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COLLEGE OF AGRICULTURE AND NATURAL RESOURCES

DEPARTMENT OF NATURAL RESOURCES MANAGEMENT

THE IMPACTS OF DEFORESTATION ON LIVELIHOODS OF LOCAL COMMUNTY: THE CASE OF GASORE KEBELE, CHEHA DISTERICT, GURAGE ZONE, IN CENTRAL OF ETHIOPIA

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ABBREVATIONS

DAs - Development Agents

FAO - Food and Agriculture Organization

ITTO - International Tropical Timber Organization

MOEF - Ministry of Environment and Forests

NGO - Non-Governmental Organization

NTFPs - Non-Timber Forest Products

KII - Key Informant Interview

FGD - Focus Group Discussion

CSA - Central Statistical Agency

EC - Ethiopian Calendar

NMA - National Meteorological Agency

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ABSTRACT

Deforestations are a significant environmental challenge that has far-reaching implications for biodiversity, climate change, and the livelihoods of local communities. In many regions of the world, including Ethiopia, forests play a crucial role in providing essential resources such as food, fuel, and income, particularly for local community populations. However currently, there are several studies examining various aspects of deforestation in Ethiopia, yet there remains a significant gap in localized research that focuses on the specific impacts of deforestation on rural communities.

Therefore the present study was aimed to investigate the livelihood strategies employed by the local community, to identify and analyze the major causes of deforestation in the study area, to assess the socio-economic impacts of deforestation on the livelihoods of local communities. To address these objectives, the study followed a mixed-method approach that includes qualitative and quantitative data including household surveys, focus group discussions, key informant interviews and field observation. A total of **88** *household survey respondents were selected by random sampling and 12 of participants key informants interview were purposively selected based on their knowledge and experience, including local elders, religious leaders, and development agents.*

The qualitative insights combined with quantitative data, provided a comprehensive understanding of the dynamics between deforestation and community livelihoods. Secondary data were also collected from the Cheha Woreda Agricultural Office, encompassing both published and unpublished documents, and were summarized using graphs and tables to facilitate analysis. The study result that, the livelihood strategies of the local community were affected due to deforestation majority of the local farmer's livelihood ways depends on forest products before deforestation. But by the different factors such as agricultural expansion, over population, and overgrazing the forest have been defrosted and changed their livelihood strategies. Due to this factor declined of soil productivity, water quality and quantity, energy resource. To improve these farmers used to practice different mechanism in the study area.

Key words; Deforestation , Livelihood Strategies, Socio-Economic Impacts , Agricultural Productivity .

1. INTRODUCTION

1.1 Background of the study

Forests are among the most vital natural resources on Earth, covering vast areas and providing numerous material goods and environmental services essential for life (Kaushik, 2006). They play a critical role in supplying food, income, and watershed protection, which are crucial for securing stable food supplies for communities globally (FAO, 2010). The benefits of forests extend from local to global levels, including carbon sequestration and supporting the livelihoods of over half a billion people (FAO, 2010). The annual economic contribution of forest-related industries is estimated at approximately $600 billion (FAO, 2010). However, Ethiopia is lagging in achieving the national target of 33% forest coverage, currently maintaining only 15.5% (FAO, 2015).

The total financial return from various forest sectors is estimated at 2.5 billion annually, although this figure may not capture all revenue sources, such as fuel wood, food, honey, and construction materials,whichsignificantlycontributetohouseholdincomes(Getachew,2007;Tesfayeetal.,2016).Forests provide a wide array of commercial goods, including timber, firewood, pulp wood, food items, gums, resins, oils, rubber, fibers, and medicines, collectively valued at over 2.5 billion annually, although this figure may not capture all revenue sources, such as fuel wood, food, honey, and construction materials, which significantly contribute to household incomes (Getachew,2007;Tesfaye *et.al*.,2016). Forests provide a wide array of commercial goods, including timber, firewood, pulp wood, food items, gums, resins, oils, rubber, fibers, and medicines, collectively valued at over 400 billion per year (Kaushik, 2006; FAO, 2015).

Ecological services offered by forests include oxygen production through photosynthesis, climate regulation, habitat provision for wildlife, hydrological cycle regulation, soil erosion prevention, and pollution moderation (Kaushik et al., 2006; FAO, 2015). Despite these benefits, forests are being deforested at alarming rates globally. In India, for instance, the per capita forest area is notably low at 0.064 hectares, highlighting the challenges posed by a large population (FAO, 2015).

Ecological services offered by forests include oxygen production through photosynthesis, climate regulation, habitat provision for wildlife, hydrological cycle regulation, soil erosion prevention, and pollution moderation (Kaushik *et al.,* 2006). Despite these benefits, forests are being deforested at alarming rates globally. In India, for instance, the per capita forest area is notably low at 0.075 hectares, highlighting the challenges posed by a large population (Kaushik, 2006).

Deforestation, defined as the loss of forest cover through tree removal or clearing (Mulgeta, 1988), is a major environmental issue in Ethiopia, leading to soil erosion and decreased soil fertility (Kidane, 2002; Tesfaye *et al*., 2016). It also results in biodiversity loss and reduced productivity (Asner et al., 2005; FAO, 2015). The impact of deforestation extends to food security, significantly affecting the availability of fuel wood, a primary income source for many households (Townson, 1995; FAO, 2010). Approximately 2.4 billion people rely on fuel wood or charcoal for heating and cooking, with about 1.2 billion facing a "fuel wood famine" (FAO, 2010). This study aims to investigate the impact of deforestation on the livelihoods of local communities in the Cheha Woreda, Gasore Kebele, Gurage Zone, and South Regional State of Ethiopia.

1.2 Statement of the Problem

Deforestation presents alarming environmental, social, and economic challenges, particularly in Gasore Kebele, Cheha District, Gurage Zone, Central Ethiopia. Rapid population growth has intensified pressure on forest resources, adversely impacting local livelihoods. As noted by Zelalem (2020), the deterioration of household livelihoods is closely linked to escalating demands for forest products. Globally, causes of deforestation include agricultural expansion, logging, and infrastructure development. In Ethiopia, unsustainable practices such as overreliance on fuel wood and charcoal exacerbate these issues, leading to serious environmental consequences, including soil erosion and biodiversity loss (Cooke, 2021).

In Gasore Kebele, communities face increasing pressure on arable land, forcing them to convert marginal lands into agricultural use, which further exacerbates deforestation and land degradation. The conversion of grazing lands to farmland depletes forest resources, compelling households to substitute animal dung for fuel wood, thus depriving the soil of essential organic

matter (Ludi, 2022). This cycle of resource depletion has profound implications, leading to increased poverty and food insecurity.

Despite these significant challenges, there is a lack of focused studies on the impacts of deforestation on local livelihoods in Gasore Kebele. This research aims to bridge this gap by providing reliable information on how deforestation affects community livelihoods, specifically regarding timber and non-timber forest products (NTFPs). Local communities often clear forests for various purposes, exacerbating the degradation of existing forest reserves (Appiah, 2021).

In light of these pressing issues, it is imperative to explore the relationship between deforestation and rural livelihoods in Gasore Kebele. This study seeks to understand community perceptions of the causes of deforestation and its implications for agricultural productivity and food security, thus providing essential insights into the impacts on rural households in the study area.

1.3 Objectives of the study

1.3.1. General objective:-

- ✓ To assess the impact of deforestation on the livelihoods of local communities in the study area.

1.3.2. Specific objectives:-

- ✓ To investigate the livelihood strategies employed by the local community in the study area.
- ✓ To identify the major causes of deforestation in the study area.
- ✓ To assess the socio-economic impacts of deforestation on local communities.
- ✓ To identify theimpact of deforestation on improving agricultural productivity, maintain water status and energy sources mechanisms.

1.4 Research questions

The study tries to answer the following research questions.

1. What are the major livelihood strategies in the study area?
2. What are the primary causes of deforestation?
3. What socio-economic impacts does deforestation have on the local community?

1.5 Significance of the Study

Livelihoods of local community are adversely affected by impacts of deforestation and land degradation since them directly or indirectly depend on forest resources. The study is useful to assess the impact of deforestation on the local community of the farming households. Furthermore, the findings of this study important in providing valuable information to policy makers, development planners, NGOs, and government institutions working in the locality; for the purpose of successful food security program enhancement practices. Local community rely mainly on the forest products for energy. Therefore, understanding of the impact of deforestation on the rural livelihood of farmers would enable policy makers and development partners of the government to plan and implement programs and projects to alleviate the problems there by improving livelihood of the community. This research is designed to understand the level of knowledge of the community about deforestation and the associated negative impacts on their local community which is essential in the development and implementation of natural resource management programs. The declining fertility of the soil leading to demand for chemical fertilizers to compensate for the loss of organic matter and essential nutrients through deforestation has been a pressing issue among communities. This study helping know the extent to local community the study area is affected by deforestation and land degradation. Therefore, the information can be useful to understand, the impact of deforestation on the local community of farmers, what are the major determinants for households to impacts environmental and socioeconomic on the study area.

1.6 Scope and Limitations of the Study

The impacts of deforestation on the livelihoods of local communities are a critical issue that warrants thorough investigation. However, this study is limited by practical constraints that prevent a comprehensive analysis across all kebeles in Cheha Woreda. Due to time limitations, it is not feasible to cover every kebele within the woreda in depth.

Additionally, a challenge faced in this research is that farmers may not be able to provide direct and accurate data regarding specific aspects of the study, which can affect the reliability of the results. As a result, this study is confined to Gasore Kebele in Cheha Woreda, focusing specifically on the local context and its unique challenges. This limitation may impact the generalizability of the findings to other kebeles within the woreda or the region.

2. LITERATURE REVIEW

2.1 Deforestation

Deforestation refers to the reduction in a forest's capacity to produce goods and services, encompassing the maintenance of ecosystem structure and function (ITTO, 2002). It results in the loss of the expected structure, function, species composition, and natural forest types in a given area (ITTO, 2005). Deforestation is often associated with a decrease in vegetation cover, particularly in forested areas, with a notable exception being the "empty forest" syndrome caused by excessive hunting of valuable timber species. When these changes exceed certain thresholds, the area is considered deforested (Lund, 2009; FAO, 2015).

The process of deforestation can occur abruptly—such as through excessive logging—or gradually over long periods, as seen with fuelwood collection and unsustainable hunting practices (Ang, 2008; FAO, 2015). Both deforestation and resulting land degradation pose global challenges, including in Ethiopia. However, reliable data on the rates of forest degradation and deforestation in Ethiopia remain scarce (Dereje, 2007; Tesfaye *et al*., 2016). Foresters argue that deforestation has accelerated over the past 150 years, primarily driven by population growth (Kaushik, 2006; FAO, 2015). Despite the evident decline in forests and other natural vegetation resources, significant efforts to reverse this trend have been lacking (Dereje, 2007; FAO, 2015).

Even with inadequate databases, the extent of annual forest loss at the national level is apparent. Reports indicate that Ethiopia continues to experience substantial losses in vegetation cover. For instance, Dereje (2007) investigated forest cover changes between 1973 and 2005 in four districts of the southwestern rainforest and found a 67% decrease over 32 years, corresponding to an annual deforestation rate of 2.1%. More recent studies indicate that Ethiopia's deforestation rate has increased to 1.8% annually (Tesfaye et al., 2016).

Furthermore, research by Revising (1998) documented a deforestation rate of approximately 163,600 wood plants per hectare per year between 1988 and 1990 (about 1% per year), while the FAO (2015) reported a deforestation rate of 1.1 to 1.3% per year from 2005 to 2015. By synthesizing these various studies, it can be concluded that Ethiopia is losing its woody biomass at an average rate of 1.5 to 2.0% annually due to deforestation.

Factors such as resettlement programs, migration, biofuel development initiatives, and persistent poverty are exacerbating the rate of deforestation in Ethiopia (FAO, 2015). This trend has significant implications both globally and locally, impacting agricultural productivity, degrading water resources, and leading to a decline in forest products, which serve as vital economic resources for local livelihoods (Dereje, 2007; Tesfaye *et al*., 2016).

2.2 Causes of Deforestation

2.2.1 Expansion of Agricultural Activities

Agricultural activities remain one of the most significant drivers of deforestation, primarily due to the increasing demand for food products. Significant numbers of trees are cleared to make way for crop cultivation (Kaushik, 2006; FAO, 2015). One major cause of deforestation is shifting cultivation, with an estimated 300 million people practicing this method globally. These shifting cultivators often engage in slash-and-burn agriculture, which results in the clearing of over 500,000 hectares of forest annually (ITTO, 2002; FAO, 2015).

In the Ethiopian context, the expansion of agricultural land accounts for a substantial proportion, nearly 80%, of the country's deforestation. This is largely attributed to smallholder farmers clearing forest areas to create arable land for subsistence farming practices (FAO, 2015; Tesfaye *et al*., 2016).

2.2.2 Human Population Growth as a Driver of Deforestation

Human population growth is widely recognized as a significant underlying factor contributing to numerous environmental challenges, prominently including deforestation. While the global population growth rate has experienced a marginal decline since the 1990s, the global population continues to increase by approximately 80 million individuals annually (FAO, 2015). A direct consequence of this persistent population growth is the annual loss of approximately 2.1% of forest cover in tropical regions due to anthropogenic activities (FAO, 2015). This deforestation is largely driven by the escalating demand for land conversion to agriculture, increased consumption of forest resources, and the expansion of infrastructure necessary to support a growing populace.

In the Ethiopian context, the impact of rapid population growth on forest ecosystems is particularly pronounced. Since the 1990s, Ethiopia's population has more than doubled, resulting in substantial pressure on the nation's forest resources. The amplified demand for agricultural land to feed a larger population, the need for fuel wood as a primary energy source, and the requirements for housing construction have collectively contributed to widespread deforestation, especially in rural areas where communities heavily rely on forest resources for their livelihoods (Tesfaye *et al*., 2016). The intricate relationship between population growth and the degradation of forest ecosystems in Ethiopia underscores the critical imperative for implementing sustainable development strategies that effectively harmonize human needs with the imperative of environmental conservation.

2.2.3 Wood Extraction

The extraction of wood has a significant driver of deforestation, especially for forest-dependent communities relying on it for fuel. Wood has long been a crucial fuel source for forest-dwelling communities. Even in the mid-20th century, approximately 80% of all harvested wood was used for fuel, while commercial loggers focused on a limited number of valuable timber species, such as teak and mahogany (Lund, 1999; FAO, 2015). Following World War II, lighter-density woods were also extracted for sale in national and international markets. Between 1950 and 1980, the export rate of tropical hardwood increased dramatically, rising fourteen fold from 4.6 million to 61.2 million cubic meters of round wood per year (FAO, 2015).

In Ethiopia, wood extraction for fuel wood and charcoal production remains a major cause of deforestation. The heavy reliance on biomass energy, primarily fuel wood, by nearly 90% of the population for cooking and heating (FAO, 2015; Tesfaye *et al*., 2016) continues to exert significant pressure on forest resources.

In Ethiopia, wood extraction for fuel wood and charcoal production is a major driver of deforestation. Nearly 90% of the population relies on biomass energy, primarily fuel wood, for cooking and heating (FAO, 2015; Tesfaye *et al.*, 2016). This intense wood extraction not only contributes to deforestation but also threatens biodiversity and disrupts the ecological balance within forest ecosystems.

2.2.4 Development of Infrastructure

The settlement and subsequent clearance of frontier land in Latin America have closely followed the expansion of the road network. Road building is often not exclusively undertaken by governments (FAO, 2015).

In Ecuador, for instance, early access roads into the environmentally sensitive eastern region were largely constructed by multinational oil companies. Mahar and Schneider (1994) argue that road construction is one of the most powerful factors contributing to deforestation in frontier areas of Latin America. Indeed, activities such as oil exploration, agricultural expansion, and timber extraction are largely dependent on road access, making road development a critical catalyst for deforestation in many forest regions (FAO, 2015).

In Ethiopia, infrastructure development, including road construction and urbanization, has contributed to deforestation, particularly in the southwestern rainforest regions. The construction of roads facilitates access to previously remote forest areas, leading to increased logging, agricultural expansion, and settlement (Tesfaye *et al*., 2016). The implications of infrastructure development highlight the need for careful planning and sustainable practices that minimize environmental impact while accommodating human needs.

2.2.5 Urbanization as a Driver of Deforestation

The expansion of urban areas to accommodate growing populations frequently results in the clearing of trees to make space for housing and the construction of transportation infrastructure (Corlett, 2011; FAO, 2015). Urbanization directly impacts forest cover, as expanding urban areas necessitate the clearing of forested lands for residential and commercial development (FAO, 2015). In Ethiopia, rapid urbanization has led to the encroachment of forests, particularly in peri-urban areas, where forests are cleared for housing and industrial development (Tesfaye *et al*., 2016).

This trend underscores the urgent need for sustainable urban planning practices that prioritize the preservation of forest ecosystems while meeting the housing and infrastructure demands of growing populations.

2.3 Impacts of Deforestation

2.3.1 Socio-Economic Impacts of Deforestation

Deforestation leads to a significant decrease in biomass production, reducing the forest's future capacity to yield wood, fodder, fruits, and medicinal plants (FAO, 2015). Forest products play a crucial role in the food security of local communities, especially in developing countries where households often rely heavily on these resources for income and sustenance. These communities typically have limited access to arable land, supplementing their agricultural production by gathering forest products from common property lands (FAO, 2015) or open-access forests—areas lacking effective collective or private ownership (Tesfaye *et al.,* 2016).

In Ethiopia, deforestation has led to the loss of critical forest resources, such as fuel wood, honey, and medicinal plants, which are essential for the livelihoods of rural communities (Tesfaye et al., 2016). The decline in these resources has exacerbated poverty and food insecurity, particularly in regions where forests are the primary source of income and sustenance (FAO, 2015).

2.3.2 Impacts of Deforestation on Biodiversity

Deforestation poses a severe threat to biodiversity, resulting in the loss of various animal species and plant diversity. It disrupts the structure, function, species composition, and productivity typically associated with natural forests (ITTO, 2002; FAO, 2015). The degradation of these ecosystems diminishes their ability to support the diverse life forms that rely on them. In Ethiopia, deforestation has led to the loss of endemic species, such as the Ethiopian wolf and the mountain nyala, which rely on forest habitats for survival (Tesfaye *et al.,* 2016).

2.3.3 Deforestation and Food Security

Forests play a vital role in food security by providing essential resources such as food, income, and watershed protection (Kaushik, 2005; FAO, 2015). For many communities, particularly those vulnerable to food insecurity, forests often represent the most readily accessible and productive natural resources. However, deforestation and the degradation of forest ecosystems significantly undermine the capacity of these environments to contribute to food security and

other fundamental human needs (Mulgeta, 2008; FAO, 2015). Globally, tropical forests, which are experiencing high rates of clearing and degradation, have suffered substantial losses.

An estimated 146 million hectares of natural forests were cleared from 1980 to 1990, with an additional 65 million hectares lost between 1990 and 1995 (FAO, 1997; FAO, 2015). These forests are located in regions with the highest concentrations of food insecurity, home to approximately 300 million people who rely on shifting cultivation, hunting, and gathering for their survival (FAO, 1996; FAO, 2015). Many of these individuals face chronic, transitory, or seasonal food shortages.

Additionally, millions of people living near forested areas depend on forests for their food security (FAO, 2015). The full implications of tropical forest loss for humanity and biodiversity are not entirely understood. However, it is clear that the loss of forest resources can lead to reduced income and food-generating capacity for forest-dependent communities, increased soil erosion, siltation of waterways, loss of species and genetic diversity, and heightened carbon emissions, all of which contribute to global warming (Kaimowitz, Byron, and Sunderlin, 1998; FAO, 2015). These interconnected impacts highlight the critical role of forest conservation in maintaining food security and overall environmental stability.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1 Location

The study was conducted in Gasore Kebele, situated within the Cheha Woreda of the Gurage Zone, which is located in the Central Ethiopia Regional State. Geographically, the kebele is positioned between 8°00′ and 8°30′ North latitude and 37°40′ and 38°00′ East longitude. Enemor Ener Woreda borders the in the south, Oromia region in the west, Ezha Woreda in the East, Gumer and Geta in the Southeast, and Wabe River, which separates it from Abeshege, and Kebena in the North. Gasore Kebele is located 10 kilometers from Emdibir, the administrative center of Cheha Woreda, and lies about 170 kilometers southwest of Addis Ababa. Accessibility to Gasore is facilitated by a network of all-weather roads that connect it to Wolkite Town, the capital of the Gurage Zone, and adjacent kebeles (Gurage Zone Agricultural Office, 2021).

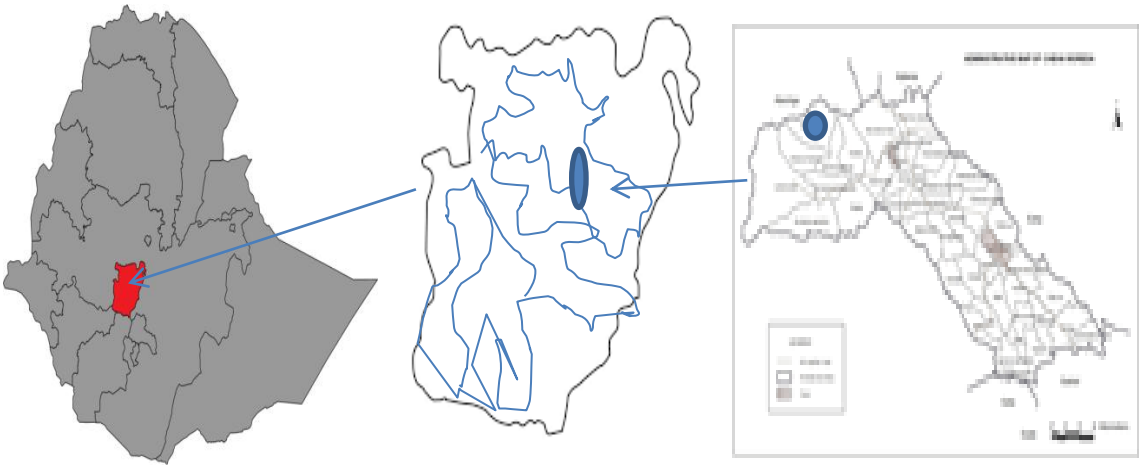


Figure 1: the map Indicate Ethiopia central region map, gurage zone map,cheha woreda,gasore kebele.

3.1.2 Population

According to Ethiopian Central Statistical Agency (CSA) report from 2007 the total populations in the woreda are 163307 of which 79788 Males and 83519 Females. Gasore Kebele has a total populations of 5773 residents which 2890 males and 2883 females**.** The demographic profile of

the kebele is predominantly rural, with a significant proportion, the total households of Gasore kebele are 708 which 585 Male headed, 123 Female headed households. It is noteworthy that population pressure in the area has contributed to challenges such as land fragmentation, an increase in agricultural activities on less productive marginal lands, and a heightened susceptibility to the impacts of deforestation(Wondwossen *et al*.,)

3.1.3. Climate

The climatic condition of study was Weina Dega (midland). The average annual rainfall is 800-1200 ml. The information obtained from the Cheha Woreda agriculture and rural development office indicates that the area receives unimodal rainfall. 'Kiremt', the main rainy season is from June to September with the peak in July and August. The maximum temperature of the area is 25°C the mean annual temperature varies from 18-25°C (NMA, 2021).

3.1.4. Soil types

The main types of soil in Gasore kebele is Nitisols and Cambisols, are reasonably fertile. However, because the area is hilly and deforestation by humans has likely removed trees that help hold the soil, these soils can be easily washed away (FAO, 2019).

3.1.5. Topography

The district has an average height of 1600-2800 meters above sea level, encompassing diverse altitudinal zones. The study area is classified within the lowland areas of the woreda, with. This varied topography influences land use patterns, agricultural practices, and the overall lifestyle of the inhabitants. The steep slopes and elevation gradients present both opportunities and challenges for sustainable land management and agricultural productivity in the region.

3.1.6. Land Use and Land Cover

Gasore Kebele features a diverse land use and land cover pattern shaped by both natural factors and human activities. The predominant land uses include agricultural land, forest areas, grazing land, and settlements. Agricultural land accounts for approximately 60% of the total area, primarily used for cultivating staple crops such as maize, teff, and enset (Ensete ventricosum).

Forest cover, comprising about 15%, plays a crucial role in protecting against soil erosion and providing fuel wood and construction materials. Grazing land makes up around 20% of the kebele, supporting livestock production, while the remaining 5% consists of residential areas and infrastructure. Over the years, deforestation and land conversion for agriculture have altered the natural vegetation cover, contributing to deforestation challenges (Gurage Zone Agricultural Office, 2021; CSA, 2022).

3.1.7. Vegetation cover

The vegetation of Gasore Kebele is characterized by a mix of natural forests, shrub lands, and cultivated plants. The forested areas, though reduced due to agricultural expansion, include indigenous tree species such as *Cordia Africana, Pod carpus falcate*, and *Junipers procure*, which play a vital role in preventing soil erosion and maintaining local biodiversity. Shrub lands consist of species like *Euphorbia* and *Acacia*, which are adapted to the region's climatic conditions. Farmlands are interspersed with perennial crops, particularly enset (*Ensete ventricosum*), coffee (*Coffea arabica*), and fruit trees such as avocado and mango. The deforestation of natural vegetation cover has heightened the need for sustainable land management practices (Gurage Zone Agricultural Office, 2021; CSA, 2022).

3.1.8. Crop Production

Crop production in Gasore Kebele is a key component of the local economy, with most households engaged in mixed farming systems that combine crop cultivation and livestock rearing. The major food crops grown include maize (*Zea mays*), teff (*Eragrostis tef*), wheat (*Triticum aestivum*), and barley (*Hordeum vulgare*), which are primarily cultivated for household consumption and local markets. Enset (*Ensete ventricosum*), a staple food in the region, is widely planted around homesteads and serves as a vital food security crop. Cash crops such as coffee (*Coffea arabica*) and khat (*Catha edulis*) also play an important role in household incomes. Seasonal vegetables, including cabbage, onions, and tomatoes, are cultivated in smaller plots, particularly during the dry season with the aid of small-scale irrigation. Despite favorable climatic conditions for diverse crop production, productivity is constrained by soil erosion,

declining soil fertility, and limited access to improved agricultural inputs (Gurage Zone Agricultural Office, 2021; CSA, 2022).

Source: survey data (2017EC)

Figure 2 Enset productions in study area

3.2. Research Design and Data Collection Methods

A cross-sectional survey design was used for this study. There are 41 kebeles in cheha Woreda. From 41 kebeles Gasore kebeles conducted.

Furthermore, this study employed mixed quantitative and qualitative research approach. Data was collected from both primary and secondary sources based on the research objectives. Primary sources of data include questionnaires, key informant interview, focus group discussion, and field observation. Secondary sources were collected from all available published and unpublished materials like, Books, Journal articles, manuals, Various research papers and Government documents found in the library, website and report from the stakeholders.

Primary Data Collection:

Questionnaires:

The objective of the household survey was to collect socio-demographic data and gather information on sources of livelihood, changes in agricultural productivity, and the impacts of deforestation as perceived by the study participants. The selected households were interviewed using questionnaires. In total, 88 survey respondents, 52 Male and 36 Female were selected using a simple random sampling technique.

Key Informant Interview (KII):

Qualitative data collection methods that help to better understand and explore the research subjects, opinions, behavior, experiences, and the phenomenon of deforestation's impact on livelihoods. Key informant interviews will involve a series of open-ended questions related to the research objectives. In total, 12 key informants were selected purposively from different social groups based on their experience and knowledge, including 4 local elders, 4 religious leaders, and 4 Development Agents (DAs).

Field Observation:

Field observation was conducted through transect walk by taking note, watching behavior, events, or noticing physical characteristics in their natural setting. Personal observation was further helped to show the environmental conditions, including soil erosion, vegetation cover, and signs of deforestation in the study area with contrasting information gathered from household through survey and interviews.

Secondary Data Collection:

Secondary data were gathered from a variety of sources, including:

Published and unpublished documents related to deforestation and agricultural practices in the region. Project reports and assessment from governmental and non-governmental organizations.

Previous research studies and data obtained from relevant online databases and websites.

Both quantitative and qualitative data types were utilized to provide a comprehensive understanding of the impacts of deforestation on the livelihoods of the local community in Gasore Kebele. This multi-faceted approach enhanced the reliability of the findings and supported robust conclusions.

3.2.3 Sampling Techniques and Sample Size Determination

Multiple sampling procedures were applied to select sample households. A sampling technique was applied to select the study site and draw representative household samples for this study. Among the 16 Woredas in the Gurage Zone, Cheha Woreda was selected purposively due to its extensive agricultural practices, particularly irrigation, and its significance in cultivating various crops.

From the 41 kebeles in Cheha Woreda, Gasore Kebele was chosen using purposive sampling. This technique was employed because not all kebeles in the Woreda lacked forest conservation practices, making Gasore a suitable case study.

According to the CSA report from 2007, the total population of Gasore Kebele was 5773 residents which 2890 males and 2883 females, with 708 households.

The sample size was determined from the total of 708 households in the kebele using the formula:

$$n=\frac{N}{1+(N*e^2)}$$

Where n=sample size

N=number of household

e=acceptable level of error 10%

$$n=\frac{708}{1+708(0.1)2} \text{ =88households}$$

n=88

Thus, the calculated sample size was 88 households. These households were selected using a systematic random sampling method to ensure representativeness.

Finally, the determined sample (88 households) was taken from the total 708 households in the study area using a simple random sampling technique. This approach ensured that the selected samples accurately represented the entire population.

3.2.3 Data Analysis

The data collected through questionnaires, key informant interviews, and observations regarding the impacts of deforestation on the livelihoods of local communities were analyzed using a combination of quantitative and qualitative methods. Quantitative data from the questionnaires were analyzed using descriptive statistics, which included calculating frequencies, percentages, and measures of central tendency (mean, median, and mode) to provide a clear summary of the findings. The results were presented in various formats, such as tables, figures, and charts, to enhance clarity and facilitate comparisons of key data points.

In addition, qualitative data gathered from key informant interviews were summarized and thematically analyzed to identify key insights and themes, providing a comprehensive understanding of community perspectives on deforestation. Relevant quotes and narratives from the interviews enriched the findings and contextualized the quantitative data. Following the analysis, the data were interpreted thoroughly to draw meaningful conclusions about the impacts of deforestation on local livelihoods, taking into account the socio-economic context and specific challenges faced by the community. Based on this analysis and interpretation, conclusions were drawn, and feasible recommendations were made to address the identified challenges and promote sustainable practices that supported both environmental conservation and community well-being.

4. RESULT AND DISCUSSION

4.1 Introduction

This chapter discussed the overall findings of the study, which examined the impacts of deforestation on the livelihoods of the local community within the study area. The analysis was conducted to identify the extent, causes, and impacts of deforestation, as well as the adaptive strategies employed by households. The discussion is divided into key thematic sections to provide a clear understanding of the results in alignment with the research objectives.

4.2. Socio-demographic characteristics of the respondents

4.2.1 Sex Distribution

Table 1 Household Sex Distribution

Sex Distribution	Number of Respondents	Percentage (%)
Male	52	59.09%
Female	36	40.91%
Total	88	100

Source: Own field data (2017 EC)

According to Table 1, the household sex distribution of respondents in the Cheha District, Gasore Kebele, reveals that male-headed households (59.09%) were more prevalent than female-headed households (40.91%). This demographic characteristic is pertinent to understanding the impacts of deforestation on livelihoods, as gender roles often influence resource access and utilization in rural Ethiopian communities. Given that men frequently hold primary rights to land and forest resources, they might be more directly involved in activities affected by deforestation, such as agriculture and timber extraction.

However, it's important to acknowledge that women play significant roles in household sustenance through activities like collecting fuelwood and non-timber forest products. Research indicates that women are often responsible for gathering resources that are critical for household

energy and nutrition, which can be severely impacted by deforestation (Agarwal, 2001). Therefore, while the higher number of male respondents might reflect traditional land ownership patterns, a comprehensive analysis of deforestation's impact must consider the differentiated experiences and vulnerabilities of both male and female members within these households. This approach is essential for developing effective policies that address the needs of all community members and promote sustainable resource management practices (World Bank, 2012).

4.2.2. Age Distribution of the Respondents

The study examined the age distribution of respondents in Gasore Kebele to understand the demographic characteristics of the population engaged in agricultural and forest-related activities.

Table 2 Age distribution of the respondent.

Age Class (Years)	Frequency	Percentage (%)
18–30	22	25.0
31–45	35	39.8
46–60	20	22.7
>60	11	12.5
Total	88	100

Source: Own field data (2017 EC)

As shown in Table 2, the age distribution of the 88 respondents reveals a notable concentration within the 31-45 year age group (39.8%), indicating a study population largely composed of individuals in their active working years. This demographic is crucial for understanding the immediate impacts of deforestation on household economies and agricultural practices, as this age cohort typically forms the primary labor force. A substantial proportion (25.0%) of younger respondents (18-30 years) suggests that the perspectives of the next generation, who will bear the long-term consequences of environmental change, are also well-represented.

The middle-aged group (46-60 years, 22.7%) brings valuable experience and historical context regarding environmental shifts, while the older generation (>60 years, 12.5%) offers insights into traditional ecological knowledge and long-term trends in resource availability. Research indicates that older generations often possess critical knowledge about sustainable practices and resource management, which can inform current strategies for adaptation and resilience in the face of environmental changes (Berkes, 2009).

This age diversity allows for a comprehensive assessment of how deforestation affects different life stages and livelihood strategies within the Cheha District, Gasore Kebele, providing a richer understanding of the community's vulnerability and adaptive capacity to forest loss. Engaging multiple age groups in discussions about environmental management can enhance community resilience, as it integrates both traditional knowledge and contemporary perspectives on sustainability (Mastrorillo *et al*., 2016). Thus, understanding the age dynamics within this population is essential for developing effective interventions that address the diverse needs and capacities of the community in response to deforestation.

4.2.3. Education Level of the Respondents

The study revealed significant disparities in educational attainment among respondents, which directly influences their capacity to forests

Table 3 Educational level of the respondents

Education level	frequency	percentage
No formal education	48	54.5
Primary (1-8 grades)	28	31.8
Secondary (9-12 grades)	10	11.4
Diploma and above	2	2.3
Total	88	100

Source: own Field data (2017 EC)

According to table 3, the educational levels of respondents in the Gasore kebele, Cheha District of Gurage Zone, Central Ethiopia, highlights significant implications for understanding the local community's perspectives on deforestation and its impacts on livelihoods. Over half of the respondents (54.5%) have no formal education, which can limit their awareness of sustainable practices and the long-term consequences of deforestation. Approximately one-third (31.8%) have completed primary education, providing them with some basic understanding but still insufficient for tackling complex environmental issues. Only 11.4% possess secondary education, suggesting they may be more open to innovative solutions, while a mere 2.3% hold diplomas or higher, indicating a greater understanding of environmental science.

This educational disparity underscores the need for tailored educational programs and awareness initiatives to empower the community in addressing deforestation and enhancing their livelihoods sustainably. Research indicates that communities with higher educational attainment are generally more aware of environmental issues and more likely to engage in sustainable practices (Mastrorillo *et al*., 2016). Furthermore, the lack of formal education can hinder the adoption of modern agricultural techniques and conservation strategies, which are crucial for mitigating the impacts of deforestation on local livelihoods (Agarwal, 2001).

4.2.4. Livelihood categories

The study identified four primary livelihood sources in Gasore Kebele, reflecting the community's dependence on natural resources and agriculture.

Table 4 Livelihood categories

Livelihood categories	Frequency of sample respondents	Percentage%
Crop production	56	63.6
Livestock production	18	20.5
Forest products	12	13.6
Other	2	2.3
Total	88	100%

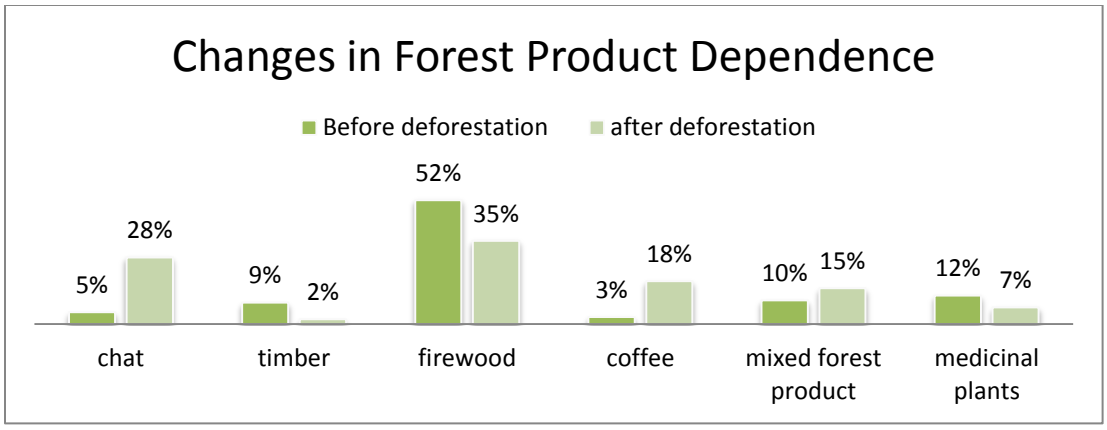
Source: own Field data (2017 EC)

As shown table 4, The Livelihood categories of Gasore Kebele in Cheha District reveals a community deeply intertwined with the natural environment for their sustenance and economic activities. The overwhelming majority (63.6%) rely on crop production, making them highly susceptible to the adverse environmental consequences of deforestation, such as soil degradation, water scarcity, and altered microclimates that can severely impact agricultural yields. A significant portion (20.5%) also depends on livestock production, a practice vulnerable to the loss of grazing land and water resources often associated with forest clearing. Furthermore, the 13.6% of the population directly reliant on forest products face an immediate threat to their livelihoods as deforestation diminishes the very resources they depend upon for income and essential materials.

Research indicates that communities heavily reliant on agriculture and livestock are particularly vulnerable to environmental changes, which can exacerbate food insecurity and economic instability (Mastrorillo *et al*., 2016). Even the small fraction categorized under "Other" livelihoods may experience indirect repercussions from the broader environmental and economic shifts caused by forest loss. For instance, decreased forest cover can lead to reduced biodiversity and ecosystem services, affecting everyone in the community. Consequently, this data strongly underscores the potential for widespread negative impacts on the livelihoods of the Gasore Kebele community due to deforestation, demanding a thorough investigation into these specific vulnerabilities. It is essential to develop sustainable solutions that not only address the immediate threats posed by deforestation but also enhance the community's adaptive capacity to changing environmental conditions.

4.3. Major Forest Products and Extent of Forest Dependency

There are different forest products obtained from forest resources are, coffee, firewood, chat, timber, homey and other indirect benefits. The forest products and their extent of dependency to local community shown before and after deforestation in the below Chart.



Source: own survey data (2017 EC)

Figure 3 chart of changes in forest product dependence

As shown in chart , coffee cultivation expanded dramatically from 5.7% to 31.8% of households, while chat production grew six-fold from 3.4% to 20.5% as farmers converted cleared lands to these profitable cash crops. This agricultural shift reflects both market opportunities and the loss of viable forest-based alternatives. Research indicates that such transitions to cash crops can lead to increased economic returns but may also contribute to environmental degradation and loss of biodiversity (Deininger & Byerlee, 2012).

Medicinal plant collection saw a moderate increase from 8% to 13.6%, as communities deliberately preserved valuable species near homesteads despite wider forest loss. This suggests recognition of the importance of maintaining certain non-timber forest resources amidst the decline in overall forest cover. Conversely, dependence on firewood dropped significantly from 59.1% to 39.8% due to physical scarcity, forcing households to adopt alternative fuels or reduce consumption. This shift highlights the challenges faced by households as traditional energy sources become less accessible, a trend noted in various studies that emphasize the need for alternative energy solutions in rural areas (Bailis *et al*., 2009).

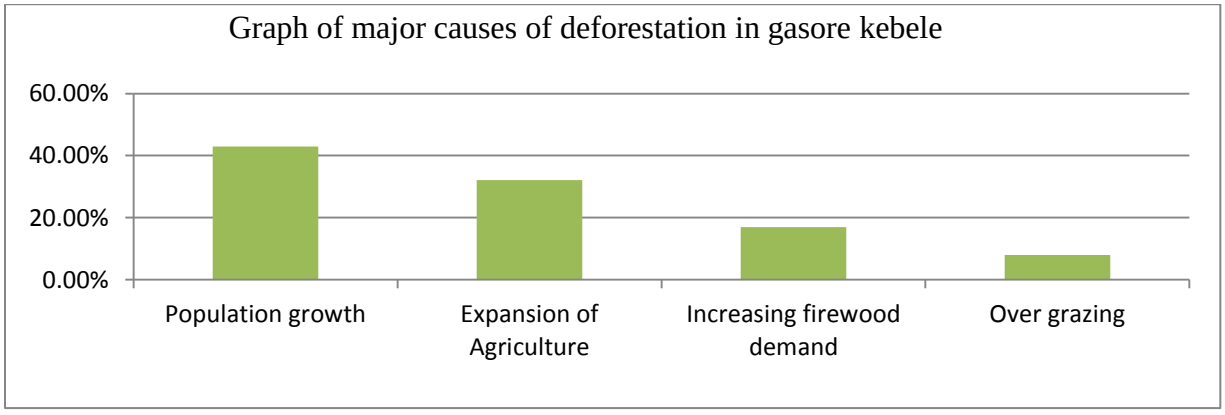
The near-disappearance of timber products, which fell from 10.2% to 2.3%, resulted from the elimination of mature native trees without subsequent regeneration, illustrating the unsustainable nature of current practices. These changes demonstrate a fundamental restructuring of resource

use from diversified forest harvesting to specialized cash cropping, with parallel efforts to maintain critical non-timber resources.

The emergence of households completely abandoning forest products (4.5%) signals both adaptation to changing economic conditions and the erosion of traditional forest-dependent livelihoods in Gasore Kebele. This trend necessitates a comprehensive approach to resource management that balances economic development with the preservation of essential forest ecosystems, as highlighted by the Food and Agriculture Organization (FAO) in their guidelines for sustainable forest management (FAO, 2013).

4.4. Major Cause of Deforestation in the Study Area

The study identified several interconnected factors driving deforestation in the area. Agricultural expansion emerged as the primary cause, with many farmers clearing forest land to create more space for crop cultivation and livestock grazing. Closely related is the high demand for fuel wood, as most households still rely heavily on wood for their daily cooking and heating needs. Population growth has intensified these pressures, leading to increased demand for both agricultural land and forest resources. Weak enforcement of forest protection measures has further exacerbated these challenges, allowing unsustainable exploitation to continue unchecked. These factors collectively contribute to the ongoing loss of forest cover, with significant consequences for local ecosystems and community livelihoods. The situation calls for integrated solutions that address both the immediate drivers of deforestation and their underlying socioeconomic causes.



Sources: Own field data (2017EC)

Figure: 4. chart of major causes of deforestation

As indicated in chart, the study revealed four primary drivers of deforestation in Gasore Kebele, each contributing through distinct mechanisms. Population growth (42.9%) is a significant driver, as expanding families clear forests for new farmland (averaging 1-2 hectares per household) and settlements, while simultaneously increasing demand for fuel wood and other forest products. Research has shown that population growth often correlates with increased land use and resource extraction, leading to substantial environmental pressures (Lambin *et al*., 2001).

Agricultural expansion (32.1%) also plays a crucial role, particularly the shift towards cash crops like coffee and chat, which leads to systematic forest clearance through slash-and-burn methods. Notably, satellite data indicates a staggering 300% increase in converted forest land since 2015. This trend aligns with findings from other studies that highlight how cash crop cultivation can drive deforestation, especially in developing regions where economic incentives encourage land conversion (Angelsen & Kaimowitz, 2001).

Firewood demand (17.0%) remains a significant factor, as 90% of households lack affordable alternatives. This reliance results in daily harvesting that outpaces forest regeneration. The dependence on firewood as a primary energy source is a common issue in many rural communities, where access to alternative energy solutions is limited (Bailis *et al*., 2009).

Finally, overgrazing (8.0%), though less prevalent, prevents forest recovery by compacting soils and destroying young saplings as livestock populations concentrate in shrinking pasture areas. This phenomenon can lead to further degradation of forest ecosystems, as noted in various studies that emphasize the impact of livestock on land degradation (Schwartz *et al.,* 2013).

These factors interact to create a self-reinforcing cycle of environmental degradation, where initial forest loss leads to resource scarcity that, in turn, drives further deforestation. The combined 100% impact reflects how these pressures collectively transform Gasore's landscape, with profound implications for both ecosystem health and community livelihoods dependent on forest resources.

4.5. Major Impacts of Deforestation on Local Livelihoods

4.5.1 Impact of Deforestation on Soil Fertility Status in the Study Area.

Deforestation changes the status of soil fertility at where it takes place. The soil of the study area is the easily susceptible by water erosion.

Table 5 Soil Fertility Statuses Before and After Deforestation

Fertility Level	Before Deforestation		After Deforestation		Change (%)
	respondents	percentage	respondents	percentage	
High	58	(65.9%)	12	(13.6%)	-52.3%
Medium	22	(25.0%)	31	(35.2%)	+10.2%
Low	8	(9.1%)	45	(51.2%)	+42.1%
Total	88	(100%)	88	(100%)	-

Source: own field (2017 EC)

As indicated in table 5, before widespread forest clearance, 65.9% of agricultural lands were classified as highly fertile, supporting robust crop yields. However, current assessments show only 13.6% of soils retains this high fertility status a dramatic 52.3% reduction. Correspondingly, the proportion of low fertility soils has increased five-fold from 9.1% to 51.2%, indicating widespread land degradation. Medium fertility soils now constitute 35.2% of farmland, representing degraded high fertility areas in transition.

Farmers reported multiple visible indicators of declining soil health. Eighty-two percent of respondents observed marked deterioration in their fields' productivity, with maize yields falling by 40% and teff by 35% over the past decade. Nearly half (45%) have been forced to abandon marginal plots that became unproductive. Scientific measurements confirm these observations, showing a 35% loss of organic matter (from 3.2% to 2.1%) and 28% reduction in nitrogen levels. Soil acidity has also increased significantly, with pH levels dropping from 6.1 to 5.4, further limiting nutrient availability.

These changes have compelled farmers to adopt costly adaptation strategies. Fertilizer use has tripled, imposing significant financial burdens, while traditional fallow periods have extended from one to three years to allow soil recovery. Approximately 15% of households have shifted to less nutrient-demanding crops, often with lower market value. The transition from predominantly high fertility (65.9%) to mostly low fertility (51.2%) soils demonstrates deforestation's severe, lasting impact on agricultural sustainability. These findings align with national research documenting 1.5% annual yield declines in deforested Ethiopian highlands, underscoring the urgent need for soil conservation interventions in Gasore Kebele.

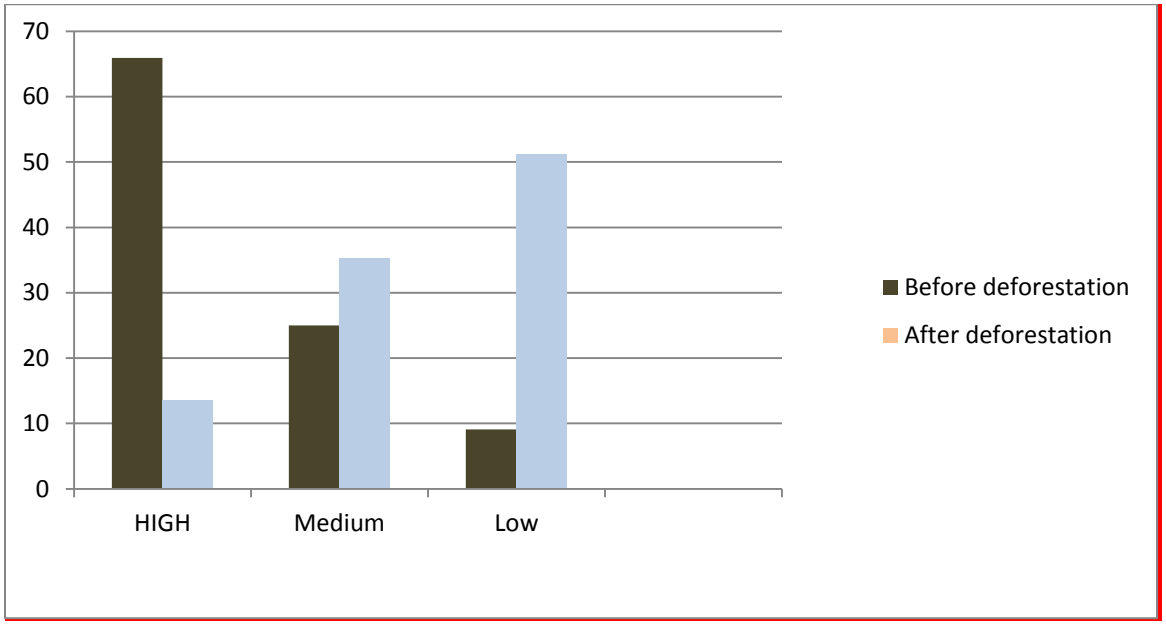


Figure: 5. chart of major causes of deforestation

4.5.2 Reduction of Agricultural Productivity

Deforestation diminishes agricultural productivity by causing soil erosion, disrupting water cycles (leading to floods and droughts), and altering local climates with increased temperatures and erratic rainfall. These changes degrade soil fertility and create unfavorable growing conditions, ultimately reducing crop yields.

Deforestation has a significant influences on the agricultural production, it makes the production to decline through erosion (see table 8).

Table: 6. Reduction of Agricultural Productivity Due to Deforestation

Crop Type	Yield Before Deforestation (tons/ha)	Current Yield (tons/ha)	Reduction (%)	Primary Causes
Maize	2.1	1.3	38.1%	Soil erosion, nutrient loss
Teff	1.4	0.9	35.7%	Moisture stress, compaction
Enset	18.5	13.8	25.4%	Reduced water retention
Wheat	1.7	1.2	29.4%	Increased pests, soil acidification
Barley	1.5	1.0	33.3%	Nutrient depletion

Source: Own Field Data (2017)

According to table 6, illustrates the significant reduction in agricultural productivity in Gasore Kebele due to deforestation, posing a serious threat to food security and local livelihoods. For instance, maize yields have plummeted from 2.1 tons per hectare before deforestation to just 1.3 tons per hectare, marking a staggering 38.1% decrease. Similarly, teff yields have decreased by 35.7%, from 1.4 tons to 0.9 tons per hectare. Even enset, a staple crop known for its drought resistance, has experienced a decline of 25%. This decline in productivity is alarming, as these crops are essential for the sustenance and economic stability of the community.

The primary causes of these yield reductions are multifaceted, with soil degradation being the most critical factor. Research indicates that deforestation contributes to soil erosion and nutrient loss, significantly impacting crop yields (Mastrorillo *et al*., 2020). In Gasore Kebele, tests have shown a 35% loss of organic matter and a 28% reduction in nitrogen levels, which farmers attribute directly to increased erosion following tree removal. As rainfall becomes more intense, the topsoil is washed away, further diminishing the land's productivity.

Additionally, 83% of farmers reported that their lands dry out more quickly due to deforestation, which reduces moisture retention—an essential factor for crop growth. The situation is compounded by the need for increased fertilizer use, which has tripled over the past five years; however, many households (45%) still face declining yields. This aligns with findings from Doss (2021), highlighting how environmental degradation can lead to increased dependency on chemical inputs, which are often not sustainable in the long term.

The economic repercussions are severe. With declining yields, 15% of households have resorted to cultivating less valuable crops, and 12% have abandoned marginal lands altogether. A poignant statement from a local farmer underscores the hardship: "We now harvest half what our fathers did from the same fields." This decline creates a vicious cycle where farmers are compelled to clear more forest land to compensate for lost productivity, further exacerbating environmental degradation. This phenomenon is supported by national trends indicating annual productivity losses of 1.2-1.8% in deforested highlands, but the situation in Gasore Kebele appears more acute due to its steep terrain and intensive farming practices.

To address this critical issue, urgent interventions are necessary. Implementing agroforestry systems could help restore soil health while maintaining crop production. Promoting drought-resistant crop varieties and developing small-scale irrigation systems are also vital to mitigate moisture loss. Without these measures, ongoing declines in agricultural productivity will deepen poverty and food insecurity in Gasore Kebele. The findings highlight the interconnectedness of environmental degradation and agricultural struggles, emphasizing the need for sustainable practices in Ethiopia's highland farming systems.

4.5.3 Impacts of Deforestation on Water Resources

Deforestation has significantly altered water availability and quality in Gasore Kebele, directly affecting both household needs and agricultural production.

Table 7 Water Status Changes After Deforestation in Gasore Kebele

Water Parameter	Number of Respondents	Percentage (%)
Spring Flow Decreased	30	34.1
Well Water Level Decreased	22	25.0
Water Quality Worsened	20	22.7
Dry Season Duration Longer	10	11.4
No Change in Water Quality	6	6.8
Total	88	100

Source: Own field data. (2017 EC)

According to table 7, water status changes in Gasore Kebele illustrate the significant impacts of deforestation on local water resources, which are crucial for sustaining livelihoods. A notable 34.1% of respondents reported a decrease in spring flow. Springs serve as vital sources of water for drinking and irrigation, and reduced flow can lead to acute water scarcity. This situation is particularly concerning given that many rural communities rely on these natural water sources for their daily needs. Research by Mastrorillo et al. (2020) highlights how deforestation disrupts local hydrological cycles, exacerbating water shortages and affecting agricultural productivity.

Additionally, 25.0% of respondents noted a decrease in well water levels. This decline can severely impact agriculture, as farmers depend on wells for irrigation, especially during dry periods. Lower water levels can lead to reduced crop yields, increasing food insecurity among local populations. A study by Doss (2021) emphasizes that access to reliable water sources is critical for agricultural resilience, and disruptions can significantly hinder food production and community stability.

Furthermore, 22.7% of respondents reported worsening water quality, which presents serious health risks. Poor water quality can lead to increased incidences of waterborne diseases, further straining local health services and diminishing the overall quality of life. According to the FAO

(2020)**,** deteriorating water quality due to environmental changes can have dire implications for community health and economic stability, particularly in rural settings.

The report also indicates that 11.4% of respondents experienced longer dry seasons, which can further challenge agricultural practices and livestock management. Extended dry periods can limit farmers' ability to cultivate crops, leading to economic hardships. This aligns with findings from Agarwal (2019), which state that changing climate patterns, exacerbated by deforestation, can lead to more severe drought conditions, affecting food security.

In contrast, only 6.8% of respondents reported no change in water quality, suggesting that while some areas may be less affected, the majority face significant challenges. Overall, the data underscores the urgent need for interventions aimed at mitigating the impacts of deforestation on water resources. Addressing these issues is essential for enhancing the resilience and sustainability of local communities in Gasore Kebele.

4.5.4. Impacts of Deforestation on Biodiversity in Gasore Kebele

Deforestation significantly affects biodiversity by disrupting ecosystems and reducing habitats for numerous species. This section outlines the main impacts of deforestation on biodiversity, supported by a table summarizing key findings.

Table 8 Impacts of Deforestation on Biodiversity in Gasore Kebele

Impact	Number of Respondents	Estimated Impact (%)
Habitat Loss	53	60%
Species Extinction	26	30%
Disruption of Ecosystem Services	44	50%
Fragmentation	35	40%
Invasive Species Proliferation	22	25%
Total Households Responded	88	100%

As shown in the table 8, "Impacts of Deforestation on Biodiversity in Gasore Kebele" summarizes the perceived consequences of deforestation as reported by 88 respondents from the local community. The most significant impact identified is habitat loss, with 60% of respondents (53 individuals) indicating that deforestation has severely reduced habitats for various species. This finding aligns with existing literature, which emphasizes that habitat destruction is a primary driver of biodiversity loss, particularly in forested areas. For example, studies by Sala et al. (2000) highlight that habitat loss leads to a significant decline in species diversity, particularly in tropical regions.

Additionally, 30% of respondents expressed concern about species extinction, underscoring the risks that deforestation poses to endemic and vulnerable species. Research supports this concern, demonstrating that habitat loss directly correlates with increased extinction rates, especially for species specialized to specific environments (Pimm et al., 1995). This highlights the urgent need for conservation efforts to protect these vulnerable populations.

Moreover, 50% of the respondents noted that deforestation disrupts essential ecosystem services, such as pollination and nutrient cycling, which can lead to broader ecological consequences affecting agricultural productivity and overall ecosystem health. The importance of these services is well documented; for instance, Daily et al. (1997) emphasize that healthy forest ecosystems are vital for maintaining agricultural productivity and food security.

Fragmentation of remaining forest patches was identified by 40% of respondents as a significant issue. Fragmentation can isolate wildlife populations, reducing genetic diversity and making species more vulnerable to extinction. This concern is echoed by Fahrig (2003), who notes that habitat fragmentation can severely impact species survival by limiting their movement and access to resources.

Lastly, 25% of respondents reported concerns about the proliferation of invasive species, which tend to thrive in disturbed environments and outcompete native species, further threatening biodiversity. The introduction of invasive species is a well-recognized consequence of habitat alteration, as highlighted by Wilcove et al. (1998), which illustrates how invasive species can disrupt local ecosystems and diminish native biodiversity.

4.6. Improving Agricultural Productivity mechanisms

The decline in agricultural productivity due to deforestation has prompted farmers in Gasore Kebele to adopt various adaptation strategies. For improving agricultural productivity to maintain water status in the study area.

4.6.1 Mechanisms Used to Improve Agricultural Productivity in Gasore Kebele

Different mechanisms used to in the community to improve agricultural productivity after deforestation (see table 9)

Table 9 Agricultural Productivity Improvement Mechanisms Used by Farmers

Types of mechanisms	Frequency respondents	Percentages%
Manure/compost	35	39.8%
Crop residue	6	6.8%
Artificial fertilizer	9	10.2%
Agro forestry	17	19.3%
Crop rotation	21	23.9%
Total	88	100%

Source: Own field data (2017 EC)

As shown in Table 8, 39.8% of households in Gasore Kebele rely primarily on manure and compost for soil improvement, reflecting a strong continued use of traditional organic methods. This reliance on organic practices is significant, especially considering that artificial fertilizers rank as the primary method for only 10.2% of farmers, which contradicts common assumptions about widespread chemical dependency in agriculture.

Additionally, agroforestry systems (19.3%) and crop rotation (23.9%) are being adopted as sustainable alternatives, together representing 43.2% of primary strategies employed by farmers. The relatively low use of crop residue (6.8%) suggests missed opportunities for enhancing soil

conservation and fertility. This distribution reveals a nuanced reality: while organic practices remain foundational (39.8% manure + 6.8% crop residue = 46.6%), nearly one-quarter of farmers now prioritize crop rotation, indicating a gradual uptake of scientifically validated traditional practices.

The limited primary use of synthetic inputs (10.2%) contrasts sharply with their perceived dominance in modern agriculture, highlighting how cost barriers and increasing ecological awareness may be influencing farmer choices more than previously expected. Studies have shown that farmers are increasingly recognizing the benefits of organic methods, not only for soil health but also for long-term sustainability and resilience against climate change (Reganold & Wachter, 2016). This shift towards organic practices is crucial for promoting sustainable agriculture in regions like Gasore Kebele, where traditional methods are deeply rooted in local culture and knowledge.

In summary, the data from Gasore Kebele illustrates a significant reliance on traditional organic methods, with a notable shift towards sustainable practices such as crop rotation and agroforestry, while the use of synthetic fertilizers remains minimal.

4.6.2 Mechanisms Used To Maintain Water Status.

Different mechanisms are practiced by local formers in order to maintain and regulate the water status in the study area (see table 10)

Table 10 Mechanisms Used to Maintain Water Status

Type of Mechanism	Frequency of Respondents	Percentage (%)
Terracing	42	47.7
Planting Trees	28	31.8
Area Closure	18	20.5
Total	88	100

Source: Own field data (2017 EC)

As shown in Table 9, planting trees, particularly indigenous species, is a well-adopted practice in Gasore Kebele to maintain groundwater levels. Trees play a crucial role in regulating water availability by improving soil infiltration and reducing runoff. Notably, 47.7% of households (42 respondents) reported planting trees along waterways and steep slopes to enhance groundwater recharge. This practice aligns with findings from various studies that emphasize the importance of tree planting in watershed management and groundwater conservation.

The second most common method reported was area closure, practiced by 20.5% of households (18 respondents). This approach, which was not utilized before deforestation, has become necessary due to severe soil erosion. Farmers are now collaborating with kebele agricultural experts to implement area closure effectively, reflecting a community-driven response to environmental challenges. Research indicates that such collaborative efforts can significantly enhance soil conservation and restore degraded landscapes (Bai *et al*., 2018). Terracing, reported by 31.8% of households (28 respondents), ranks as the third key method for conserving both soil and water, especially on steep slopes. This technique is well-documented as an effective strategy for reducing soil erosion and improving water retention in hilly terrains (González *et al*., 2019).

These findings demonstrate that local communities in Gasore Kebele are actively adopting land restoration practices to counter the impacts of erosion and overgrazing, with tree planting emerging as the most widespread solution. The integration of traditional knowledge with modern agricultural practices is crucial for sustainable land management and enhancing groundwater levels in the region.

4.6.3 Mechanisms Used to Improve Energy Sources

Before deforestation the total source of energy in the study area natural forest. But offer deforestation the local community depends on other sours of energy such as plantation forest, leaves and crop residue, and kerosene (see table 11).

Table 11 Energy Source Alternatives Adopted in Gasore Kebele

Source of energy	Frequency of respondent	percentage
Firewood (Natural Forest)	67	76.1
Plantation forest	35	39.8
Cow gung	28	31.8
Leaves/crop residue	18	20.5
kerosene	12	13.5
Electricity	0	0
Total	88	100

Source: own field data (2017 EC)

The data presented in Table 10, highlights the diverse energy sources adopted by households in Gasore Kebele, reflecting the impacts of deforestation on local livelihoods. The reliance on firewood from natural forests (76.1%) indicates a significant dependence on forest resources for energy needs. This heavy reliance can exacerbate deforestation, as households continue to clear forested areas to access firewood, leading to a cycle of environmental degradation that threatens both ecosystem health and community livelihoods.

The alternative energy sources reported, such as plantation forests (39.8%) and cow dung (31.8%), suggest some community efforts to diversify energy sources and reduce pressure on natural forests. However, the limited adoption of crop residues (20.5%) and kerosene (13.5%) illustrates the challenges faced by households in accessing sustainable alternatives. The absence

of electricity as a primary energy source highlights infrastructural gaps and underscores the need for improved energy access in rural areas.

Recent studies emphasize the link between deforestation and local livelihoods, noting that as forests are depleted, communities face increased energy scarcity and rising costs associated with alternative energy sources (Angelsen & Kaimowitz, 2001). This situation often forces households to rely more heavily on unsustainable practices, further perpetuating the cycle of deforestation and poverty (Bailis *et al.*, 2009).

In the context of Gasore Kebele, the data indicates that the local community is at a critical juncture. While traditional energy sources remain predominant, there is an urgent need for initiatives that promote sustainable energy alternatives, enhance forest conservation, and improve the overall resilience of local livelihoods. Addressing these challenges is essential for balancing the energy needs of the community with the imperative of preserving the local environment.

5. CONCLUSION

This study reveals that deforestation in Gasore Kebele has profoundly altered the livelihoods of local communities, leading to significant habitat loss, reduced biodiversity, and diminished ecosystem services essential for agricultural productivity and food security. Initially, community members relied heavily on diverse forest products such as timber and fuel wood; however, increased deforestation has forced them to shift towards secondary forest products like coffee and chat cultivation. This transition underscores the vulnerability of local livelihoods as they adapt to changing environmental conditions.

The study identifies the major cause of deforestation on the study area is growth of population and demands of agricultural land, around 43% and 32% respectively. which collectively account for the observed forest loss. This demographic pressure exacerbates the challenges of resource management and contributes to a cycle of environmental degradation that threatens both ecological stability and community well-being.

Moreover, Deforestation also has indirect impacts on the livelihood strategy in the local community by reducing soil productivity and water status both on the quantity and quality. the decline in soil fertility and water quality due to deforestation poses additional challenges for agricultural productivity. As communities grapple with these changes, there is an urgent need for targeted educational initiatives and sustainable development strategies that prioritize forest conservation, enhance agricultural resilience, and improve access to alternative energy sources.

By fostering community engagement and integrating traditional knowledge with modern practices, it is possible to create a more resilient local economy that supports both environmental sustainability and the livelihoods of the residents of Gasore Kebele. This research serves as a crucial call to action for further studies and interventions aimed at preserving Ethiopia's invaluable forest resources while ensuring the long-term security of its communities against ongoing environmental challenges.

6. RECOMMENDATION

As the study result shows, the following recommendations were forwarded;

- ✓ Participatory Forest Management: Collaborate with government and local communities to implement participatory forest management initiatives that empower community members in forest protection and sustainable use.
- ✓ Community-Based Forest Management: Focus on community-based forest management practices that enhance agricultural productivity while preserving soil fertility and water quality. Develop training programs on sustainable agricultural techniques.
- ✓ Promotion of Agroforestry Systems: Encourage the adoption of agroforestry systems by integrating tree planting with crop and livestock farming to enhance productivity and restore ecological balance.
- ✓ Planting Indigenous Tree Species: Promote the planting of indigenous tree species that improve water status and contribute to sustainable land management.
- ✓ Awareness of Forest Values: Implement awareness campaigns to educate the local community about the ecological and economic values of forests, fostering a culture of sustainability.
- ✓ Family Planning Initiatives: Encourage participation in family planning programs to manage population growth, reducing pressure on agricultural land and forest resources.
- ✓ Economic Diversification Programs: Promote initiatives that provide alternative income sources beyond agriculture and forest products, enhancing community resilience.
- ✓ Water Conservation Techniques: Implement community-based water conservation projects focusing on maintaining and improving water quality and availability through techniques like terracing and planting trees.
- ✓ Monitoring and Evaluation Framework: Establish a framework to assess the effectiveness of implemented strategies and adapt them as needed, ensuring community needs and environmental goals are met.

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8. APPENDIX

DEPARTMENT OF NATURAL RESOUCE MANGMENT

Questioner to be filled by respondents

This questionnaire will be prepared to collect information about the farmer's perception and response towards deforestation in gasore kebele, Cheha Woreda,Gurage zone, central Ethiopia regional state, Ethiopia.

Respondents Name _____ Woreda _____Kebele village _____

1. Demographic Information

Sex:

☐A, Male

☐B, Female

Age:

☐A, <18 ☐B, 19–30

☐C, 31–45 ☐D, 46–60 ☐ E, >60

2. Educational Status:

☐A, Cannot read and write ☐ B, Can read and write

☐C, Primary education ☐D, Secondary education ☐ E, Higher education

3. Are you aware of deforestation in your area?

☐A, Yes

☐B, No

4. How do you perceive deforestation to be in your area?

☐Avery severe ☐C, Moderate ☐E, not severe

☐B, severe ☐D, Mild

5. What are the primary causes of deforestation in your area?

☐A, Population growth ☐C, Urbanization

☐B, wood extraction ☐D, Agricultural expansion

☐E, Development of Infrastructure

6. How has deforestation affected your access to forest resources (e.g., firewood, timber, medicinal plants)?

☐A, severely reduced ☐C, slightly reduced

☐B, moderately reduced ☐D, No impact Increased

7. Has deforestation impacted your agricultural productivity?

☐A, Yes

☐B, No

If yes, how? (Please specify): _____

8. Has deforestation affected water status in your area?

☐A, Yes

☐B, No

If yes, how? (Please specify): _____

9. How has deforestation impacted your income sources?

☐A, severely reduced ☐C, slightly reduced

☐B, moderately reduced ☐D, No impact ☐E, increased

10. Has deforestation led to the loss of biodiversity (e.g., wildlife, plant species) in your area?

☐A, Yes

☐B, No

If yes, describe the impacts: _____

11. What measures have you taken to cope with the impacts of deforestation?

☐Planting trees ☐Adopting sustainable farming practices

☐Using alternative energy sources ☐Seeking alternative income sources

☐No action taken

Other (please specify): _____

12. What mechanism (methods) you are using in order to improve your agricultural production:

A, Mannering (Compost) C. Agro forestry E. Crop rotation (legume)

B. Crop residue D. Artificial fertilizer F. Others

13. Has Socio-Economic Impact of deforestation

☐Yes

☐No

14. Has deforestation affected energy sources in your area?

☐A, Yes

☐B, No

15. Has deforestation affected soil fertility in your area?

☐A, Yes

☐B, No ☐C, If you say yes how?

OPEN-ENDED QUESTIONS

16. What is your understanding about deforestation?

_____

_____

_____

17. Explain what causes of deforestation in the area?

_____

_____

_____

18. What is the impact of deforestation the area?

_____

_____