest adjacent areas through the smallest units: the '*Ollaa*' and '*Maddaa*'. Project staff camped at the different sites to discuss forest management issues with community members.

However, there remains a challenge that was not addressed and thus an issue of concern that emerges. This needs the joint efforts of all stakeholders that are working for sustainable management and utilization of natural resources; forest and rangeland. Accordingly, issues of concern are described as follows:

(i) Increasing of enclosures

Within the common property regime, there is an evolving trend of privatization. Extensive private ranches and privately established enclosures and farmlands constrain the mobility of the livestock and impact upon the livelihood of the pastoral communities.

(ii) Expansion of farmland

These days there has been increasing settlement of other groups which mainly depended on agriculture in the pastoral areas. This is putting pressure on pastoralist livelihoods and shrinking the rangeland. Most forest areas and rangelands have been altered to agricultural

lands. Some parts of the rangelands in Borena have been completely changed to farmlands. The denial of access to dry season grazing reserves in the forest areas and lack of access to the deep wells in the forest also constrain the livelihood of the pastoral communities. This has hampered the pastoralists from livestock corridors to access resources. The farmlands which are randomly placed here and there constrain grazing patterns for the pastoral communities.

(iii) Conflicts within and between institutions

There are conflicts between institutions organized SOS Sahel Ethiopia; however, it is managed by '*Gadaa*' systems every time. Some cause of the conflicts is on position leading each institution, hiring of guards for protection of the forest and other forest resource benefits either woody or Non-Timber forest Product Resources.

Modern forest management practices

There were also forest guarding, planting, and fire protection by a government organization in collaboration with a non-governmental organization. In Arero forest, planting was carried out where the forest is damaged by the fire. Enrichment planting of forest during damage of fire was funded by SOS Sahel Ethiopia to strengthen capacity of the governmental institution. Participatory planting by communities was high input for rehabilitation of damaged forest.

The forest management agreement was signed between the local institution, the '*Gadaa*' and the Pastoralist Area Development Commission. The power to manage and govern resources was thus developed by the local communities. Expansion of farmlands within the pastoralist livestock-based economy and erosion of the pastoralist social and institutional systems has led to destruction of forest resources and subsequent loss of biodiversity potentials. Examples of community-based forest monitoring systems emerging from PFM experiences include:

- (i) Monitoring of farmland in the forest;
- (ii) Forest boundary monitoring;
- (iii) Regular patrolling by the forest management group members; and,
- (iv) Either written or verbal reporting
- (v) Regeneration counting to develop data concerning seedling regeneration from year to year is also being carried out.
- (vi) Regular district level PFM working group meetings to bring key government and community PFM actors together to discuss issues arising and resolve problems have also emerged as a useful monitoring and evaluation mechanism. According to the discussion held with key informants, this project has brought significant change

than before on forest management and forest conditions in Arero forest.

DISCUSSIONS

Forest resources and livelihood strategy

Natural resources such as forests play a key role in the livelihoods of local people in developing countries. Forests and rural livelihoods are basically connected. Forest values include various products of wood, non-wood, and environmental services (Tsegaye et al., 2009). On average, the contribution of forest related activities to cash income in this study was 16.5% (Figure 4) and higher than percentages found in studies by Ambrose-Oji (2003) in Cameroon (6-15%) and Elizabeth et al. (2009) in Tanzania (12%). This finding is also almost similar with results of other study in Bangladesh Satchari National Park (Belal and Mukul, 2006) which had a significant component of their livelihood strategies, accounting for 19% of their total annual income.

Studies suggest that the poor are highly dependent upon forest income for their livelihoods but the total value of what they obtain from the forest is less than that which better-off households obtain (Yemiru et al., 2010; Watson, 2016; Langat et al., 2016). While in this case both groups are interested in maintaining the forest, this is not necessarily always the case. Even if in the Borana society particularly in this particular study area it is difficult to categorize households into classes within short period of time and limited budget and because they are mobile with their herds from place to place, it was recognized that different socio-economic groups have different views of the forest. The poor usually have to live hand to mouth through doing a variety of tasks (Wood, 2007). One reason they are poor may be because they do not have enough farmland or other assets. In some cases, they will see the forest as the source of that additional land, although wage labor opportunities for immediate cash are probably more attractive to them. Certainly they have no capital reserves to build up enterprises based on the production, harvesting and marketing of NTFPs once or twice a year. Middle income households expanding their economic basis with a growing family may also see forestland as a way to expand their farmland, given their labor resources and capital. On the other hand middle income and rich households may have enough agricultural production to support them and see forest maintenance as a way of diversifying their income-generating opportunities, and so reduce their risks (Wood, 2007).

Collections of wild fruits and medicinal plants were indications of the contribution forest resources for a household annual subsistence income. But these forest resources were not taken to local markets. The findings of this study in terms of income generated from forests

are far lower than most studies in Ethiopia. For instance, the study by Mohammed (2007) found an income of 96.33USD per household from various NTFPs in South Western Ethiopia, which is even greater than the total income generated by the entire households interviewed in this study. Similarly, the study by Arsema (2008) shows 47% of annual cash income contribution of bamboo as NTFPs in Shedem Peasant Association (PA) in Goba district, while Neima (2008) in the same region reports that various NTFPs extracted from vegetation of the region contribute on average 54% of household total annual income. In Bench Maji, 52% of annual cash income of households is obtained from NTFPs, while in Sheka it contributes to about 41% of household income (Mohammed, 2007). In Gore district 88% of households collect NTFPs, and generate 23% of their average annual income of 1,895 ETB (Berhanu, 2004). NTFPs also contribute a similar Figure of 27.4% to the average annual income of households around Menagesha Forest (Aramde, 2006). The mean annual income from beekeeping among households in Walmara district was between 47 and 347 USD or 11.6 and 81.9% of total household income depending on wealth status of the households (Debissa, 2006). Fuel wood, fodder, honey and construction material productions from Chilimo forests contribute significantly to the livelihoods of households in Dendi district, contributing an average to 39 % of the annual household income (Getachew et al., 2007). These studies all reported an income contribution from forest that is far higher than what the current study recorded. This probably shows many things: household asset base, market access, culture and resources endowment of the forests in terms of stock and quality of NTFPs. Indeed, the role of forests in general and their NTFPs in particular in household livelihoods needs to be explained and assessed context specific. Hence, the role of forest resources particularly forest grazing for communities leads them to manage forests traditionally and in collaboration with other governments and non-governmental organization institutionally. The 'Gadaa' leaders with traditional and state laws are decisive for sustainable management of the Arero forest.

Forest management practices

As the result of the above forest related activities to their livelihood strategies, the forest management groups in collaboration with other institutions have setup new forest management arrangement. These forest management institutions in Arero forest are part of the PFM approach largely promoted throughout Ethiopia. It is facilitated by SOS Sahel in collaboration with Oromia Regional State. Such a move is common in Southeast Asia as well as in most of the countries in Africa. Although PFM is found good from the forest, the role it played in Arero forest's conservation and management is hard to comprehend

since there is no original data at the start of the project. However, local people are of the opinion that the approach has contributed to improvement of the forests through reduced illegal forest product harvest and unregulated grazing. These achievements confer with many PFM reports from various countries such as Damayanti et al. (2007) in India, Golam Rasu and Karki (2009) in south Asia, Dominik et al. (2008) East Africa, and Paul (2007) from Kenya.

The forest management by-law, Karra Mataa (control resources) was taken to be the working customary by-law to control and monitor people who abuse the resources. Violation of the by-laws is sanctioned by five animals or five years prison penalty per head. As the result the forest user groups in Arero forest were either traditionally organized or reorganized in collaboration with SOS Sahel Ethiopia to manage the forest in the area. Furthermore, forest resources were managed by forest users in the forest or in the surrounding to generate subsistence income sources. These results indicated that there were an interaction between forest resources management practices to improve conditions of forest thought their livelihood forced them to use the forest resources like animal feeds (pasture), water or fuel wood and others directly. Forest resources are also used as supplement the income obtained from major livelihood activities particularly livestock production (Mitiku and Ginjo, 2008).

Conclusions

Livestock production is the dominant occupation in Borena zone particularly in the study area, is influenced by the recurrent drought and the consequent fodder shortage thereby leading to food insecurity and famine. Hence, looking for other alternative strategies that diversify the pastoral and agro-pastoral livelihoods is very important. This study revealed the fact that exploitation of forest resources especially NTFPs integrating this sector with other land use options forms one of the sustainable livelihoods to the community while leading to environmentally friend to forest resource management while providing several socio-economic contributions.

Arero forest provides diverse forest products for local community. The most valued product is forest grazing but also honey production, medicinal and wild fruits. However, except through forest grazing, the overall contribution of the forests in terms of other NTFPs is very low compared to many reports from various parts of Ethiopia. Forest grazing the local communities most income of livelihoods in Arero because they depend largely on animal production without which they cannot survive. Water and fuel wood sources for their life and animals are also the main source of income as livelihood roles are derived from this forest. This does not mean that contribution of NTFPs like wild honey; wild fruit, medicinal plants, and others in relative terms are small.

Even in relative terms, the contribution of Arero forests to local livelihood is comparable with many reports from outside Ethiopia.

Community in the study area employ traditional institutions supported with modern new institutions called forest user groups whose formation is facilitated by NGOs to manage their forest resources in a participatory manner. Borena Gadaa is the most useful in both traditional and modern new institution with other external state laws to control natural resources especially forests in Borena zone. Borana society cannot separate grazing land from forest land. Hence, they are grazing their animals in the forest during drought period.

The impact of the management system has a contribution for improving forest resources for livelihoods role as well as conditions of the forest and also opinions of the local community's show a positive and progressive contribution. The result of the contribution of forest resources could have been better if wider time and sufficient budget allowed accomplishing during data collection. However, the structural analyses of the population of some dominant species experience poor regeneration. This also implies that current management practices are not satisfactory to sustain the forest conditions. Indeed, it deserves concerted effort by local traditional 'Gadaa' and SOS Sahel Ethiopia institutions to improve its conservation and sustainable use of forests. Unless improved management interventions are made the sustainability of contribution to livelihoods from the forest will be at stake in the future.

RECOMMENDATIONS

Since Arero forest is one of the 37 Regional Forest Priority Areas (NFPA's) under Oromiya Regional Forest and Wildlife Enterprise now a day to be conserved. This forest under discussion might probably be the last few remaining forests in Ethiopia with distinct vegetation zones could be used to carry more scientific studies. It could also be considered as resources for livelihoods of communities, climate change mitigation and habitat for wildlife, especially endemic animals. However, from the foregoing discussion, it can be seen that the forest requires better management so that its resources could be effectively utilized on sustainable bases. Therefore, the following recommendations are made to meet these requirements:

- (1) Creating awareness on the various uses of the forest resources so as to utilize and facilitate a market for various resources in the forest.
- (2) Control bush encroachment on grazing land so that pressure of grazing in the forest can be reduced.
- (3) Extension program including forest management (tree planting) should be extended so as to reduce pressure on forest resources and awareness creation for communities

in utilization of the forest.

(4) Selective logging from the forest should be minimized and if possible stopped.

(5) Livestock husbandry (a common practice in the forest) should be reduced so that regeneration of the species in the forest can be improved.

(6) Improved management interventions for sustainability of forest resources will improve contribution of livelihoods in the future.

(7) Eventually, to conserve the forest resources and improve the socio-economic benefits, for instance, research on postfire succession of species, causes of natural damage of *Juniperus procera* in the forest, soil seed bank should be investigated to sustain the forest resources for ecosystem services as well. In general, the dynamics of forest conditions in Arero forest needs detail studies in the future.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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