



**Potential Opportunities and challenges of tree plantation in Albuko  
Woreda, South Wollo, Ethiopia**

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**Approval Sheets**

This is to certify that the thesis prepared by **Mekbib Melaku**, entitled, “**Potential opportunities and challenges of tree plantation in Albuko woreda, south wollo Zone, Ethiopia,**” and submitted to the partial fulfillment of requirements for the degree of master of art in Geography and Environmental Studies compiles with the regulation of the University and meets the accepted standards with respect to originality and quality.

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## **Statement of Declaration**

I, the undersigned, declare that this thesis entitled “**Potential opportunities and challenges of tree plantation in Albuko woreda, south wollo Zone, Ethiopia,**” is my original work, prepared under the guidance of **Dr. Asmamaw Legas** .All sources of materials used for the thesis have been duly acknowledged. I further confirm that the thesis has not been presented either in part or in full for the purpose of earning any diploma or degree in any other higher learning institution.

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## List of Acronyms

|                   |   |
|-------------------|---|
| A.S.L             | Above Sea Level   |
| AWARDB            | <i>Albuko Woreda</i> Agriculture and Rural Development Bureau |
| AWHB              | <i>Albuko Woreda</i> Health Bureau                            |
| CAS               | Central Statistical Agency                                    |
| ECRGES            | Ethiopia Claiming Resilient Green Economy Strategy            |
| FA                | Food and Agriculture Organizing                               |
| FDRE              | Federal Democratic Republic Of Ethiopia                       |
| GHG               | Greenhouse Gases  |
| GOE               | Government of Ethiopia  |
| Ha                | Hectare   |
| Km                | kilometers  |
| MA                | Millennium Assessment   |
| REDD <sup>+</sup> | Reducing Emission From Deforestation And Forest Degradation   |
| UNESCO            | United Nations Education Science and Cultural Organization    |
| FGD               | Focus Group Discussion  |
| MS                | Mean Score  |
| RII               | Relative Importance Index                                     |
| ANOVA             | Analysis of variances   |
| SPSS              | Statically Package for Social Sciences                        |
| EVA               | Equal Variances Assumed                                       |
| EVNA              | Equal Variances Not Assumed                                   |
| MD                | Mean Difference   |
| CI                | Confidence Interval of The Difference                         |
| BG                | Between Group   |
| WG                | With in Group   |
| MOA               | Minister of Agriculture                                       |
| MEFCC             | Minister of Environment and Forest and Climate Change         |
| EFCCC             | Environment and Forest and Climate Change Commission          |
| ABD               | African Development Bank                                      |
| SDGs              | Sustainable Development Goals                                 |
| GLI               | Green legacy Initiatives                                      |

## **ABSTRACT**

*Ethiopia hopes to achieve 50% of its total domestic greenhouse gas (GHG) emissions abatements potential by 2030. To this end, the country is engaged in various tree plantation under takings and plans to scale up good practices (FDRE: ECRGES, 2011). As part of the country Albuko woreda undertaking tree plantation process. The objective of this study is to assess the potential opportunities and challenges of tree plantation in Albuko Woreda as well as the perceptions of the community for tree plantation. To meet this objective, cross-sectional research design was implemented with qualitative and quantitative research methods. From a total of 17 kebeles, 2 kebeles having a total of 2684 farmers were selected by multi-stage sampling technique. The researcher used purposive sampling technique to identify sample kebeles. For this study, both primary and secondary data were used. Questionnaire, key informants interview and focus group discussions, field observation were employed to collect primary data. A total of 114 households were covered by the questionnaire in a mix of closed and open-ended questions. Both qualitative and quantitative methods were used for data analysis and the later included descriptive statistics and inferential statistics. The data were checked for completeness, coded, entered, and analyzed using SPSS version 2022. Descriptive and inferential statistical technique such as  $X^2$  and t-test, chi-square test, ANNOVA were also used. The result reveals that the potential opportunities for tree plantation were availability of comfortable environment for plantation like soil types and areas (sites) such as along roadsides, mountain, around farmlands, etc., interests and Starting tree planting campaign (green plant legacy) in national level in high degree level with MS values of 4.05, 3.95 and 3.69, respectively. , unlimited using of lands for livestock grazing (crops) and encroachment by livestock (MS=4.8, RII =0.96), less seedling availability: lower production of seeds, high cost of seeds and lack of trends on seed sowing and cultivation (MS=4.73, RII =0.946), lack of nurseries and lack of tree species that you have wanted to plant (MS=4.56, RII=0.912), lack of water sources (MS=4.56, RII=0.912), lack of land sizes (MS=3.93, RII =0.786), lack of insight learning (people awareness) (MS=3.90, RII=0.78), lack of tree substitution culture (MS=3.83, RII =0.766) and human influences like increasing demand for wood products (for fuel and construction) (MS=3.72, RII=0.744) were the most eight significant challenges for tree plantation. The community were asked to identify their perception about primary solutions for overcoming the difficulties of growing trees, as analysis revealed that make the people educated (28.9%), give consideration for policy formulation and enforcement (17.5%), and selection of suitable species (14.9%) were the most solutions to overcome the drawbacks for tree plantation. Therefore, the woreda Office of Agriculture and natural resource in collaboration with other stakeholders must work intensively to use the opportunities for tree plantation and combat the challenges of tree plantation farmers in the study area.*

**Keywords;** tree plantation, opportunities of tree plantation, challenges of tree plantation, perception of the community for tree plantation.

# CHAPTER ONE

## 1. INTRODUCTION

### 1.1 Background of the study

A significant portion of the global forest has been lost or damaged, and the issue is still present. The Food and Agriculture Organization of the United Nations (FAO) estimates that between 2000 and 2010, 13 million hectares (ha) of forest were lost to natural causes or converted to other uses, while in 1990, 16 million ha were lost annually due to land use change. Africa's woods and woodlands are thought to encompass 675 million hectares, or 23% of the continent's total land area (African Development Bank, 2018). The continent's forests provide food, energy, and income for several hundred million people and serve as a safety net in rough times (FAO, 2018). Ethiopia and other developing nations rely heavily on their forests and forest resources for their daily needs. Furthermore, research suggests that forests and tree-based ecosystems can act as a safeguard for livelihoods, act as a natural insurance policy, and offer environmental services including carbon sequestration, water protection, and biodiversity preservation.

Additionally, locals gain socially and culturally from woodlands. Though the net loss of forest area has significantly decreased since 1990, deforestation and forest degradation remain widespread in many parts of Africa. With a loss of 3.94 million hectares year, Africa saw the largest net loss of forest area between 2010 and 2020 (FAO and UNEP, 2020). In a similar vein, Ethiopia's forest cover, which at the start of the century accounted for over 40% of the country's total land area, decreased to 3% in the 1970s and 1980s.

The nation's land cover percentage covered by forests increased to 15.7% (MEFCC, 2018). Research indicates that the average annual net deforestation rate is around 72,000 hectares (MEFCC, 2018). Because of this, afforestation and reforestation efforts to restore damaged areas are essential to the nation.

Ethiopia has just started to take action to restore degraded forests and forest areas. Ethiopia is a country with a long history of severe deforestation, particularly in the central and northern highlands, where subsistence farming and communities have been altering the terrain for millennia. The majority of the nation's surviving natural highlands are located in the southwest, which until recently was a remote and inaccessible area. Until the early 1900s, people and political centers dealt with the shortage of forest products, particularly wood, by producing cloth from forested areas. However, in the 1890s, Ethiopian Emperor Minilik II promoted an alternative strategy involving re-greening through afforestation and replanting (FAO,1978).

There are more than 90 million people living in the nation, and biomass provides more than 90% of their energy needs. Reductions in the amount of woody biomass produced by UN-mandated sustainable harvesting from natural forests and woods have increased the gap between supply and demand. Due to the high number of imports, the low level of industrial supply from domestic production is offset.

The need to lessen deforestation and forest degradation is becoming increasingly apparent. The government of Ethiopia (GOE) named the forestry industry as one of the cornerstones of the green economy the nation intends to establish by 2030 in its policy statement from December 2011. Ethiopia aims to achieve 50% of its total domestic greenhouse gas (GHG) emissions abatements potential by 2030. The government has set the following major targets for the forestry sector: afforestation on 2 million ha, reforestation on 1 million ha, and improved management on 3 million ha of natural forests and wood lands in order to achieve this, the nation is working on a number of forest and tree plantation initiatives and has plans to expand effective methods (FDRE: ECRGES, 2011). As of right now, Ethiopia can cover 23.6% of its territory with greenery, according to a report from the Ethiopian government (EBC News,2023).

The study area covers 14% of its total area 50937.05 kilometer square with plants in 1998 and 18% in 2015 E.c, according to the statistics of Albuko woreda Agricultur and natural resource development office. The goal of this study is to investigate or evaluate the potential opportunities and difficulties associated with tree plantation in Albuko woreda, a woreda of Ethiopia, in Amhara regional state.

## **1.2 Statement of the Problem**

According to studies conducted in certain regions of Ethiopia, there has been an increase in forest cover in the northeastern Ethiopian highlands since 1961 (Meire et al., 2013). This includes the region's southern and eastern regions (Teka et al., 2014; Woien, 1995), the wollo in northern Ethiopia since the 1930s (Crummey, 1998), and the chimoga watershed in northwestern Ethiopia (Bewket, 2002). But most scientists now concluded that there is a decline in many areas of Ethiopia, and the Millennium Assessment (MA, 2005) listed Ethiopia as one of the 29 nations that had lost more than 90% of its natural forest cover. Presently, Ethiopia's high woodlands are mostly found in its south-eastern and south-western regions( MA, 2005).

Millions of small-scale farmers rely on the forests of southwest Ethiopia, which are home to a variety of species and ecosystem services such as wild coffee, spices, forest honey, and a range of other timber and non-timber forest products (Gole, 2013; Senbeta and Danich, 2006; Tadesse, et al, 2014). But these forests are also constantly being destroyed, and they are being connected to adjacent agricultural fields (Dessie et al., 2007).

Ethiopia has recently made major progress in the worldwide "Reducing Emissions from Deforestation and Forest Degradation" (REDD+) project, which is a cornerstone of Ethiopia's National Climate Resilient Green Economy Strategy (Ethiopian, 2011), with assistance from the UN-REDD program. Monitoring, improving, conserving, and managing forests sustainably are some of the objectives of this endeavor ( Bekele et al., 2015:). Under this endeavor, the Ethiopian government is in charge of accounting for the current forest extents and preserving forests in a sustainable manner moving forward. There is a national need for accurate and reliable maps of the changes in forest cover since REDD+ requires reports to quantify greenhouse gas emissions and reductions from forests, among other sectors.

According to estimates from the FAO in 1990, there were 189,000 hectares of forest plantation. The plantation grew to 216,000 hectares in 2000 and 419,000 hectares in 2005. As of right now, the estimate is 972,000ha, derived from data collected in 2010. 190,400ha, or 20 percent, of the entire area of planted woods are categorized as commercial plantations that gives wood for poles and swan wood. Large portions of the age class structure are found in the older age classes, which reflect the recent decline in the rate of plantation establishment. The remaining 80% consist primarily of woodlots and farm-grown trees on non-industrial estates. Together with NTFPS, these plantations also generate building and fuel wood. The area of plantations in relation to total forest area of the country increased from 3.2% in 1990 to 3.8% in 2005 (FAO, 2005).

The Green Legacy Initiative recently launched a nationwide tree planting campaign throughout Ethiopia in 2019G.C. with the goal of re-greening the nation, lowering soil erosion and environmental degradation, containing the effects of climate change and achieving environmental balance, as well as generating employment opportunities and achieving food security. Albuko woreda is taking part the tree-planting initiative as a component of Ethiopia. Accordingly, the research makes an effort to close this gap by utilizing descriptive and inferential data analysis techniques in the study area to evaluate the potential opportunities and challenges of tree plantations.

In the study area, the *Albuko Woreda*, the potential opportunities and challenges of forest or tree plantation practice has not been investigated. In addition, there was no well-organized and documented data or information on the opportunities and challenges of tree plantation, the perception of the population on tree plantation, rate of forest declining from year to year, and the green legacy campaign in *Albuko Woreda* and in the study *kebeles* in particular are the main gaps to be address. Therefore, the primary concern of this research is to assess the opportunities and challenges of tree plantation, that don't treat still in the study area.

### **1.3 Objective of the study**

#### **1.3.1 General objective**

The general objective of this study is to assess the potential opportunities and challenges of tree plantation in *Albuko woreda*, wollo, Ethiopia.

#### **1.3.2 Specific Objectives**

This study incorporates several specific research objectives in line with the general objective of the study, the specific objectives of the research attempts to;

- ❖ Examine the opportunities for tree plantation in the study area.
- ❖ Identify the major challenges of tree plantation in the study area.
- ❖ Evaluate the perceptions of the community for tree plantation in the study area.
- ❖ Investigate the relationships and effects of major variables with and with out tree plantation.

### **1.4 Research Questions and Hypothesis**

To achieve the objectives stated in the above, the following research questions or hypothesis were formulated based on the above objectives.

- What are the potential opportunities for tree plantations in the study area?
- What are the major challenges for tree plantation in the study area?
- How has been the perception of the community for adoption of tree plantation in the study area?
- $H_0$ : Households adoption of tree plantation not related to their demographic and socio-economic determinants.

## **1.5 Significance of the study**

Even though, the study is carried out for academic purpose and confined to single *Woreda*, the findings will contributing to deepen knowledge about the challenges of tree plantation and opportunities of tree plantation as well as from tree plantation practiced in general and in the study area in particular. Therefore, the outcome of this study will used to identify the challenges and opportunities of tree plantation in the study area. Which in turn expected to contribute to have better understanding of the kind of challenges facing during tree plantation and the solution to be taking as well as the opportunities for tree plantation and from tree plantation by the study area community. In addition, the study result is expected to serve as a reference material for further research under takings in the area or other area. It also gives a hint about the challenges and opportunities of tree plantation (green legacy) as a whole.

## **1.6 Organization of The study**

The thesis is organized into five interconnected chapters, beginning with this introduction. Chapter one provides essential background information on the study. Chapter two situates the research within the existing literature, examining the opportunities, challenges, and perceptions related to tree plantations. It also reviews relevant studies, highlighting key findings and identifying knowledge gaps that need further exploration, which helps to shape the study's purpose and central research questions. Chapter three describes the biophysical characteristics of the study areas, the methods used to collect primary and secondary data, and the approaches followed in analyzing both spatial and socio-economic data. Chapter four presents the study's core findings, discussing them in relation to existing knowledge and linking them to the study's objectives, central questions, and overall framework. Finally, chapter five offers concluding remarks, discussing the implications of the findings for addressing the challenges, opportunities, and perceptions in the study areas, and suggesting recommendations.

## **1.7 Operational Definitions of Terms**

- **Tree Plantation:** The act of planting tree seedlings in various locations such as gardens, farmlands, roadsides, and government-controlled areas.
- **Deforestation:** The indiscriminate destruction of natural vegetation in an area without adequate replacement.

- **Green Legacy:** An ongoing tree plantation campaign in Ethiopia, initiated in 2011 e.c(NDC,2020).
- **Agroforestry:** Land use practices that integrate trees with pasture and crops(Hoeskstra,1990).
- **Social Forestry:** The management of forests to benefit local communities.
- **Zone:** The third level in the administrative structure of the Federal Democratic Republic of Ethiopia (FDRE).
- **Woreda:** A local administrative unit, larger than a Kebele but smaller than a Zone.
- **Kebele:** The smallest administrative unit in Ethiopia, adjacent to the Woreda.
- **Rural:** Characteristic of areas located far from large towns and cities.
- **Qolla:** An agro-climatic zone in Ethiopia, with altitudes ranging from 500 to 1,500 meters above sea level and average annual temperatures between 20°C and 30°C.
- **Woina Dega:** An agro-climatic zone in Ethiopia, with altitudes ranging from 1,500 to 2,400 meters above sea level and average annual temperatures between 15°C and 20°C.

## **CHAPTER TWO**

### **2. LITRETURE REVIEW**

#### **2.1. The concept of tree plantation and forest**

The UN's agency for food and agriculture, FAO, defined a forest according to this concept. A forest, according to FAO standards, has a minimum land size of 0.05-1ha, a tree crown cover of more than 10-30%, and mature trees that reach a height of 2-5 meters. Young natural stands and all plantations established for forestry purposes that have not yet reached a tree height of 5 meters or a crown density of 10%, according to FAO, are included under forest as an area that normally forms part of the forest area and is temporarily un stocked due to natural causes or human intervention, but which are expected to return to forest. Ethiopia defines a forest as an area with more than 0.5 hectares and a minimum height of 20 meters, covered by trees (both natural and cultivated, including bamboo) that reach a maturity height of more than 2 meters and have a canopy cover of more than 20%. As a result, both natural forests and plantations are considered forests (FAO,2020).

#### **2.2. The contribution of forest development in Ethiopia**

##### **2.2.1. For food security and poverty alleviation**

For their welfare and means of subsistence, people living in mountainous regions mainly depend on forest resources. Ethiopia is mostly an agrarian nation, with over 90 million people living in rural areas. For generations, numerous rural people in Ethiopia have been residing in places surrounded by vegetation, relying on the harvest of timber and non-timber forest products for their subsistence.

People can get food, housing, oxygen, recreation, and both timber and non-timber forest products from forests. They are the source of more than 5000 commercially traded products. The main contributions of forest development is that it provide various types of forest products that can make to the livelihoods of the rural poor through increasing incomes, improving food security, reducing vulnerability and enhancing wellbeing. In an agrarian society such as Ethiopia, forestry can have a major impact on the development of the local and national economy. In fact, the contribution of forestry to Ethiopian GDP has been very low as a proportion of the whole economy and in relation to agriculture. The forestry sector's primary contribution to the GDP of the country for the previous 10 years (2002–2011),

according to CSA, was 4.5%. Its share of the GDP decreased over time, from 6.3% in 2002 to 3% in 2011. Nonetheless, a different assessment places the forestry sector's contribution to the national GDP at 9% (CSA). The country's national economic accounts undervalue the economic significance of forest goods and services (CSA, 2012).

The majority of forestry operations occur in Ethiopia's rural areas, where afforestation, reforestation, and forest nursery operations all require a large workforce for construction and maintenance. Those who create incense, collect gum, sell charcoal, and gather firewood also profit from employment in the forest. Afforestation makes up around 34% of all jobs in the forestry industry, with the production of fuel wood responsible for about 50% of all forestry jobs. 2.8% of all jobs in the nation and 2.2% of all positions in the agriculture sector were in the forestry sector in 1988–1989 respectively. Numerous studies carried out throughout Ethiopia have revealed that forests account for roughly 27% of household income in some sections of Tigray, 39% in central Shewa, and 34% in the Bale area (ARTOAJ.MS.ID.556286, 2020).

### **2.2.2. Trees for combating Climate Change**

Climate change puts the entire world and developing countries like Ethiopia especially at risk. The implications of climate change are particularly severe in countries like Ethiopia, where the agricultural sector is crucial to overall economic success. Based on empirical study on climate change and the sector, Ethiopia's agriculture industry is significantly impacted by land degradation caused by deforestation, just as other sub-Saharan African countries. Several empirical studies show that farmers employ a range of climate-smart agricultural practices, like planting trees, to adapt to the consequences of climate change (Abegunde et al., 2019). Indeed, trees play a crucial role in mitigating the consequences of climate change by absorbing carbon dioxide (CO<sub>2</sub>) from the atmosphere.

Through the process of photosynthesis, trees take in CO<sub>2</sub>, store it in their biomass (trunks, branches, leaves, and roots), and then release oxygen back into the atmosphere. Lowering the concentration of CO<sub>2</sub>—a major greenhouse gas that contributes to global warming—is made possible by this organic process.

In addition to carbon sequestration, trees offer other environmental benefits, such as:

1. **Cooling Effect:** Trees provide shade and release water vapor through their leaves, helping to cool the surrounding air and reducing the urban heat island effect.

2. **Biodiversity Support:** Forests and wooded areas are home to a wide variety of plant and animal species, supporting ecosystems and biodiversity.
3. **Soil Conservation:** Trees help prevent soil erosion by stabilizing the soil with their roots and reducing runoff.
4. **Air Quality Improvement:** Trees can absorb pollutants and particulate matter from the air, improving overall air quality.

In addition to helping the government combat the effects of climate change brought on by deforestation and desertification, the GLI makes a variety of contributions to society. The primary categories of contributions resulting from Green Legacy Initiatives are as follows:

**a) A sustainable supply of forest products:** When more land is covered by trees, then more forest products will be available. This will support millions of people for their livelihood. Food, firewood, spices, and medicinal plants are all provided by trees.

Since biomass is the dominant source of energy for households in Ethiopia, tree planting help increase availability of energy supply. This is in line with the energy policy of the country in that renewable energy sources should increase and more trees should be planted in order to satisfy the growing demand for energy.

**b) Awareness creation:** As this is initiated by the Prime Minister, people become better aware of the role and importance of tree planting. People will get the opportunity to interact with different people and learn about tree planting skills; learn about tree maintenance and protection, and natural resource management in general.

### **C) Job Creation:**

- **Seedling Preparation:** Preparing and nurturing seedlings for planting is a labor-intensive process, requiring many workers to manage nurseries, care for young plants, and ensure they are healthy and ready for transplantation.
- **Transporting Goods and Services:** The logistics of transporting seedlings, tools, and other materials to planting sites require a robust workforce, including drivers, loaders, and coordinators.
- **Planting and Maintenance:** Once seedlings are in the ground, ongoing maintenance is critical. This includes watering, weeding, and protecting the young plants from

pests and environmental stressors. A large number of unskilled laborers are often needed for these tasks.

As a result, reforestation and tree planting initiatives can create numerous job opportunities, especially in rural areas where employment options may be limited. Over the past four years, these activities have reportedly generated more than 700,000 jobs, demonstrating the potential of environmental projects to drive economic development while addressing climate change (pei et al,2018).

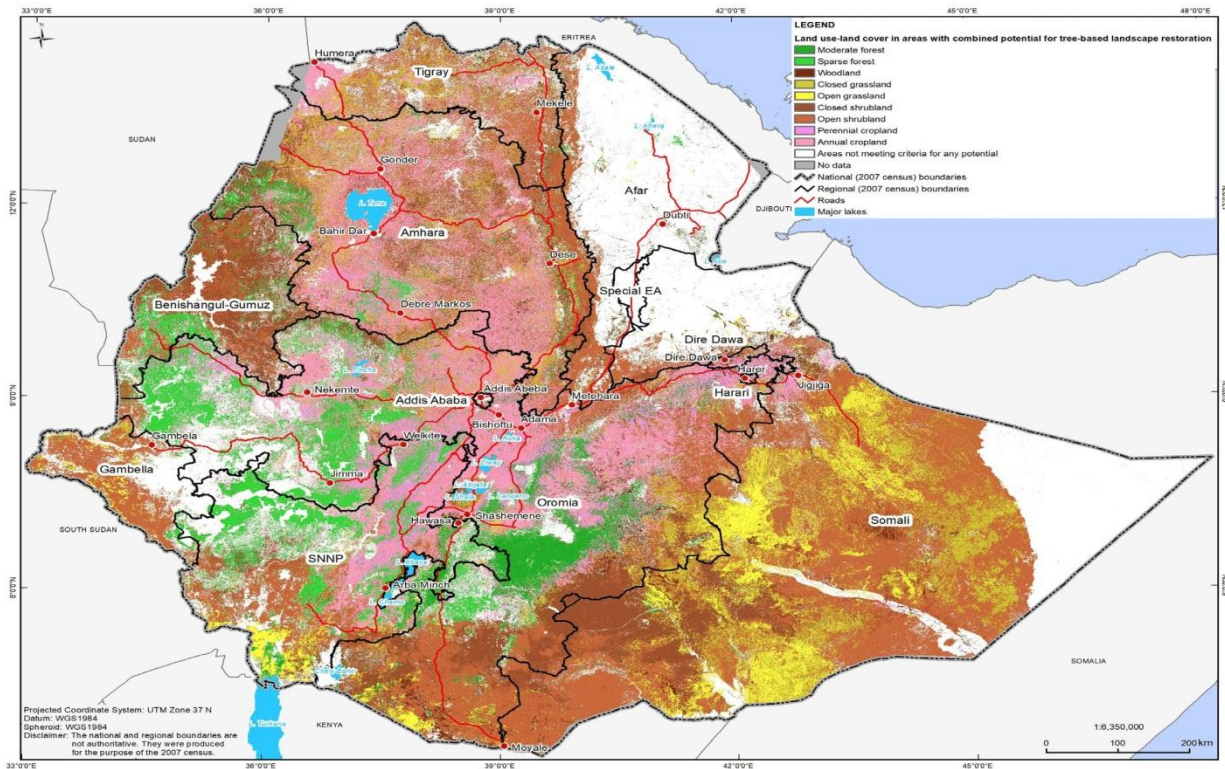
**d) Carbon finance;** Increased attempts to cover land with trees can aid in acting as a carbon sink, as trees can store atmospheric CO<sub>2</sub> as carbon in soils and plants. The planting of trees allows the nation to claim carbon credits (pei et al,2018).

**e) Improve air quality:** the quality of air at the local level would be improved because trees absorb carbon and produce oxygen. Trees help airborne dust and pollutants and hence clean air. **f) Conserve biodiversity:** trees are home to several types of species of insect, fungi, moss, mammals, and plants. For example, afforestation efforts in China results in an increase bird species diversity (Pei et al., 2018).

### **2.3 Forest degradation and its cause in Ethiopia**

It is known that before the start of the 19th century, 40% of Ethiopia's land area was covered in forest. Even with the abundance of biodiversity resources and the potential benefits that come with it, such as forests, the threats facing species and ecosystems now are the biggest that have been seen in recent memory.

Ethiopia is now dealing with several environmental issues. Ethiopia's forest resources are running out as a result of deforestation and forest degradation. Environmental degradation, or the process of gradually losing biodiversity and deforestation of biological (flora and fauna) and physical (soil, water, microclimate, etc.) resources of the land, is one of the main obstacles Ethiopia faces in its fight for agricultural development. The conversion of forest land to a permanent non-forest use, such as urban development, agriculture, or razing, is known as deforestation.



**Figure 2.1: The plant coverage map of Ethiopia**

Deforestation is a major issue that affects not only the forest sector but also crops, animal husbandry, water resources, and wildlife habitat, according to the national conservation strategy of the Federal Democratic Republic of Ethiopia (FDRE). As a result, people suffer from poverty and food insecurity. The country's high forest cover shrank from 16% in 1965 to 2.7% in early 1995 as a result of a large deforestation rate of 160,000 to 200,000ha/year. Ethiopia lost approximately two million hectares of forest between 1990 and 2005, with an average yearly loss of 140,000 hectares, according to (FAO,2005).

Various studies indicate that deforestation is a major concern in Ethiopia, contributing to land and forest degradation. The majority of the causes of this virtual degradation are mishandled human actions, either directly or indirectly. The situation is made worse by the world's fastest population growth, which aggravates the demand for unsustainable resource exploitation.

Ethiopia's continued population growth is directly associated with the destruction of its forests. Human activity is having a negative impact on Ethiopia's biodiversity. It is estimated that human activity accounts for 83% of the loss of endangered plant species. More population usually means more land needed for agriculture and habitation.

Due to the agricultural communities' strong reliance on forests and their declining standard of living, they have had to cut down trees and shrubs for fuel wood, produce charcoal for their own use as well as for sale and clear or burn forest resources for substance farming.

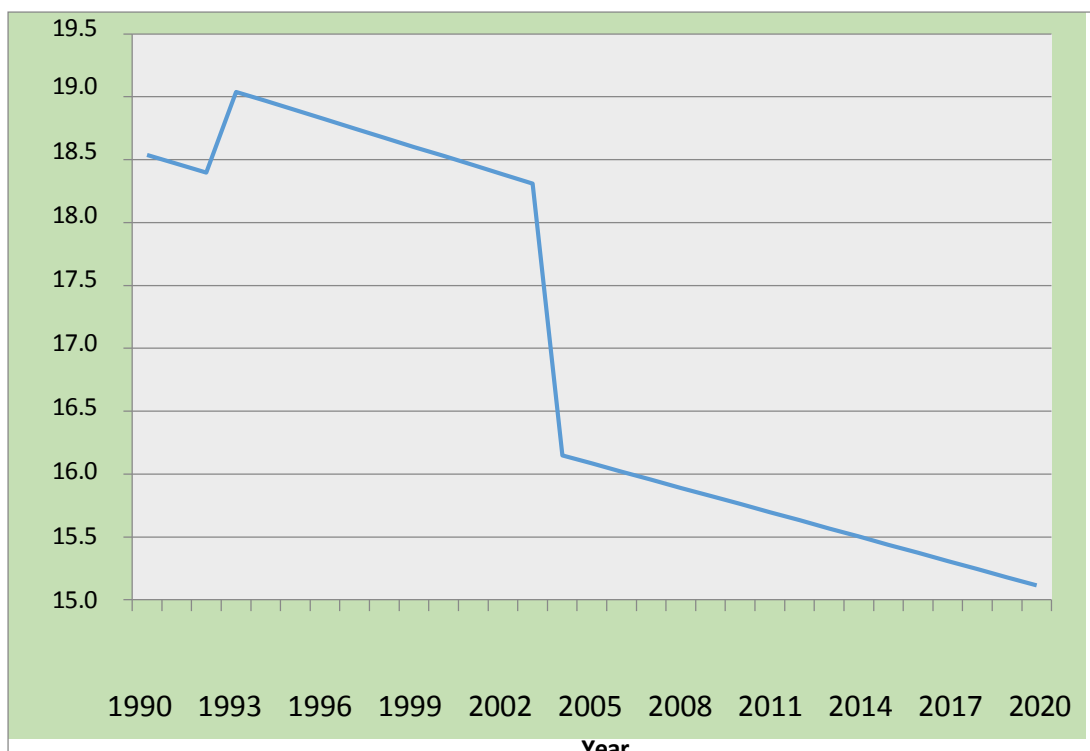
Similar to this, selective harvesting pressure was placed on some forest trees, especially indigenous species like *Cordia africana* and *Hagenia abyssinica*, due to rising demand and market value for forest goods like office and home furnishings. Consequently, there has been a considerable influence of human activity on forests, with an estimated 85,000 hectares of deforestation year on average.

Ethiopia's expanding population increases the demand for agricultural products and fuel wood, increasing the quantity of farmland required and placing increasing strain on the country's forest resources. The construction of infrastructure related to roads, energy, and water is also contributing to Ethiopia's deforestation and forest degradation. According to projections, if nothing is done to change the traditional development trend, a 9 million hectare area would become deforested between 2010 and 2030. In general, forests cover 2.2% of the country and 5.6% of the highlands, respectively, compared to 65% and 90% of the former. Ethiopia's population relies heavily on biomass energy for cooking; hence deforestation is a major problem.

Large-scale forest degradation at the national level is not the only alteration, though; significant changes in land cover have also taken place locally. The state of the forest ecosystem and its continued survival are significantly impacted by these changes at the local level( *Research Technology in Agriculture: An open-access journal*).

## **2.4 Ethiopian Forest Coverage Declining Trend**

In 2000, Ethiopia's percentage of land covered by forest cover was 18.5%. The nation has long been beset by serious problems. The most recent estimate (FAO, 2020) is 15.7%, corresponding to a total forest area of 17.22 million hectares. The conversion of forest lands to agricultural land is somewhat to blame for this. The majority of the nation's surviving, intact natural forests are found in the south-west and south-east of the country. The trends in the forest cover of the nation are displayed in Figure 2.3 below.



**Figure 2.2: Forest coverage declining trend in Ethiopia.**

Source: WB data on forest inventory (FAO,2020).

As shown in Figure 2.3, the forest cover has been declining for the last two decades.

## **2.5 Potential Opportunities of forestry development and conservation in Ethiopia**

There are numerous chances in Ethiopia to improve forestry development and conservation efforts. These opportunities include the presence of large land areas and diverse types of agro ecology (extensive areas for forest development (identified and demarcated), best practices on area enclosure, afforestation/reforestation programs, the presence of potential plantation species, Agro forestry practices, payments for environmental services such as carbon financing from REDD+, participatory forest management, and the existence of forest policies and legislations (the development and promotion of CRGE, watershed protection, increasing demand for organic forest products, participation of NGOs and donor support for in situ conservation of biodiversity).

The nation has been working toward various conservation measures, such as watershed management, afforestation and reforestation, restoration and rehabilitation initiatives, in order to mitigate various threats to the vegetation cover. It was discovered that these methods were

essential to achieving increased vegetation cover and helping the local population's standard of living.

### **2.5.1. Plantations in forest conservation**

Several varieties of eucalyptus make up the majority of the forest plantations in Ethiopia, accounting for over 50% of the total area. Since most plantation woods are monocultures, their biodiversity is low. Teketay and Feyera's (2001) study on the ecology of plantations and their management, however, suggested that plantations could encourage the regrowth of secondary natural vegetation.

Stated differently, when plantations age, numerous species of the natural flora re-enter them, and if they are destroyed and not replaced by new plantations, the natural vegetation will swiftly re-establish itself. It is widely believed in the country that eucalyptus trees, when planted near agricultural crops, impair crop yield and dry out streams and moist areas. Farmers and government plantations appear less concerned about the ecological and environmental effects of the main tree species in spite of these relationships.

Research findings suggest that eucalyptus are effective users of water. It was reported, for instance, that eucalyptus plantations in the Oromia region could generate 46.6 m<sup>3</sup> ha/year without decreasing water reserves, but conifers, acacias, and other broad-leaved species could only produce 16.4, 16, and 24.4 m<sup>3</sup>/ha/year of biomass, respectively. This demonstrates that eucalyptus produces more biomass with the same amount of water used, which is profitable economically (Tesfaye, 2006). It is commonly known that trees have an impact on climate change as well as that forests help mitigate climate change.

Additionally, studies are being conducted to demonstrate Ethiopia's planted trees' capacity to sequester carbon. Tesfaye (2007) estimated that the value of carbon sequestration for the Arsi forest was 8.5 million dollars annually and claimed that this value was higher than that of any other land use system in an effort to give a better understanding of the prospects arising from carbon financing.

### **2.5.2. The Green Legacy Initiative**

One of the main tenets of the CRGE strategy, which seeks to eliminate national emissions by 50% by 2030, is forestry. One of the four fast track initiatives for achieving the government's vision of a green economy is the national REDD+ program. Furthermore, the National Forest Sector Development Program aims to improve environmental services, such as emission

reduction, and catalyze GDP transformation in the sector. Therefore, as the CRGE policy states, forestry is seen as a crucial tool for lowering emissions while also acting as a buffer for emissions from other sectors.

In order to plant 4 billion trees, 200 million of which were to be planted in a single day of statewide mobilization, Ethiopia launched the Green Legacy Initiative in 2019 G.C. Women and girls made up 30% of the 23 million people that were mobilized for this operation. The project surpassed its initial target by planting 4.75 billion trees by the end of August 2019 (2.45 billion forest trees and 2.3 billion mixed agroforestry species). A world record of 354 million tree seedlings planted in a single day was set on July 30, 2019. This was an achievement that was generally acknowledged(NDC,2020).

To increase the survival percentage of tree seedlings, post-planting care was implemented after the plantation program. This included watering, weeding, and replacement planting. A recent average survival rate of 78% has been established. In this follow-up operation, roughly 13 million seedlings were replanted and 3.2 billion seedlings were supplemented by watering and weeding. The majority of plantation sites have relocation capabilities that allow for ground trusting evaluation. For example, there are 435 spatially referenced plantation locations in Amhara Regional State.

This demonstrates Ethiopia's deep understanding of the benefits of a national greening program that encompasses agroforestry, integrated water and soil resource management, the expansion of the forest sector, and the greening and regeneration of urban areas. In addition to assisting the country in achieving its long-term objectives for social, economic, and environmental development, this will help it fulfill its international commitments under the Paris Agreement, the 2030 Agenda for Sustainable Development, and the African Agenda 2063.

The efforts on the ground are guided by strategic documents such as the Climate Resilient Green Strategy, CRGE, and Economy the REDD+ strategy, the bamboo development strategy and action plan, and the ten-year national forest sector development program. For the next ten years, Ethiopians can follow these programs and policies, which are in line with global goals, for afforestation, restoration, urban greening, forest protection, and sustainable uses of forest resources (NDC Highlights; volume 1, no2, September 2020). Between 2011 and 2014 E.C., Ethiopia planted 25 billion tree seedlings; between 2015 and 2020 E.C., it

plans to plant an additional 25 billion tree seedlings. Additionally, 17 million hectares of plant cover were covered overall (NDC, 2020).

### **2.5.3 Community's Participation in Afforestation and Reforestation Programs**

There have been studies that look at households' willingness to take part in afforestation efforts, although the majority of these studies use a straightforward regression or correlation analysis with a binary or likert scale type of dependent variable. For instance, Liu et al. (2019) investigated the variables influencing rural families' engagement in afforestation initiatives using microeconomic data from Western China. To perform this study, however, the willingness of families was simply divided into four categories: forced willingness, neutral willingness, unwillingness, and positive willingness. The findings indicate that there is a positive willingness to engage in afforestation among families with more information channels, higher levels of satisfaction with the current forest structures, more funding for forestry activity, and lower degrees of cropland fragmentation in locations with high rainfall.

Salam et al. (2006) found that farmers who were involved in the Tree Farming Fund (TFF) and had favorable sentiments towards the initiative, together with higher incomes and educational attainment, demonstrated a greater inclination to pay. Free seedlings, food assistance, and free inputs are said to be the main elements driving participation in the planting program, according to a different study conducted in Ghana by Obiri et al. (2011). Inadequate extension services and a weak, ineffective organization were the other main barriers preventing individuals from participating.

The desire of the local population to take part in community projects like planting trees has generally been evaluated using several techniques. However, local populations' preferences for paying, say, for the rehabilitation of damaged lands have not been frequently valued using environmental valuation methodologies like the contingency valuation method (Beyene et al., 2021). There is a dearth of empirical research on the valuation of the forest sector overall. Empirical studies that are now available are Beyene et al. (2021), Broch et al. (2013), and Vedel et al. (2015).

Studies on forest value related to REDD+ have been conducted in Ethiopia. In evaluating community forestry in Ethiopia, Mekonnen (2000) found that socioeconomic factors such as household size, income, number of downed trees, distance from homestead to plantation site, and ssex of household head are important predictors of willingness to pay for community forests.

A comparable study on the valuation of participatory forest management (PFM) was carried out in the southwest region of Ethiopia by Gelo and Koch (2015). Dissanayake et al. (2015) used a choice experiment in another study to examine Ethiopians' preferences for REDD+ contract features. To align with the present government's goal of increasing plant cover and rehabilitating damaged lands, the local people must be actively mobilized and included in the tree planting effort. Therefore, it is preferable to research the locals' willingness to pay to take



part in the tree-planting initiative.



Source: Own Survey photograph, 2023.

**Figure 2.3:** *Participation of local communities in tree plantation.*

## **2.6. Determinants of Tree Planting**

There is a compelling case to be made for forestry in Africa, and Ethiopia in particular, given its significant potential to increase household income, government revenue, and assist the green economy (ADB, 2018).

Evidence suggests that, despite the advantages of trees for human livelihood, their significant role in mitigating climate change, and their fulfillment of the Sustainable Development Goals, there are still barriers to the decision to grow trees on private land and to people's participation in community-level afforestation/reforestation programs. The factors

influencing a household's decision to plant trees have been the subject of some empirical research (see, for example, Lee et al., 2020; Gessese et al., 2016; Mekonnen and Damte, 2011). These studies demonstrate the various socioeconomic and environmental elements that are believed to have an impact on tree planting decisions.

**1. Age of the Household Head:**

- Older household heads may have more experience and knowledge about the benefits of tree planting, making them more likely to engage in such activities.
- Conversely, younger household heads might be more open to adopting new practices and technologies related to sustainable farming and tree planting.

**2. Gender of the Household Head:**

- Gender can influence tree planting decisions, as cultural norms and roles often affect land management practices. In some communities, men may have more control over land and resources, while in others, women might be more involved in agriculture and environmental conservation.

**3. Family Size:**

- Larger families may have more labor available for tree planting and maintenance, increasing the likelihood of participation.
- However, larger families might also prioritize immediate food production over long-term investments like tree planting, depending on their economic situation.

**4. Land Size:**

- Households with larger landholdings are generally more likely to plant trees because they have more space and may see greater long-term benefits from agroforestry or reforestation.
- Conversely, households with smaller plots might focus on intensive cultivation of crops, leaving less room or incentive for tree planting.

**5. Education and Awareness:**

- Households with higher levels of education may be more aware of the environmental and economic benefits of tree planting, leading to greater participation in such initiatives.

**6. Income Level:**

- Wealthier households might have more resources to invest in tree planting, such as purchasing seedlings, fencing, and irrigation systems.

- On the other hand, lower-income households may rely on community or government support to engage in tree planting activities.

#### **7. Access to Resources and Support:**

- Access to information, technical support, and financial resources can also influence tree planting decisions. Households with better access to these resources are more likely to participate in tree planting programs.

Comprehending these factors is essential to creating successful tree planting initiatives that consider the various requirements and capacities of various homes. The success of such programs can be greatly increased by customizing tactics to match the unique socioeconomic situation of communities (Lee et al., 2020; Gessese et al. 2016; Kulindwa, 2016; Danquah, 2015; Mekonnen and Damte, 2011). On the other hand, different studies may find different amounts and sizes of tree plantations. For example, Danquah (2015) finds that large family sizes and an increase in the amount of farmed land utilized for grain production reduce a farmer's likelihood of taking part in voluntary tree planting in the target regions in Ghana.

When deciding on long-term projects like planting trees, tenure security is an important consideration. According to Boissiere et al. (2021), one of the keys to a successful tree planting project is ensuring that the local communities benefit from the trees and obtaining long-term rights. According to a 2015 study conducted in Ghana by Danquah, farmers' decisions to plant trees voluntarily are strongly and favorably influenced by their rights to secure land tenure. Mekonnen and Damte (2011) discovered that the quantity of trees planted by farm households in Ethiopia is influenced by several environmental, regional, and household factors.

For example, Kulindwa (2016) discovered a positive and significant correlation between Tanzania's tree planting volume and household awareness of the country's tree-planting initiatives. However, Tanzanian households' planting habits are negatively impacted by factors such as family size, planting attitudes, and the freedom to harvest and transport tree products (Kulindwa, 2016). Physical characteristics including the dynamics of soil erosion, the kind of land, the slope, and the size of the forest area are assumed to have an impact on household tree planting behavior (Danquah, 2015). (Gessese et al., 2016).

## 2.7. Ethiopia's Forest Challenges

Ethiopian woods offer social, economic, and environmental advantages, but they are also threatened by farmland expansion brought on by population growth, a rise in the need for fuel wood, unrestricted grazing, lax law enforcement, unstable tenure, etc. Based on an analysis of research on deforestation and forest degradation in Ethiopia, the following factors were found.

*i) Ploughing land expansion;* Based on available data, logging and agriculture are responsible for about 80% of the world's deforestation (Duker et al., 2019). Ethiopia's concerning population increase has resulted in deforestation to support increased agriculture, endangering the nation's forest sector (Bekele et al., 2015). The type of crops that are grown can affect how much forest is destroyed. The primary drivers of deforestation, according to the empirical data currently available, are smallholders (Solomon et al., 2018; MEFCC, 2017; EFCCC, 2017). In addition to small-scale farming, large-scale commercial farms are considered a significant contributing factor to the nation's deforestation (EFCCC, 2017).

*ii) Increasing demand for fuel wood;* the nation's active population expansion and urbanization are driving up demand for wood products (FSR, 2015). Another important factor contributing to the nation's deforestation is the exploitation of fuel wood for use as firewood and to make charcoal. The majority of the times, these fuel sources are illegally extracted by locals who are unaware of the effects of their actions on the environment (EFCC, 2017; MEFCC, 2016).

Ethiopia imports as well as produces its own timber and other forest products. The importation of wood goods, which could have been replaced by domestic production, has been funded by the country's foreign reserves. For instance, according to the EFCCC (2015), Ethiopia imported a total of USD 182.53 million worth of industrial wood goods in 2015. The same research also showed that the trend of imports had more than doubled between 2007 and 2015.

*iii) Overgrazing/free grazing* Over 81% of Ethiopia's population is thought to live in rural areas and is mostly dependent on agriculture, which includes raising livestock. Ethiopia, like other Sub-Saharan African nations, relies heavily on unrestricted grazing for animal rearing. Overstocking, overgrazing, and poor livestock management—which mostly relies on the free grazing system—are some of the main factors contributing to Ethiopia's declining natural resource quality (Melkie, 2020; Solomon et al., 2018; EFCCC, 2017). In a different study,

Legesse et al. (2019) presented a similar case, pointing to overgrazing as one of the causes of Ethiopia's forest loss.

**iv) Poorly planned infrastructural development** Infrastructure projects like roads and hydroelectric dams significantly worsen the nation's deforestation (Melaku et al., 2015). Nevertheless, the data is equivocal. For example, a recent study by Baehr et al. (2020) asserted that less heavily wooded areas in Cambodia are unaffected by the development of local infrastructure, especially roads. According to Legesse et al. (2019), one of the main factors contributing to deforestation in Ethiopia's southeast is road development. As previously mentioned in (i) above, the country's changing forest cover is significantly influenced by the growth of large-scale commercial agriculture.

Moreover, farmers may migrate into the remaining forest areas in search of agricultural land as a result of huge farms dispersing them, further deforesting the natural forest lands (Bekele et al., 2015). MEFCC (2016) states that large-scale agricultural investments, which are often made in areas with a lot of forest cover, are one of the main sources of deforestation in Ethiopia.

**v) Forest fires;** Large tracts of forest are damaged by forest fires in several regions of the country. The historic practice of using fire to clear forests in pursuit of more space for cultivation or to remove wild animals' dens, or to make charcoal, could be the root of the problem. Furthermore, the worrying population expansion makes forest fires more devastating. For instance, in Ethiopia's highlands, where population expansion is rapid, fires are the primary means of clearing forest area for agricultural use.

Smoking out wild bees so they can collect honey also starts forest fires. Melkie (2020) claims that fires—whether started by people or wildfires—are growing more frequent in the country's many regions (including North Gondar, Bale, and Benishangul Gumuz Regional State), severely endangering the nation's forest resources.

**vi) Frequent institutional restructuring;** the forestry sector suffers from frequent institutional upheaval, which has left it with an insufficient system for handling forest information and unable to manage forest resources sustainably. Over the previous four years, the forest sector has been reduced from a ministerial position to a commission, and it was recently reconstituted under the MoA as Ethiopian Forest Development (EFD). Moreover, the organizational structure at the regional level varies, and there are situations where it is unclear how one regional office relates to another.

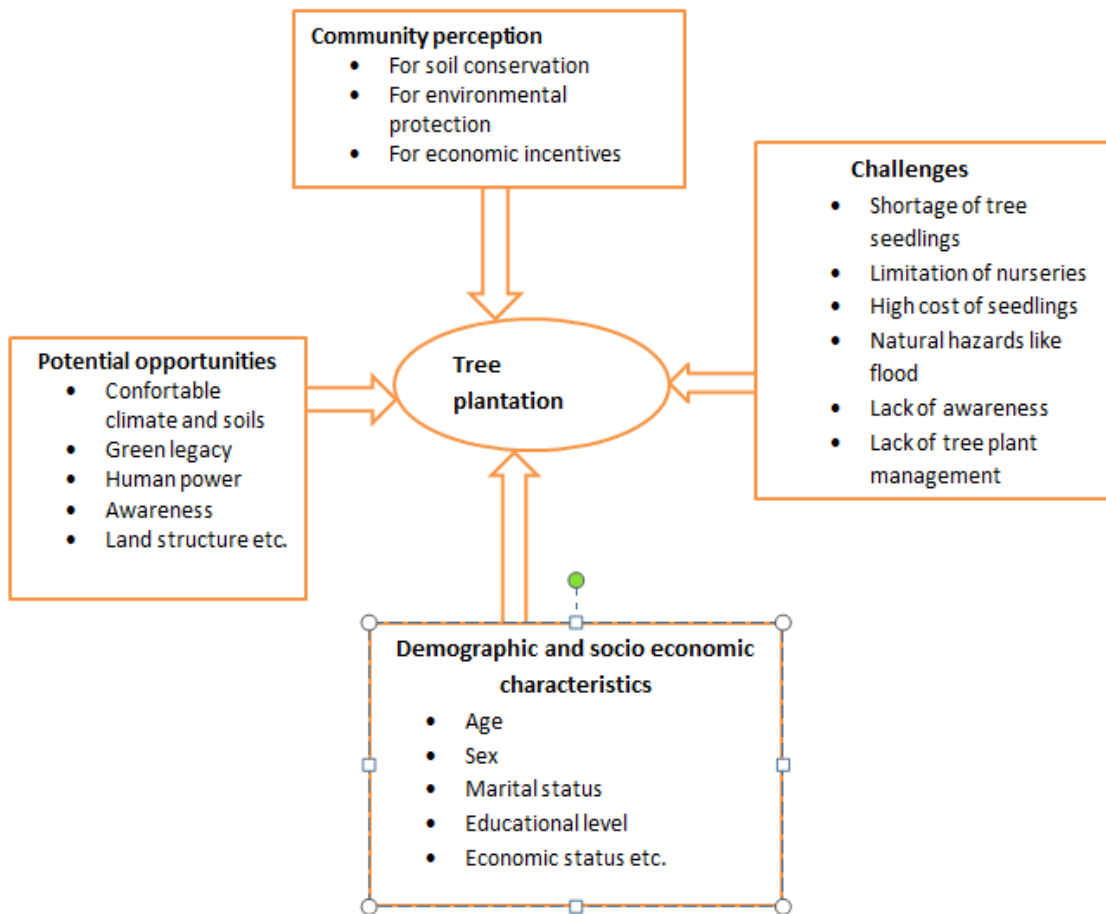
*vii) Tenure insecurity and weak enforcement;* Ethiopian deforestation has a number of underlying factors, including slack enforcement and uncertain tenure (EFCCC, 2017). Making long-term investment decisions requires tenure security. Investment in the sector is discouraged by Ethiopia's lax implementation of forest laws and the absence of tenure security brought about by the state's recognition of individual and community rights to forests (McLain et al., 2019). Communities and organizations are now able to possess ownership rights over woods thanks to the 2018 National Forest Law. The nation must enact and carry out relevant forest rules and recommendations in order to expedite the law's implementation (FDRE, 2018).

**viii) Lack of human and institutional capacity development:** This is essential to the forest sector's development. The availability of qualified human resources is essential to the entire cycle of sustainable forest management, encompassing the establishment and maintenance of forests and trees as well as the proper harvesting, processing, and marketing of products and services. A prerequisite for the effective development of a sector is the availability of people resources that are both productive and technically qualified. This includes attracting private sector investments. To attain the targeted growth and industrialization of the industry, the country needs to promptly address its skilled workforce scarcity. Generally speaking, a lot of other variables also affect Ethiopia's forest sector.

The difficulties the industry encounters must be resolved if forests and forest resources are to be beneficially utilized. It may be difficult to obtain significant emission reductions from reducing deforestation and degradation if these causes are not addressed.

## **2.8. Conceptual framework of the study**

The accompanying picture provides a schematic representation of the conceptual framework that will direct this study and address the opportunities and problems associated with planting trees and forests. The conceptual framework illustrates the connections between the possible opportunities of tree planting, the difficulties associated with planting trees in the study region, and the overall potential opportunities and difficulties associated with demographic and socio-economic variables and community perception.



**Figure 2.4: Conceptual Framework of the Study**

## **CHAPTER THREE**

### **3. DESCRIPTION AND RESEARCH METHODOLOGY**

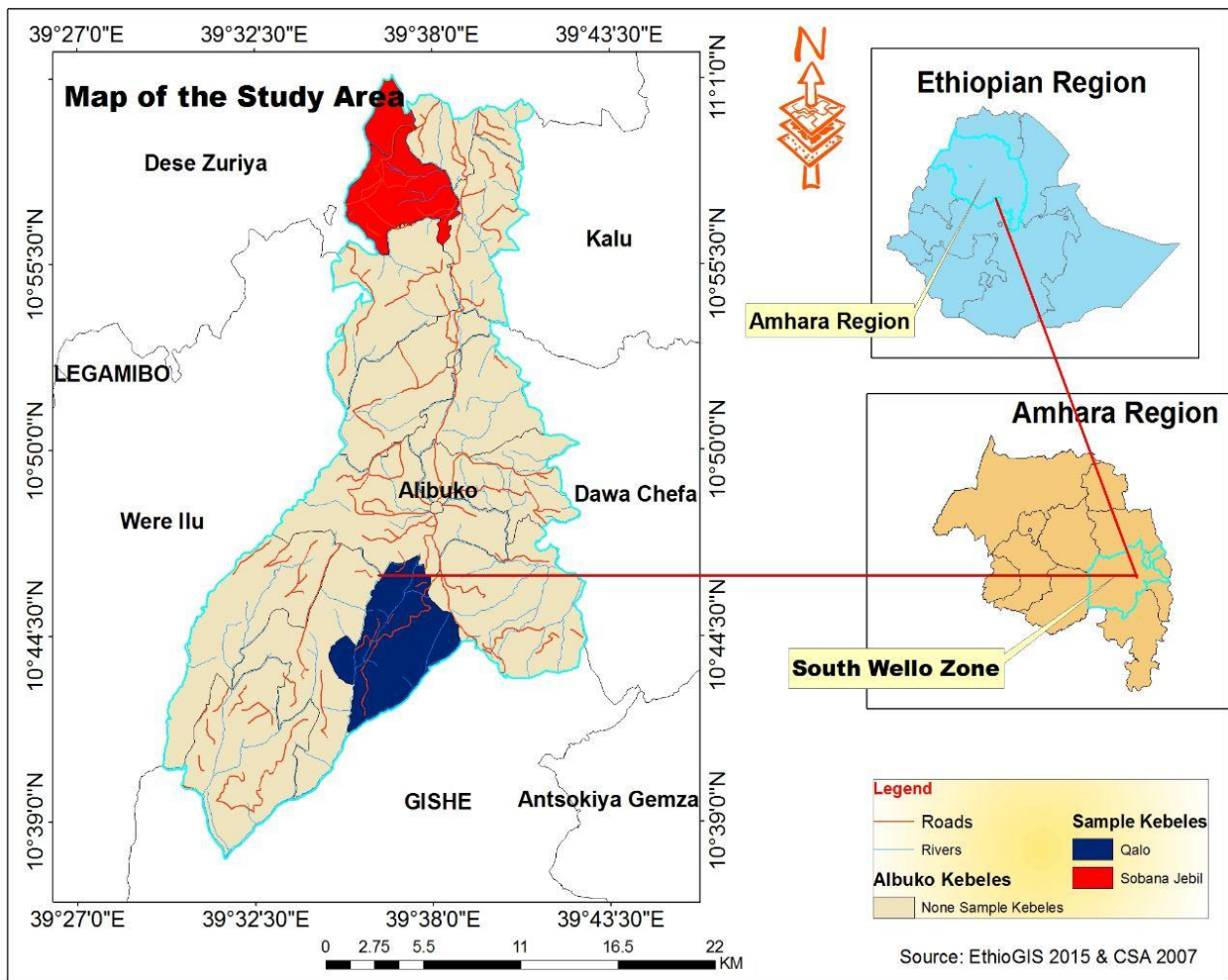
#### **3.1 DESCRIPTION OF THE STUDY AREA**

##### **3.1.1 Location**

*Albuko Woreda* is found in Amhara regional state of Ethiopia almost in Western part of south Wollo zone administration. The name of the central administration town is *Salmene* town, which is 438 kms far from Addis Ababa to the north direction 581 kms far from *Bahir Dar* and 37kms South Wollo Zone Administration town, *Dessie* and has a total of 17 kebeles.

*Albuko Woreda* is astronomically located between  $10^{\circ} 40' 0'' N$  -  $11^{\circ} 00' 00'' N$  latitudes and from  $39^{\circ} 27' 0'' E$  -  $39^{\circ} 43' 30'' E$  longitudes. *Albuko wereda* is bordered on the north by *Dessie Zuriysa woreda* , on the east by *KalluWereda* and *Oromiya special zone*, on the south

by Gisherabel Woreda and north Showa zone, and on the west, by Woreilu woreda.



**Figure 3.1: map of the study area**

### 3.1.4 Topography

The total area of *Albuko Woreda* is 50937.05 km<sup>2</sup> according to the structure of the surface area 27% of the land is mountainous 35% is rugged, 27 % of the land is plain and 11% of the land is somewhat gorge. Elevations of *Albuko Woreda* ranges from 1800to2900 meter.

**Table 3.1: Topography of Albuko Woreda**

| No | Topography     | Area km <sup>2</sup> | %  |
|----|----------------|----------------------|----|
| 1  | Mountain       | 13753.0035           | 27 |
| 2  | Rugged         | 17827.9675           | 35 |
| 3  | Plain and lake | 13753.0035           | 27 |

|   |                 |           |    |
|---|-----------------|-----------|----|
| 4 | Valley or gorge | 5603.0755 | 11 |
|---|-----------------|-----------|----|

### 3.1.5 Climates

According to the climate condition of the study area 76.6 % of the land area has *Woynadaga* climate, 11.44% of the land area has *Dega climate*, 11% of the land area has kolla climate , 0.765 the land area has *wurch* type of climate.

The total annual amount of rainfall of the study area is estimated from the range between 800-1000 and the annual mean temperature of the area range from 24-25 °c.

### 3.1.6 Soil Types

The study area possessed different soil types associated with geomorphology and the geology of the area. According to the extracted digital soil data obtained from ( MOA& RDE 2005 ), the area has four major soil classes based on FOA UNESCO soil classification system , these are *vertisols*, *cambisols*, *fluvisols* and *luvisols*. From these type of soil *vertisols*, are categorized by formation of deep cracks in winter season and become sticky in summer season and cover much of the study area. The gentle slopes and plains have very deep soils. Soils of moderately stream dissected plateaus with steep slope have shallow soils.

### 3.1.7 Land covers pattern

The major source of income of the study area is subsistence mixed agriculture. Rearing of animals and growing of crops are equally important activities practiced by farmers. The major crops grown in *Albuko Woreda* included cereals like *barely*, *wheat*, *teff*, *maize* and *pulses* like *beans*, *pea*. *Fruits* (*apple*, *lemon*, *papaya*, and *banana* etc. *Root crop* like *potato*, *carrot* and the like. Crops are grown for food and cash needs and livestock reared to meet farmers cash need and as means of insurance during food shortage. Goats, sheep's, hen, oxen, caw mules, and horses etc are commonly reared domestic animals by farming of the *Albuko Woreda*. Moreover, some farmers practice modern and traditional bee keeping practice in some kolla climatic areas of *Albuko Woreda*. And, *Eucalyptus* tree is widely grown for the purpose of house constricton and fuel sources, fencning and commercial purpose. Now generally, according to its use and coverage 36.3% of the land is used for farming 28.8% of the land is covered by forest, 21.3% of the land is doesn't give any use, 0.72 % is covered by water or lake, 0.07% is covered by permanent plants 6.5 % of the land is used for constraction, 11.3% of the land is used for grazing.

### **3.1.8 Demographic and structure**

Based on the 2007 national census conducted by the central statistical agency of Ethiopia (CSA), this *woreda* has a total population of 77,167 of which 38,462 are men and 38,705 are women. 3465 or 4.49% of the population are urban inhabitants of *Salmene, Degage, Tossa Felana* small towns. While that rest are rural inhabitants living with domestically substances agriculture / 95.51 %/. CSA / central statistical agency/, majority of the inhabitants of Albuko Woreda are Muslims with 94.22% reporting that as their religion. While 5.69% of the population said, they practiced Ethiopia Orthodox Christianity.

According to the *Albuko Woreda* health bureau statistical data 2014, *Albuko Woreda* population projected to a total of 93027 populations, of whom 49864 are male and 43167 are female and a total households of 21634. (*Albuko Woreda Health bearo-2014 E.C*).

### **3.1.9 Farming system**

Agriculture in the area is characterized by small scale substance mixed farming system, with crop production as an integral part and mainly rain feed. Almost all of the cropland are planted to annual food crops included cereals (maize, barley, wheat, teff, pulses beans, pea and root crop (potato, carrot. Wheat is the most dominant crop in the area.

A very small fraction farmers produce vegetables and fruit. Those crops are mainly grown in homestead gardens or where irrigation exists 1070 of the land area is used for irrigation.

Livestock's are also very important to agriculture in the study area. The *woreda* has an estimated population of 53992cattelle, 29555 goats, 83032 sheeps, 16787 horses, donkey &mules, 87524 chickens, 434 camel.(source *Albuko Woreda* Animals wealth office Bureau).

### **3.1.10 Infrastructure**

*Albuko woreda* has different types of infrastructures and services. These are road transportation from Dessie town to salmene& to each *kebelle* center. All *kebeles* has full mobile network service, school and health centers are there in most kebeles, lighting power /electric power supply/ in each town of the *woreda* like *Salmene, Degage, Tossa Felan, jemanigus and Neti teki* is there. Bank & micro finance institution also there,are some of the infrastructures and services which exists in *Albuko woreda*.

*In addition Albuko woreda* has many tourism attraction sites such as capitain gora, the hill like place where Italian army force leader killed by the local population governor of Dejjach Mengesha Abuye during the 2<sup>nd</sup> Italo -Ethiopian war, Kote, Jemanigus mousque of Islamic

*education center and Maybar high land lake having 145 meter depth and 54mk<sup>2</sup> total area and founded at 2500m altitude asl.*

## **3.2 Research Methodology**

### **3.2.1. Research Approach**

The mixed approach was used to assess the challenge and potential opportunity of tree plantation in *Albuko wereda*, qualitative and quantitative approach. The reason for using these approaches is that it enables to understand the different challenges and opportunity of tree plantation process now a day in detail. Thus, data obtained from open ended question, interviews and focus group discussion, field observation were discussed and presented qualitatively. Whereas, questionnaires', close ended questions were discussed and presented quantitatively

### **3.2.2. Research Design**

In this research the researcher employed cross-sectional research design to collect data. This research design examines data from a population or a representative sample of the population at a specific point in time .Cross-sectional research design provides good controls over the measurement process. A cross-sectional study is just as good as the measurement procedures used to gather data, just like any other study. It offers increased sampling procedure precision. When studying a population as a whole, researchers take samples of certain groups, regions, or people and compare the information from the subgroups to the whole population. A cross-sectional study is just as good as the measurement procedures used to gather data, just like any other study. It offers increased sampling procedure precision. This type of research design allows anyone to analyze the data to draw conclusions. Cross-sectional studies yield information that is appropriate for secondary data analysis. Additionally, it gives researchers access to a variety of exposures and outcomes. Researchers can look at multiple exposures and outcomes at once with cross-sectional studies. A descriptive analysis can be conducted using data from a cross-sectional study approach. It offers a starting point for upcoming research projects.

#### **3.2.2.1 Validity analysis**

This study employed different types of procedures for collecting data and obtaining that information through different resources can augment the validity of the data. For study that applies both qualitative and quantitative tools (mixed approach), pilot test is an effective and realistic method to test validity. As such, the researcher conducted a pilot survey to ensure the content, sequence and the quality of questionnaire.

So far, a pilot survey was conducted to test the validity of the measurements. The pilot survey questionnaire administered to 15 randomly picked subjects. The feedback from the survey was analyzed and based on the feedback the items of the questionnaire and wording in presenting the item were rearranged.

#### **3.2.3 Data source and data collection Instruments**

To conduct this study both primary and secondary source of data were used to get vital information's about issues that the researcher going to deal or investigate to know the challenges and opportunities of tree plantation in the study area.

### **3.2.3.1. Primary data sources**

The study's main sources of data were

- Sample house hold farmer of 07 and 013 Kebele
- *Albuko Woreda* agriculture and rural development office, natural resource development professionals. And 07 and 013 kebeles natural resource development professionals.
- Field observation of the study area and Group discussion members of the study area.

### **3.2.3.2 Secondary Data Sources**

The secondary data sources of this study were written documents such as books, articles researches papers, journals and documents were be used. The essence of gathering and taking into account primary and secondary sources was to enhance and supplement the varied data produced from various sources, which is then utilized to make the data and the research's conclusion dependable.

### **3.2.4 Data collection instruments**

The instrument used to collect data from primary sources were includes the following

#### **3.2.4.1 Questionnaires**

The purpose of the survey questionnaires was to gather quantitative information from the sample group. The purpose of the questionnaires was to gather data about the study area's continuous green legacy as well as the opportunities and problems associated with planting trees. Additionally, it addresses variables related to demographics like age, sex, family location, level of education, and marital status. Both closed-ended and open-ended questions are included in the questionnaires. Every question has a number assigned to it. Prior to being disseminated to the samples, the questions were developed in English and then translated into Amharic, the local language of the study area.

#### **3.2.4.2 Key informant Interview**

It is one of the methods used to collect primary data. It was used to collect depth information about the challenges of tree plantation in the study area as well as the main opportunities to expand tree plantation in the study area or in *Albuko woreda*. The information which gathered through interview will used complement and supplement the data collected from house hold survey through structured questionnaires other sources tool. The key in formants will be

*woreda* natural resource experts, *kebeles* natural resource experts because of their strong connection with natural resource development. Check lists were developed and used to guide the interview.

The major issues which were explored during the interview include the trend of forest area percentage declining in the study area, the cause of forest declining the consequences ducting and the measures should be taken, the opportunities for tree plantation in the study area and the challenges faced during tree plantation in the study area and the trend of green legacy in the study area.

#### **3.2.4.3 Field Observation**

Field Observation was started know in the proposal and continued on the whole process of data collection to make sure to the validity of acquired information .It's aim was to understand the study area, current status of forest coverage, plantation and related vegetation , the type of soil and land structure and related vegetation's

During the walk, the researcher was take notes on the opportunities for tree plantation and measures should be taken for taken for expanding tree plantation in the study area and all about the above points. And the researcher was observe the former green planted areas, there challenges and other conditions.

#### **3.2.4.4 Focus Group Discussion**

It is among the most significant research techniques for gathering qualitative data. FGD was held with farmers of the two *kebeles*. Two groups were organized in the two sample *kebeles* having amember of 6 farmers, those were selected purposefully for the study. These farmer/house holdhead/ were selected based on their perception level to tree/forest plantation / opportunities and the challenges they faced on their own plantation land around their home guardians or other areas.

A check list were prepared to guide the open-ended discussion with the identified members. The data were collected from the focus groups were qualitative and general which reflects the perception of the house holder for forest/tree plantation, the opportunities and challenges of trees /forest plantation ,the types of plant/ trees which are conducive for the area and the ongoing conditions of green legacy in their area.

### 3.3. Techniques for Sampling and Determining Sample Size

Multi-stage sampling techniques was applied in the sampling procedure of the study area. Purposive techniques was applied to identify the representative Kebele's from the Woreda. Purposive sampling technique is important to select more vulnerable areas that to study /important to select more degraded undulated, mountainous and less vegetation cover areas /kebeles/. From 15 rural kebeles, kalo(07) and soba(Jeble/013) were selected by purposive sampling technique for these study. The main criteria's considered to select the kebeles the more degradedness of the area, the more undulatedness and the less vegetation cover of the area.

A total list of households living in the study *kebeles* are obtained from *Albuko Woreda* agriculture and rural development office as well as from *Albuko Woreda* health bureau (AWARDO and AWHB-2014), The total number of house holder in the two sample *kebeles* (Jeble/soba and Kalo) were about 2684(Jeble/soba -1540, Kalo-1144), of which 2596 male headed and 88 are female headed. With the list, a random sampling technique was used to select 119 sample house hold heads. Then, 68 households from *Soba (Jeble kebele)* and 51 households from *Kalo kebele* were taken as a sample size respectively .

To determine the sample size with a known confidence level was selected on *Kothari(2004)*.

$$n = \frac{z^2 \times p \times q \times N}{((N-1) \times e^2) + z^2 \times p \times q}$$

Where:

$n$  = sample size

$P$  = probability of committing type two errors (0.03)

$Q = 1 - P = 1 - 0.03 = 0.97$

$Z$  = value at 0.025 probability table = 1.96

$N$  = the size of the population which will be sampled = 2684

$e$  = the probability of committing type one error (0.03)

Therefore, based on the above formula the sample size of their study will

$$n = \frac{z^2 \times p \times q \times N}{((N-1) \times e^2) + z^2 \times p \times q} = \frac{1.96^2 \times 0.03 \times (1-0.03) \times 2684}{((2684-1) \times 0.03^2) + 1.96^2 \times 0.03 \times (1-0.03)}$$

$$= \frac{300.045863}{2.53} = 119$$

By using proportion, from the total population, select the sample from each kebele

$$\text{For kalso (p1)} = \frac{1144}{2684} = 0.43$$

$$\text{The sample selected from kalso (n1)} = 0.43 \times 119 = 51$$

Kalso have 3 ketena . select the sample from each ketena by using proportion.

$$\text{From ketene 1(30\%)} = 15$$

$$\text{From ketene 2(33\%)} = 17$$

$$\text{From ketene 3(37\%)} = 19$$

$$\text{For Jeble (p2)} = \frac{1540}{2684} = 0.57$$

$$\text{The sample selected from Jeble} = 0.57 \times 119 = 68$$

Jeble have 3 ketena. select the sample from each ketene by using proportion from the sample selected from that kebele.

$$\text{From ketene 1(30\%)} = 20$$

$$\text{From ketene 2(33\%)} = 23$$

$$\text{From ketene 3 (37\%)} = 25$$

**Table 3.2: Sample size distribution tables of sample kebeles**

| Sample kebeles | Total household head |        |       | Sample household |        |       |
|----------------|----------------------|--------|-------|------------------|--------|-------|
|                | Male                 | Female | Total | Male             | Female | Total |
| Kalo           | 1109                 | 35     | 1144  | 33               | 16     | 49    |
| Soba jebble    | 1487                 | 53     | 1540  | 43               | 22     | 65    |
| Total          | 2596                 | 88     | 2684  | 76               | 38     | 114   |

### **3.4. The study variables**

The variables include in the study are dependent and independent variables. Dependent variable is a variable whose value is determined by the functional relationship. Independent variables are variables whose values are not determined by the functional relationship.

#### **3.4.1. Dependent variables**

- Tree plantation

#### **3.4.2. Independent variables**

##### **3.4.2.1. Demographic and Socio-economic variables**

- *Kebele*
- Gender of household head
- Age category
- Education status
- Main source of income
- Economic status
- Marital status
- Major participant according to gender

- Land size
- Number of active household
- **Opportunities as good factors**
- **Challenges as bad factors**
- **Perception as hybrid factors in hierarchical way**

### 3.5 Data Analysis and Presentation methods

The data which were generating from different sources was analyzed using both qualitative and quantitative methods. Questionaries’ were analyzed using qualitative method and interview, FGD, Observation results were analyzed using qualitative approach. The finding of the study will present in tables, figures, graphs and charts. Some structure household survey data will analyze quantitatively and qualitatively using percentage, frequency, cross-tabulation and descriptive statistics (by using statistical package for social science).

In analyzing quantitative data both descriptive and inferential statistical methods will be apply. Discussion will held with development agents, key informants and selected local people on the opportunities and challenges of tree plantation will analyze descriptively.

Data’s which will gathered by observation also analyzed qualitatively by narration.

The main bases for selecting an appropriate statistical technique are the nature of data and number of variables included in the investigation (Singh, 2016).

In this study both descriptive and inferential statistics have been employed through SPSS (Statistical Package for Social Sciences) version 2022 software.

#### 3.5.1. Descriptive statistics

The data was summarized by descriptive statistics using clustered bar chart and cross tabulations that contain frequencies, percentages, mean score, standard deviation , RII and rank.

The mean score (MS) can be calculated by using the following formula as:

$$MS = \frac{\sum S_i f_i}{N}; i=1, 2, \dots, 5 \dots \dots \dots \text{Eq. (1)}$$

Where: MS = Mean (average) score value; f = frequency of response for each score; S= score given to each factor (1 to 5); and N= total number of respondents.

And again, the respondent’s answers were ranked using Relative Importance Index (RII) as indicated in the equation below (Muhwezi, Acai& Otim, 2014) ; (Somiah, Osei-Poku& Aidoo, 2015).

$$RII = \frac{MS}{A} * 100\% \dots\dots\dots Eq. (2)$$

Where: MS- Mean score and A is the highest weight for likert-scale data (i.e. 5 in our case).

For the clarity of the interpretation, the researcher used level of existence degree (low, medium and high) by using the formula as:

$$Class\ Interval = \frac{Maximum\ Class - Minimum\ Class}{Number\ of\ Levels} = \frac{5-1}{3} = 1.33; \text{ where,}$$

- 5 is maximum rating scale (very high)
- 1 is minimum rating scale (very low)
- 3 is the number of levels as: low, medium and high degrees

Low, medium and high degrees can be expressed in the range from 1- 2.33, 2.34- 3.66 and 3.67-5.00 respectively. Each opportunity/ challenge items were analysed and interpreted in accordance with the level of existence with respect to mean score.

### 3.5.2. Inferential statistics

In general, the researcher used different techniques as inferential method including independent sample t-test, one way ANOVA, Pearson correlation and Chi-Square test to check whether there is a significant relationship between variables or not.

#### 3.5.2.1. Independent Sample T-Test

The independent sample t test is used to compare only two groups' mean scores on the same variable. In this study, it could be used to evaluate whether there is a significant mean difference of planted trees between groups of variables such as gender of household head, main participants in tree plantation according to gender and respondent’s resident *kebele*.

### 3.5.2.2. One Way ANOVA

The one-way ANOVA is a generalization of the independent sample t test that is used to compare the means of three or more groups' scores on the same variable (Puri, 996). In this study, it could be used to compare the views of different groups of variables such as marital status, age groups, economic status, education level and major sources of income on determining the effects of number of trees planted in the study area.

The test statistics for testing of hypothesis;  $H_0: \mu_1 = \mu_2 = \dots = \mu_n$  versus  $H_1$ : At least two groups have different views is given by the variance ratio as:

$$F_{cal} = \frac{\text{between groups mean square}}{\text{within groups mean square}} \dots \dots \dots (3)$$

In order to decide whether the null hypothesis to be rejected or not, we compare the test statistic with the value of the F-distribution with (k - 1) degrees of freedom in the numerator and (N - k) degrees of freedom in the denominator for a given level of significance  $\alpha$  (Kothari (2018).

Decision rule: If the calculated value exceeds the critical value from the F-distribution for a given significance level  $\alpha$ , we reject  $H_0$  and conclude that the groups have a significant difference on their average number of trees planted.

The analysis of variance (ANOVA) is only the first step in studying the results of experiments. The next step is to determine which differences among the view of parties are significant by using Post Hoc multiple comparisons under the equal variances assumed or not assumed. Then, deciding which assumption is appropriate; we use Levene statistic test (Kothari, (2018).

### 3.5.2.3. Correlation coefficient Analysis

It is used to measures the linear association between two variables. The correlation coefficient typically has a value between -1 and +1. According to Kothari (2018), a correlation coefficient of +1 denotes a significant positive linear relationship between two variables, a correlation coefficient of -1 denotes a significant negative linear relationship, and a correlation coefficient of 0 denotes no linear relationship at all between the two variables.s In this study, number of manpower who can participant in each household, land size and number of planter trees have been assessed with correlation analysis.

#### **3.5.2.4. Chi-Square Test**

Chi-Square is a tool in the armory of inferential statistics or significance testing. This test evaluates the importance of the correlations displayed in cross-tabulations, or contingency tables.

Any pattern of association we find in a Crosstab is usually a pattern in sample data. The issue that Chi-Square addresses is whether any relationship in the sample data is strong enough to justify our making inferences about the larger population from which the sample has been drawn.

Chi-Square effectively compares each cell's observed (data frequencies) and expected (fit values), which are calculated from the data based on an assumption, to overcome this problem.

The precise calculation of Chi-Square ( $\chi^2$ ) is given by:

$$\chi^2 = \sum \frac{(o - e)^2}{e}$$

#### **Hypothesis**

$H_0$ : There is no association between the two variables such as preferred trees to plant with their reasons to plant.

### **3.6 Ethical Issues**

Ethical consideration will be seriously taken in to account so that the concern, integrity, anonymity, consents and other human elements of the participants, discussants, and interviewees will be protected. The researcher assures to them that any information concerning that will be never being passed to other unauthorized persons on institutes without their consent. The names of the respondents will not be specifies in any part. The selected participants will be request kindly whether they agree to participate in the study or not.

## CHAPTER FOUR

### 4. POTENTIAL OPPORTUNITIES AND CHALLENGES OF TREE PLANTATION

#### 4.1 Result

##### 4.1.1. Questionnaire response rate

Out of the 119 questionnaires, 114 households responded to the survey, and it was therefore 95.8% returned. This shows how the respondents were very interested to fill the questionnaires and had given well attention on it. 5 respondents were failed (2 from kalo, 3 from soba/jeble).

##### 4.1.2. Demographic and Socio-Economic Variables results

Demographic variables have a great role to identify the respondents' background information. Hence, the demographic variables such as *kebele*, gender, education level, marital status, main source of household income, economic status age category, and main participant for tree plantation according to gender were emphasized.

The majority of respondents in Soba-013kebele were from ketena-03 with 21.05% and contrarily from ketena-02 with 16.67% according to the study survey. For Kalo-07 kebele had 16.67% of respondents in ketena-03 with high degree of occurrence and while contrarily 12.28% were ketena-01 respondents. Generally, the aggregate of all the three ketena groups, the majority of the respondents were from Soba-013 kebele with 57% according to the result.

**Table 4. 1: Distribution of demographic and Socio-Economic categorical variables**

| Variables             | Categories | Kebele    |            |           |            | Total |
|-----------------------|------------|-----------|------------|-----------|------------|-------|
|                       |            | Kalo-07   |            | Soba-013  |            |       |
|                       |            | Frequency | Percentage | Frequency | Percentage |       |
| Gender                | Female     | 16        | 42.1       | 22        | 57.9       | 38    |
|                       | Male       | 33        | 43.4       | 43        | 56.6       | 76    |
| Education Level       | Illiterate | 22        | 48.9       | 23        | 51.1       | 45    |
|                       | 1-4        | 18        | 35.3       | 33        | 64.7       | 51    |
|                       | 5-8        | 3         | 42.9       | 4         | 57.1       | 7     |
|                       | 9-10       | 4         | 57.1       | 3         | 42.9       | 7     |
|                       | 11-12      | 2         | 50         | 2         | 50         | 4     |
| Marital Status        | Single     | 1         | 33.3       | 2         | 66.7       | 3     |
|                       | Married    | 28        | 39.4       | 43        | 60.6       | 71    |
|                       | Divorced   | 9         | 60         | 6         | 40         | 15    |
|                       | Widowed    | 11        | 44         | 14        | 56         | 25    |
| Main Source of Income | Farming    | 40        | 46         | 47        | 54         | 87    |
|                       | Trading    | 5         | 31.3       | 11        | 68.7       | 16    |
|                       | Crafting   | 4         | 36.4       | 7         | 63.6       | 11    |
| Age                   | ≤ 20       | 1         | 50         | 1         | 50         | 2     |
|                       | 21-30      | 4         | 40         | 6         | 60         | 10    |
|                       | 31-40      | 10        | 40         | 15        | 60         | 25    |
|                       | 41-50      | 9         | 33.3       | 18        | 66.7       | 27    |
|                       | 51-60      | 11        | 44         | 14        | 56         | 25    |
|                       | 61-70      | 10        | 62.5       | 6         | 37.5       | 16    |
|                       | >70        | 4         | 44.4       | 5         | 55.6       | 9     |
| Economic Status       | Low        | 14        | 38.9       | 22        | 62.1       | 36    |
|                       | Medium     | 31        | 44.9       | 38        | 55.1       | 69    |
|                       | High       | 4         | 44.4       | 5         | 55.6       | 9     |
| Main Participant      | Female     | 7         | 43.8       | 9         | 56.2       | 16    |
|                       | Male       | 42        | 42.9       | 56        | 57.1       | 98    |

Source: Survey result obtained through SPSS, 2022

With respect to gender of household head and major participant according to gender, as shown in Table 4.1 above indicated that 38 (33.33%) of them were females and 76 (66.67%) of them were males. So the reader can generalize that the ratio of male and female employees in both *kebeles* was not proportional. According to main participant, males had taken the major responsibility with 98 (85.9%) according to participating for planting the trees in their community. Hence, the majority of the respondents and active participants were males and it also indicated that majority of households rely mainly on males for tree plantation activities.

With regards to education level, the respondents were asked to state their grade level in education. Accordingly, the higher number 51 (44.74%) of them were accounted in grade 1-

4, while the least 4 (0.04%) were grade 11-12. This shows that they were not well educated and not have knowledge to evaluate whether tree plantation gives high benefits for balancing environments in their community.

Regarding to the marital status of respondents, more than half 71 (62.3%) of the respondents indicated that they got married. While, 21.9%, 13.2% and 2.6% of them were widowed, divorced and single, respectively. Therefore, this result indicated that most of the respondents were engaged. This shows that the respondents were married, and we can easily understand and identify that marital status have played a great role to improving the forest coverage in the study area.

With respect to the main sources of income and their economic status, farming is the main economic source of income for 76.32% of the population. Most of the agriculture is rain fed, so a majority of the people in the study area depends on rainfall for their income. The major food crops are maize, beans, *teff* and other pulses. *Maize* and *teff* are mostly grown in the lower area. Due to the low availability of water sources; the production of irrigated crops (tomatoes, onions, cabbage and carrot) is relatively low. On the other hand, with regards to economic status more than half of respondents have medium income which accounted for 60.53%. However, 31.58% and 7.89% of respondents have low and high sources of income respectively.

The survey result on age category is summarized in the table 4.1 revealed that out of the total respondents of the study area the majority of the respondents fall within 41-50 age which accounted for 27 (23.3%), followed by the age group of 31-40 and also 51-60 which accounted for 25 (21.9%) in the same manner. The rest 14.04%, 0.09%, 0.8% and 0.2% were found between the age range of 61-70 years, 21-30 years, > 70 years and  $\leq 20$  years, respectively. This implies that the majority of the respondents who participated in the survey were adults. Therefore, from this result, the reader expected as the adult aged residents were responsible for tree plantation in their area of community.

#### ➤ **Descriptive analysis**

In this case of study, only the default statistics have been applied (mean, standard deviation, minimum and maximum) a descriptive statistics for only quantitative variables.

**Table 4. 2: Descriptive analysis for the mean number of trees, mean size of land and number of active households in each sample kebeles .**

| <i>Kebele</i>    |           | Trees  | Land size (in hectare) | Number of active households |
|------------------|-----------|--------|------------------------|-----------------------------|
| Kalo-07<br>N=49  | Mean      | 332.47 | 1.1371                 | 2.80                        |
|                  | Std. Dev. | 105.33 | 0.50687                | 0.816                       |
| Soba-013<br>N=65 | Mean      | 329.09 | 1.0835                 | 2.71                        |
|                  | Std. Dev. | 95.342 | .51764                 | 0.947                       |
| Total<br>N=114   | Minimum   | 210    | 0.49                   | 1                           |
|                  | Maximum   | 615    | 2.10                   | 5                           |
|                  | Mean      | 330.54 | 1.1066                 | 2.75                        |
|                  | Std. Dev. | 99.316 | 0.51147                | 0.891                       |

Source: Survey result obtained through SPSS, 2022

The result in Table 4.2 presented several pieces of information that can be useful to understand the descriptive qualities of survey data. Information about the range of variables is contained in the Minimum and Maximum rows. In this study the average number of trees and land size ranged from 210 to 615 and 0.49 to 2.10 hectares, respectively. Whereas, number of active household for tree plantation ranges from 1 to 5. Variability has been assessed by examining the values in the Std. Dev. row. The standard deviation provides information about how far a variable deviates from the mean. It could be helpful to look at variability differences in order to anticipate more analyses. It is evident in this instance that the quantity of trees varied considerably more than the size of the land and the number of occupied dwellings.

#### **4.1.3. Potential Opportunities**

When planting the trees, the community is able to access many opportunities. Some of the opportunities include:

- 1-Availability of comfortable environment for plantation like soil types and areas (sites) such as along roadsides, mountain, around farmlands, etc.(Opportunity-1)
- 2-Interests.(Opportunity-2)
- 3-Availability of manpower (labor input) due to unemployment.(Opportunity-3)
- 4-Availability of homemade traditional tools and equipment.(Opportunity-4)
- 5-Enough space relative to low coverage of plants/ forests.(Opportunity-5)
- 6-Starting tree planting campaign (green plant legacy) in our country.(opportunity-6)
- 7-Somewhat availability of naturally grown seedlings in forest area.(opportunity-7)
- 8-There is a small local private planter (seedling sources) in your community.(Opportunity-8)

**Table 4. 3: Opportunities for tree plantation in the study area.**

| <b>Opportunities</b> | <b>Min</b> | <b>Max</b> | <b>MS</b> | <b>St. Dev.</b> | <b>RII</b> | <b>Rank</b> |
|----------------------|------------|------------|-----------|-----------------|------------|-------------|
| Opportunity_1        | 3          | 5          | 4.05      | 0.881           | 81         | 1           |
| Opportunity_2        | 3          | 5          | 3.95      | 0.727           | 79         | 2           |
| Opportunity_3        | 2          | 4          | 3.11      | 0.791           | 62.2       | 5           |
| Opportunity_4        | 2          | 4          | 3.56      | 0.729           | 71.2       | 4           |
| Opportunity_5        | 2          | 4          | 2.61      | 0.723           | 52.2       | 6           |
| Opportunity_6        | 2          | 5          | 3.69      | 0.853           | 73.8       | 3           |
| Opportunity_7        | 1          | 3          | 1.92      | 0.654           | 38.4       | 8           |
| Opportunity_8        | 1          | 3          | 1.96      | 0.757           | 39.2       | 7           |

Source: Survey result obtained through SPSS, 2022

As presented in Table 4.3, the relative opportunities for tree plantation were availability of comfortable environment for plantation like soil types and areas (sites) such as along roadsides, mountain, around farmlands, etc., interests and Starting tree planting campaign (green plant legacy) in national level in high degree level with MS values of 4.05, 3.95 and 3.69, respectively.

The other opportunities which had a medium level of importance for tree plantation were availability of homemade traditional tools and equipment, and availability of manpower (labor input) due to unemployment with their MS values of 3.56 and 3.11 respectively. However, somewhat availability of naturally grown seedlings in forest area had low level of opportunity for tree plantation.

#### **4.1.4. Challenges**

In terms of challenges that have been affecting tree plantation on the selected kebeles, the views of respondents on challenges was assessed by the following items:

- -Lack of institutional support.(Challenge-1)
- -Lack of water sources.(Challenge-2)
- -Lack of nurseries and lack of tree species that you have wanted to plant.(Challenge-3)
- -Less seed availability: lower production of seeds, high cost of seeds and lack of trends on seed sowing and cultivation.(Challenge-4)
- -Human influences like increasing demand for wood products (for fuel and construction).(Challenge-5)
- -Lack (proportion) of land sizes.(Challenge-6)

- - Lack of tools and tools mainly watering cans, wheelbarrows and spades.(Challenge-7)
- - Unexpected natural accidents like drought, massive erosion, cracking of earth, etc.(Challenge-8)
- - Lack of insight learning (people awareness) about tree plantation.(Challenge-9)
- - Lack of tree substitution culture (planting when you cut).(Challenge-10)
- - Unlimited using of lands for livestock grazing and crops, and encroachment by livestock.(Challenge-11)
- - Shortage/expensiveness of chemical fertilizers (DAP and CAN) to improve the growth of seedlings.(Challenge-12)

**Table 4. 4: Challenges for tree plantation in the study area.**

| Challenges   | Min | Max | MS   | St. Dev. | RII  | Rank |
|--------------|-----|-----|------|----------|------|------|
| Challenge_1  | 1   | 3   | 2.34 | 0.836    | 46.8 | 11   |
| Challenge_2  | 2   | 5   | 4.56 | 0.810    | 91.2 | 4    |
| Challenge_3  | 3   | 5   | 4.56 | 0.565    | 91.2 | 3    |
| Challenge_4  | 3   | 5   | 4.73 | 0.520    | 94.6 | 2    |
| Challenge_5  | 2   | 4   | 3.72 | 0.507    | 74.4 | 8    |
| Challenge_6  | 2   | 5   | 3.93 | 0.880    | 78.6 | 5    |
| Challenge_7  | 1   | 3   | 2.08 | 0.822    | 41.6 | 12   |
| Challenge_8  | 2   | 4   | 3.55 | 0.653    | 71   | 9    |
| Challenge_9  | 2   | 5   | 3.90 | 0.579    | 78   | 6    |
| Challenge_10 | 2   | 5   | 3.83 | 0.496    | 76.6 | 7    |
| Challenge_11 | 4   | 5   | 4.80 | 0.403    | 96   | 1    |
| Challenge_12 | 1   | 3   | 2.49 | 0.719    | 49.8 | 10   |

Source: Survey result obtained through SPSS, 2022

As it is indicated in Table 4.4, unlimited using of lands for livestock grazing (crops) and encroachment by livestock (MS=4.8, RII =0.96), less seed availability: lower production of seeds, high cost of seeds and lack of trends on seed sowing and cultivation (MS=4.73, RII =0.946), lack of nurseries and lack of tree species that you have wanted to plant (MS=4.56, RII=0.912), lack of water sources (MS=4.56, RII=0.912), lack of land sizes (MS=3.93, RII =0.786), lack of insight learning (people awareness) (MS=3.90, RII=0.78), lack of tree substitution culture (MS=3.83, RII =0.766) and human influences like increasing demand for wood products (for fuel and construction) (MS=3.72, RII=0.744) were the most eight significant challenges for tree plantation. Generally the result concluded that these eight (8) items made contribute a lions' share as main challenges, because all of them were found in a high level of degree.

The result in Table 4.4 also tells us lack of tools and tools mainly watering cans, wheelbarrows and spades (MS=2.08, RII =0.416) was as the least challenge for tree plantation with low degree of level. However, the result indicated that almost three quarter of the items challenges were found in a high level of degree (MS lies within the class interval from 3.67-5.00).

#### 4.1.5. Perception of the community

As community are living in the study are, they also pass through a lot of experience related to tree plantation. The surveyed respondents were asked about what were the causes, effects, solutions and benefits of tree plantation in order to perceive the general perception of the community of the study area.

- Causes: Causes of disappearance of trees from farm lands
- Effects: Effect of trees on farm productivity
- Solutions: Primary solutions for overcoming the difficulties of growing trees
- Benefits: What kind of benefit you will get if tree plantation organization is established

For the clarity of the interpretation, the researcher has drawn a valid conclusion according to the degree of existence on the basis of ranking.

**Table 4. 5: General assessment of the community perception related to tree plantation**

| Variables | Categories                         | Frequency | Percentage | Rank |
|-----------|------------------------------------|-----------|------------|------|
|           |                                    |           |            |      |
| Causes    | Lack of people awareness           | 16        | 14.03      | 4    |
|           | Effects of small plot size         | 19        | 16.7       | 3    |
|           | Miss management of trees           | 21        | 18.4       | 2    |
|           | Use pressure                       | 30        | 26.3       | 1    |
|           | Drought                            | 11        | 9.6        | 5    |
|           | Competitions with trees            | 8         | 7.0        | 6    |
|           | Aging and death of trees           | 6         | 5.3        | 7    |
|           | Land management (Frequent blowing) | 3         | 2.6        | 8    |
| Effects   | Soil conservation                  | 42        | 36.8       | 1    |

|           |   |    |      |   |
|-----------|---|----|------|---|
|           | Improvement on tree coverage                | 32 | 28.1 | 2 |
|           | Destroyed soil nutrients                    | 21 | 18.4 | 3 |
|           | Improvement in soil fertility               | 12 | 10.5 | 4 |
|           | Reducing crops production                   | 7  | 6.1  | 5 |
| Solutions | Educating people                            | 33 | 28.9 | 1 |
|           | Policy formulation and enforcement          | 20 | 17.5 | 2 |
|           | Selection of suitable species               | 17 | 14.9 | 3 |
|           | Appropriate site selection                  | 17 | 14.9 | 4 |
|           | Encouraging tree nursery establishment      | 14 | 12.3 | 5 |
|           | Community participation                     | 9  | 7.9  | 6 |
|           | Tree protection                             | 4  | 3.5  | 7 |
| Benefits  | To engage in nursery operations             | 42 | 36.8 | 1 |
|           | To engage in silviculture                   | 34 | 29.8 | 2 |
|           | Works with charcoal production              | 26 | 22.8 | 3 |
|           | Work as drivers to transport tree seedlings | 12 | 10.5 | 4 |

Source: Survey result obtained through SPSS, 2022

From the above table, Based on the Community's perception ,use pressure(26.3%), miss management of trees(18.4%) and effects of small plot size (16.7%) are the major causes of disappearance of trees.

According to the effects in Table 4.5; trees had more than three quarter (75.4 in aggregate) of positive effects for soil conservation, improvement on tree coverage and soil fertility on farm lands. Trees on farm lands had not a bold negative effect by destroying soil nutrients and reducing crops production.

The community were asked to identify their perception about primary solutions for overcoming the difficulties of growing trees, as Table 4.5 revealed that make the people educated (28.9%), give consideration for policy formulation and enforcement (17.5%), and

selection of suitable species (14.9%) were the most solutions to overcome the drawbacks for tree plantation.

Finally, the respondents perception related to what will be their benefits if a tree plantation organization would be established in your resident are has been assessed. As Table 4.5 shows that engaging in nursery operation (36.8%) followed by engaging in silviculture (29.8%) were the first two ultimate goals of the community.

#### 4.1.6. Variables relationship with tree plantation

➤ **Independent sample t-test**

**Table 4. 6: Group statistics for the relationship between two catgorical Demographic and socio-economic variables with the mean number of trees planted.**

| <b>Variables</b>                        | <b>Groups</b>   | <b>N</b> | <b>Mean</b> |
|---|-----------------|----------|-------------|
| <i>Kebele</i>                           | <i>Kalo-07</i>  | 49       | 332.47      |
|   | <i>Soba-013</i> | 65       | 329.09      |
| Gender of Household Head                | Female          | 38       | 297.05      |
|   | Male            | 76       | 347.29      |
| Main Participant with respect to Gender | Female          | 16       | 257.06      |
|   | Male            | 98       | 342.54      |

Source: Survey result obtained through SPSS, 2022

**Table 4.7: T-test for equality of means**

| Variables        | Assumptions | Levene's Test for Equality of Variances |       | t-test for Equality of Means |       |        |        |        |
|------------------|-------------|---|-------|------------------------------|-------|--------|--------|--------|
|                  |             | F                                       | Sig.  | T                            | Sig.  | MD     | 95% CI |        |
|                  |             |   |       |                              |       |        | Lower  | Upper  |
| <i>Kebele</i>    | EVA         | 0.287                                   | 0.590 | 0.179                        | 0.85  | 3.38   | -34.01 | 40.77  |
|                  | EVNA        |   |       | 0.176                        | 0.86  | 3.38   | -34.60 | 41.36  |
| Gender           | EVA         | 3.72                                    | 0.056 | -2.61                        | 0.010 | -50.24 | -88.37 | -12.11 |
|                  | EVNA        |   |       | -2.77                        | 0.007 | -50.24 | -86.24 | -14.23 |
| Main participant | EVA         | 11.38                                   | 0.001 | -3.33                        | 0.001 | -85.48 | -136.3 | -34.64 |
|                  | EVNA        |   |       | -6.25                        | 0.000 | -85.48 | -112.8 | -58.13 |

Source: Survey result obtained through SPSS, 2022

\*\*\*\*Where: MD-Mean Difference, Sig- Sig (2-tailed), CI- Confidence Interval of the difference, EVA-Equal Variances Assumed, EVNA-Equal Variances Not Assumed.

The first output Table 4.6, labeled Group Statistics, displays descriptive statistics. The second output Table 4.7, labeled Independent Samples Test, contains the statistics that are critical to evaluating the current research hypothesis. Table 4.7 contains two sets of analyses: the first assumes equal variances and the second does not. To assess whether we should use the statistics for equal or unequal variances with 5% significance level (*Sig.*), go under the heading Levene's Test for Equality of Variances. If this value is less than 0.05 = 5%, then the null hypothesis of equal variances for the two groups is rejected.

In our case, the large *Sig.* values (corresponding to *kebele* and gender) indicate that the variances of the two groups are equal. Thus, we should use the statistics in the row labeled Equal variances assumed. But, the small *Sig.* value (corresponding to main participant) indicates that the variances of the two groups are not equal. Thus, we should use the statistics in the row labeled EVNA.

In the presented study, the null hypothesis is that the two groups do not differ in average number of planted trees. The *t* statistic under the assumption of equal as well as unequal variances has a value of -2.61 and -6.25 with an associated p-value of 0.010 and 0.000 respectively. The significance level (p-value) tells us that the probability that there is no difference between two groups for (gender and main participant) is very small. Contrarily, there were no really differences between the two *kebeles* in their average number of planted trees due to large *Sig.* values.

➤ **One way ANOVA**

In this study, one way ANOVA could be used to compare the mean number of trees for groups of marital status, major sources of income, economic status, age category and education level.

**Table 4.8: General one way ANOVA results for three categorical variables, on the relationship between Demographic and socio-Economic variables with the number of trees planted.(on page 42 categories)**

| Variables            | Sum of Squares<br>(in 1000) |        | Mean of Squares<br>(in 1000) |      | F     | Sig.  | Decision on Null Hypothesis |
|----------------------|-----------------------------|--------|------------------------------|------|-------|-------|-----------------------------|
|                      | BG                          | WG     | BG                           | WG   |       |       |                             |
| Marital Status       | 253.6                       | 861.1  | 84.6                         | 7.83 | 10.80 | 0.000 | Rejected                    |
| Major Income Sources | 33.94                       | 1080.7 | 16.97                        | 9.74 | 1.742 | 0.180 | Accepted                    |
| Economic Status      | 858.5                       | 529.1  | 292.8                        | 4.77 | 61.38 | 0.000 | Rejected                    |
| Age Category         | 289.7                       | 824.9  | 48.28                        | 7.71 | 6.262 | 0.000 | Rejected                    |
| Education Level      | 861.3                       | 253.3  | 215.3                        | 2.32 | 92.80 | 0.001 | Rejected                    |

Source: Survey result obtained through SPSS, 2022

The result in Table 4.8 shows that the F-statistic equals 10.80, 61.38, 6.626 and 92.80 with a p-value of 0.000, 0.000, 0.000 and 0.001 respectively. Since these p-values are less than 5%, the researcher rejects the null that there are an equal average number of trees for groups for marital status, economic status, and age category and education level at 5% level of significant, but not major income source.

In Table 4.8, the F statistic tests whether the treatment effects are all equal, i.e. that there are no differences among the means of groups. A significant F value indicates that there are differences in the means, but it does not tell us where those differences are, e.g.in marital status case: average trees of single might be different than marrieds' mean but not different from divorce's and mean of widowed. To determine which differences among the means are significant, POSTHOC method (test of homogeneity of variance) has been adopted.

**Table 4.9: Test of homogeneity of variances**

| Variables       | Tree             |     |     |       | Decision on Null Hypothesis |
|-----------------|------------------|-----|-----|-------|-----------------------------|
|                 | Levene Statistic | df1 | df2 | Sig.  |                             |
| Marital Status  | 5.761            | 3   | 110 | 0.001 | Rejected                    |
| Economic Status | 5.887            | 2   | 111 | 0.004 | Rejected                    |
| Age Category    | 7.753            | 6   | 107 | 0.000 | Rejected                    |
| Education Level | 5.340            | 4   | 109 | 0.001 | Rejected                    |

Source: Survey result obtained through SPSS, 2022

In Table 4.9; we can see that the Levene’s test statistic with less sig. values. Thus, we reject the null hypothesis of equal variances of number of trees for groups of all variables at the 5% level of significance. Thus, to determine which differences among the means are significant, we have to go for tests that do not assume equal variances (Tamehane  $T_2$  test) (Puri, B. K. (2016).

Tamehane  $T_2$  test (Ref-Appendix V) indicates that there are significant differences between the mean number of trees between all pairwise groups in economic status and education, but not in marital status age category.

➤ **Correlation analysis**

In the present study, the researcher used Pearson correlation to ascertain the association between independent variables with dependent variable.

As it is indicated in Table 4.10, there is a significant strong positive relationship between land size and number of active household with number of trees with Pearson correlation of 0.782 and 0.778 at sig. = 0 .000, respectively. Therefore, this information implies that these independent variables have significant positive relationships with number of trees.

**Table 4.10: Correlation analysis results, on the relationship between land size and number of active households with number of trees planted.**

| Variables                  |                     | Trees   |
|----------------------------|---------------------|---------|
| Land size (in hectare)     | Pearson Correlation | 0.782** |
|                            | Sig. (2-tailed)     | 0.000   |
| Number of active household | Pearson Correlation | 0.778** |
|                            | Sig. (2-tailed)     | 0.000   |

Source: Survey result obtained through SPSS, 2022

➤ **Chi-square test**

The cross tabulation statistics provide several interesting observations about the survey data.

**Table 4. 11: Cross tabulation results which shows the reason behind preferred planted trees.**

|  |                                       |                  | Trees you prefer to plant |                 |              | <b>Total</b> |
|--|---------------------------------------|------------------|---------------------------|-----------------|--------------|--------------|
|  |                                       |                  | <i>Tid</i>                | <i>Bahirzaf</i> | <i>Wanza</i> |              |
| Reasons you prefer planting such trees | Better price for sale                 | Count            | 6                         | 10              | 21           | 37           |
|  |                                       | % with prefer    | 19.35                     | 22.73           | 53.85        | 32.46        |
|  |                                       | % within Reasons | 16.2                      | 27.0            | 56.8         |              |
|  | Need small amount of water to plant   | Count            | 6                         | 5               | 13           | 24           |
|  |                                       | % with prefer    | 19.35                     | 11.36           | 33.33        | 21.05        |
|  |                                       | % within Reasons | 25.0                      | 20.8            | 54.2         |              |
|  | Quickly grown for purpose             | Count            | 4                         | 16              | 0            | 20           |
|  |                                       | % with prefer    | 12.90                     | 36.36           | 0.0          | 17.54        |
|  |                                       | % within Reasons | 20.0                      | 80.0            | 0.0          |              |
|  | Effective in controlling soil erosion | Count            | 6                         | 13              | 5            | 24           |
|  |                                       | % with prefer    | 19.35                     | 29.55           | 12.82        | 21.05        |
|  |                                       | % within Reasons | 25.0                      | 54.2            | 20.8         |              |
|  | Aesthetic beauty for environment      | Count            | 9                         | 0               | 0            | 9            |
|  |                                       | % with prefer    | 29.03                     | 0.0             | 0.0          | 7.90         |
|  |                                       | % within Reasons | 100                       | 0.0             | 0.0          |              |
| <b>Total</b>                           |                                       | Count            | 31                        | 44              | 39           | 114          |
|  |                                       | % with prefer    | 31.0                      | 44.0            | 39.0         | <b>100</b>   |
|  |                                       | % within Reasons | 27.2                      | 38.6            | 34.2         |              |

Source: Survey result obtained through SPSS, 2022

Respondents had varied preferences for different tree types in their resident area as presented in Table 4.11. Among these tree types, the most preferred tree type was *Bahirzaf* (38.6 %) followed by *wanza* (34.2%). This *bahirzaf* tree was planted mainly for the reasons that it is quickly grow for any purpose (36.36%) and effective in controlling soil erosion (29.55%). *Wanza* and *Tid* trees were used mainly for better price for sale (53.85%) and aesthetic beauty for environment (29.03%) respectively. Most people planted trees because they wanted to increase their income from trees (32.46%) and also to soil erosion protection requirements (21.05%). The magnitude of these reasons depended on people’s needs and environment.

**Table 4.12: Tests of independency (Chi-square test) results**

|                              | Value               | Df | Significance (2-sided) |
|------------------------------|---------------------|----|------------------------|
| Pearson Chi-Square           | 56.226 <sup>a</sup> | 8  | .000                   |
| Likelihood Ratio             | 59.853              | 8  | .000                   |
| Linear-by-Linear Association | 23.649              | 1  | .000                   |
| N of Valid Cases             | 114                 |    |                        |

a. The projected count of 3 cells (20.0%) is fewer than 5. 2.45 is the bare minimum anticipated count.

Source: Survey result obtained through SPSS, 2022

The output in Table 4.12 provides a statistical hypothesis test for the hypothesis that preferred tree types and reasons to be planted were independent of each other. The large Chi-Square statistic (56.27) and its small significance level ( $p < 0.001$ ) indicate that it is very unlikely that these variables are independent of each other. Thus, it can be concluded that there is a relationship between a preferred tree typed and the reasons to be planted at the 1% level of significance.

## 4.2. Discussion

There is always a chance that study participants will provide misleading information while answering questionnaires. Not many homes provided misleading information, though, and even if they did, there are a few strategies to handle it. The majority of lies were blatantly clear, and thankfully, our interpreter was highly perceptive. In the questionnaire (see Appendix II) several questions were specifically added to crosscheck the answers given. Many other questions are usable for crosschecking. However, the dataset is considered trustworthy and that the amount of interviews is sufficient to clear out false information.

As half of the respondents were married, it is evident in our study that most of the responsibility of managing the family rested with men. In addition, the participation of men in various occupations/ activities, including planting trees was higher than that of women. The fact that the education level of the majority of the society was below 4<sup>th</sup> grade is an indication of their low understanding of the importance of tree plantation especially for balancing the environment. Farming was the main source of income. However, more than half of the communities were in medium level of economy relative to the respondents' economic status. Among the age groups listed in the questionnaire, the majority of the respondents were adults, i.e. 41-50 ages.

The study calculated the average score based on three different quantitative variables, namely number of trees, land size and number of active household for tree plantation. Thus, kebele 07 was better than kebele 013 in all outcome variables. However, the study using independent sample test has confirmed that this mean difference is observational but not significant at 5% significance level.

Although there were no good chances/ opportunities for tree plantation, relatively speaking, availability of comfortable environment for plantation like soil types and areas (sites) such as along roadsides, mountain, around farmlands, etc., interests and Starting tree planting campaign (green plant legacy) in national level occupied the first three ranks of the series and had the largest share in this study. This result is consistent with Kadenyi Nancy, 2013 and Ogwenno et al., (2001).

In the two areas (kebele 07 and 013) selected for this study, there was a high loss of forest cover and the small number of trees owned by the local community was a clear indication that there were many serious and dangerous conditions that hinder the planting of trees. Following this, it has been confirmed in this study that unlimited using of lands for livestock grazing (crops) and encroachment by livestock, less seed availability (lower production of seeds, high cost of seeds and lack of trends on seed sowing and cultivation), lack of nurseries, lack of tree species that you have wanted to plant and lack of water sources were some of the many challenges that require great attention. Our results confirmed that unlimited livestock grazing and encroachment by livestock was as the main challenge limiting tree plantation. Some reports agreed with that this is mainly caused by lack proper fencing around the farms hence enhancing random movement of livestock like goats and cows all over the farm. Trees planted along the road are mostly destructed by the animals when they feed on them or even sometimes by people passing by. Communities would rather search for water for domestic use than to water the trees due to a shortage of water for tree care (Kadenyi Nancy, 2013). According to Ogwenno et al. (2001), the primary obstacles to tree planting were seed availability, animal damage, and a lack of funding for the procurement of potting materials, tools, and equipment (mostly wheelbarrows, watering cans, and spades).

This study used independent t test, one way ANOVA and correlation analysis as the main techniques/ methods to identify the variables that have relationships and influence with tree plantation. Therefore, the variables gender of household, main participant according to gender, marital status, economic status, age, education status, land size and active number of

household were directly or indirectly influential and were included in this study but not resident kebele and sources of income. However, no other study directly related to this result could be found. Furthermore, the investigator used chi-square test to identify that whether plants which were prefer to plant and their reasons are related or not. The majority of respondents preferred Bahirzaf, Wanza and Tid probably because of their high commercial value. The most dominant trees in the study area was Bahirzaf and had been deliberately left by the community for the reasons that it is quickly grow for any purpose and effective in controlling soil erosion. On the other word, the result showed that the link the relationship of variables was significant at 5% significant level.

In addition to questionnaire, our study was able to reach conclusions by compressing the data of FGD and interview. Accordingly, lack of people awareness was as the first cause of disappearance of trees from farm lands. Lack of awareness on how to improve/protect forest coverage was the main causes of disappearance of trees. In other way, soil conservation had the lion's share of the study done around the effect of trees on farm productivity.

For tree plantation causes and effects listed as the best solutions to overcome the gaps, educating people occupied the primary solution for overcoming the difficulties of growing trees. In the same way, based on the questions asked/discussed about benefit (what kind of benefit you will get if tree plantation program will be established) and the information mainly obtained by questionnaire and FGD, engaging in nursery operations would be the benefit of the majority. According to the data that were collected from key informants using interview, the forest or plant coverage of the study area, that is Albuko woreda, was declined from time to time or year to year. It was declined too and reached 14 % in 1998 E.C. and reaches 9182ha, 18.6702% percentage now a day.

In order to reverses this situation, farmers individually were try to plant trees in there farmlands, gardens, roadsides, rough land structures, Goarges etc. in the study area. The establishment of tree plantation campaign or the green legacy initiative, since 2011 E.c in Ethiopia as a whole strengthen/ facilitate the tree plantation process of the study area farmers.

As such many tree plants are planted in each *kebeles* of the study area including the two sample *kebeles* 07 *kallo* and 013 *soba/jebil* but all tree plants are planted on farmers legal protectorate and some government institution but not on government control plantation areas. The major tree seedlings planted in the study area are bahirzaf, tid, woira, wanza, Abesha tid, zidba, kundoberbere, girar, *gravilia robusta*, *turrisur*, *suspania* , and the like. The sources of

these tree seedlings are Government nurseries, from community small scale nurseries/ FTC/, from tree seedling propagation enterprises, from individual farmers , from NGOs as well as from forests. On average around 2,250,000 tree seedlings planted in the study area per year and on average 45 ,0000 people participating in the plantation process per year.

According to information from key informants, the most preferred areas for tree plantation in the study area, particularly in the sample kebeles of 07 Kallo and 013 Sobo/Jebil, include terraced lands, degraded and eroded zones, road sides, less fertile areas, mountainous regions, and windy spots, as well as around gardens. The reasons for selecting these areas for tree planting are multifaceted. Trees are planted to control water and wind erosion, especially in sloped and windy areas. They help reinforce terraces on highland farms, preventing soil erosion and providing animal feed and shade during winter. Trees also offer protection for constructed houses against wind and can occasionally produce fruit. Additionally, planting trees along roadsides helps protect farmland from road encroachment and reduces dust affecting homes and harvested grains. Trees in these areas can also be sold at a higher cost, and they enhance the aesthetic appeal of gardens and surroundings.

In relation to the first objective of this study, key informants noted several positive factors that facilitate tree plantation in the study area. These include favorable climatic conditions for tree growth, a high level of community participation in planting trees in various areas, and increasing tree prices due to expanding residential construction in the region. The ongoing soil and water conservation campaigns in the Amhara region and Ethiopia as a whole, as well as the Green Legacy Initiative launched by Prime Minister Abiy Ahmed in 2011E.C, support large-scale tree planting efforts and climate change mitigation. Additionally, training and orientation from natural resource conservation professionals and nursery operators provide further support.

For the second objective, key informants identified several challenges in the tree plantation process. These include irregular rainfall patterns during the summer season, leading to suboptimal tree growth conditions. There is also a shortage and high cost of tree seedlings due to the limited number of nurseries—only two in the study area, with an average cost of 7,000 birr per row of seedlings. The shortage of endemic tree seedlings and the transportation issues in moving seedlings from nurseries to planting sites further complicate the process. Additionally, there is inadequate protection for newly planted trees, leading to human

encroachment, and some areas are expanding farmland instead of focusing on tree plantation due to the increasing number of unemployed youths in rural areas.

Regarding the third objective, the key informants observed that the community's perception of tree plantation is generally positive. The community recognizes the economic, environmental, and aesthetic benefits of tree planting. Farmers engage in various forms of plantation in gardens, road sides, and mountainous areas, indicating a favorable attitude towards tree planting. They also practice small-scale seedling propagation near rivers and springs and participate in government and NGO-sponsored tree planting campaigns. The local proverb, “□□ □□□□ □□ □□ □□□□ □□ □□□□□!” (“A child born and a tree planted, their names will not fade away!”), reflects the community's positive perception and value placed on tree planting.

## CHAPTER FIVE

### 5. CONCLUSION AND RECOMMENDATION

#### 5.1 Conclusion

The study provides a comprehensive overview of the current status and dynamics of tree plantation in the selected kebeles, focusing on demographic and socio-economic variables, potential opportunities, challenges, and community perceptions.

##### 1-Demographic and Socio-Economic Variables:

- **Gender Disparity:** There is a notable gender imbalance in both the roles of household heads and the main participants in tree plantation, with males predominating in both categories.
- **Education Levels:** A significant portion of respondents has minimal formal education, with most falling within the 1-4 grade range. This suggests a need for enhanced educational initiatives to improve understanding of tree plantation benefits.
- **Marital Status and Economic Factors:** The majority of respondents are married, and farming is the primary source of income. Economic status varies, with most having a medium income level.
- **Age Distribution:** Most respondents are adults (41-50 years), which indicates that tree plantation efforts are largely managed by mature individuals in the community.

##### 2. Descriptive Analysis:

- **Quantitative Variables:** The average number of trees planted and land size varies across kebeles, with a significant range in both the number of trees and land size. The number of active household members also shows variability, affecting tree planting efforts.

##### 3. Opportunities:

- The study identified several opportunities for enhancing tree plantation, including favorable environmental conditions, community interest, and the presence of traditional tools and local nurseries. However, the availability of naturally grown seedlings and local private planters were less significant.

##### 4. Challenges:

- Major challenges affecting tree plantation include limited land availability for grazing, inadequate seed supply, lack of water sources, and insufficient institutional support. These challenges highlight critical areas that need to be addressed to improve tree planting outcomes.

##### 5. Community Perception:

- **Causes of Tree Disappearance:** Key causes include use pressure, mismanagement of trees, and small plot sizes.
- **Effects of Trees:** Trees positively impact soil conservation and soil fertility, with minimal negative effects on crop production.
- **Solutions:** Community members emphasize the need for education, policy enforcement, and suitable species selection as primary solutions to improve tree planting efforts.

- **Benefits:** The establishment of tree plantation organizations is perceived to offer significant benefits, including opportunities for engaging in nursery operations and silviculture.

The analysis of tree plantation data reveals several key insights into the relationships between demographic, socio-economic variables, and tree planting practices.

1. **Kebele and Tree Plantation:** The t-test results show that there is no significant difference in the mean number of trees planted between the two kebeles (Kalo-07 and Soba-013). The p-values are large, indicating that the variances in the number of trees planted in these areas are similar.
2. **Gender of Household Head:** Significant differences are observed based on the gender of the household head. Male-headed households plant significantly more trees (mean = 347.29) compared to female-headed households (mean = 297.05), with a p-value less than 0.05.
3. **Main Participant Gender:** The analysis also shows a significant difference based on the gender of the main participant in tree planting activities. Male participants (mean = 342.54) engage in planting more trees compared to female participants (mean = 257.06), with a p-value less than 0.05.
4. **Demographic and Socio-Economic Variables:** One-way ANOVA results reveal significant differences in the mean number of trees planted with respect to marital status, economic status, age category, and education level, while no significant difference is found with major income sources. Post-hoc tests indicate that these differences are significant across all pairwise groups within economic status and education level, but not for marital status or age category.
5. **Correlation Analysis:** There is a strong positive correlation between land size and the number of active household members with the number of trees planted. The Pearson correlations of 0.782 and 0.778, respectively, are significant, suggesting that larger land sizes and more active household members are associated with a higher number of trees planted.
6. **Chi-Square Test:** The chi-square test results indicate a significant relationship between the type of tree preferred and the reasons for planting. The preference for different tree types (e.g., Bahirzaf, Wanza) is influenced by various factors such as price, water requirements, growth rate, erosion control, and aesthetic value. The significant p-value (less than 0.001) suggests that tree preferences and planting reasons are not independent of each other.

## 5.2. Recommendations

The collected qualitative data analysis and empirical results reported in this thesis led us to the following recommendations: Based on the findings of the study the following issues are forwarded as recommendation to improve the tree plantation process, identify the opportunities for tree plantation and challenges of tree plantation in Albuko woreda;

- **Educational Programs:** There is a clear need for educational programs that target low education levels to enhance understanding of tree plantation benefits and best practices.
- **Policy and Support:** Strengthening institutional support and formulating policies that address the identified challenges can significantly improve tree plantation efforts.
- **Community Engagement:** Increasing community participation and awareness can help address the causes of tree disappearance and leverage the opportunities for tree planting.
- **Resource Allocation:** Addressing resource limitations, such as seed availability and water sources, is crucial for sustaining tree plantation initiatives.

While, there are several opportunities for enhancing tree plantation, overcoming the challenges and leveraging community perceptions will be key to promoting more effective and sustainable tree planting practices in the kebeles.

The findings suggest that tree planting practices are influenced by a range of factors including the demographic characteristics of household heads and participants, as well as socio-economic variables such as economic status and education level. Understanding these factors can help in designing targeted interventions to promote tree planting, particularly focusing on increasing the participation of female-headed households and providing support for those with limited economic resources.

Additionally, the significant relationship between land size and the number of active household members with tree planting underscores the importance of these variables in determining the extent of tree plantation. The preferences for specific tree types based on various reasons highlight the need for tailored tree planting strategies that address both economic and environmental motivations.

Overall, these insights provide a comprehensive understanding of the factors affecting tree plantation and can guide future policies and programs aimed at enhancing afforestation efforts.

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## Appendix-I

### Questionnaire Survey Prepared for Household Heads

Addis Ababa University

College of Social Sciences

Department of Geography and Environmental Studies

The purpose of this questionnaire is to collect information regarding the opportunities and challenges of tree plantation as well as respondents' perception about tree plantation in Albuko Woreda, South Wollo administrative Zone of Amhara regional State.

The final paper that will be composed using the data you submitted is meant to be used for academic purposes. As such, we respectfully ask that you supply as much correct information as you can. The researcher wants to reassure you that all information will be handled in confidence. I appreciate your cooperation in advance!

Your Sincerely.

For more, please contact the researcher via:  
Tell: +251920217638 [Mekbib Melaku]  
Email: mekbibmelaku0920@gmail.com

### **PART I: Demographic Characteristics**

Please answer the questions by making tick mark [√] on the provided spaces.

1. Kebele: 07 (Kalo) \_\_\_\_\_ 012 (Soba) \_\_\_\_\_
2. Sex of household head: Male \_\_\_\_\_ Female \_\_\_\_\_
3. Marital Status: Single \_\_\_\_ Married \_\_\_\_ Divorced \_\_\_\_ Widowed \_\_\_\_
4. Age : \_\_\_\_\_
5. Education level: Illiterate \_\_\_\_ 1-8 \_\_\_\_ 9-12 \_\_\_\_ Diploma \_\_\_\_ Degree and above  
\_\_\_\_\_
6. What is your major source of income in your family?  
Farming \_\_\_\_ Plantation \_\_\_\_ Trade \_\_\_\_ Crafting \_\_\_\_ Others (specify) \_\_\_\_
7. Number of active household(s): \_\_\_\_\_

8. Main participant in tree plantation according to gender: Male \_\_\_ Female \_\_\_
9. Economic status: Low \_\_\_\_\_ Medium \_\_\_\_\_ High \_\_\_\_\_

**PART II: General questions related to tree plantation in the study area.**

1. Do you plant trees in your farm or compound or locality?    A. Yes            B. No
2. If your answer is yes for Q1, express the expected number of trees you planted for the listed tree types with range?
  - Tid: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Bahirzaf: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Kosso: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Zigba: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Girar: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Wanza: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Weyra: minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
  - Specify if others\_\_\_\_\_ : minimum\_\_\_\_\_ maximum\_\_\_\_\_ Class mark: \_\_\_\_\_
3. What are the primary reasons behind you're planting of such trees?
  - A. For protecting soil from erosion
  - B. For wood fuel
  - C. For construction and furniture
  - D. For income source
  - E. For aesthetic beauty
  - F. For court yard        G. Other(specify) \_\_\_\_\_
4. In which areas do you plant trees most of the times?
  - A. Mountainous \sloppy\ rugged
  - B. Plain areas
  - C. At the edges of rivers and valleys
  - D. Gardens
  - E. Around farmland\ plots
  - F. Around roadsides
  - G. At government protectorate sites
5. How many times you plant trees per year?
  - A. 1 time        B. .2 times        C. All year months
6. How much trees do you plant per year on Average?
  - A.50-100    B. 101-200    C.201-300    D. 301-400    E.401-500    F. Above 500
7. Did you plant fruit trees?    A. Yes            B. No
8. If your answer is yes for Q7, What kind of fruit trees did you plant? \_\_\_\_\_





**PART IV: Questions to identify the challenges of tree plantation in the study area.**

Please indicate your degree of perception on the challenges of tree plantation by circling the number that best represents your opinion. 1 indicates very low (VL), 2 indicates low (L), 3 indicates medium (M), 4 indicates high (H), and 5 indicates very high (VH).

| No | Challenges  | VL | L | M | H | VH |
|----|---|----|---|---|---|----|
| 1  | Lack of institutional support such as: technical support, funds, tree plantation campaign program, tree maintenance program, long term evaluation program by government officials, etc. |    |   |   |   |    |
| 2  | Lack of water sources.  |    |   |   |   |    |
| 3  | Lack of nurseries and lack of tree species that you have wanted to plant.   |    |   |   |   |    |
| 4  | Less seed availability: lower production of seeds, high cost of seeds and lack of trends on seed sowing and cultivation.  |    |   |   |   |    |
| 5  | Human influences like increasing demand for wood products (for fuel and construction).  |    |   |   |   |    |
| 6  | Lack (proportion) of land sizes.  |    |   |   |   |    |
| 7  | Lack of tools and tools mainly watering cans, wheelbarrows and spades.  |    |   |   |   |    |
| 8  | Unexpected natural accidents like drought, massive erosion, cracking of earth, etc.   |    |   |   |   |    |
| 9  | Lack of insight learning (people awareness) about tree plantation.  |    |   |   |   |    |
| 10 | Lack of tree substitution culture (planting when you cut).  |    |   |   |   |    |
| 11 | Unlimited using of lands for livestock grazing and crops, and encroachment by livestock.  |    |   |   |   |    |
| 12 | Shortage/expensiveness of chemical fertilizers (DAP and CAN) to improve the growth of seedlings.  |    |   |   |   |    |

**PART V: Questions to evaluate the perception of respondents about tree plantation.**

1. Do tree maintenance practices in your community or on farm plots change from those in the past? If so, please explain the distinction? It's...

2. What would be better method of tree establishment in your area or locality?

A. Plantation of trees   B. Natural regeneration   C. Not sure

3. What are your perceptions on these primary effects (as positive/ negative) of trees on farm lands?

A. Soil conservation

B. Destroyed soil nutrients

C. Improvement on tree cover

D. Improvement in soil fertility

E. Reducing crops production

F. No effect

4. What were the causes of disappearance of trees from farm lands or localities?

A. Land management issues (Frequent plowing)

B. Drought

C. Lack of people awareness

D. Aging and death of trees

E. Use pressure

F. Impacts of invasive species

G. Miss management of trees

H. Competitions with trees

I. Effects of small plot size

5. What do you think is being first solution for overcoming difficulties of growing trees?

A. Selection of suitable species

B. Educating people

C. Appropriate site selection

D. Policy formulation and enforcement

E. Sound tree management

F. Providing external support

G. Controlling free browsing

H. Watering tree seedlings

I. Tree protection

J. Encouraging tree nursery establishment

k. Community participation

L. Ensuring tree ownership

6. What has been the result of applying the information about tree plantation which if offered by the government or others?

A. More trees in farm

B. Diversified income sources

C. Planted different species

D. Diversified tree products

E. Controlling erosion

F. Tree management skills increased

G. Technical support to other farmers

H. Ability to manage my tree nursery.

I. Others (specify) \_\_\_\_\_

7. What type of benefits you obtain from tree plantation establishment as an opportunity of employment?

A. To engage in silviculture

B. To engage in nursery operations

C. Work as drivers to transport tree seedlings

D. Works with charcoal production

G. Others (specify) \_\_\_\_\_

**Thank You!!!!**

## APPENDIX II

### SEMI-STRUCTURED INTERVIEW

#### Key Informant Interview Guideline For Woreda agriculture development Officials (DA Task Force Members)

1.How do you evaluate the forest coverage declining in Albuko woreda ? from past to now? Please evaluate with in percentage?-----

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2.How much area is covered by plants or forests in Albuko woreda know adays?-----

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3.How do you evaluate the tree plantation campaign in Albuko woreda?-----

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4.How much trees are planted per year in Albuko woreda?.....state the number in each kebeles and in each plant types?-----

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5.Are there government control plantation areas in the woreda ?.....what are they?-----

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6.How many people are participating in tree plantation process in the woreda per year and in 07 and 013kebeles per year?-----

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7.What type of areas are preferred for tree plantation in Albuko woreda and 07 and 013 kebeles ?and what are these areas? Why are you selecting them?-----

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8.List down the tree plants that are planted in Albuko woreda ? and in each kebeles?-----

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9. Where do you get tree seedlings?-----  
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10. Do you spend high amount of money for tree plantation? How much is it?-----  
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11. What are the opportunities you have for tree plantation process? Please elaborate it?-----  
-----  
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12. What are the challenges you faced during the tree plantation campaign in Albuko woreda ?-----  
-----  
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13. How do you evaluate the perception of the community for tree plantation ?-----  
-----  
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14. How many trees are perfectly grown in each year in each kebeles ?especially in 07 and 013 kebeles ? after plantation was held?-----  
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-----

-----**THANK YOU**-----

### APPENDEX-III

#### የቡድን ውይይት ማድረጊያ ጥያቄዎች

1. የችግኝ ወይም የዛፍ ተከላ ለአካባቢችሁ ማህበረሰብ እና ለሌሎችም የሚሰጠው ጠቀሜታዎች ምን ምን ናቸው?
2. የአካባቢችሁ ማህበረሰብ የዛፍ ተክሎችን የሚተክለው የት የት ስፍራዎች ነው? ለምን ይመስላችሁዋል?
3. የችግኝ ወይም የዛፍ ተከላ ዘመች በኢትዮጵያ እተካሄደ ይገኛል ይህ የአገረ አቀፍ የዛፍ ተከላ ዘመቻ እና ፕሮግራም ምን ምን እንቅፋቶች ገጥመዉታል?
4. የአካባቢያችሁ ማህበረሰብ የ07እና የ013 ቀበሌ የችግኝ ተከላ ወይም የዛፍ ተከላውን ዘመቻ ወይም ለዛፍ ተከላ ያለውን አመለካከት እንደት ትገመግሙታላችሁ? አወንታዊ ጎኑ ይመዘናል ወይስ አሎታዊ? አመለካኝ ነገሮችን አብራሩ ወይም ዘርዝሩ?
5. የተተክሉ ዛፎችን የመጠብቅ እና የመንከባከብ ክሰው እና ክዕንሰሳት ንክኪ የመጠብቅ ሰራ በማህበረሰቡ ይተገበራልን? መገለጫ አስቀምጡ? ክልተጠበቁ ደግሞ ምክንያቱን በዝርዝር ግለፁ?
6. የተተክሉ ዛፎችን እንዳይፀድቁ እና ከተፈለገው አላማ እንዳይደርሱ የሚያደረጉዎቸው ነገሮች በአካባቢያችሁ ምን ምን ናቸው?
7. በአካባቢያችሁ ይበልጥ የሚታወቁ እና የሚተክሉ የዛፍ ተክሎች ምን ምን ናቸው?

## **APPENDEX-IV**

### **Field Observation Chacklist**

1. Major challenges of tree plantation in the study area.
2. The type of seedlings commonly planted.
3. The level of planted tree seedlings protection and supervision.
4. Sites for tree plantation.
5. The contributions or opportunities that the plants give for the community as well as the opportunities that exist in the study area for tree plantation.

## APPENDIX V

### SPSS OUTPUT

| Descriptive Statistics                    |           |           |           |           |           |            |                |           |
|---|-----------|-----------|-----------|-----------|-----------|------------|----------------|-----------|
|   | N         | Minimum   | Maximum   | Sum       | Mean      |            | Std. Deviation | Variance  |
|   | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic      | Statistic |
| Tree                                      | 114       | 210       | 615       | 37682     | 330.54    | 9.302      | 99.316         | 9863.755  |
| Total size of your farm size (in hectare) | 114       | .49       | 2.10      | 126.15    | 1.1066    | .04790     | .51147         | .262      |
| Number of household                       | 114       | 1         | 5         | 313       | 2.75      | .083       | .891           | .793      |

| Group Statistics |          |    |        |                |                 |
|------------------|----------|----|--------|----------------|-----------------|
|                  | Kebele   | N  | Mean   | Std. Deviation | Std. Error Mean |
| Tree             | Kalo 07  | 49 | 332.47 | 105.329        | 15.047          |
|                  | Soba 012 | 65 | 329.09 | 95.342         | 11.826          |

| Independent Samples Test |                             |   |      |                              |        |                 |                 |                       |   |        |
|--------------------------|-----------------------------|---|------|------------------------------|--------|-----------------|-----------------|-----------------------|---|--------|
|                          |                             | Levene's Test for Equality of Variances |      | t-test for Equality of Means |        |                 |                 |                       |   |        |
|                          |                             | F                                       | Sig. | t                            | Df     | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |        |
|                          |                             |   |      |                              |        |                 |                 |                       | Lower                                     | Upper  |
| Tree                     | Equal variances assumed     | .287                                    | .593 | .179                         | 112    | .858            | 3.377           | 18.871                | -34.013                                   | 40.767 |
|                          | Equal variances not assumed |   |      | .176                         | 97.664 | .860            | 3.377           | 19.138                | -34.603                                   | 41.357 |

| Group Statistics |                       |    |        |                |                 |
|------------------|-----------------------|----|--------|----------------|-----------------|
|                  | Sex of household head | N  | Mean   | Std. Deviation | Std. Error Mean |
| Tree             | Female                | 38 | 297.05 | 85.171         | 13.817          |
|                  | Male                  | 76 | 347.29 | 102.129        | 11.715          |

| Independent Samples Test |                             |   |      |                              |                   |                 |                 |                       |   |         |
|--------------------------|-----------------------------|---|------|------------------------------|-------------------|-----------------|-----------------|-----------------------|---|---------|
|                          |                             | Levene's Test for Equality of Variances |      | t-test for Equality of Means |                   |                 |                 |                       |   |         |
|                          |                             | F                                       | Sig. | T                            | Degree of Freedom | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |         |
|                          |                             |   |      |                              |                   |                 |                 |                       | Lower                                     | Upper   |
| Tree                     | Equal variances assumed     | 3.720                                   | .056 | -2.611                       | 112               | .010            | -50.237         | 19.243                | -88.365                                   | -12.109 |
|                          | Equal variances not assumed |   |      | -2.773                       | 87.112            | .007            | -50.237         | 18.115                | -86.241                                   | -14.233 |

| Group Statistics |                                     |    |        |                |                 |
|------------------|-------------------------------------|----|--------|----------------|-----------------|
|                  | Main participant in tree plantation | N  | Mean   | Std. Deviation | Std. Error Mean |
| Tree             | Female                              | 16 | 257.06 | 36.342         | 9.085           |
|                  | Male                                | 98 | 342.54 | 101.245        | 10.227          |

| <b>Independent Samples Test</b> |                             |   |      |                              |                   |                 |                 |                       |   |         |
|---------------------------------|-----------------------------|---|------|------------------------------|-------------------|-----------------|-----------------|-----------------------|---|---------|
|                                 |                             | Levene's Test for Equality of Variances |      | t-test for Equality of Means |                   |                 |                 |                       |   |         |
|                                 |                             | F                                       | Sig. | T                            | Degree of Freedom | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |         |
|                                 |                             |   |      |                              |                   |                 |                 |                       | Lower                                     | Upper   |
| Tree                            | Equal variances assumed     | 11.378                                  | .001 | -3.332                       | 112               | .001            | -85.478         | 25.657                | -136.315                                  | -34.642 |
|                                 | Equal variances not assumed |   |      | -6.248                       | 61.763            | .000            | -85.478         | 13.680                | -112.826                                  | -58.130 |

| <b>Test of Homogeneity of Variances</b> |     |     |      |
|---|-----|-----|------|
| Tree                                    |     |     |      |
| Levene Statistic                        | df1 | df2 | Sig. |
| 5.761                                   | 3   | 110 | .001 |

| <b>ANOVA</b>   |                |                   |             |        |      |
|----------------|----------------|-------------------|-------------|--------|------|
| Tree           |                |                   |             |        |      |
|                | Sum of Squares | Degree of Freedom | Mean Square | F      | Sig. |
| Between Groups | 253584.930     | 3                 | 84528.310   | 10.799 | .000 |
| Within Groups  | 861019.351     | 110               | 7827.449    |        |      |
| Total          | 1114604.281    | 113               |             |        |      |

### Post Hoc Tests

| <b>Multiple Comparisons</b>                              |                |                          |            |      |                         |             |
|--|----------------|--------------------------|------------|------|-------------------------|-------------|
| Dependent Variable: Tree                                 |                |                          |            |      |                         |             |
| Tamhane  |                |                          |            |      |                         |             |
| (I) Mar_Status   | (J) Mar_Status | Mean Difference<br>(I-J) | Std. Error | Sig. | 95% Confidence Interval |             |
|  |                |                          |            |      | Lower Bound             | Upper Bound |
| Single   | Married        | -106.911*                | 10.267     | .000 | -134.86                 | -78.96      |
|  | Divorced       | -44.933                  | 18.376     | .154 | -100.62                 | 10.75       |
|  | Widowed        | -188.693*                | 23.466     | .000 | -255.74                 | -121.65     |
| Married  | Single         | 106.911*                 | 10.267     | .000 | 78.96                   | 134.86      |
|  | Divorced       | 61.977*                  | 20.515     | .036 | 2.92                    | 121.03      |
|  | Widowed        | -81.783*                 | 25.176     | .016 | -152.26                 | -11.30      |
| Divorced   | Single         | 44.933                   | 18.376     | .154 | -10.75                  | 100.62      |
|  | Married        | -61.977*                 | 20.515     | .036 | -121.03                 | -2.92       |
|  | Widowed        | -143.760*                | 29.430     | .000 | -225.43                 | -62.09      |
| Widowed  | Single         | 188.693*                 | 23.466     | .000 | 121.65                  | 255.74      |
|  | Married        | 81.783*                  | 25.176     | .016 | 11.30                   | 152.26      |
|  | Divorced       | 143.760*                 | 29.430     | .000 | 62.09                   | 225.43      |
| *. The mean difference is significant at the 0.05 level. |                |                          |            |      |                         |             |

| <b>Test of Homogeneity of Variances</b> |     |     |      |
|---|-----|-----|------|
| Tree                                    |     |     |      |
| Levene Statistic                        | df1 | df2 | Sig. |
| 3.878                                   | 2   | 111 | .024 |

| ANOVA          |                |                   |             |       |      |
|----------------|----------------|-------------------|-------------|-------|------|
| Tree           |                |                   |             |       |      |
|                | Sum of Squares | Degree of Freedom | Mean Square | F     | Sig. |
| Between Groups | 33939.627      | 2                 | 16969.814   | 1.743 | .180 |
| Within Groups  | 1080664.653    | 111               | 9735.718    |       |      |
| Total          | 1114604.281    | 113               |             |       |      |

### Post Hoc Tests

| Multiple Comparisons        |                             |                       |            |      |                         |             |  |
|-----------------------------|-----------------------------|-----------------------|------------|------|-------------------------|-------------|--|
| Dependent Variable: Tree    |                             |                       |            |      |                         |             |  |
| Tamhane                     |                             |                       |            |      |                         |             |  |
| (I) Major sources of income | (J) Major sources of income | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |             |  |
|                             |                             |                       |            |      | Lower Bound             | Upper Bound |  |
| Farming                     | Trading                     | -50.074               | 33.380     | .388 | -137.97                 | 37.82       |  |
|                             | Crafting                    | -5.466                | 36.105     | .998 | -106.03                 | 95.10       |  |
| Trading                     | Farming                     | 50.074                | 33.380     | .388 | -37.82                  | 137.97      |  |
|                             | Crafting                    | 44.608                | 47.223     | .731 | -76.94                  | 166.16      |  |
| Crafting                    | Farming                     | 5.466                 | 36.105     | .998 | -95.10                  | 106.03      |  |
|                             | Trading                     | -44.608               | 47.223     | .731 | -166.16                 | 76.94       |  |

| Test of Homogeneity of Variances |     |     |      |
|----------------------------------|-----|-----|------|
| Tree                             |     |     |      |
| Levene Statistic                 | df1 | df2 | Sig. |
| 5.887                            | 2   | 111 | .004 |

| ANOVA          |                |                   |             |        |      |
|----------------|----------------|-------------------|-------------|--------|------|
| Tree           |                |                   |             |        |      |
|                | Sum of Squares | Degree of Freedom | Mean Square | F      | Sig. |
| Between Groups | 585527.424     | 2                 | 292763.712  | 61.422 | .000 |
| Within Groups  | 529076.856     | 111               | 4766.458    |        |      |
| Total          | 1114604.281    | 113               |             |        |      |

### Post Hoc Tests

| Multiple Comparisons                 |                                      |                       |            |      |                         |             |
|--------------------------------------|--------------------------------------|-----------------------|------------|------|-------------------------|-------------|
| Dependent Variable: Tree             |                                      |                       |            |      |                         |             |
| Tamhane                              |                                      |                       |            |      |                         |             |
| (I) Economic status of the household | (J) Economic status of the household | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |             |
|                                      |                                      |                       |            |      | Lower Bound             | Upper Bound |
| Low                                  | Medium                               | -64.395*              | 12.343     | .000 | -94.36                  | -34.43      |
|                                      | High                                 | -284.806*             | 19.394     | .000 | -339.08                 | -230.53     |
| Medium                               | Low                                  | 64.395*               | 12.343     | .000 | 34.43                   | 94.36       |
|                                      | High                                 | -220.411*             | 20.175     | .000 | -275.51                 | -165.31     |
| High                                 | Low                                  | 284.806*              | 19.394     | .000 | 230.53                  | 339.08      |
|                                      | Medium                               | 220.411*              | 20.175     | .000 | 165.31                  | 275.51      |

\*. The mean difference is significant at the 0.05 level.

| Test of Homogeneity of Variances |     |     |      |
|----------------------------------|-----|-----|------|
| Tree                             |     |     |      |
| Levene Statistic                 | df1 | df2 | Sig. |
| 7.753                            | 6   | 107 | .000 |

| ANOVA          |                |                   |             |       |      |
|----------------|----------------|-------------------|-------------|-------|------|
| Tree           |                |                   |             |       |      |
|                | Sum of Squares | Degree of Freedom | Mean Square | F     | Sig. |
| Between Groups | 289676.703     | 6                 | 48279.450   | 6.262 | .000 |
| Within Groups  | 824927.578     | 107               | 7709.604    |       |      |
| Total          | 1114604.281    | 113               |             |       |      |

### Post Hoc Tests

| Multiple Comparisons     |         |                       |            |       |                         |             |
|--------------------------|---------|-----------------------|------------|-------|-------------------------|-------------|
| Dependent Variable: Tree |         |                       |            |       |                         |             |
| Tamhane                  |         |                       |            |       |                         |             |
| (I) Age                  | (J) Age | Mean Difference (I-J) | Std. Error | Sig.  | 95% Confidence Interval |             |
|                          |         |                       |            |       | Lower Bound             | Upper Bound |
| <20                      | 21-30   | 219.900               | 41.973     | .103  | -46.82                  | 486.62      |
|                          | 31-40   | 185.040               | 38.006     | .244  | -134.97                 | 505.05      |
|                          | 41-50   | 215.259               | 32.705     | .437  | -584.67                 | 1015.19     |
|                          | 51-60   | 254.720               | 31.292     | .464  | -1013.70                | 1523.14     |
|                          | 61-70   | 311.438               | 29.054     | .596  | -3345.85                | 3968.73     |
|                          | >70     | 253.778               | 29.693     | .622  | -2327.79                | 2835.35     |
| 21-30                    | <20     | -219.900              | 41.973     | .103  | -486.62                 | 46.82       |
|                          | 31-40   | -34.860               | 40.475     | 1.000 | -173.71                 | 103.99      |
|                          | 41-50   | -4.641                | 35.544     | 1.000 | -134.57                 | 125.29      |
|                          | 51-60   | 34.820                | 34.247     | 1.000 | -94.07                  | 163.71      |
|                          | 61-70   | 91.538                | 32.215     | .307  | -37.49                  | 220.57      |

|       |       |           |        |       |          |         |
|-------|-------|-----------|--------|-------|----------|---------|
|       | >70   | 33.878    | 32.793 | 1.000 | -95.08   | 162.83  |
| 31-40 | <20   | -185.040  | 38.006 | .244  | -505.05  | 134.97  |
|       | 21-30 | 34.860    | 40.475 | 1.000 | -103.99  | 173.71  |
|       | 41-50 | 30.219    | 30.759 | 1.000 | -68.98   | 129.42  |
|       | 51-60 | 69.680    | 29.251 | .379  | -25.47   | 164.83  |
|       | 61-70 | 126.398*  | 26.844 | .001  | 37.04    | 215.75  |
|       | >70   | 68.738    | 27.535 | .322  | -22.47   | 159.95  |
| 41-50 | <20   | -215.259  | 32.705 | .437  | -1015.19 | 584.67  |
|       | 21-30 | 4.641     | 35.544 | 1.000 | -125.29  | 134.57  |
|       | 31-40 | -30.219   | 30.759 | 1.000 | -129.42  | 68.98   |
|       | 51-60 | 39.461    | 21.927 | .819  | -30.63   | 109.55  |
|       | 61-70 | 96.178*   | 18.595 | .000  | 35.48    | 156.87  |
|       | >70   | 38.519    | 19.579 | .711  | -25.60   | 102.63  |
| 51-60 | <20   | -254.720  | 31.292 | .464  | -1523.14 | 1013.70 |
|       | 21-30 | -34.820   | 34.247 | 1.000 | -163.71  | 94.07   |
|       | 31-40 | -69.680   | 29.251 | .379  | -164.83  | 25.47   |
|       | 41-50 | -39.461   | 21.927 | .819  | -109.55  | 30.63   |
|       | 61-70 | 56.718*   | 15.978 | .023  | 4.60     | 108.84  |
|       | >70   | -.942     | 17.113 | 1.000 | -57.43   | 55.55   |
| 61-70 | <20   | -311.438  | 29.054 | .596  | -3968.73 | 3345.85 |
|       | 21-30 | -91.538   | 32.215 | .307  | -220.57  | 37.49   |
|       | 31-40 | -126.398* | 26.844 | .001  | -215.75  | -37.04  |
|       | 41-50 | -96.178*  | 18.595 | .000  | -156.87  | -35.48  |
|       | 51-60 | -56.718*  | 15.978 | .023  | -108.84  | -4.60   |
|       | >70   | -57.660*  | 12.562 | .005  | -102.15  | -13.17  |

|     |       |          |        |       |          |         |
|-----|-------|----------|--------|-------|----------|---------|
| >70 | <20   | -253.778 | 29.693 | .622  | -2835.35 | 2327.79 |
|     | 21-30 | -33.878  | 32.793 | 1.000 | -162.83  | 95.08   |
|     | 31-40 | -68.738  | 27.535 | .322  | -159.95  | 22.47   |
|     | 41-50 | -38.519  | 19.579 | .711  | -102.63  | 25.60   |
|     | 51-60 | .942     | 17.113 | 1.000 | -55.55   | 57.43   |
|     | 61-70 | 57.660*  | 12.562 | .005  | 13.17    | 102.15  |

\*. The mean difference is significant at the 0.05 level.

| Test of Homogeneity of Variances |     |     |      |
|----------------------------------|-----|-----|------|
| Tree                             |     |     |      |
| Levene Statistic                 | df1 | df2 | Sig. |
| 5.340                            | 4   | 109 | .001 |

| ANOVA          |                |                   |             |        |      |
|----------------|----------------|-------------------|-------------|--------|------|
| Tree           |                |                   |             |        |      |
|                | Sum of Squares | Degree of Freedom | Mean Square | F      | Sig. |
| Between Groups | 861274.760     | 4                 | 215318.690  | 92.645 | .000 |
| Within Groups  | 253329.521     | 109               | 2324.124    |        |      |
| Total          | 1114604.281    | 113               |             |        |      |

## Post Hoc Tests

| Multiple Comparisons     |                |                       |            |      |                         |             |
|--------------------------|----------------|-----------------------|------------|------|-------------------------|-------------|
| Dependent Variable: Tree |                |                       |            |      |                         |             |
| Tamhane                  |                |                       |            |      |                         |             |
| (I) Educ_Level           | (J) Educ_Level | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |             |
|                          |                |                       |            |      | Lower Bound             | Upper Bound |
| Illiterate               | 1-4            | -54.488*              | 10.431     | .000 | -84.39                  | -24.58      |
|                          | 5-8            | -198.311*             | 10.461     | .000 | -231.40                 | -165.22     |
|                          | 9-10           | -251.740*             | 9.937      | .000 | -282.61                 | -220.87     |
|                          | 11-12          | -337.561*             | 9.370      | .000 | -368.23                 | -306.89     |
| 1-4                      | Illiterate     | 54.488*               | 10.431     | .000 | 24.58                   | 84.39       |
|                          | 5-8            | -143.824*             | 10.790     | .000 | -177.50                 | -110.15     |
|                          | 9-10           | -197.252*             | 10.283     | .000 | -228.82                 | -165.69     |
|                          | 11-12          | -283.074*             | 9.736      | .000 | -314.28                 | -251.87     |
| 5-8                      | Illiterate     | 198.311*              | 10.461     | .000 | 165.22                  | 231.40      |
|                          | 1-4            | 143.824*              | 10.790     | .000 | 110.15                  | 177.50      |
|                          | 9-10           | -53.429*              | 10.314     | .002 | -88.74                  | -18.12      |
|                          | 11-12          | -139.250*             | 9.768      | .000 | -175.28                 | -103.22     |
| 9-10                     | Illiterate     | 251.740*              | 9.937      | .000 | 220.87                  | 282.61      |
|                          | 1-4            | 197.252*              | 10.283     | .000 | 165.69                  | 228.82      |
|                          | 5-8            | 53.429*               | 10.314     | .002 | 18.12                   | 88.74       |
|                          | 11-12          | -85.821*              | 9.206      | .000 | -120.13                 | -51.51      |
| 11-12                    | Illiterate     | 337.561*              | 9.370      | .000 | 306.89                  | 368.23      |
|                          | 1-4            | 283.074*              | 9.736      | .000 | 251.87                  | 314.28      |
|                          | 5-8            | 139.250*              | 9.768      | .000 | 103.22                  | 175.28      |
|                          | 9-10           | 85.821*               | 9.206      | .000 | 51.51                   | 120.13      |

\*. The mean difference is significant at the 0.05 level.

| <b>Correlations</b>                       |                     |        |   |                     |
|---|---------------------|--------|---|---------------------|
|   |                     | Tree   | Total size of your farm size (in hectare) | Number of household |
| Tree                                      | Pearson Correlation | 1      | .782**                                    | .778**              |
|   | Sig. (2-tailed)     |        | .000                                      | .000                |
|   | N                   | 114    | 114                                       | 114                 |
| Total size of your farm size (in hectare) | Pearson Correlation | .782** | 1   | .603**              |
|   | Sig. (2-tailed)     | .000   |   | .000                |
|   | N                   | 114    | 114                                       | 114                 |
| Number of household                       | Pearson Correlation | .778** | .603**                                    | 1                   |
|   | Sig. (2-tailed)     | .000   | .000                                      |                     |
|   | N                   | 114    | 114                                       | 114                 |

\*\* . Correlation is significant at the 0.01 level (2-tailed).

| <b>Chi-Square Tests</b>      |                     |                   |                                   |
|------------------------------|---------------------|-------------------|-----------------------------------|
|                              | Value               | Degree of Freedom | Asymptotic Significance (2-sided) |
| Pearson Chi-Square           | 56.226 <sup>a</sup> | 8                 | .000                              |
| Likelihood Ratio             | 59.853              | 8                 | .000                              |
| Linear-by-Linear Association | 23.649              | 1                 | .000                              |
| N of Valid Cases             | 114                 |                   |                                   |

a. 3 cells (20.0%) have expected count less than 5. The minimum expected count is 2.45.