Jimma University

College of Natural Sciences

Department of Biology

Impacts of Deforestation on the livelihood of the community in West Arsi Zone, Oromia Regional State, Ethiopia

By: Mohammed Hamda

Advisor: Tamene Belude (Asst-Prof.)

Co-advisor- Belachew Beyene(MSC)

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A thesis submitted to College of Natural sciences Department of Biology, Jimma University in Partial Fulfilment of the requirements for the master's degree in Botanical Sciences

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Approval Sheet

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Name: Mohammed Hamda

Signature_____

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Table of Contents   page

List of figure

List of tables

List of Acronyms

CBD: Convention on Biological Diversity

CBO: community-based organization

CSA: Central Statistical Agency

DBH: Diameter at breast height

EFAP: Ethiopian Forestry Action program

EFS: Ethiopian Forestry Society report

EPA: Environment Protection Authority

ETH: National Herbarium of Ethiopia

GDP: Global growth Domestic Product

IUCN: International Union for Conservation of Nature

MEA: Millennium Ecosystem Assessment

MNF: Munessa-shashamane forest

NGO: Non-Governmental Organization

RIL: Reduced impact of logging

SUA: Swedish University of Agriculture

UNEP: United Nations Environment Programmers

WCMC: World Conservation Monitoring Center

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Abstract

Impacts of deforestation, both naturally occurring and human induced, is an ongoing issue, caused loss in biodiversity, land-cover change, soil erosion, water pollution, soil degradation, air pollution, habitat fragmentation and selective exploitation of species. Therefore this study was attempts to assess the impact of deforestation on farmer livelihood, ecological change and to predict possible solutions. Four "Ganda" (lowest administrative units next to district) in Oromia Regional State were selected as study sites out of the total 16 villages in the patch of Munesa forest. The selection was done purposively on the bases of the series impacts of deforestation. Accordingly, 267 household heads 172 men and 95 women were interviewed. Face to face interview using questionnaires were adopted to gather information based on the prepared questionnaires. Each data collectors have the capacity to interviewed 10 -13 households for prevention of Covid-19. In addition essential information was collected from 16 key informants 4from each "Ganda.". 8FGDs were undertaken in groups consisting of 20 to 25 people by wearing their mask and keeping social distance for prevention of Covid-19 in four selected "Ganda" to reject contradictory information. The results obtained from respondents and observation showed that the impacts of deforestation on farmer's livelihood and Ecological condition resulting in decreasing of productivity on crop yield from 40 quintal to 20 quintal, honey product from 12kg to 4 kg, cow's milk from 5L to 0.5L,the price of Equipment and tool increase from 243 to 700 Birr. Loss of many wild life, plant species, and climate change occurred for more than one decade. Currently government and people are working hard together to make their country a better place especially in green legacy and rift valley development policy by making dam and planting tree over it to protect soil erosion and climate change for promising solution .

Key words: Climate change, Deforestation, Ecological degradation, Munessaforest.

CHAPTER ONE

1. INTRODUCTION

1.1BACKGROUND OF THE STUDY

Forests are very useful natural resources. Human beings destroy forests for different purposes. These include construction, expanding farmland, timber production and collecting fire wood (Mader, 1985).When forest woody species are destroyed; the wild animals including endemic ones lose their home and are forced to migration. The level of carbon dioxide increases in the atmosphere which leads to global warming. Impacts of woody plants also reduce the quality of land. Because trees anchor the soil with their roots to the ground, their loss causes widespread erosion throughout an area. Cutting down forests is not the only way to ruin the soil but overgrazing and other poor farming practices have caused permanent damage in areas where there have been forests (Keeton *et al*., 1993). When humans remove trees and vegetation, tropical rain forests transpire huge quantities of water from the soil into the atmosphere stops and land becomes susceptible to flooding and erosion. Soil and nutrients are washed away seriously changing the landscape. According to FAO (2000), currently, it is a global problem because the annual rate of global deforestation is about 13 million hectares, most of which occurs in the developing world.

In Africa, majority of the population derives their livelihood from agriculture. Smallholding agriculture accounts for 75% of agricultural production of which the majority constitutes of rain fed farming. Drought is Africa's principal form of natural disaster which often affects rain fed agriculture dramatically. The impact of population growth in rural areas is pushing communities into unsustainable farming practices such as burning and razing of tropical forests in order to plant crops, planting in steep, moving into fragile marginal eco-system, over cropping and over grazing and subsequent depletion of fragile arable land and over-utilization of ground water resources. It has been estimated that a sixth of the world's land area, nearly 2 billion hectares, is now degraded as a result of impacts of woody species deforestation, overgrazing and poor farming practices. Water resources for agricultural purposes are getting scarce, and there are hardly any land reserves to be brought into production to widen the agricultural base. By 2025 close to three billion people in 48 countries will be affected by critical water shortage for all or

part of the year due to deforestation. GebremarkosDeribe (2005) pointed out that, lack of proper forest management and utilization, land tenure policy, lack of compatible forest proclamation on and other legislations, and extensions of cultivation to marginal lands were indicated as major causes of deforestation. Forest loss in Africa is particularly troubling, however, two-thirds of the continent's population depends on forest resources for income and food. 90% of Africans use fuel wood and charcoal as sources of energy. Perhaps because of this dependence on forest resources and non-timber forest products, deforestation in Africa is estimated at about 3.4 million hectares/year (FAO, 2010).

Ethiopia is one of the countries which have different varieties of plant species. Today, more woody species are endangered than ever before due to human activities. As a result of different wild animals lost their homes and started to migrate and many native woody species are destructed. The farmlands are exposed to erosion and agricultural productivity is also decreasing. In a forest resource assessment of Ethiopia, it was found that within 17 years (1973–1990) high-forest cover decreased from 54,410 to 45,055 km² or from 4.75 to 3.96% of the land area. Forest degradation has been a serious challenge to Ethiopia. The major causes for the forest degradation are multifaceted and attributed to mixture of different factors. The availability of accurate data on forest resources is an essential requirement for management and planning within the context of sustainable development (FAO, 2007).

Ethiopia is regarded as one of the most important countries in Africa with respect to biological resources (flora and fauna). The number of species of higher plants found in Flora of Ethiopia and Eritrea Volumes 1-8 is about 6,500, of which about 10 % are endemic to the country (EnsermuKelbessa and SebsebeDerrissew, 2006). Again the country had experienced substantial deforestation, soil degradation and an increase in the area of bare land over the years. The need for fuel wood, arable land and grazing areas have been indicated as the main causes of forest degradation; frequently leading to loss of forest cover and biodiversity, erosion, desertification and reduced water resources (EnsermuKelbessa and TeshomeSoromessa, 2008). Impacts of woody species deforestation have caused loss in biodiversity through, inter alia, land-use and land-cover change, soil and water pollution and degradation, and air pollution, habitat fragmentation, selective exploitation of species and the introduction of non-native species (Gitay*et al*., 2002). It is further argued that the "current rate of biodiversity loss is greater than the natural background rate of extinction (Gitay*et al*., 2002). Deforestation and land degradation, however, are impairing the capacity of forests and the land to contribute to food security, and to

provide other benefits, such as fuel wood and fodder in Ethiopia. In the past four decades, it is estimated that 80,000-200,000 hectares of forestland is cleared per annum in Ethiopia for various reasons (EPA, 2002). Ethiopia is among countries that have forest cover ranging between 10 to 30 percent of their total land area and forest cover is 12.4milion hectares (11.5 percent)(FAO, 2015). Between 1990 and 2000, the extent of Ethiopia's forests (including both forests and woodland) decreased by 1.4 million hectares. In other words, Ethiopia lost over two million hectares of forest, with an annual average loss of 140, 000 hectares between 1990 and 2005 (FAO, 2015).

Currently in the study area trees are cut down, it affects the availability of one of life's basic needs. Climate changes occur if forests are cut down, and the oxygen levels are also affected. A recent report by the Ethiopian Ministry of Agriculture and Rural Development announced, for instance, that the country managed to increase its forest cover three fold: to 9% (ENA, 2010). Such a dramatic increase was attributed to the forestation campaigns; and river basin-based natural resources conservation activity undertaken over the last 10 years. Fewer trees also mean the loss of jobs for forest workers and there is a loss of future markets for ecotourism. Heavy rainfall and high sunlight damages the topsoil once the trees are gone and the forest takes much longer to regenerate and the land is unsuitable for agriculture. Arable land is transformed to desert, reduce productivity and expose farmer's livelihood for poverty and poor ecological situation therefore the situation of Munesa forest woody species deforestation is burning issue that requires attention to minimize environmental impacts.

1.2. Statement of the problems

Most studies conducted so far did not focus of this study area, therefore this study attempts to assess the impact of deforestation on the livelihood of the community. The distribution of the land use of the surrounding Districts such as HebanArsi, ArsiNagele, Munesa and Kore have been changing greatly over time because of subsequent cultivation after deforestation due to high population, economic pressures, and infrastructure.   The area that was once covered by forest is now deforested. In the escarpment between lowland catchments and highland areas, the scattered trees were also disappearing from those places. However, nowadays these important traditions which are tourist attraction sites and sources of country economy have been changed to other land use system.

As far as I know, there is knowledge gap concerning on the Munesaforest. Therefore, this study designed to undertake the impact of deforestation on the livelihood of the communityin west Arsi zone,Oromia Regional .state, Ethiopia

1.3 Basic research question

✓ What are impacts of deforestation on farmer's livelihood, such as crop yield, cattle production, honey production and wood products (Equipment and tool)?

✓ What are the impacts of deforestation on Ecological situation of the area? Particularly on climate change, soil, water, wild animals and plant species?

✓ What are the possible solutions for impacts of deforestation on ecologicalsituation?

1.4 Objective of the study

1.4 .1 General objective

→To assess impact of deforestation on the livelihood of the community (Jemaasardo,Basakuuilala,BombaasoorejiiandShophaa genet)*Gandas*in west Arsi zone Oromia regional state Ethiopia

1.4.2 Specific objectives

The specific objectives were

✓ To identify the impacts of deforestation on farmer livelihood and their roles in forest management activities.

✓ To evaluate the ecological situation that occurred because of deforestation

✓ To focus on immediate and long run solutions to mitigate the problems of forest destruction.

1.5 Significance of the study

The findings of the study may help other researchers who may need to pursue further research on the impact of deforestation on the livelihood of the community. Hence this workwasintendedto give good attention for the proximate districts (ArsiNagele, Kore, HebanArsi and munesa) and may be beneficial to policy makers, agricultural and forest research center, NGO and development agents since it may show different environmental influences, biodiversity benefits and meet people's short and long-term needs. Therefore, the nearby districts could use the result

for evidence based decision making on impact of deforestation on the livelihood of the community.

1.6 Scope of the study

The study was delimited both in content and geographically. The contents were delimited to investigating impacts of deforestation on the livelihood community. The study was also determined to four "Ganda"(Jemaasardo, Basakuilala, SHophaGanet and Bonbasooreeji) and to Munessaforestbecause of time and budget constraints.

1.7 Limitation of the study

Limitation for this study was:

- ✓ Unwilling of the respondents to participate in interview because of covid-19 spread.
- ✓ Lack of enough budget and transportation.
- ✓ Shortage of time, lack of access to network causing unable to contact with advisor, etc

CHAPTER TWO

2. Literature Review

2.1. Impacts of deforestation

Impacts of deforestation, both naturally occurring and human induced, is an ongoing issue. It causes extinction, changes in climatic conditions, desertification, and displacement of populations as observed by current conditions and in the past through the fossil record (Culas, 2006). By 1990 cropland and pastureland occupied 35-39% of the global land surface. It is estimated that the world is currently losing over 9 million hectares of forests per year which is an area the size of Portugal.

Impacts of deforestation have been practiced by humans for tens of thousands of years before the beginnings of civilization (Hence and Jeremy, 2008). Fire was the first tool that allowed humans to modify the landscape (Uncovsky, 1998). It is used to convert closed forests into more open ecosystems favorable to grazing land and crop cultivation. A typical progress trap is that settlements were often built in a forested area providing wood for some industry (e.g. construction, pottery). When deforestation occurs without proper replanting, local wood supplies become difficult to obtain near enough to remain competitive; leading to the settlements abandonment consequently enforced them to other new settlement area in forests (Helmut, et al., 2002.). Meanwhile most of the population in Ethiopia remaining active in the agricultural sector, the main pressure in most areas remained land clearing for crop and cattle farming, particularly at present investors are looking the dry land forests to divert in to commercial crops like tea, coffee and rice cultivation (Adam and David, 2008.) .

Impacts of deforestation are an ongoing issue that is causing extinction, changes in climatic conditions, desertification, and displacement of indigenous people. However, among countries with a per capita GDP of at least $4,600, net deforestation rates have ceased to increase (Rojahn, 2006). Deforestation is the logging and/or burning of trees in a forested area (Maddox, 2006.).

There are several reasons deforestation occurs: trees or derived charcoal can be sold as a commodity and used by humans, while cleared land is used as pasture, plantations of commodities and human settlement (TsegayeTadesse, 2007). The removal of trees without sufficient reforestation has resulted in damage to habitat, biodiversity loss and aridity and deforested regions often degrade into wasteland. Disregard or ignorance of intrinsic value lack of ascribed value, lax forest management and deficient environmental law are some of the factors that allow deforestation to occur on a large scale (Rojahn, 2006).

There are many root causes of deforestation in Ethiopia, including corruption of government institutions, the inequitable distribution of wealth and a power, population growth and overpopulation, and urbanization (Sucoff, 2003.). Globalization is often viewed as another root cause of deforestation, though there are cases in which the impacts of globalization (new flows of labor, capital, commodities, and ideas) have promoted localized forest recovery.

The degradation of forest ecosystems has also been traced to economic incentives that make forest conversion appear more profitable than forest conservation in Ethiopia(Reij and Steeds, 2003). Many important forest functions have no markets, and hence, no economic value that is readily apparent to the forests' owners or the communities that rely on forests for their well – being. From the perspective of the developing world, the benefits of forest as carbon sinks or biodiversity reserves go primarily to richer developed nations and there is insufficient compensation for these services (Deininger and Jin, 2006). Developing countries like Ethiopia feel that some countries in the developed world, cut down their forests centuries ago and benefited greatly from this deforestation, and that it is hypocritical to deny developing countries the same opportunities: that the poor shouldn't have to bear the cost of preservation when the rich created the problem (Pearce and David, 2001).

Experts from Ethiopia do not agree on whether industrial logging is an important contributor to Ethiopia deforestation (Butler and Rhett, 2009). Similarly, there is no consensus on whether poverty is important in deforestation. Some argue that poor people are more likely to clear forest because they have no alternatives, others that the poor lack the ability to pay for the materials and labor needed to clear forest. Claims that population growth drives deforestation have been disputed; one study found that population increases due to high fertility rates were a primary driver of tropical deforestation in only 8% of cases (Ehrhardt, 2003). An impact of woody species Deforestation is caused by the growing demand for forest products and the conversion of

forest to agriculture as the human population continues to expand. Impacts of woody species deforestation are not only affects the climate by increasing the atmospheric level of carbon dioxide but also affects the environment by inhibiting water recycling, triggering severe flooding, aquifer depletion, soil degradation and the extinction of plant and animal species.

Munessa Forest is a state-owned forest managed by OFWE. It is degraded due to constant grazing and extraction of fuel wood. There is a forest plantation surrounding the natural forest, which demarcates the state land and is used for timber production. There is one local office for each of the blocks: Degaga, Sole and Gambo.Next to each office is a timber processing facility. OFWE employs guards (from thennearby communities) that patrol the forest and plantations to ensure that no illegal activities take place. Guards are empowered to detain illegal users if found in the plantations but not if found in the forest. In the latter situation, guards identify the illegal user and inform the CBO managing the forest. A CBO was created in 2012 with the support of OFWE, following the assumption that forest conservation would only succeed if local communities were involved in its management (based on previous experience). The CBO consists of ~150 members, all residents or settlements that border the forest in four *kebeles*. Its objectives are: (1) to conserve the forest and wildlife;
 (2) To share the benefits with the CBO members
 (3) To protect the springs that provide water and to full other infrastructure to the communities and(4) to restore the forest back to its original state. A committee of 30 members including a leader, a vice-leader, a secretary, a cashier and managers makes decisions. Leaders are in charge of activity planning, and managers execute these activities and supervise the work of other members. If any member of this CBO encounters financial problems, the cashier can provide credit and will guarantee repayment. The cashier is also responsible for fund-raising. Membership is not open to all: "only the ones that show potential and interest in conserving the forest can join." The leaders of each settlement make a pre-selection and the committee makes the final decision. Details about forest access rights are discussed in Section 2.5A local ecotourism cooperative provides guided tours and promotes sustainable use of the forest. They return 10% of their income to the communities through supports of development projects promoted by the settlement leaders.

2.1.1 Loss of Biodiversity

Ethiopia owes its remarkable biological diversity to the favorable eco-geographic conditions.

That prevails the flora comprises 6,500 – 7, 000 species of which 12 % are considered endemic, mainly in the Ogden region, and in the western and south western woodlands. The forests host the major portion of the flora including about 25% of families of close relatives of cultivated crops. The Government of Ethiopia has devoted important efforts to the conservation of the Country's biodiversity including the formulation of policies for the sustainable use of genetic resources. Protected areas cover 14 % of the country and contribute significantly to conserving the diversity of the forest genetic resources, as is the case for the *in situ* conservation of wild coffee in the south-western part of the country. There are 40 wildlife conservation areas in Ethiopia comprising 9 national parks (2.3 million ha.), 4 wildlife sanctuaries (1 million ha), 8 wildlife reserves and 18 controlled hunting areas. Seven of the national parks are located in the lowlands while two are in the alpine highlands. Only two of these parks are gazetted. The Institute of Biodiversity Conservation and Research (IBCR) is responsible body for conserving the country's biological resources. It has collected and stored about 804 accessions of seeds of 14 tree and shrub species. With German financial assistance, the IBCR has launched a Forest Genetic Resources Conservation Project the goal of which is to contribute towards developing and sustaining the economic, socio-cultural and ecological values of forest ecosystems.

2.1.2 Climate Change

Changes in climate are known to exert additional pressure on biodiversity. Climate change has affected, for instance, the timing of reproduction in animals and plants, the length of the growing season, species distributions and forests and the benefits they provide in the form of wood, food, income, and watershed protection have an important and critical role in enabling people to secure a stable and adequate food supply. It is well-known that global warming is being caused largely due to emissions of greenhouse gases like carbon dioxide into the atmosphere (NAPA, 2007). However, what is not known quite as well is that impacts of deforestation have a direct association with carbon dioxide emissions into the atmosphere. Trees act as a major storage depot for carbon since they absorb carbon dioxide from the atmosphere, which is then used to produce carbohydrates, fats, and proteins that makeup trees. When deforestation occurs, many of the trees are burnt or they are allowed to rot, which results in releasing the carbon that is stored in them as carbon dioxide. This, in turn, leads to greater concentrations of carbon dioxide in the atmosphere. People dependent on the forests for their survival lose their livelihood. Deforestation not only affects the climate by increasing the atmospheric level of carbon dioxide but also affects the environment by inhibiting water recycling, triggering severe flooding, aquifer depletion, soil

degradation and the extinction of plant and animal species (Robalino and Pfaff, 2012). Agriculture is the source of income of many families in developing countries as precipitation patterns are being affected greatly by climate change; it can lead to floods as well as drought conditions. These both conditions have negative effects of climate change on poor people as their crops are destroyed in both situations. This is also a great loss to our economy as combating poverty is a major issue for our economy. With large scale, deforestation soil erosion and landslides have become a normal phenomenon. During heavy rains and typhoons, soil is washed away to lower regions. This increases the risk for landslides which can cause seriously threaten the safety of the people and damage their properties (Brehane and Mekonen, 2009.

2.1.3 Drought

In Ethiopia Drought is an extended period of time where rainfall is deficient. Drought occurs when sufficient water needed to sustain an area is not available, causing economic impacts on agriculture, society, and ecosystems (Bekele and Draike, 2003). It is most often caused by lack of rainfall over a long time period but can also be affected by unusually high temperatures and dry spells, particularly during summer months. The impact of drought on agriculture, land use and degradation and water resource management is especially visible in semi-arid and sub-humid areas. In many semi-arid and sub-humid areas, the occurrence of drought has been a phenomenon observed periodically for hundreds or thousands of years in Ethiopia. Basically, the local plant, animal and human life had adapted itself to the occurrence of drought. In a "balanced" system, the exploitation of micro-climatic opportunities maintains or even enhances their existence. Time of droughts can have significant environmental, agricultural, health, economic and social consequences. The effect varies according to vulnerability. For example, subsistence farmers are more likely to migrate during drought because they do not have alternative food sources. Areas with populations that depend on water sources as a major food source are more vulnerable to famine. Drought can also reduce water quality because lower water flows reduce dilution of pollutants and increase contamination of remaining water sources. Common consequences of drought in Ethiopia include: diminished crop growth or yield productions and carrying capacity for livestock; dust bowls, themselves a sign of erosion, which further erodes the landscape; dust storms, when drought hits an area suffering from desertification and erosion; famine due to lack of water for irrigation, habitat damage, affecting both terrestrial and aquatic wildlife hunger, drought provides too little water to Support food crops.

2.1.4 Impacts of deforestation on wildlife

Due to the massive felling of trees, many species of animals are being lost each day. The outcome of which is the extinction of animals and plants on a massive scale. The effects on animals are very heartbreaking many beautiful creatures; both plants and animals have vanished from the face of the earth (Karkee, 2004). They not only lose their habitat and protective cover, but they are also pushed to extinction. The important flagship species, endemic to Ethiopia, are the Ethiopian Wolf (Canissimensis), Walia Ibex (Capra walie), Gelada Baboon (Theropithecus gelada), Giant Lobelia (*Lobelia rhyncopetalum*), amongst others. These species are characteristic of the Ethiopian afro-alpine eco-region, reflecting the biodiversity value of the Ethiopian Protected Area system. Examples for the exceptional biodiversity value of the Ethiopian Protected Area System are the wetlands and floodplains found in Gambella National Park. Ethiopia and the Sudan share the second largest mammal migration on the continent. Almostone million White-eared Kob (Kobuskobleucotis) migrate between the two countries to take advantage of the vast grassland areas and floodplains. The Shoe-billed Stork (Balaenicepsrex) was present in the Gambella floodplains but its presence has not been confirmed for some time.

2.1.5. Impacts on forest products

Forest products comprise of timber and wood products and non-timber forests products (e.g. forest coffee, honey, medicinal plants, pepper, gum, raisin, oils, etc.). Considered endemic, meaning they do not occur in any other country. 4.6% of faunal species are believed to be threatened. Ethiopia is the cradle of the coffee gene pool, including many wild coffee land races. The genetic diversity of coffee and wild coffee derivate, found in Ethiopia, has a tremendous value in terms of breeding potential for a globally important food commodity, grown in many countries. It is estimated that more than 90% of Ethiopians depend on fuel wood to meet their household energy needs. Ethiopia has a long history of honey and beeswax production, with the former having developed into the largest honey industry in Africa, exporting to world markets. Honey and wax are traditionally produced at household level as a cash crop.

It is estimated that more than 85% of the Ethiopian population use and partly depend on medicinal plants as their primary source of healthcare. Hence, medicinal plants are an important component of the national healthcare system, supplementing the modern healthcare service, which is limited and too expensive for the majority of people. Many plant species, used for traditional medicines are becoming rare and limited in distribution. They are threatened by

human-induced and natural factors, such as environmental degradation, agricultural expansion, loss of forest and woodlands, over-harvesting, fire and urbanization.

2.1 .6 Atmospheric Impact

Impacts of Deforestation are ongoing and are shaping climate and geography of Ethiopia. Deforestation is a contributor to global climate change, and is often cited as one of the major causes of the enhanced greenhouse effect (Adam and David, 2008). Tropical deforestation is responsible for approximately 20% of world greenhouse gas emissions. Deforestation mainly in tropical areas, account for up to one-third of total anthropogenic carbon dioxide emissions (TsegayeTedessa, 2007). Trees and other plants remove carbon in the form of carbon dioxide from the atmosphere during the process of photosynthesis and release oxygen back into the atmosphere during normal respiration. Only when actively growing can a tree or forests remove carbon over an annual or longer time frame. Both the decay and burning of wood releases much of these stored carbon back to the atmosphere. In order for forests to take up carbon, the wood must be harvested and turned into long-lived products and trees must be re-planted. Forests are stores of carbon and can be either sinks or sources depending upon environmental circumstances. Mature forests alternate between being net sinks and net sources of carbon dioxide. Reducing emissions from the tropical deforestation and forest degradation (REDD) in developing countries has emerged as new potential to complement ongoing climate policies. The idea consists in providing financial compensations for the reduction of greenhouse gas (GHG) emissions from deforestation and forest degradation (Bjorn, 2001). Ethiopian rain forests are widely believed by laymen to contribute a significant amount of world's oxygen, although it is now accepted by scientists that rain forests contribute little net oxygen to the atmosphere and deforestation will have no effect on atmospheric oxygen levels. However, the incineration and burning of forest plants in order to clear land releases tones of CO_2 which contributes to global warming. Forests are also able to extract carbon dioxide and pollutants from the air, thus contributing to biosphere stability.

2.1 .7 Hydrological Impact

Water cycle is also affected due to woody species deforestation. Trees extract groundwater through their roots and release it into the atmosphere. When part of a forest is removed, the trees no longer evaporate away this water, resulting in a much drier climate which clearly visible in Ethiopia evidenced by the current frequent drought and Elnino. Impacts of woody species

deforestation reduce the content of water in the soil and groundwater as well as atmospheric moisture. Deforestation reduces soil cohesion, so that erosion, flooding and landslides ensue. Forests enhance the recharge of aquifers in some locales; however, forests are a major source of aquifer depletion on most locales. Shrinking forest cover lessens the landscape's capacity to intercept, retain and transpire precipitation. Instead of trapping precipitation, which then percolates to groundwater systems, deforested areas become sources of surface water runoff, which moves much faster than subsurface flows. That quicker transport of surface water can translate into flash flooding and more localized floods than would occur with the forest cover (Pearce and David, 2001). Deforestation also contributes to decreased vapor-transpiration which lessens atmospheric moisture which in some cases affects precipitation levels downwind from the deforested area, as water is not recycled to downwind forests, but is lost in runoff and returns directly to the oceans (Jonath*et al*, 2005). As a result, the presence or absence of trees can change the quantity of water on the surface, in the soil or groundwater, or in the atmosphere. This in turn changes erosion rates and the availability of water for either ecosystem functions or human services. The forest may have little impact on flooding in the case of large rainfall events, which overwhelm the storage capacity of forest soil if the soils are at or close to saturation which in turn dries out the rivers, streams and springs (Susanna *et al*., 2006).

2.1 .8 Impact on soil

Undisturbed forest has very low rates of soil loss, approximately two metric tons per square kilometer. An impact of woody species deforestation generally increases rates of soil erosion, by increasing the amount of runoff and reducing the protection of the soil from tree litter. This can be an advantage in excessively leached tropical rain forest soils. Ethiopia is part of the tropics (Hobbs, and Harri, 2001). Ethiopia's Plateau was covered of forest millennia ago. Since then it has been eroding, creating dramatic incised valleys, and providing the sediment that causes the flooding of the river in the lower reaches. Tree roots bind soil together, and if the soil is sufficiently shallow they act to keep the soil in place by also binding with underlying bedrock. Tree removal on steep slopes with shallow soil thus increases the risk of landslides, which can threaten people living nearby. However most deforestation only affects the trunks of trees, allowing for the roots to stay rooted, negating the landslide (Mishra *et al*., 2004..)

2.1 .9 Ecological Impact

According to Angelsen and David (1999), impacts of deforestation results in decline of biodiversity. The removal or destruction of areas of forest cover has resulted in a degraded environment with reduced biodiversity. Forests support biodiversity, providing habitat for wildlife; moreover, forests for medicinal plant conservation. With forest biotopes being irreplaceable source of new drugs, deforestation can destroy genetic variations (such as crop resistance) irretrievably. Since the tropical rain forests are the most diverse ecosystems on Earth and about 80% of the world's known biodiversity could be found in tropical rain forests, removal or destruction of significant areas of forest cover has resulted in a degraded environment with reduced biodiversity.

2.1.10 Solutions to control the impacts of deforestation

We advocate the planning and management of land resources that is integrated and holistic with awareness of land users. This will ensure the long term quality of the land use system. For every tree that is cut, three, not two should be planted in its case. We have reached such a critical point that to prevent the desertification of the world that many more trees need to be planted. Unless it is necessary, water catchments areas should strictly be left alone Quick growing varieties of soft wood trees should be grown for commercial uses e.g. making of furniture, pencils and paper. We should carry out consistent mass education on a worldwide scale, on the importance of reforestation and the dangers of deforestation. We need to enact and enforce strict laws against deforestation, worldwide. It is high time that we reduced our dependence on charcoal as a source of fuel and make use of wind and solar energy.

CHAPTER THREE

3. MATERIALS AND METHODS

3.1 DESCRIPTION OF THE STUDY AREA

This study was conducted at the selected site includes(Four districts ArsiiNageelee,Koree,MunessaandHebanArsii) four "*Ganda*"(the smallest administration unit next to the districts in Oromia Regional State) namely: BombasoRegi, JemaSardo, Basakulala and Shopa Genet, near the Munesa forest Oromia Regional State, West Arsi zone, South East Ethiopia. It is located about 240 km south of Addis Ababa.Lies within latitudes 7^0 12' and$7^0$32'N and longitudes 38^0 45, and 38 ^{0}56'E and covers an altitudinal range between 2,100 and 2,700 meters above sea level. The study area originally supported deciduous natural forest, however, dominated by *Podocarpusfalcatus*(Thunb.) Mirb.(Chaffey, 1980). Plantation establishment in this area began in the late 1950s and early 1960s (Lundgren, 1969). Most of the plantations were established on disturbed Afromontane forest areas, which had been selectively logged at various intervals over the previous 30 to 40 years. Remnant natural forest areas were cleared and burned prior to the establishment of the plantation (personal observation). The plantations were established at densities of approximately 1,600–2,500 trees / ha, and were thinned to a final stocking of about 500–600 tree / ha. Munessa Forest is a protected forest that is owned by the State and controlled by OFWE. It has an estimated area totally 203,000 ha of those 15, 000 ha plantation and 187,000ha natural forest .But this study was conducted only on 80, 000ha natural forest 6,000ha plantation areas and which subdivided into three management blocks: Degage, Sole and Gambo.
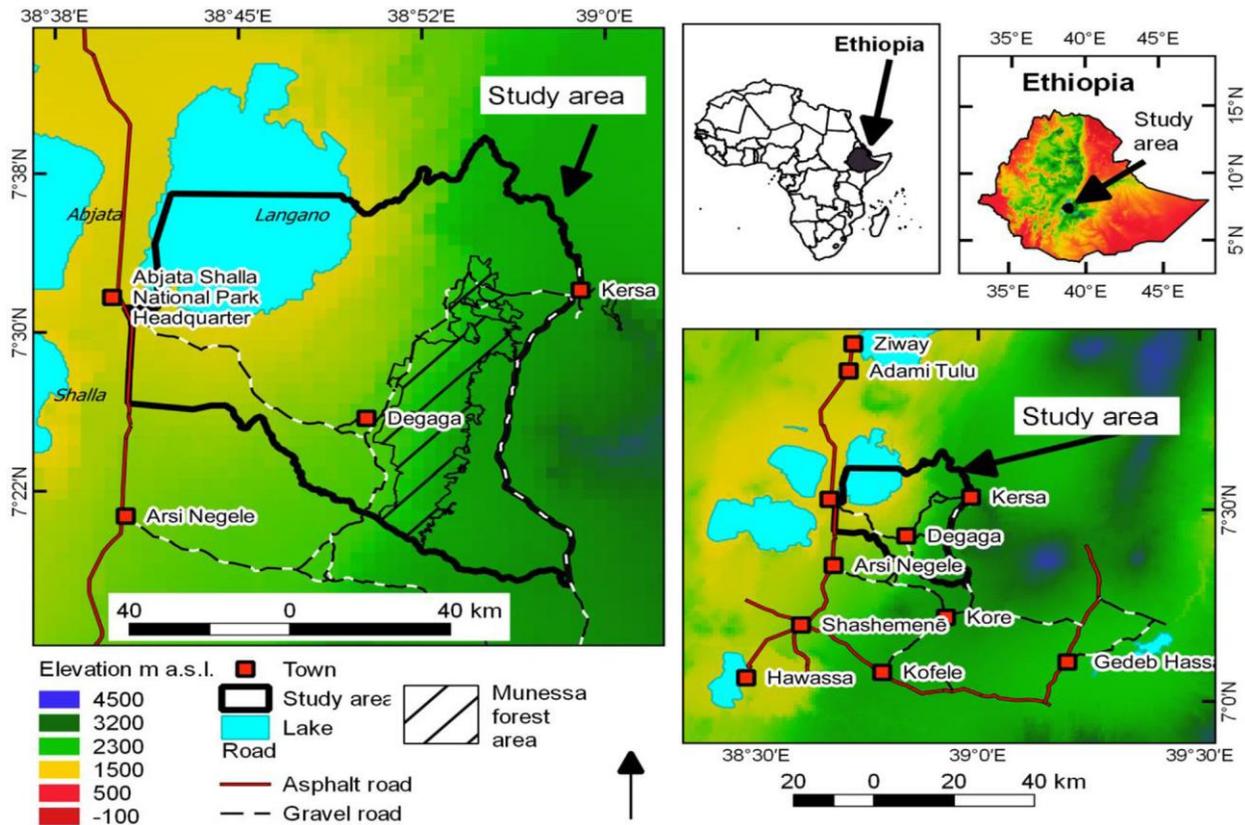
Figure 1.Munessa forest map: source from (Article in Applied Geography) by Kedirnino;(2017)

3.1.1 Classification of climatic zones

According to the Ethiopian classification of climatic zones, Munessa Forest and its surroundings can be classified as lowland (1500–2300 masl) and highland (2300–3200 masl) zones (Teshome,1996).

3.1.2 Soil type

Soils are mainly developed in volcanic ash deposits from Quaternary volcanic activities in the Rift Valley and its surroundings (Mesfin, 1998), and they are classified as (Lemenih, 2004;
The soils are derived from weathered parent volcanic rocks, mainly reddish in color freely draining, and are of medium to heavy texture, and humid feral sol (Ludgren, 1971). The clay content increases with depth whereas the proportion of sand showed a marked decline with depth. The soil is acidic and pH varies from 5.4 in the upper (0-15 cm) layer to 4.7 in the lower 30-60 cm. Soil organic carbon and total nitrogen showed declining tendency with soil depth. As in other parts of Ethiopia Precambrian rock forms the basement of the study area (MesfinWeldemariam, 1972).

16

3 .1.3 Rainfall

The main rain season extends from mid-June to mid-October with maximum rainfall occurring between July and August. There is also a small rain season called "Belg Rain" between March and May. The monthly temperature ranges between 15.8 and 18.79 ^{0}C. The dry season of the area extends from November to February. The mean annual rainfall calculated for the area based on ten years data (1996-2005 G.C) collected from Degage (2000 m.a.s.l) station was about 1067 mm, out of which 68.74 percent occurred during the major rainy season while the remaining 24.47 and 6.79 percent was recorded in the small rain and dry seasons respectively.

3.1.4Vegetation

The vegetation of the area can be categorized as dry afromontane evergreen forest. The upper story of natural forest consists almost entirely of *Podocarpusfalactus* (Thumb.) R. Br. ex Mirb. In the intermediate and lower stories, the most common species include: *Maesalanceolata*Forssk, *Allophylusabysinicus* (Hochst.) Radkl, *Prunusafricana*(Hook. F.) Kalkman, *Apodytesdimidiata*E. Mey. And Arn.,*Bersamaabyssinica*Fresen., *Buddlejapolystachyas*Fresen., *Croton macrostachyus*Hochst. ExEndl.,*Dombeyatorida*(J. F. Gmel.) P. Bamps., *(A.* Rich*)* Warb, *Hageniaabyssinica* (Bruce) J. F. Gmel*., Myrsinemelanophloeos*(L.) R.Br.,*Tecleanobilis*Del. and*Vernoniaauriculifera*Hiern (Chaffey, 1979; GemedoDalle, 1999).These are part of the Forest that covers the eastern escarpment of the Central Ethiopian Rift Valley. The natural forest has been subject to extensive deforestation and converted to permanent croplands, a process that is still continuing (Kebede, 1998). The farm fields were all manually cleared by slashing and burning the vegetation using manual labored hand tools such as axes.

3.1.5Socioeconomic activities

Agricultural production is the most important economic activity in the area. Most farms are mixed crop–livestock systems; therefore, livestock rearing is also common though it comes after crop production in perceived socioeconomic importance (note that this conclusion is drawn based on the great decline of grazing areas and livestock numbers due to cropping area expansion and the perception of higher food security due to crop production as mentioned during the PRA and FGDs. Trading and transport services for agricultural products are other agriculture-related activities in the study area. Fuel wood extraction is also common in the area, being most important close to the forest where illegal trading remains common.

The four major crops (planted in the area and perceived importance) are: maize (*Zea mays*), wheat (*Triticumaestivum*), potato (*Solanumtuberosum*) and teff (*Eragrostistef*). Other crops vary in importance across the lowland area and include: barley (*Hordeum vulgaris*), vegetables and enset (*Enseteventricosum*). Enset is mostly found in highland and lowland in few amounts, usually planted in home gardens. It is sometimes planted with or next to small number of coffee (*Coffeaarabica*), avocado (*Perseaamericana*) and banana in lowlands of study areas.

.3.1.7 Population

The population of the study area is estimated 25,560 of those 13,470 females and 12,090 males in which 95 % are rural and 5 % are urban. With a current annual growth rate is 2.92 %. The present average population density is 15 inhabitants /km^2. The structure of the population reflects a high dependency ratio because 48.6 % of people are economically inactive (CSA, 2007). "Afan Oromo" is the common language in the area. Most people are Oromo; few are Amhara and otherethnic groups.

3.2 Survey and Site Selection

Survey was conducted in March 2020, to depict the impacts of deforestation on livelihood community .First, a discussion was conducted with Munesa forest administration, forest expert, other forest workers and "Ganda "leaders for two days how to select the site for investigation. After discussionfromfour districts (Kore, Arsinagele, Munesa and Heban-Arsi) have 16 farmer Associations in the forest patches, Four representative "Ganda " (BonbosaReji, Basakuilala, Jemasardo, and shopha genet)were purposively selected as study sites on the basis of:

(1) Serious forest degradation

 (2) Large number of population pressure

At this stage, the investigator took great care to ensure that the selected "ganda" sufficiently represented the district in terms of socio-economic and physical characteristics

3.3 Materials

The equipment needed for data collection and survey

Basic equipment

- ➢ Waterproof field notebook to record habitat and location information.
- ➢ Soft lead pencils for writing.
- ➢ Topographic maps and location information.

➢ Rope (string)

3.4. Research design

Survey was carried out to collect primary data and to generate reliable information on the intended topic. Consequently, the fieldwork for this study was carried out from mid-March to April 2020. A descriptive type of research design was employed to get answer for the question how deforestation influences environmental components. Using questionnaires were adopted to gather information based on the prepared questionnaires. The questionnaires were developed with the objective of obtaining meaningful information and views from the household members living in the study area and from the key informants. The key Informants including community representatives and elders, experts at district office of Agriculture and development agents who are assigned at community level were considered in the survey.16 key informants 4 from each ganda were selected purposively as key informants' particularly elderly people and village heads that have lived in the area for a long period. They represented different villages and different religious groups .The ages of the respondents were between 15 years and 60 years. Such age group is believed to have advantages of full information on impacts of deforestation on farmer livelihood, ecological condition and forest resources management or conservation activities. Data was collected by 20 well-trained personals that are well acquainted with each"Ganda" and trained before the starter of the data collection. The first two days of the survey period was devoted to training the data collectors by which they were tolerant to how to handle the respondents and fill the questionnaires.

3.5. Sampling techniques

Random sampling method was used to select sample households for the survey from population because the focus is on the households near the forest area. The number of household heads of each "Ganda"(BonbosaReji, Basakuilala, Jemasardo and Shopha genet) were 808,1071,637 and 906 respectively. Totally 3,422 household heads were recorded. Secondly, the sample household heads were selected from each "ganda".Finally, 267 households (HHs) were selected (Table 1) using the formula of Kothari (2004) to assess impacts of deforestation on farmer's livelihood and Ecological satiation. The sample size in the village was selected based on the formula of Kothari (2004) as given below so as to avoid the bias.

n=Z^{2}PQN/E^2 (N-1) +Z^{2}PQthe formula of Kothari (2004)

Where, n= Sample size; N= Number of house hold; P= Level of precision which is 5%=0.05; E= Allowed error which is 5%=0.05; Q=1-P=1-0.05=0.95; Z= Confident interval 95%,

1.96 From Z–table.

e.g.Jeemaasardoo N =637

 P=0.05

E=0.05

Q=0.95

Z=1.96

n=?

n=Z^2 PQN/E^2(N-1)+Z^{2}PQ

=(1.196)^2*0.05*0.95*637/(0.05)^2(637-1)+(1.96)^2*0.05*0.95

=3.8416*30.2575/0.0025*636+3.8416*0.0475

 =116.237212/1.59+0.182476

 =116.237212/1.772476

Sample size (n) =65

Table 1.The number of household heads and sample size   in the study "Ganda"

No	Name of"Ganda"	Household size	Sample size (n)	Sample size by gender		Total household by gender in each 'Ganda'	
				Male	Female	Male	Female
1	Jeemaasardo	637	65	33	32	500	137
2	Basakuuilaala	1071	68	46	22	723	348
3	BonbaasooReejii	808	67	47	20	572	236
4	Shopa genet	909	67	47	20	63 8	268
	Total	3422	267	172	95	2433	989

This was carried out based on the list of households registered in the respective farmer's associations obtained from "ganda" administration. 267 registered households 172 Males and 95 females.

3.6 Data collection method

Semi-structured questionnaires, focus-group discussions and field observations carried for data collection. Information on impacts of deforestation was gathered through an individual interview using sem-stuructured questionnaires. Within four "*Ganda*" BonbosaReji, Basakuilala, Jemasardoandshophagenet. The names of all household heads (total 267) were identified from each *"ganda"*. Accordingly, 267 household heads 172 men and 95 women were interviewed. This information was about Munesa forest impacts on deforestation and biophysical environment of the sites, and served to cross-check the data collected from households. The name of all households heads available from each "ganda" administration officers was listedaccordingtheir "tokko-shanee"(five members of household).Gandas manager and Ganda officials were consulted to identify the location of each household's residence within Ganda. Respondents were selected at different intervals in different *Gandas*but the same intervals with in a*Ganda*e.g .Jemaasardo1 out of 9,Basakuilala 1out of15,Bonbasobejii 1out of12and SHophagenet 1out of 13households selected purposively from the prepared list of the whole household heads living in each Keble near the forest patches.The questionnaires were first prepared in English and then translated to Afaan Oromo (the local language). It was filled carefully by assistant of 20 data collectors who live in four Farmers Associations. Each data collectors have the capacity to interview 10-13 households at time to avoid Covid-19 spread. .Because of Covid-19 spread at a time could interviewed only4 informants by keeping their social distance. The investigator helps the data collectors by giving professional support, supervising and even by involving in data collection. These activities were done similarly in four "ganda".(Accordingly, 8 FGDs were undertaken in groups consisting of 20 to 25 people by wearing their mask and keeping social distance for prevention of Covid-19 in four selected "ganda". All idiosyncratic ideas (data having single respondent and not supported by group discussion) was removed from the data. A repeated market survey (2 times) in, March and May of woody plants products was also conducted in Kofele, kore, Goljota and keta towns to verify the price of marketable products recorded in questionnaire during interview by comparing of indigenous woody species materials price and exotic plants species.

3.8 Data analysis

All quantitative and qualitative data were analyzed using SPSS stat. version 23 for Descriptive statistics. The analyzed data was presented using percentages, tables and figure. Priority ranking was employed to determine threats; to woody plant species by give value 1-6 6 for high threat and 1 for last threaten plants pecies.

CHAPTER FOUR

4. RESULTAND DISCUSSION

4.1 RESULTS

4.1.1Negative Impacts of deforestation on farmer's livelihood

4. 1.1.1Crop Production

In this study the impacts of deforestation reported as negative and positive impact based on its influence on physical and biological entities. Agriculture is the most important economic activity in the study area because it is the source of food, dairy and general livestock production, beverages and industrial raw materials. The importance of agriculture as an economic activity is more crucial in the area where most of the inhabitants are farmers. More than 80% respondents indicate, in study area, agricultural activities include the growing of crops and rearing of livestock. Farmers often do deforestation to raise crops for self-subsistence, and are driven by the basic human need for food. Most farmers are poor and farming is a basic way of life for a large part of the population. Farmers in these areas do not have the money to buy necessities and must raise crops for food and to sell. The declining productivity has serious negative impacts on the farmer's livelihood and food security of the rural population in this study. Decline in soil fertility was observed in all sampling areas because of deforestation. Farmers in study area used to sustain their agriculture through expansion of crop lands by clearing natural forests and wood lands. They depend on the resources from the forest for their very survival. Land is needed for crops; trees are burned and used for fuel, and fodder for their animals. They do not have very much experience with modern agriculture and do not use new technology such as modified seed and fertilizer. They simply use slash and burn farming, with the belief that setting fire on the forest will rejuvenate the land which holds true for some forest trees. In some pine forests, they assume fire can help spread seeds and the heat helps release nutrients in the soil.

Figure 2. Soil erosion occurring due to deforestation around Faaji sole village

As field observation shows that deforestation makes soil prone to erosion by agents such as wind and water. The rain leaches out the nutrients from the soil and the wind blows the soil away. There are no roots of trees hold the particles of soil together thus, preventing the fertile top soil from being carried away. Soil erosion leads to loss of productivity of the land due to loss of mineral nutrients and soil microorganisms'. About 88.2% respondents said that in the past 20 years the cereal crop production is reduced from 40 quintal to 20 quintal /hectare annually indicating that deforestation has negative impact.

4. 1.1.2Impact on Livestock and their products

Livestock plays a critical economic and social role in the lives of farmer in study area. 80% respondents said Livestock fulfills an important function in helping people cope with shocks and accumulate wealth, and they also serve as a store of value in the absence of formal financial institutions and other missing markets. In smallholder mixed farming systems, livestock provides nutritious food, additional emergency and cash income, farm outputs and inputs, and fuel for cooking food. Livestock is central to support and sustain the livelihoods of community. 88% respondents indicate Cattle are primarily used to provide draft power and dairy products. Commercial sales and meat production are secondary reasons for herd keeping in the study area. Households largely rely on communal grazing and crop residues to feed their cattle, and this is becoming increasingly challenging for the highland herd keepers due to expanding crop areas and hence decreasing pasturelands. Farmers appear to be adapting to changes by adopting a

diversification strategy that allows them to mitigate both risks of crop failure and losses of livestock. However, deforestation resulting in exposing soils various erosion agents. 90% respondents indicate the grass and other plants stunted growth in study area due to soil erosion, the livestock suffer from starvation. Cattle are exposed to feed shortage due to impacts of deforestation rather than sheep and goats. Sheep and goats don't need wide range of field to feed, because they are eating plants leaves and grass. Farmers migrating their cattle into nearby forest to save their life, this generating conflict between farmers and guard every time. This crime leads the farmer to punishment of 100-250 birr per cattle. Therefore, both production and marketing systems in the area suffer from serious bottlenecks and constraints. The average productivity of livestock in the area is among the lowest in the West Arsi zone; the ratio of livestock to humans is on a perpetual downward trend, pasturelands are declining fast, and the livestock mortality rate remains one of the highest in the region. The result also shows more than 55% respondents said, the number of livestock declining from time to time. e.g. cow from 6 to 3 cows, oxen from 2 pair to1pair, sheep from10 to 5, and goat from 10 to 5 , due to deforestation. Animal products especially milk decreases gradually for decades (2000- 2012E.C) as indicated in the table2 below.

Table2. The amount of milk in ml/cow around Munessa-shashamane forest area

	Name of ganda	Amount of milk in L/cowbefore decades	amount of milk in L/cow currently	Difference
1	Basakuilala	5L	1.5L	3.5L
2	Shopha genet	5L	1.5L	3.5L
3	JemaaSardo	6L	2L	4L
4	Bonbosareji	4L	1L	3L
	Total	20L	6L	14L
	Average	5L	1.5L	3.5L

As indicated on the table above (94.2%) respondents said that the mean product of milk decreased from 5L to 1.5L due to   impacts of deforestation directly on animals' product and indirectly on farmer's livelihood.

Figure 3. Traditional cattle keeping in Kumbivillage

4.1.1.3. Impacts on Honey production

Bee keeping is a long lasting practice in the study area. As a result, beekeepers have developed indigenous technical knowledge on traditional hive construction from different locally available materials, on honeybee management practices like honey season identification, swarm catching and attractant methods, swarm control method, honeybee enemy protection, traditional methods of sting protection and reduction of pain. The diversified agro-climatic conditions of the Munessa-shashamane forest was created environmental conditions conducive for the growth of different species of flowering plants of which most are bee plants. Most of the people placing the hive on the tall tree and some are placing under the house. The productivity of traditional hives is extremely low as the data available from respondents in which (88.2%) indicated the annual honey production in the study area was 12kg before 10 yearsand currently decreased to 4kg due to deforestation.

4. 1.1.4 Impact on Wood products

Forests are very useful natural resources. Human beings get different uses from forest ecosystems. In study area 80% respondents indicate, man destroys forests for different purposes such as construction, fencing, timber production, for charcoal and collecting fire wood. Rapid human population growth, poverty, forest clearing for cultivation, over grazing, exploitation of forests for fuel wood and construction materials without replantation are some of the major factors that contribute to the loss of forest resources in the area. In the study area traditionally

farmers have been using a variety of wood tools and weapons in their everyday life, often for agricultural operations and household purpose. While both men and women use some tools which have been developed in combination with iron tool and wooden handle or completely wood product tools.   Farmers brought with them their important material culture and traditional farming practices which are carried on by their generations along with their traditional farming tools and equipment which they inherited from their forefathers. Traditionally, farmers in study area as in any parts in Ethiopia use agricultural tools for land preparation, planting, harvesting and post-harvest. Most equipment and tools of the farmers were made of wood. Wood extraction is the principal cause of forest degradation and can also lead to deforestation, either directly or indirectly. This is resulting to increase the price of wooden tool and equipment gradually.

Figure4. Wood product tools in Kore market

Deforestation of plant species about 95% specially indigenous plants such as *Podocarpusfalcatus*, *adolfi-friedericii*, *Prunusafricana*, *Juniperusprocera*, *Hygeniaabyssinica*, *Croton macrostachyus*, and *Cordiaafricana* are the most important plants species to make tool and equipment for local community in study area. The price of the tool currently increases more than 100% in all market on every tool and equipment due to deforestation, e.g. the price of equipment such as table increases from50 birr to 700 birr, a chair from 25 birr to 550 birr and Bed from 300 birr to 10,000 birr and the price of Agricultural tools also increase as show in the table 3 using data available from field observation in Kore market HawwiGuddina Micro-enterprise shop.

Table 3 Price difference of tool and equipment before ten years and currently in Kore market (2020)

	Tool/equipment	Price before one decade	Current Price	Difference in birr
	Equipment			
1	Table	50 birr	700 birr	650 birr
2	Chair	25 birr	550 birr	525 birr
3	Bed	300 birr	10,000 birr	9,700 birr
	Agricultural tool			
4	Yoke	7birr	250 birr	243 birr
5	Plough	10 birr	300 birr	290 birr

In table 3: the lowest additional price was 243 birr and the highest 9,700 birr due to deforestation of woody species. Comparatively the tool that is made up of exotic plants such as *Eucalyptus globulus, and Cupressuslusitanica are* relatively *cheaper.*

Wood is extracted from forests for timber, pulpwood, fuel wood and charcoal. While logging practices usually causes forest degradation. However, uncontrolled or under-regulated timber extraction, whether legal or illegal, often leads to degradation and indirectly to deforestation.

4. 1.1.2. Negative impacts on Ecological situation

4. 1.1.2.1 The forest covers change

The forest cover in study area was changed mainly due to the transformation of natural forest to cultivated land and grassland. Information from experts and documents show, the natural forest which is common to the area found within the MSF and consists of trees such as *Podocarpusfalcatus, poueriaadolfifriedericii, Prunusafricana, Juniperusprocera, Hygeniaabyssinica, Croton macrostachyus, and Cordiaafricana*. Along the major natural forests, there are 15,000 hectares plantation forests of Pines, Cypress, and Eucalyptus species. Currently, the forest is under severe anthropogenic pressure from the local community especially in the more densely populatedareaBasakuilala, Bonbosareejii and Shopa genet "Ganda". Today, the species composition and the tree density have been decreasing, in almost all forested areas. Natural regeneration is scarce due to the high impact of livestock on natural forest. As information obtained from respondents indicates, human activities such as illegal cuttings, theft

of *Cupressuslusitanica*to sale at NageleArsi market, generating great conflict between guards and the robbers. *Eucalyptus* saw logs and cattle grazing in the young plantations of *Eucalyptus* is the same thing. Indiscriminate exploitation of Munessa-shashamane forest is destroying the properties of the soil, displacing animals and causing loss of biodiversity. The practices of lumbering, fetching of wood for fuel and bush burning are common in study area. Data available from documents indicate forest cover changes natural forest from 80,000 hectares to 79, 900 hectares; plantation from 6000 hectares to 5950 hectares between 2000-2012 E.C.. Totally, 150 ha (0.17%) forest changed to farmland and grassland due to deforestation in the past 12 years. Most species were threatened by these activities. Table 5 shows threats of woody plant species, values from 1–5 in which 1 is the least destructive threat and 5 is the most destructive threat.

Table4..Ranking value for threats of woody plant species.

	Plants	Informants					
		1	2	3	4	Sum	Rank
1	*Podocarpusfalcatus*	6	5	6	4	21	1
2	*Cordiaafricana*	4	6	4	5	19	3
3	*Hageniaabyssinica*	5	4	5	6	20	2
4	*Croton acrostachyu*	1	1	2	1	5	6
5	*Acaiaabyssinica*	2	3	1	2	7	5
6	*Juniperusprocera*	3	2	3	3	11	4

Podocarpusfalcatus and Hageniaabyssinica(Table 4)are (highly threatened woody plants in study area *but Croton macrostachyusandAcaiaabyssnica*they are least threatened. Normally traditional farmers clear their farmlands by burning. As a result, several hectares of forest including economic trees and plantations have been destroyed in Area. The net effect of the widely reported cases of wood burning in the area of study is the systematic depletion of forest wealth which also has serious consequences on the soil chemical, biological and physical properties. The consequences of indiscriminate exploitation of forest accounts for the loss of soil nutrient contents, loss of biodiversity, extinction of flora and fauna of rare species and the reduction of tourism potentials. Since forestation is the significant method of restoring and

sustaining the fertility of the soil, and since the practice is being threatened by the activities of the lumbermen on daily basis. The indiscriminate exploitation of forest is resulting in erosion, soil degradation, loss of biodiversity and loss of productivity at a time when there is a need for increase quality of food supply for better quality of life.

4.1.1.2.2 Reduction in herbal medicine

Some woody species provide herbal medicine; more than 90% respondents' indicate they can use medicinal plants singly or in combinations for the treatment of ailments for humans and livestock. The commonly known medicinal plant in study area was *Hageniaabyssinica* which is used for removalof tapeworm from human intestine. This medicinal plant can be gathered and sold in both rural and urban markets for cash income. Medicinal plants collected from the forest are neither cultivated nor protected, so they disappear at a rapid rate with a good number of them under threat of extinction. With deforestation, the fallow environments where medicinal plants are collected are disappearing and in extreme cases they have disappeared especially *Hageniaabyssinica* in the low land areas of BonbaasoReeji and shopha genet 'Ganda', because the flower parts of this plant is used for medicinal purpose. Thus, inhibit pollination to sustain regeneration of plant species. In order to continue trading in medicinal plants, harvesters move into forest to continue exploitation. If this situation is not properly managed, it can threaten the sustainable management of forest and aggravate the problems of deforestation, thus, escalating the supply problem of herbal medicines.

4.1.1.2.3 Reduction in wild edible plants food

Forests contribute to food production and food security. More than 80% respondent said, substantial amount of food can be obtained from the forest such as fruits, vegetable and wild gum.*Syzygiumguineense, Tremaorientalis*and*Ficussurare*the typical wild edible plants in the area. These forest foods provide carbohydrate, protein, fats and oils, vitamins and minerals and play a significant role in the nutrition of the people. Many respondents said, wild edible plants are all non-domesticated plants species used by people which are a continuum results from co-evolutionary relationships between humans and their environment. Forest foods are sources of subsistence and cash income to the rural populace. During seasonal food shortages and other periods of hardships, forest food are relied upon to provide nutrition to the people. Forest resources are also sold to generate extra income in amounts that can be quite substantial.

Wild edible plants are mostly serving as supplementary foods in Munesa-shashamaneforest and the surrounding communities. Gathering the natural product of these WEPs, especially 65% children are the most consumers of the wild edible plants, 25% youngsters and the women are the second to the children. Wild edible plants are also consumed by other parts of community about 10% consumed by hunters, passenger and guests. However, nowadays these wild edible plants that have important traditions which are tourist attraction, natural resource and sources of country economy have been changed to other land use system.

4.1.1.2.4 Wildlife loss

Animals' lives in Munessa-shashamane forest are under pressure, facing threats that include habitat loss from forest clearance, agriculture, herding and hunting for food and profit. The indiscriminate exploitation of forest cover has resulted to a degraded environment with reduction in biodiversity. Forest supports biodiversity, providing habitat for wildlife. The informants listed lion, red fox, and many birds' species from the place called shuganna and Dimaa dense forest area which left the area because of deforestation.

But six large mammalian species including the endangered endemic mountain Nyala (*Tragelaphusbuxtoni*) and Menlik's bushbuck (*Tragelaphusscriptusmeneliki*) were observed during the present study by key informants. These animals are potentials for ecotourism development; especially foreign people that come from different country to the Gamboo rural Hospital for different purposes have visited many times. The wildlife resource in the study area encompassed the important species that provide immense satisfaction in the eye of tourists. Some of them were unique to the country as well as worldwide. The major animal species specifically Mountain Nyala (*Tragelaphusbuxtoni*) Menelik's Bushbuck (*Tragelaphusscriptusmeneliki*), Leopard (*Pantherapardus)*, Anubis Baboon (*Papioanubis)* and Black and white Colobus Monkey (*Colobusguereza*).

The study area is classified into three zones according to the major wild animals. The first zone is characterized by Mountain Niyala zone and is located both in the natural and plantation forests adjoining the natural forest in the middle Lephis river valley water fall and near Duroomountain in the dense forest (near Bonbosareji and Basakuilala).

Figure5. The mountain Nyala zone near Bonbosareji and Basakuilala village

The second zone is characterized by Greater Kudu and seasonally occurring Mountain Nyala and is located in the natural and grass land along the Eastern part of lake Lanagano in Shopha genet Ganda in kukee dense forest. The third zone consists of grass and woodland where Mountain Nyala rarely occurs.

Figure 6. The wild life zone around Shopha genet village which shows the major tourist attractions area

4.1.1.2.5 Climate change

There are many reasons accounting for deforestation despite its harmful effect on the environment. People need timber and wood from the trees to make house, buildings, fence,

making equipment, tool, fuel wood and charcoal in study areas. Deforestation has impact on the global carbon cycle. Gas molecules that absorb thermal infrared radiation are greenhouse gases. If greenhouse gases are in large enough quantity, they can force climate change. It is now widely recognized that rising concentration of so-called greenhouse gases (GHGs) are driving changes in the areas climate patterns, resulting in catastrophic weather events, such as, heat waves, droughts and floods, and threatening plant and animal life in munnessa-shashamane forest and its surrounding community. It causes the following manmade disasters.

4.1.1.2.5.1 The shortage of rainfall.

The shortage of rainfall in study area was extended for long month including summer season. This was resulting in decrease in crop yield specially potato and maize in low land parts of Basakuilala, Shopagenet and Bonbosareji "ganda". The dry season of the area extends from November to February. The mean annual rainfall calculated for the area based on ten years data (1996-2005 E.C) collected from Degage Metrology station (2000 m.a.s.l) was about 1067 mm but currently the mean annual rainfall was decreased from 1067mm to 950mm in the same place. It causes drought which affect the growth of grass and seedling. These conditions also decreasing crop yield and animal products of the farmers.

4.1.1.2.5.2 Temperature change

Temperature change was other deforestation inducing problem in whole parts of the study area. It increases from the east to the west with decreasing elevation. The monthly temperature ranges recorded in Dagaga Metrology station was between 15.8^0C and 18.79^0C in 1996 E.C. Currently the monthly temperature increased in range between 22 and 27^0C .

4.1.1.2.5.3 Frost

.Frost was typical weather condition problem rather than pest and disease in highland areas during October and November months. It highly affects crops like potato, cabbage, barley and maize in most area of Jemasardo and Basakuilala. As data available from Jemasardo DA office the minimum 63 quintal per hectares were destroyed in one village every year due to frost (2006-2011E.C)

Table5. The amount of crop yield ruined by frost in a year in Jemasardo "Ganda"

No	Crop Name	The mount of yield destroyed in quintal per hectares
1	Barley	15q/ha
2	Maize	10q/ha
3	Potato	20q//ha
4	Cabbage	18q//ha
Total		63q/ha

4.1.2 The positive impact of sustainable logging

The result shows forest serve a wide range of purposes for farming families in the study area. 95.2% respondents mentioned that woody species have diverse benefits in the study sites such as soil fertility, animal fodder, bee forage, timber, firewood, fruit, cash income, farm tool, house construction, charcoal, local beer production, fencing, farm tool purposes implements, expansion of farmland and grassland. In general, they provide the following benefits upon clearing.
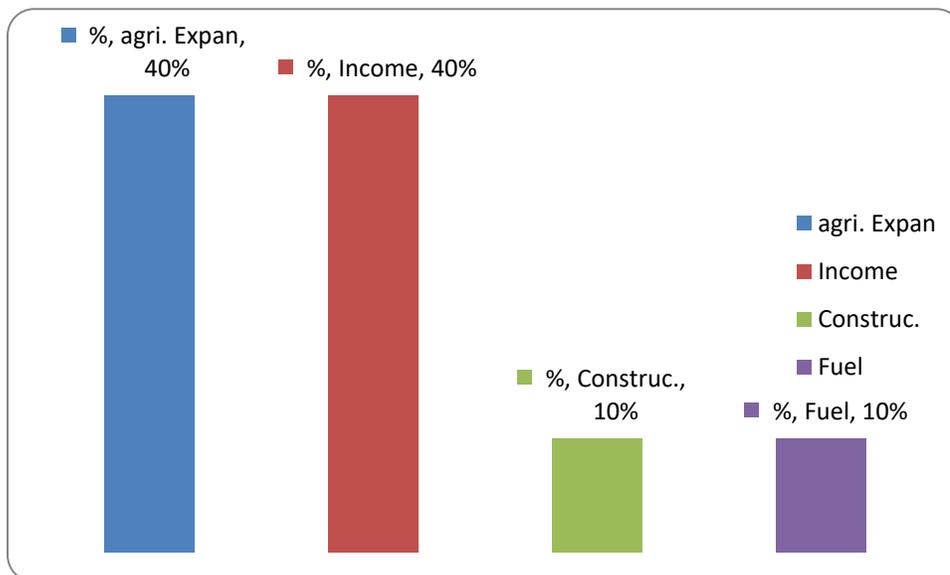
Figure 8 .The positive benefits of sustainable logging of forest trees

4.1.1.4. Possible solution to divert deforestation process

Most informants said, to combat impacts of deforestation in Munessa-shashamane forest and its surrounding, protecting wood species exploitation such as illegal timber production, charcoal, fire wood, expansion of farmland and over grazing should be reduced. Government and nongovernment organizations need to enhance the introduction and promote improved energy saving stoves, Biogas and other affordable alternative technologies which save biomass. Farmers protect, plant, and encourage woody species within and around their gardens, crop fields, and communal pasture lands to derive a range of benefits, including provisions of food, fodder, construction, textiles, farm equipment, fuel wood, and medicines as an agro forestry practice. More than 87% respondents indicate implementation of green legacy By current Government of Ethiopia, river basin and valley development making dam and the integration of trees, agricultural crops, and/or animals in an agro forestry system has the potential to enhance soil fertility, reduce erosion, better water quality, enhance biodiversity, increase beauty, and avoid carbon. Teaching the nearby community how to use and conserve plant species, the values of plants within subsistence and market economic systems, soil and other resource tenure systems. "Abbaagada" and elders should teach the community about spiritual feelings and traditions associated with plants to sustain forest development in order to preserve our forest for the future generation

4.2 Discussion

From collected data about 85% respondents said that the driving force behind Munesa Forest deforestation was necessity or subsistence needs, e.g., clearance of land for agriculture and cutting trees for wood for fuel energy and construction. Similar findings were also reported in Ghana whereby subsistence needs drive deforestation and forest degradation(Appiah*et.al)*(2009). Angelsen,*(1999.)* emphasized subsistence needs influenced by population growth as one of the key drivers of deforestation.

Totally, 150ha (0.17%) of forest changed in to farmland and grassland due to impacts of deforestation which is extremely smaller than the to the findings of Negassa*et al. (2020)*atKomto forest priority area in which the coverage of grassland and agricultural land increased by 10.16% and 33.5% respectively. Dramatic increase of agricultural land from (24.78%) in 1991

to (33.5%) in 2019 with annual expansion rate (23.68%) per annum, where forest cover declined by 20.1% in 1991 and 37.38% in 2019 with annual decreasing rate of 4.18% per *annum.*

Themagnitude and rate of deforestation have intensified due to increased human population, poverty, expansion of agricultural land and unsustainable exploitation of forest resources, need for grazing land, construction materials extraction, fuel-wood and charcoal production are the main factors responsible for the decline of forest in study areas which is in line with study reported by Otegbeye (2003)which says. Deforestation brings about serious ecological and socio-economic problems, some of which include wood shortage, food shortage, flooding, erosion, destruction of wildlife habitat and increased poverty especially in rural communities.

Forest have diverse benefits in the study sites for income generation (40%), fuel (10%), constructions (10%) and agricultural expansion (40%) in line with the study of Negassa*et al. (2020),* Agricultural land expansion (50.8%) in the periphery of the forest is the most contributing factors for forest loss which were followed by fire wood collection (29.7%) and charcoal production (15.3%). Grazing lands contributes for about 4.2% of deforestation)atKomto forest priority area.

Agriculturalactivities include the growing of crops and rearing of livestock. Farmers often do deforestation to raise crops for self-subsistence. This finding is in line with the work reported by (MEDAC, 1999) which says crop production is estimated to contribute on average about 60%, livestock accounts around 27% and forestry and other sub-sectors around 13% of the total agricultural activities.

Theannual honey production in the study area was 12kg before 10years And now decreased to 4kg due to deforestation. This is in line with the work of (MoARD, 2007) which says the productivity of traditional hives is extremely low and the average yield is only about 5–8kg/per colony/per annum in Ethiopia.

The wild edible plants are mostly serving as supplementary foods for surrounding communities. The gathered natural product of these WEPs, specially 65% are used for children consumption

25% for youngsters and the women and 10% consumed by hunters, passenger and This result similar with the work of Famuyide*et al*., 2000 in Nigeria which says about 12.22% of the rural community depends on mushroom and snails as food supplement while over 34.44 per cent of them consume forest fruits as part of their food habits.

Implementationof green legacy by current Government of Ethiopia is similar with the work of (Jose, 2009) which says the integration of trees, agricultural crops, and/or animals in an agro-forestry system has the potential to enhance soil fertility, reduce erosion, improves water quality, enhance biodiversity, increase aesthetics, and sequester carbon.

CHAPTER FIVE

5. Conclusion and Recommendation

5.1Conclusion

The results of the study shows, Deforestation has major impacts on ecological, social, economic, and political aspects of human society. over time the rate of deforestation have been expand due to increased human population, poverty, expansion of agricultural land and unsustainable exploitation of forest resources, grazing land, construction materials, fuel-wood and charcoal are the main factors responsible for the decline of forest in study areas. These cause low agricultural productivity such as crop production, livestock and livestock production due to impacts of deforestation. The declining of productivity has serious negative impacts on the farmer's livelihood and food security of the rural population in Munesa forest and its surrounding 'Ganda'. The species composition and the tree density have been decreasing in almost all in the margin of four villages, which consist now mainly of deformed and over aged trees. Result from field observation shows forest cover changed both in natural and plantation areas, natural regeneration of plants were scarce due to the high impact of livestock grazing in the forest especially in the summer season to protect their cattle from starvation.

About 88% respondents indicated that deforestation also drives climate change such as increasing in temperature and decreasing in rainfall in lowland area in BobaasoReejii and ShophaGanet which is the cause for low productivity on crops like potato and maize in study area. Thus, deforestation is an important issue to be discussed. It has adverse effects on each living beings'. Deforestation has become a huge concern in today's life as there has been a rise in the decline of forests. Rates of decline in the forests are increasing at a rapid rate. This has led the area to warm up and leading the lowland "ganda" to high temperatures. This cycle would continue for the following years unless necessary steps are taken to prevent deforestation.

In this studies soil erosion as a form of land degradation which is widespread phenomena in the study area especially in Basakuilala,Jemasardo and Bonbaasoreji farmers' association. Soil erosion leads to loss of productivity of the land due to loss of mineral nutrients and soil microorganisms. 'As most informants said the decline in agricultural production started 20 to 30 years after the decline in soil fertility which was usually the first step towards more serious soil degradation. This condition has negative impact on food security and the livelihoods of the community members. The monthly temperature increases and its range is between 22 and 27^{0}C.

The mean annual rainfall was decreased from 1068mm to 950mm. Pest, disease and frost were another problem which observed in study area. Informants' listed lion, red fox, and many bird species and other wildlife were disappeared from this forest due to deforestation. Soil conservation efforts in study area although considerable, but failed to achieve the desired objectives. Some of the reasons for this can be the absence of local participation and the lack of recognition for indigenous conservation oriented land use practices. Attention has to be focused on finding a promising solution to the menace of deforestation.

5.2 Recommendation

Impacts of Deforestation have contributed to the continued decline of forest resources in study area. The low level of living standard and illiteracy of most of the people coupled with lack of alternatives contribute to the decline in forest areas. Conversion of natural forests into cultivated fields can affect soil fertility and carbon sequestration; as a result carbon dioxide induces climate change phenomena, low crop production, low animal products, and loss of wild animals and plants species, loss of related ecosystems, and the lack of efficient resource use, which constitute the largest threats to forestry development. A successful environmental management constitutes a means to keep a balance between utilization and conservation of both natural and manmade resources. This can be achieved when consumers have a sound understanding about conservation, proper utilization, concern of coming generation, and creating functioning policies, laws and regulations as well as stable organizations to implement efficiently.
It is therefore urgent to intensify efforts to:

- ➢ Protect and improve the management of natural forests and plantation.

- ➢ Shift the present fuel-wood energy consumption pattern by promoting alternative energy sources and developing more efficient participatory woody biomass resource uses; developing solar energy and improve access to electricity

- ➢ Women and women's groups should have direct support for forest products programmers 'because of their important role as key resource managers in rural areas.

- ➢ We advocate the planning and management of land resources that is integrated and holistic where land users are central and have to be aware of benefits.

- ➢ To reduce existing pressure on remaining forests and keep the valuable products and ecosystem services provided by woody plants, many local communities are renewing efforts to retain or plant useful trees and shrubs within croplands, grazing areas, and other

portions of their landscapes. These exercises can increase the availability of intellectual nourishment health, and energy resources to raising families, diversify opportunities for income generation, and thereby optimize the productivity, stability, and resilience of farming systems.

➢ Improving land productivity through proper soil conservation e.g., conservation agriculture and no-tillage practices, cover crops, and crop rotations, integrated soil and pest management, and agroforestry

➢ Expansion of agro-forestry-based wood growing practices through trainings and technical support

➢ Devise an effective, fair, and equitable policy process and governance approaches that incentivize people and recognize their needs

➢ Develop effective and transparent land allocation practices participatory land use planning (land policy/land reform/land rights, etc

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Appendix

I. Questionnaires for Farmers

1. What are the impacts of woody species deforestation on your crop production?

2. How many quintals of maize, wheat, barley and potato do you have from a plot of land before deforestation and at moment?

3. What are the impacts of woody species deforestation on your farmland soilerosion?

4. What are the impacts of woody species deforestation on your grass land?

5. What are the impacts of woody species deforestation on climate change of your area?

6. What are the impacts of woody species deforestation on Rainfall?

7. What are the impacts of woody species deforestation on Temperature?

8. What are the impacts of woody species deforestation on your livestock?

9. How many cows, ox, sheep and goats do you have before 2000EC? And at moment?

10. How many Littre of milk do you have from one cow in a day?

11. What services you get from forests? Where did you obtain fuel wood from? What is happening if the forest is disappearing?

12. Where did you obtain material culture from? What is happening if the forest is disappearing?

13. Where did you obtain wood for construction of house and fence?

14. Where did you obtain medicinal plants for you and your livestock diseases?

15. Where did you obtain wild edible plants from? As supplementary food What is happening if the forest is disappearing?

16. Where did you obtain honey from? How many Kg do you get in a year before and at a moment?

17. What are the positive impacts of woody species deforestation?

18. Whatare the possible solutions to conserve and sustain forest and forest resource for generation?

II. Questionnaires for experts and professionals

1 How many hectares of land cover by natural forest before? At moment.?

2. How many hectares of land cover by plantation forest before? At moment?.

3. Whatare the factors of deforestation? What the impacts of deforestation?

4. How many animals and birds species were lived in this forest before deforestation and at moment?

5. How many plants species were lived in this forest before and at moment?

6. What are the impacts of woody species deforestation on changing rainfall, temperature and humidity?

7. What is the role of munesa forest project to reduce carbon sink that affect environment?

8. How many cubic meters of soil could be loss per year?

9. What are the possible solutions to reduce soil erosion and environmental change?

10. How Munesa forest project works to sustain forest management and conservation to benefit community and to keep natural resource?

Questionnaires for data collection

Name of data collector --age --------------sex ------------

Address------------------------

Name of Respondent ---age--------------------sex--------------

Address -------------------------

I. Questionnaires for Farmers

1. Do you feel impacts of woody species deforestation affect farmer's livelihood and Ecological condition?

   Cod   1-agree   2 disagree

2. How many quintals of maize, wheat, barley and potato do you have from a plot of land

   before deforestation and at moment?

3. Before 2000EC   after 2000EC

4.   Cod 1   2   3   4   cod   1   2   3

   5ku   6ku   7ku   8 ku   2ku   3ku 4ku   4 ku

5. M Q2.1--

6. W Q2.2 ----------5----------6------10--3----------4--------6----------------

7. BQ2.3--------5----------6-----------10--3-------4---------6 ------------------

8. P Q2.4---------10------15----------20-------------------------------------6-------10---------12 ------------------------

3. What are the impacts of woody species deforestation on your farmland soil erosion?

          Cod   1 medium yield   2 low yield

4. What are the impacts of woody species deforestation on your grass land?

           Cod   1 medium yield   2 low yield

5. What are the impacts of woody species deforestation on climate change of your area?

           Cod 1temp change 2 shortage of rainfall 3both

6. What are the impacts of woody species deforestation on Rainfall?

          Cod   1   2   3   4   cod   1   2   3   4

1000mm 1020mm 1010mm   900mm 950mm 700mm 600

7. What are the impacts of woody species deforestation on Temperature?

Cod   1   2   3   4   cod   1   2   3   4

$14c^0$ $15c^0$ 16c0 $17c^0$$18c^0$ 20c0   21c0 22c 0 23c 0   24c0

8. What are the impacts of woody species deforestation   on your livestock?

9. How many cows, ox, sheep and goats do you have before 2000EC? And at moment?

COD   1   2   3   4

5 tonocow6to3cow10to5cows

5tono sheep10to5sheep20to15 sheep

5tono goat8to4goats10to 5 goats

10. How many Letre of milk do you have from one cow in a day?

Before 2000EC   after 2000EC

Cod   1   2   3   4   cod   1   2   3   4

5L   6L   7L   8 L   1L   1.5L   2L   3L

11. What services you get from forests? Where did you obtain fuel wood from? What is
happening if the forest is disappearing?

Cod 1 woody plant   2 cow waste   3 Electricity

12.From what do you make most equipment and tool from? What is happening if the

forestdisappearing?   Cod   1 plastic   2.irone   3 wood   4.clay

13. Where did you obtain wood for construction of house and fence?

Cod 1 plants   2   stone

14. Where did you obtain medicinal plants for you and your livestock diseases?

Cod 1 drug   2 plants

15. Are you eat wild edible plants as supplementary food?

  Cod 1 agree   1childran 2yougth and women 3passenger, hunter and guests

 2 disagree   1childran   2youth and women 3passenger, hunter and guests

16. Where did you obtain honey from? How many Kg do you get in a year before and at a moment?

   Before 2000EC   after 2000EC

Cod   1   2   3   4   cod   1   2   3   4

     12kg   6kg   7kg   8 kg   1kg   5kg   8kg   3kg

17. What are the positive impacts of woody species deforestation?

18. Whatare the possible solutions to conserve and sustain forest and forest resource for generation?

cod 1 making dam   2 planting tree   3 both

Questionnaires for data collection

Name of data collector ---age ---------------sex -------------

Address------------------------

Name of Respondent ---age--------------------sex---------------

Address --------------------------

II. Questionnaires for experts and professionals

1 How many hectares of land cover by natural forest before? At moment.?

Before 2000   after2000

Cod 180,000 hec   2, 79,900hec

2. How many hectares of land cover by plantation forest before? At moment?.

Before 2000   after 2000

6,000hec   5,550hec

3. Whatare the factors of deforestation? What the impacts of deforestation?

4. How many animals and birds species were lived in this forest before deforestation and at moment?

Before 2000EC					after 2000EC			
Cod	1	2	3	4	cod	1	2	3	4
	12	11	13	14		6	7	8	9

8.1Animals---

8.2Birds---

5. How many plants species were lived in this forest before and at moment?

Before 2000EC					after 2000EC			
Cod	1	2	3	4	cod	1	2	3	4
	102	91	83	64		5 6	4 7	3 8	30 9

6. What are the impacts of woody species deforestation on changing rainfall, temperature and humidity?

Before 2000EC					after 2000EC				
Cod	1	2	3	4	cod	1	2	3	4
Rainfall	1000mm	1020mm	1010mm			900mm	950mm	700mm	600
Tem	$14c^0$	$15c^0$	16c0	$17c^0$ $18c^0$		20c0	21c0	22c 0	23c 0 24c0

7. What is the role of munesa forest project to reduce carbon sink that affect environment?

8. How many cubic meters of soil could be loss per year?

Cod 1 1000 cubic meters   2 2000meters 3, unknown

9. What are the possible solutions to reduce soil erosion and environmental change?

10. How Munesa forest project works to sustain forest management and conservation to benefit community and to keep natural resource?

cod 1 conservation   2 protection   3 both

Gaafannooragaanittiinfunannamu

Maqaanama raga funanuu---------------------------saala ----------------umrii----------

Teessoo------------------------------

Maqaagaafatamaa raga-------------------------------saala ----------------------umrii----------

Teessoo ----------------------------

1.ciramuunbosonaajireenyaqoteebulaa fi naannooirrattidhiibbaageessajetteeyaaddaa?

Cod   1.eeyyee   2 lakki

2 .lafasangaatokkooirraaBoqqolloo,Qamadii,Garbuu fi dinichaakumtaalameeqaargatta ?

   Bara 2000dura   2000 booda

   Cod   1   2   3   4   cod   1   2   3   4

        5ku   6ku   7ku   8 ku   2ku   3ku   4ku   4 ku

BO Q2.1--

QA Q2.2 --

GAQ2.3---

DI Q2.4---

3.ciramuunBosonaa loon keeirramiidhaamaalfide?guyyattisa'itokkoaannan L meeqabaha?

   Bara2000 dura   2000 booda

Cod   1   2   3   4   cod   1   2   3   4

        5L   6L   7L   8 L   1L   1.5L   2L   3L

4.sooratabilcheessuufboba'aaeessaaargattu?

Cod 1 Biqilootabosonaa 2 kosiiloonii 3 Elekitiriikii

5.meeshaaleemanaafiomishaaheduumaaliirraatolichituu?

Cod 1 pilaastika 2sibiila 3 muka 4suphee

6.dawaaaadaaofiifibeeladootaeessaaargatta ?

Cod 1bineensota   2 Biqiltoota   3 laeenuu

7.kanaandurawaggattidamma kg meeqaargatta ?ammahoo?

   Bara 2000dura   2000booda

Cod   1   2   3   4   cod   1   2   3   4

      12kg   6kg   7kg   8 kg   1kg   5kg   8kg   3kg

8. Bineensotaafisimbirootagosameeqatubosonakeessajiraataaturan ?ammahoo?

      Bara 2000 dura   2000booda
      Cod   1   2   3   4   cod   1   2   3   4
            12   11   13   14   6   7   8   9

8.1Bin--

8.2Sim--

9.biqiltootagosameeqatubosonakeessajiraataaturan ?ammahoo?

      Bara 2000dura 2000booda

   Cod   1   2   3   4   cod   1   2   3   4

         102   91   83   64   5 6   4 7   3 8   30 9

10.ciramuunbosonaahammaroobaa fi ho'iinsanannooirrattijijjiramamaal fide ?

      Bara 2000 dura   2000 booda
      Cod   1   2   3   4   cod   1   2   3   4

Q10,1HRO   1000mm 1020mm 1010mm   900mm 850mm 700mm 600

Q10.2 Tem $14c^0$ $15c^0$ 16c0 $17c^0$$18c^0$ 20c0   21c0   22c 0   23c 0   24c0

11.Biyyookubikimeetiriimeeqatuwaggattiharama ?

Cod 1 $1000m3$ 2 $2000 m3$ 3, hinbeekkamu

 12.furmaanniharamabiyyoo fi jijjiramanaannohir'isuufgodhamumaaljetteeyaadda?

Cod 1 daagaatolchuu   2.biqiltoota dhaabuu

 13.haallidhabbannibosonaMunessaashashaanneehaalaittifuufinsaqabuunbosona   kana kunuunsedhalootadabarsuufhojjatumaalfakkaata?

Cod 1 gaarii   2 baay'eegaarii

Gaafannooragaanittiinfunannamu

I.odeffannooQoteebulaairraafunaanamu

Maqaanama raga funanuu---------------------------saala -----------------umrii----------

Teessoo------------------------------

Maqaagaafatamaa raga--------------------------------saala ----------------------umrii---------

Teessoo ---------------------------

1.ciramuunbosonaajireenyaqoteebulaa fi naannooirrattidhiibbaageessajetteeyaaddaa?

Cod   1.eeyyee   2 lakki

2 .lafasangaatokkooirraaBoqqolloo,Qamadii,Garbuu fi dinichaakumtaalameeqaargatta ?

    Bara 2000dura   2000 booda

    Cod   1   2   3   4   cod   1   2   3   4

      5ku   6ku   7ku   8 ku   2ku   3ku   4ku   4 ku

Boqqolloo Q2.1---

Qamadii Q2.2 ---

Garbuu Q2.3---

Dinnicha Q2.4---

3.ciramuunBosonaa loon keeirrattimiidhaamaalfide?guyyattisa'atokkoaannan L meeqabaha?

    Bara2000 dura   2000 booda

Cod   1   2   3   4   cod   1   2   3   4

    5L   6L   7L   8 L   1L   1.5L   2L   3L

4.kanaandurawaggattidamma kg meeqaargatta ?ammahoo?

    Bara 2000dura   2000booda

Cod   1   2   3   4   cod   1   2   3   4

    12kg   6kg   7kg   8 kg   1kg   5kg   8kg   3kg

5.sooratabilcheessuufboba'aaeessaaargattu?

Cod 1 Biqilootabosonaa 2 kosiiloonii 3 Elekitiriikii

6.meeshaaleemanaa fi omishaaheduumaaliirraatolichituu?

Cod 1 pilaastika 2sibiila 3 muka 4suphee

7. dawaaaadaaofii fi beeladootakeetiifeessaaargatta ?

Cod 1bineensota   2 Biqiltoota   3 laeenuu

II.Gaafannooiksipartii fi ogeeyyiinqofaanguuttamu.

1. Bineensotaa fi simbirootagosameeqatubosonakeessajiraataaturan ?ammahoo?

	Bara 2000 dura								
Cod	1	2	3	4		cod	1	2	3	4
	12	11	13	14			6	7	8	9

1.1Bineensota ---

1.2Simbirrota ---

2.Biqiltootagosameeqatubosonakeessajiraataaturan ?ammahoo?

Bara 2000dura 2000booda

	Bara 2000dura				2000booda			
Cod	1	2	3	4	cod	1	2	3	4
	102	91	83	64	5 6	4 7	3 8	30 9	

3. Ciramuunbosonaahammaroobaa fi ho'iinsanannooirrattijijjiramamaalfide ?

	Bara 2000 dura				2000 booda			
Cod	1	2	3	4	cod	1	2	3	4
Q3,1HRO	1000mm	1020mm	1010mm		900mm	850mm	700mm	600
Q3.2 Tem	$14c^0$	$15c^0$	16c0	$17c^0$	$18c^0$	20c0	21c0	22c 0	23c 0	24c0

4.Biyyookubikimeetiriiimeeqatuwaggattiharama ?

Cod 1 1000m3 2 2000 m3 3, hinbeekkamu

5.furmaanniharamabiyyoo fi jijjiramanaannohir'isuufgodhamumaaljetteeyaadda?

Cod 1 daagaatolchuu   2.biqiltoota dhaabuu 3 lamaanu nit ta'a

6.haallidhabbannibosonaMunessaashashaanneehaalaittifuufinsaqabuunbosona   kana

kunuunsedhalootadabarsuufhojjatumaalfakkaata

Analysis data

Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Jemasardo	65	23.2	24.3	24.3
	Basakuilaala	68	24.3	25.5	49.8
	Shopajenet	67	23.9	25.1	74.9
	Bonbaasoreeji	67	23.9	25.1	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	172	61.4	64.4	64.4
	female	95	33.9	35.6	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

education leval

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Uneducated	97	34.6	36.3	36.3
	grade 1-8	97	34.6	36.3	72.7
	above grade 8	73	26.1	27.3	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

milk in L

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5LTO1.5L	264	94.3	98.9	98.9
	5LTO2L	3	1.1	1.1	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

fuel

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Plants	255	91.1	95.5	95.5
	cow waste	8	2.9	3.0	98.5
	Electricity	4	1.4	1.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

t.medicine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Drug	3	1.1	1.1	1.1
	Plants	264	94.3	98.9	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

WEPsuse

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Children	173	61.8	64.8	64.8
	Youngsterandwomen	70	25.0	26.2	91.0
	passenger,hunter and guest	24	8.6	9.0	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Maize

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6quto3qu	22	7.9	8.2	8.2
	8quto4qu	245	87.5	91.8	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

barley yield

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6quto4qu	29	10.4	10.9	10.9
	10quto6qu	238	85.0	89.1	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

potato yield

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15quto10qu	25	8.9	9.4	9.4
	20quto12qu	242	86.4	90.6	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

honey in kg

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7kgto5kg	30	10.7	11.2	11.2
	12kgto4kg	237	84.6	88.8	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

wheat yield

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6quto4qu	28	10.0	10.5	10.5
	10quto6qu	239	85.4	89.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Rainfall

rainfall					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1067mmto950mm	264	94.3	98.9	98.9
	1010mmto900mm	3	1.1	1.1	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Temp

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15cto21c	20	7.1	7.5	7.5
	18.79cto27c	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Statistics

		Table	Chair	Bed	yoke	Plough
N	Valid	267	267	267	267	267
	Missing	13	13	13	13	13
Mean		2.9251	2.9251	2.9251	2.9251	2.9251
Median		3.0000	3.0000	3.0000	3.0000	3.0000
Mode		3.00	3.00	3.00	3.00	3.00
Variance		.070	.070	.070	.070	.070
Range		1.00	1.00	1.00	1.00	1.00
Sum		781.00	781.00	781.00	781.00	781.00

Table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	50to600birr	20	7.1	7.5	7.5
	50to700birr	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Chair

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25to 400birr	20	7.1	7.5	7.5
	25to 550birr	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Bed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	300to800birr	20	7.1	7.5	7.5
	300to9,700birr	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Yoke

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7to200birr	20	7.1	7.5	7.5
	7to250birr	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Plough

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10to250birr	20	7.1	7.5	7.5
	10to300birr	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Cow

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5 tonocow	68	24.3	25.5	25.5
	6to3cow	175	62.5	65.5	91.0
	10to5cows	24	8.6	9.0	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Ox

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1tono ox	65	23.2	24.3	24.3
	2pair to1pair ox	176	62.9	65.9	90.3
	6to 3ox	26	9.3	9.7	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Sheep

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5tono sheep	38	13.6	14.2	14.2
	10to5sheep	154	55.0	57.7	71.9
	20to15 sheep	75	26.8	28.1	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

Goat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5tono goat	12	4.3	4.5	4.5
	8to4goats	15	5.4	5.6	10.1
	10to 5 goats	240	85.7	89.9	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		

No	Local name	Scientific name /genera &species name	Family	Habit

Statistics

		honey in kg	milk in L
N	Valid	267	267
	Missing	13	13
Mean		2.9251	2.0112
Median		3.0000	2.0000
Mode		3.00	2.00
Variance		.070	.011
Range		1.00	1.00
Sum		781.00	537.00

honey in kg

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	7kgto5kg	20	7.1	7.5	7.5
	12kgto4kg	247	88.2	92.5	100.0
	Total	267	95.4	100.0	
Missing	System	13	4.6		
Total		280	100.0		