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ASSESSMENT OF THE CAUSES AND CONSEQUENCES OF SOIL DEGRADATION IN LAYARMACHIHO WOREDA, AMHARA REGION, ETHIOPIA

A THESIS SUBMITTED FOR THE PARTIAL FULFILMENT FOR THE DEGREE OF MASTER OF ART IN INGEOGRAPHY AND ENIVIRONMENTAL STUDIES, ADDISABABA UNIVERSITY.

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Approval Sheet

The thesis titled 'Causes and Consequences of soil Degradation in Lay Armachiho Woreda, Central Gondar, Amhara National Regional State by Abuye Tsehay Ademe is approved for the Master's of Art (MA) in Geography and Environmental Studies.

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Declaration

I declare that this thesis for the partial fulfillment of Master's Art (MA) in Geography and Environmental Studies at Addis Ababa University. This thesis has not previously submitted to this university and any other university as a fulfillment of first degree or second degree, it is my work in design and execution, and that all the sources I have used or quoted and duly acknowledged by means of complete references of different materials.

Student’s Name_________________ Date _________________Signature_________________

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ACRONMY

ANRS	Amhara National Regional State
BOA	Bureau of Agriculture
CRGE	Climate Resilient Green Economy
DAs	Development Agencies
DPSIR	Driver Pressure State Impact Response
ECR	Ethiopia Country Report
EFAP	Ethiopia Forest Action Plan
FAO	Food and Agricultural Organization
GM	Government Ministers
INGOs	International Non-Governmental Organization
ISFM	Integrated Soil Fertility Management
LADA	Land Degradation Assessment
LAWAO	Lay Armachiho Woreda Agricultural Office
LAWCO	Lay Armachiho Woreda Communication Office
LD	Land Degradation
NGOs	Non-Governmental Organization
SCRP	Soil Conservation Research Project
SOM	Soil Organic Matter
SPSS	Statistical Package for Social Science
SSA	Sub-Sahara Africa
SWC	Soil and Water conservation
UN	United Nation
UNCCD	United Nation Convention to Combat Desertification
UNDP	United Nation Development Program
WMO	World Meteorological Organization

Abstract

Soil degradation remains one of the most critical environmental challenges globally. This study aims to identify the primary causes and impacts of soil degradation in Lay Armachiho Woreda. To achieve this, both qualitative and quantitative research methods were employed. A total of 150 household heads were randomly selected from two kebeles using a simple random sampling technique. Additionally, four key informant development agents (DAs), model farmers, agricultural experts from the woreda, and kebele leaders were purposively selected for interviews. Data collection tools included structured and semi-structured questionnaires, direct observation, and in-person interviews. Secondary information was sourced from both published and unpublished materials such as journals, books, magazine, newspapers, and government documents. The data were analyzed using descriptive statistics, including frequency tables and percentages, as well as narrative explanations. The findings indicate that overgrazing, population pressure, and intensive cultivation are the major contributors to soil degradation in the study area. A significant consequence is the depletion of soil nutrients, leading to reduced agricultural productivity. As a result, farmers are facing serious socio-economic difficulties. Despite these challenges, some farmers have adopted soil management techniques such as crop rotation, conservation tillage, fertilizer application, and contour farming. The study recommends that government bodies, development agents, and other stakeholders enhance community awareness regarding the causes and effects of soil degradation. Soil degradation poses a substantial threat not only to agricultural productivity but also to ecosystem stability and global food security. This review highlights the major natural and human-induced factors driving soil degradation, including deforestation, overgrazing, and unsustainable farming methods The impacts are widespread diminishing biodiversity, altering nutrient cycles, reducing crop yields,. To address these challenges, integrated soil management strategies are essential. Sustainable practices such as conservation agriculture, agro forestry, cover cropping, crop rotation, and the use of organic soil amendments offer potential solutions to restore soil health and ensure long-term productivity.

Keyword Keywords*: Causes of soil degradation, effects of soil degradation*

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Soil degradation is a global issue affecting both highland and lowland regions, irrespective of whether they are in developed or developing nations (Blakie et al., 2015). As noted by Utuk and Daniel (2015), soil degradation was a major concern throughout the twentieth century and remains a key environmental challenge in the twenty-first. Hurni et al. (2010) describe it as a result of complex interactions between natural ecosystems and human socio-economic systems. In developing countries, particularly across the African continent, soil degradation is widespread and severe. Ethiopia is one such country experiencing extensive land degradation and depletion of natural resources (Assefa & Rudolf, 2017). The Ethiopian highlands are particularly vulnerable, largely due to a long history of sedentary farming and dense populations of both humans and livestock (Mesene, 2017; Amenu, 2021).

Soil degradation encompasses physical, chemical, and biological deterioration of soil quality, driven by geological, climatic, biological, and anthropogenic factors. These changes threaten biodiversity, impact land usability, and ultimately challenge human survival by reducing the soil's ability to deliver essential ecosystem services (FAO, 2021). Severely degraded soils can no longer support normal ecological functions or productivity.

A major contributor to soil degradation is human-induced disruption of natural soil processes. Activities such as overgrazing, deforestation, and unsustainable farming techniques are frequently cited as key drivers (Lal, 1997). These human interventions result in a cascade of effects that degrade the soil's physical and chemical properties (Doran et al., 1998; Cavelier et al., 1999; Chew, 2001; Liu et al., 2002; Johnson & Lewis, 2007; Seeger & Ries, 2008).

According to Lal (2009), degraded soil has a negative influence on the amount and quality of food produced, which influences human nutrition and health. Food insecurity is made worse by declining agricultural yields and agronomic production. Enters (1998) further explains that it encompasses a decline in physical, chemical, and biological properties.

In Ethiopia and other sub-Saharan African nations, where about 85 of the population depends directly on husbandry, the impacts are especially pronounced (Wendimu, 2021). Poor land operation practices and a growing population have accelerated soil corrosion across the country. The forms of declination include corrosion, nutrient loss, and reduction in foliage cover recognized as core environmental challenges in Ethiopia(Alemu, 2015).

The country’s fleetly expanding population having nearly tripled in the last five decades has placed immense pressure on land through deforestation and conversion to husbandry and grassland. These pressures, compounded by recreating famines, have led to repeated food dearth. Soil degradation in Ethiopia is generally distributed into three main types physical, chemical, and natural(Lehman et al., 2015). Globally, this degradation poses serious threats to food security, biodiversity, climate resilience, and genetic resource conservation (Young et al., 2015).

For centuries, the country's natural coffers have been under strain(Hurni et al., 2010). Berry(2003) emphasized that the productivity of Ethiopian land continues to decline, and this trend is. Soil erosion, nutrient loss, and humidity insufficiency remain the most burning forms of land declination. Environmental declination, particularly in the mounds, has come one of Ethiopia’s most serious long- term challenges (Kassa et al., 2018).

In the Amhara Region, where 90% of the population resides in upland areas and nearly all the land is under civilization, the issue is especially severe(Wassie, 2020). The Lay Armachiho Woreda in Central Gondar Zone is no exception. As in numerous corridor of Ethiopia, original residers are facing the negative consequences of ongoing soil degradation. this study was carried out to assess the causes and impacts of soil degradation specifically in Lay Armachiho Woreda, Amhara Region, Ethiopia.

1.2 Problem Statement

Globally, agricultural productivity, environmental sustainability, and community livelihoods are all seriously threatened by soil deterioration. In the research area, there is a compelling need to understand the diverse causes and repercussions of this environmental challenge although isolated observations and anecdotal evidence point to the existence and effects of soil degradation, a thorough and organized evaluation is absent. The creation and application of efficient management techniques suited to the particular circumstances of the research region are hampered by this information gap. It is challenging to identify the most important intervention locations when there is a lack of comprehensive knowledge about the main causes of soil degradation, which include unsustainable land use practices, deforestation, overgrazing, inadequate irrigation, and climate change. Additionally, it is still very difficult to quantify the current state and spatial extent of several types of soil degradation (such as compaction, nutrient depletion, erosion, and salinization) within the research region. An accurate assessment of the problem's seriousness and urgency is made impossible by the absence of reliable data Gavrilescu(2021)

The social and environmental effects of soil deterioration in the research area are not entirely understood, aside from the biophysical elements. Assessing the effects of decreased soil fertility and productivity on household incomes, food security, agricultural yields, and the general economic well-being of the local populace is essential. At the same time, a detailed evaluation of the environmental effects such as diminished biodiversity, declining water quality, heightened flooding, and greenhouse gas emissions is necessary to comprehend their wider ecological ramifications *Environmental Research* 245 (2024). Lastly, even though the area may use a variety of soil degradation management techniques, little is known about their efficacy, adoption rates, and overall effects on halting degradation and reestablishing soil health. It is difficult to identify best practices, eliminate adoption barriers, and suggest suitable policy responses if current management techniques and their effectiveness are not well understood.

Soil declination is a global issue; it's particularly severe in the dry and semi-arid regions of sub-Saharan Africa. Crucial anthropogenic factors include overgrazing, poor operation of pastoralist land, and the use of husbandry practices that are unsuited to original environmental conditions (FAO, 2017). On the other hand, natural factors similar as steep terrain, heavy rainfall, famines, floods, high winds, and tornadoes also play a part in accelerating soil declination.(Balayan, 2000). According to the World Meteorological Organization(WMO, 2005), the causes of soil declination can be classified into biophysical factors similar as environmental stress and indecorous land use and socioeconomic factors, including poor land tenure systems, weak request access, and lack of institutional support.). In Ethiopia, erosion has had a substantial impact on husbandry, leading to dropped productivity and worsening poverty conditions (Debrie, 2018). The problem is especially acute in Ethiopia's upland areas, which constitute about 66% of the Amhara Region and 45 %of the public land area(Heyder et al., 2023). analogous conditions are observed in Lay Armachiho Woreda, located in the Central Gondar Zone, where the goods of soil degradation are decreasingly visible. Despite this, numerous original growers remain ignorant of the crucial causes and long- term counter accusations of soil declination. this study aims to explore the localized causes and consequences of soil declination in two kebeles of Lay Armachiho Woreda. The exploration intends to fill critical knowledge gaps and support targeted interventions in the area**.**

1.3 Objectives

1.3.1 General objective

The general objective of this study is to investigate the causes and consequences of soil degradation in Lay Armachiho *Woreda*.

1.3.2 Specific objectives

The specific objectives of the study are to:

1. Assess the causes of soil degradation in the study areas.
2. Examine the extent of soil degradation in the study areas.
3. Evaluate the socio-economic and environmental consequences of soil degradation in the study area.
4. Assess the soil management practices implemented to mitigate soil degradation in the study area.

1.4 Research Questions

In line with the stated objectives, the study seeks to address the following research questions:

1. What are the main causes of soil degradation in the study area?
2. What is the extent of soil degradation in the study area?
3. What are the socio-economic and environmental consequences of soil degradation in the study area?
4. What are the soil management practices implemented to mitigate soil degradation in the study area?

1.5 Significance of the Study

This research is significant for several reasons. First, it provides essential baseline data regarding the causes and consequences of soil degradation in Lay Armachiho Woreda under different land use types. Such data will be valuable for policymakers, development practitioners, and agricultural experts working at both the woreda and regional levels.

Second, the study is expected to raise awareness among local farmers about the long-term risks of soil degradation and the importance of adopting sustainable land management practices. The findings could guide future land use planning and environmental protection efforts aimed at combating soil degradation and enhancing agricultural productivity.Third, the insights generated from this research may serve as a reference for future studies in similar agro-ecological contexts. Additionally, it could inspire further research to refine theoretical and methodological approaches for investigating soil degradation.

Therefore, this study aims to address these critical knowledge gaps by:

1. Evaluating the main causes of soil deterioration in the research region, taking into account both natural and man-made influences.

2. Using suitable indicators and defined procedures, assessing the present state and spatial distribution of various forms of soil degradation within the study area.

3. Assessing how soil degradation affects nearby communities and ecosystems on a socioeconomic and environmental level

4. Assessing existing soil degradation management practices to identify their strengths, weaknesses, and potential for improvement.

1.6 Scope of the Study

This study's primary focus is on the causes and consequences of soil degradation in Lay Armachiho Woreda, which is located in Ethiopia's Amhara Region's Central Gondar Zone. Due to time, financial, and logistical limitations, a thorough coverage of the entire woreda is not feasible. Therefore, only two specifically selected kebeles Abela Sayena and Kerewa Mezewa are included in the study. Since soil erosion and physical degradation are the most significant forms of soil degradation in the area, this study concentrates on them even though there are several interrelated mechanisms that could cause soil degradation.

Soil erosion happens when water and wind wash away the topsoil. **Physical degradation** is a larger term that includes erosion as well as changes to the soil's physical structure and qualities, like compaction, crusting, and loss of organic content.

1.7 Operational Definitions of Key Terms

- **Soil Degradation**: Refers to the Physical decline in land's productivity or its environmental utility, either temporarily or permanently (Ejersa, 2021).
- **Deforestation**: The process of removing or cutting down trees in forested areas for various human purposes.
- **Degraded Soil**: Soil that has lost its fertility or effectiveness due to human influence or natural phenomena.

1.8 Structure of the Thesis

- **Chapter One** presents the introduction, including background, problem statement, objectives, research questions, significance, scope, definitions of key terms, and the organization of the paper.
- **Chapter Two** provides a comprehensive literature review, drawing on relevant studies to support the research.
- **Chapter Three** outlines the research methodology, detailing the study area, data sources, target population, sampling methods, data collection tools, and analysis techniques.
- **Chapter Four** discusses the data presentation, analysis, and interpretation of the findings.
- **Chapter Five** concludes the study and offers recommendations based on the research outcomes.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 Concept of Soil Degradation

In various literary works, the phrase "soil degradation" has been defined and interpreted in a number of ways. Ejersa (2021) defines soil degradation as a temporary or permanent reduction in a land's capacity to support human habitation or carry out vital environmental tasks. Similarly,. An early description of soil degradation was given by the Food and Agriculture Organization (FAO) in 1979. They defined it as a decrease in the soil's existing ability to produce commodities and services, both in terms of quantity and quality.

Soil degradation involves deterioration in the physical, chemical, and biological attributes of soil, negatively affecting the productivity of agricultural and forest ecosystems. Fagbemi (2000) considers it a pressing issue for humanity, as it reduces the ecosystems productivity and plays a major role in global environmental degradation by disturbing water and energy balances and disrupting essential biogeochemical cycles such as those of carbon (C), nitrogen (N), and sulfur (S). Isarimah (2004) further highlights that soil degradation contributes to deforestation, increased surface runoff and erosion, water pollution, and greenhouse gas emissions.

Gavrilescu (2021) defines “ecosystem goods” as a land’s capacity to provide production outputs such as water, plant growth, animal resources, and healthy soil all of which are valuable both economically and socially. On the other hand, “ecosystem services” refer to functions like biodiversity preservation and the regulation of water, carbon, and nitrogen cycles. Tadesse and Hailu (2024) argue that degradation also encompasses natural processes that result in a loss of ecological, physical, and socioeconomic soil properties, along with declines in biodiversity and ecosystem functionality.

A more succinct definition is provided by Nedd and Anandhi (2024), who describe soil degradation as a long-term decline in productivity and ecosystem services due to disturbances that cannot be reversed without external intervention. Typical signs include deforestation, overgrazing, soil erosion, and poor land use practices. According to Munthali (2020), the accumulation of these negative factors reduces the soil's health and productivity over time, and changes in land use and cover often signal this process.

Abebaw(2019) defines soil declination from a specialized viewpoint as the loss of natural and profitable productivity, especially in areas similar as spreads, woods, rangelands, and irrigated lands. The degradation is attributed to a combination of natural and mortal- convinced factors, including outdated tending practices, nonstop cropping without nutrient loss, and lack of conservation sweats. This issue is particularly serious in the upland regions where husbandry is most concentrated. Due to population growth of over 3 % annually, the rising number of growers and beast has led to deforestation, overgrazing, and husbandry in ecologically sensitive and borderline lands(Tesfa & Mekuriaw, 2014; Wassie, 2020).

2.2 Extent of Soil degradation

Soil degradation remains a critical environmental challenge in numerous developing regions, particularly in Africa, where wide land declination threatens both ecology and food security. According to the FAO(2004), about 40% of global agrarian soil declination occurs in developing countries, with Africa being one of the most oppressively affected main lands. Abebe(2021) notes that around 47% of Africa's land is too thirsty for effective rain- fed husbandry, while only 16 is considered rich and agriculturally feasible. The United Nations Convention to Combat Desertification (UNCCD), as cited by Smith(2020), defines soil degradation as any natural process that diminishes the soil 's capability to give services over time. This has passed throughout history and has occasionally redounded in unrecoverable damage(Wassie, 2020)., unsustainable husbandry practices, encroachment into fragile ecosystems, and poor land operation are the primary contributors to declination across Africa. These conduct frequently strip watershed areas of vital foliage cover, leading to ecological insecurity(Wassie, 2020).

Khwene (2020) emphasizes the importance of accurate, localized data for effective environmental and natural resource management. Without reliable information, crafting viable mitigation strategies or implementing sustainable land-use policies becomes extremely difficult.

Institutional shortcomings are a further barrier. Despite numerous policy initiatives aimed at land reform and sustainable practices, challenges such as unclear land rights, overlapping institutional mandates, funding limitations, and poor adoption of technology persist (Etana, 2020). The largely traditional agricultural system also suffers from limited modernization, high risk aversion, low participation of communities in decision-making, and weak agricultural extension services.

Ethiopia’s natural geography further compounds the degradation problem. Solomon et al. (2024) highlight that rugged topography, steep slopes, and erratic rainfall make the land especially susceptible to erosion, particularly when heavy rains follow droughts, reducing ground cover. The country's mountainous landscape, marked by escarpments and valleys, also hinders the development of infrastructure and access to markets.

One of the root causes of soil degradation in Ethiopia is the increasing pressure from population growth. As land demand rises, farming expands into marginal and ecologically fragile zones (Behnke, 2021). Instead of intensifying production using technology and better agricultural inputs, the prevailing strategy has been horizontal expansion into unsuitable land. This is worsened by the cultural and economic tendency to accumulate wealth through livestock, which contributes to overgrazing and further land depletion (Behnke, 2021).

According to Abebaw (2019), rapid degradation is driven by rural populations’ dependence on agriculture for survival and unsustainable resource use. While soil degradation is prevalent throughout Africa, Ethiopia faces unique pressures due to its dense population and long-standing sedentary agricultural practices. In the Ethiopian highlands, environmental degradation is widespread. Constant farming, heavy grazing, and population concentration over centuries have severely stressed natural resources. Marginal lands previously untouched are now being used for both crop production and grazing, exacerbating the degradation (Wondie, 2016; Kohler, 2015).

The low economic development level further intensifies the problem. Kassa (2018) explains that poverty and environmental degradation are deeply linked: poverty limits the capacity of individuals and communities to implement conservation practices, while declining natural resources in turn worsen economic hardship. Ironically, despite the ongoing degradation of Ethiopia's ecosystems, the vast majority of its population still relies on them for sustenance.

The Amhara National Regional State, located in northwestern Ethiopia and covering about 170,152 square kilometers (Yitayal, 2020), is one of the country's most agriculturally vital areas. According to Mwinike (2021), approximately 30% of the land in this region is used for agriculture and grazing. Other land uses include forests, shrubs, wastelands, and water bodies, which together account for roughly 37%, while settlement areas make up the remaining 3%. This region also supports more than 35% of Ethiopia's cattle population. Livestock in Amhara primarily rely on crop residues, fallow land, stubble fields, and communal grazing areas for feed (Zewdu & Desta, 2015).

Soil erosion remains one of the most pressing environmental concerns in the region. Field tests conducted by the Soil Conservation Research Project (SCRP) in 1987 and 1988 indicated annual soil loss rates ranging from as little as 0.04 tons per hectare to as high as 212 tons per hectare, underscoring the severity of the issue.

2.3 Causes and Consequence of Soil Degradation

Kirui (2015) divides the main causes of soil deterioration into two major groups these are: natural causes and human-induced causes. Topographic and climatic factors such as steep slopes, frequent floods and tornadoes, storms and high-velocity wind, high-intensity rains, and drought in dry regions are among the natural causes. Deforestation and overexploitation of vegetation, shifting cultivation, soil resurfacing, and overgrazing, indiscriminate use of agrochemicals and lack of soil conservation practices, and over extraction of ground water are anthropogenic causes of soil degradation.

2.3 .1 The major causes of soil degradation are:

1. **Deforestation**

Deforestation is the process of converting a forest into agriculture, ranchland, or pasture. Roughly half of the forests that previously covered the country have been cleared, according to Kapos (2000). Deforestation is increasing and extending into previously unaltered areas, and the state of the remaining woodlands is deteriorating. According to the FAO (2000) study, the main causes of deforestation are the expansion of subsistence farming and government-sponsored forest conversion to other uses. Poverty, unemployment, unequal land distribution, and other land uses, such as extensive ranching, which forces many landless farmers make for other resources in the forests.

Deforestation has a wide range of negative effects, such as the loss of forests, the disturbance of the water cycle, sedimentation, increased greenhouse gas emissions, climate change, floods, and drought. Deforestation raises the quantity of carbon dioxide released into the atmosphere, accounting for about 20% of global carbon dioxide (CO2) emissions (IPCC 2007). The topsoil, which is home to the majority of the organic materials and nutrients, is consequently drastically reduced (Borrelli et al., 2020).

2. **Shifting Cultivation**

Shifting cultivation also referred to as slash-and-burn agriculture, as a traditional agricultural practice. Usually on hilltops or gentle slopes, the procedure involves cutting and burning the plants, making holes for the earth, and clearing a section of woodland. Excavated in the ground with simple tools and shifting agricultural. The land is then left fallow. A new woodland section is cleared for cultivation the next season. In contrast to the traditional practice of returning to the former land for farming after 15 to 20 years, the rotation period has decreased to less than three years, which is alarming. According to Detwiler and Hall (1988), shifting agriculture is resulting in the loss of many hectares of forest space. . Many hectares of forest space are being destroyed as a result of shifting cultivation, according to Detwiler and Hall (1988).

3. Overpopulation

This decline is caused by the lack of arable land and the migration of plain Landers to hills. Deforestation, biodiversity loss, and soil degradation have all gotten worse as a result. According to Adebayo et al. (2021), soil degradation has intensified in several ways due to the rapid urbanization of rural areas, which is particularly common in developing countries. These include shifting land use, widespread deforestation for fuel and wood, and the release of pollutants from industrial and urban areas that degrade the environment's quality of soil, water, and air.

4. Overgrazing

Overgrazing occurs when there are so many animals grazing the area that it negatively impacts the vegetation's species composition, growth, or quality. Animal performance is also taken into consideration by Wilson and MacLeod (1991), who claims that overgrazing in grasslands happens when flora changes concurrently and that herbivores' grazing of the land lowers animal productivity. One of the main factors contributing to soil degradation worldwide is overgrazing. The most detrimental cause of desertification in dry regions is overgrazing. In many arid and semiarid nations, livestock are the primary source of income.

Domestic animals come in many different varieties, such as horses, donkeys, sheep, cattle, goats, and camels. A substantial decline is the outcome of a series of degradations brought on by overgrazing by cattle and foraging. Livestock overgrazing starts the cycle of degradation by compacting the soil, decreasing water infiltration, and destroying plant cover. This is especially true in rangeland ecosystems, where deteriorating productivity and increasing degradation create a feedback loop (IPBES, 2018). Vegetation cover, soil fertility, and growing erosion because they quickly destroy flora, domestic animals increase strain on terrain that already has little plant cover. Intense grazing leads to overgrazing, which has a major impact on plant growth, composition, and quality.

Grasslands are negatively impacted by livestock because they lose their plant cover and consequently their soil fertility, which makes them more vulnerable to erosion. Over the past 40 years, overgrazing has resulted in an irreversible 12% decrease in total soil carbon (Li et al., 1997). The indigenous people frequently use shifting cultivation, also referred to as slash-and-burn agriculture, an antiquated farming method. This technique comprises chopping and burning the vegetation, making holes, and removing a piece of forest, usually on the summits of hills or moderate slopes.

Overgrazing occurs when there are enough animals grazing the area to seriously affect the species composition, growth, or quality of the vegetation there (Statutory Instrument 1996). Wilson and MacLeod (1991), who claim that grassland is overgrazed when there is a concurrent change in the vegetation, also include animal performance. And herbivores grazing the area reduce animal productivity.

One of the main factors contributing to soil degradation globally is overgrazing. Overgrazing is the most harmful cause causing desertification in arid regions. Among the numerous domesticated animals are goats, sheep, cows, horses, donkeys, and camels. Numerous issues brought on by overgrazing by livestock and foraging lead to a dramatic decrease. By mixing the soil, decreasing water infiltration, and eliminating plant cover, livestock overgrazing initiates the degradation process. a cycle where productivity declines and deterioration increases, especially in rangeland ecosystems (IPBES, 2018). Home animals strain a place with limited plant cover because they rapidly eliminate flora. Plant development, quality, and composition are severely disrupted by intensive grazing that leads to overgrazing. Livestock-intensive grasslands lose their plant cover and, as a result, soil fertility, leaving them vulnerable to erosion. Overgrazing changes the soil's organic matter, nitrogen content, moisture content, and microbial activity, according to several studies. Overgrazing has caused an irreversible 12% reduction in total soil carbon over the past 40 years (Li et al., 1997).

5. Monocroping

Growing the same crop on the same plot of land year after year without switching up your crop rotation is known as Monocroping. Soil deterioration, rice, maize, and soybeans are the most often planted monocarps. Despite being a cost-effective strategy, it could negatively impact the ecosystem and the productivity of the soil. The crop's roots get the same kind and amount of nutrients from the soil over an extended period of time. The nutritional composition of the soil becomes unbalanced over a prolonged period of agricultural planting (Tiamiyu, A.G.Tet al., 2024.).

In addition to disrupting natural pest and disease control cycles and increasing dependency on chemical inputs that may be detrimental to soil microbial populations, Monocroping depletes specific soil nutrients (Gomiero, 2016). Monocroping, excessive irrigation, and the overuse of chemical fertilizers all lead to Stalinization and nutrient depletion (piemntel & Burgess, 2013).

6. Poverty:

Malerba (2020) asserts that poverty is caused by and exacerbated by soil degradation. Degradation worsens when resource constrained farmers are unable to make investments in sustainable land-use practices. However, the poverty cycle is exacerbated when household incomes fall in tandem with soil output. According to studies, less fortunate farming households frequently end up with lower-quality or damaged land as a result of a mix of environmental and sociopolitical variables. Therefore, creating effective and sustainable treatments requires an awareness of the various socioeconomic and demographic factors that influence farmers' knowledge and behavior. How soil degradation is perceived (Malerba 2020).

2.4 Consequences of Soil Degradation

1. Loss of fertile top soil

According to Girma (2001), Ethiopia loses 1.5–2 billion tons of topsoil a year, with an economic value of $1–2 billion. Preserving this degrading soil might have produced an additional 1.5 million tons of grain, which would have significantly improved the country's food security. Previous farming practices have worsened soil degradation. Soil erosion is the most obvious impact, with an estimated 20 to 30 billion tons of topsoil lost globally each year (Borrelli et al., 2017). Due to the removal of the nutrient-rich A-horizon, this loss immediately lowers agricultural productivity. Chemically, degradation manifests as a decrease in soil organic matter and nutrient loss.

Because it lowers soil fertility, water retention, and structural stability all of which lessen the land's resistance to drought and climate change the loss of soil organic matter is especially significant (Paustian et al., 2016). Degradation has a significant biological impact by reducing the quantity and variety of soil life, including bacteria, fungi, and earthworms all of which are crucial for managing pests, cycling nutrients, and maintaining soil structure (DelgadoBaquerizo et al., 2020). Water sedimentation can result from erosion, which is more likely to occur in degraded soils. Aquatic ecosystems suffer as a result of these practices (Pimentel et al., 2020).

The soil becomes exposed and susceptible to erosion as a result of this ongoing deforestation, which usually happens without any conservation or reforestation efforts. There is a significant loss of topsoil as a result; estimates indicate that the annual volume of nutrient-rich topsoil that is carried into rivers and lakes is The removal of plant cover resulted in a yield of 1.95 to 3.5 billion tons. Additional ecological repercussions result from the loss of this topsoil since it lowers soil productivity and causes sedimentation in water bodies (Shintani 2020). Ethiopian society's social, political, and economic facets are all impacted by the effects of soil degradation (Debrie, 2018).

Because continuous deforestation often happens without conservation or reforestation efforts, this exposes the soil and makes the area vulnerable to erosion. Deforestation is a major contributing cause to the diminishing soil quality in the Amhara Region. A large amount of forest is cleared for fuel, lumber, and construction materials. According to Shintani (2020), logging and other extractive activities result in the annual loss of about 20,000 hectares of forest.

2. Decreased soil productivity

Soil erosion and nutrient loss are the two main consequences of soil degradation, according to Tefera (2012). These practices result in lower agricultural productivity, which lowers soil fertility considerably. The difficulties of sustainable agriculture are exacerbated by the loss of topsoil, which in particular reduces the soil's capacity to hold onto water and vital minerals. The whole effect is a vicious cycle that jeopardizes both the environment and human livelihoods. Ethiopian society's social, economic, and political institutions are all impacted by the consequences of soil degradation (Debrie, 2018).According to Yigezu (2021), one of Ethiopia's most urgent problems is the reduction in soil fertility, which will only get worse as the nation's population grows. The scope and consequences of soil deterioration nationwide have been examined in a number of national studies (Tesfa & Mekuriaw, 2014). Soil erosion, nutrient depletion, and soil moisture loss are the most prevalent types of deterioration in Ethiopia, according to Kassa et al. (2018). These issues present serious obstacles to agricultural productivity and environmental sustainability. It is concerning how much soil erosion is taking place throughout the nation.

3 . Increase in poverty and Decreasing Agricultural output

community growth and the illegal removal of trees for building materials and fuel (Kumar, 2020). Thus, surface runoff has increased, flash floods have increased, groundwater infiltration has decreased, and soil erosion and sediment deposition in reservoirs and bodies of water have increased. These environmental effects decrease agricultural productivity and worsen soil degradation (Kumar, 2020). Due to the tight relationship between poverty and soil degradation, socioeconomic problems are made worse by environmental deterioration, and vice versa (Khwene 2020). Forecasting and policymaking are made more difficult by this intricate relationship, particularly at the national level (Khwene 2020). Because degraded soils retain water and are less fertile, they diminish crop yields and pose a danger to food security (Tilman et al.,2021).

One of the biggest consequences of soil degradation is the acute poverty that millions of Ethiopians endure. As soil fertility and agricultural output decline, households' inability to produce enough food leads to food insecurity. Thus, poverty worsens and economic advancement is impeded (Debrie, 2018).

The agricultural sector, which accounts for more than 85% of Ethiopia's GDP, is the one most adversely affected by soil degradation. As land becomes less productive, food production decreases, leading to economic stagnation and a reduction in the standard of living for many people (Debrie, 2018). It's not just farmers that are impacted. Ethiopian forests are being destroyed at an alarming rate for the purposes of agriculture, fuel wood, pasture, housing construction, and food production (Eshetu & Tesfaye, 2024). This deforestation exacerbates the loss of soil cover and makes the land even more vulnerable to erosion and nutrient depletion. The development of agricultural methods, which may come at the price of natural ecosystems, only serves to exacerbate the problem. The degree of soil degradation in the nation is influenced by both natural phenomena, such as frequent droughts, and human activity (Eswaran, 2019).Food poverty, economic downturns, and political instability are all consequences of soil degradation (Constable, 2014).

The effects are particularly bad in Ethiopia, where they have major implications for both public health and environmental integrity. According to Megerssa and Bekere (2019), they include deforestation, desertification, biodiversity loss, the depletion of fuel timber resources. Another significant factor causing the soil in the Amhara Region to deteriorate is deforestation. For building materials, lumber, and firewood, a lot of forest is destroyed. Shintani (2020) estimates that logging and other mining operations result in the yearly loss of roughly 20,000 hectares of forest. The area is now exposed and susceptible to erosion as a result of the ongoing deforestation, which frequently occurs without any conservation or replanting initiatives. There is a significant loss of topsoil; estimates indicate that the yearly volume of nutrient-rich topsoil that enters rivers and lakes is a 1.9 to 3.5 billion tons of plant cover were removed as a result. Because it reduces soil production and causes sedimentation in water bodies, the loss of this topsoil has further ecological repercussions (Shintani 2020). According to Debrie (2018), Ethiopian society's social, economic, and political facets are all impacted by the effects of soil degradation. The agriculture sector, which contributes over 85% of the nation's GDP, is most negatively impacted by soil degradation.

Food production falls as land becomes less productive, which causes economic stagnation and a drop in living conditions for many people (Debrie, 2018). Farmers are not the only ones affected. It is concerning how quickly Ethiopian woods are being cut down for feed, housing development, grazing land, fuelwood, and agriculture (Eshetu & Tesfaye, 2024). The land becomes even more susceptible to erosion and nutrient depletion as a result of this deforestation, which intensifies the loss of soil cover. The issue is made worse by the growth of farming practices, which frequently come at the expense of the environment. The rate of soil deterioration in the country is influenced by both natural phenomena like recurrent droughts and human activity (Eswaran, 2019).

4. The Socioeconomic Impacts of Soil Degradation

The most significant socioeconomic outcome of soil degradation is the reduction of agricultural productivity, which threatens global food security. As soil loses its fertility and capacity to retain water, crop yields decline, and harvests become less reliable, making agriculture increasingly uncertain (Lal, 2019). This is especially devastating for the estimated 500 million smallholder farmers worldwide who depend directly on the land for both subsistence and income. For such vulnerable groups, falling yields often trigger cycles of poverty, forcing households either to cultivate fragile marginal lands intensifying degradation or to abandon agriculture entirely (FAO, 2022).

The cost to the world economy is enormous. The annual cost of soil deterioration due to land-use changes is estimated to be in the trillions of dollars, taking into account lost ecosystem services including water management and nutrient recycling (Sutton et al., 2016). Soil deterioration has been connected to social instability, conflict, and migration as individuals are uprooted in pursuit of sustainable livelihoods, in addition to financial losses (Abel et al., 2019).

In Ethiopia, where agriculture contributes more than 85% of GDP, the impacts are particularly severe. Widespread soil fertility decline and reduced yields have left millions in chronic poverty and food insecurity, slowing national economic growth and lowering living standards (Debrie, 2018). As farming becomes less sustainable, many households are forced to migrate, creating "environmental refugees." This situation fuels social unrest, resource conflicts, and in extreme cases, armed clashes over shrinking arable land (Constable, 2014). The economic strain also undermines the state's capacity to invest in critical sectors like healthcare, education, and infrastructure, thereby perpetuating a cycle of poverty and degradation.

5 . The Environmental Impacts of Soil Degradation

The environmental implications of soil degradation are equally profound. One major impact is the erosion of topsoil, which acts as a significant source of non-point pollution. Nutrient-rich sediments, pesticides, and fertilizers washed away by erosion enter rivers, reservoirs, and coastal ecosystems, leading to siltation, eutrophication, algal blooms, oxygen depletion, and the creation of aquatic "dead zones" (Borrelli et al., 2017; Panagos et al., 2018). Degradation also alters hydrological cycles. Compaction and surface crusting reduce soil infiltration rates, intensifying surface runoff and flood risks. At the same time, degraded soils hold less water, leaving ecosystems more exposed to drought stress (Keesstra et al., 2018).

Another critical dimension is climate change. Soils are the largest terrestrial carbon reservoir. When degradation occurs particularly through the depletion of soil organic matter (SOM)—large amounts of carbon dioxide (CO_2) are released into the atmosphere (Paustian et al., 2016). It is estimated that agricultural cultivation has caused a loss of 50– 70% of original soil organic carbon stocks, turning soils from carbon sinks into net carbon sources (Lal, 2015). This creates a feedback loop: soil degradation contributes to global warming, which in turn intensifies degradation through more frequent droughts, floods, and extreme weather (IPCC, 2019).

In Ethiopia, human activities such as deforestation for agriculture, construction, and fuelwood collection have accelerated these processes (Kumar, 2020). The removal of vegetation increases runoff, reduces groundwater recharge, and enhances soil erosion and sedimentation. Poverty further reinforces this cycle, as resource-constrained households exploit forests and fragile land for survival, worsening environmental decline (Khwene, 2020). Forest loss in Ethiopia driven by agricultural expansion, grazing, fuel demand, and settlement has drastically reduced soil cover, making land highly vulnerable to erosion and nutrient depletion (Eshetu & Tesfaye, 2024). Natural pressures such as recurrent droughts exacerbate these human-induced effects (Eswaran, 2019). The resulting environmental consequences include deforestation, desertification, biodiversity loss, scarcity of timber and firewood, and shifts in regional climate systems, all of which have serious implications for ecological sustainability and human welfare (Megerssa & Bekere, 2019).

2.5. Soil Management Practices for Mitigation

In response to the severe impacts of soil degradation, a suite of evidence-based soil management practices has been developed and promoted under the umbrella of Sustainable Soil Management (SSM) and Conservation Agriculture (CA). These practices aim not only to halt degradation but also to restore soil health and enhance its productive capacity and resilience (FAO, 2022; Smith et al., 2020).

1. Agronomic Practices

Agronomic measures are central to sustainable soil management. Conservation tillage systems such as minimum and zero tillage reduce disturbance of the soil surface, thereby lowering erosion risks. Retaining crop residues on the field improves infiltration, prevents soil loss, and promotes the gradual build-up of soil organic matter (SOM) (Pittelkow et al., 2015). Cover cropping, the use of non-commercial crops such as legumes and grasses during fallow periods, is another essential strategy. Cover crops maintain continuous soil cover, suppress weeds, add organic matter, and, in the case of legumes, biologically fix nitrogen reducing dependence on chemical fertilizers (Basche et al., 2016). Additionally, crop rotation, or the sequential planting of different crops on the same plot, interrupts pest and disease cycles, balances nutrient extraction, and improves soil structure through diverse rooting systems (Bullock, 1992; St. Luce et al., 2021).

2. Agro forestry and Structural Measures

Vegetative and structural techniques provide further soil protection. Agro forestry, the integration of trees into agricultural systems, offers multiple ecological and economic benefits. Deep-rooted trees act as windbreaks, stabilize soils, enrich SOM through litter fall, and diversify household income (Jose, 2009; Smith et al., 2020). On sloping terrain, engineering interventions such as terracing and contour farming are effective erosion-control measures. Terraces create level surfaces that reduce runoff and enhance water infiltration, while contour plowing establishes natural barriers that slow water flow and minimize soil loss (Prats et al., 2020).

3. Integrated Soil Fertility Management (ISFM)

Integrated Soil Fertility Management (ISFM) provides a holistic approach by combining organic amendments (manure, compost), carefully balanced mineral fertilizers, and locally adapted crop varieties. This integration enhances nutrient efficiency, replenishes SOM, and sustainably boosts yields (Vanlauwe et al., 2015). In addition, precision agriculture technologies such as GPS mapping, sensors, and remote sensingenable site-specific nutrient and water application, reducing waste, limiting runoff, and increasing profitability (Schimmelpfennig, 2016). Collectively, these strategies not only mitigate soil degradation but also enhance carbon sequestration, contributing to climate change mitigation and long-term agricultural resilience (IPCC, 2019).

4. Reducing deforestation

It's challenging to completely stop deforestation. However, it is possible to decrease deforestation, which can result in an impressive plan for reforesting and reforesting vegetation. As populations grow, reforestation efforts and sustainable forest management can be promoted and people made more aware of them. Furthermore, preserving protected places can significantly reduce damage. People must therefore respect forests and abstain from some of the human-driven activities that encourage logging everywhere in the globe. Deforestation can be reduced to restore the natural regeneration of soil (Ferreira-Ferreira, J. et al 2025). The implementation of zero net deforestation must be sufficiently implemented by governments, international organizations, and other environmental stakeholders in order to minimize soil deterioration.

5. Conservation through tillage

Using appropriate tillage practices is one of the most sustainable ways to stop a decline in soil quality. Conservation tillage, which describes tillage methods meant to increase soil productivity with minimal impact on the soil's natural state, is another name for this. Keeping previous year's crop residue on the surface to limit soil erosion and avoiding bad tillage techniques like deep plowing are two examples. Conservation tillage techniques such as low tillage and no-tillage improve soil health by decreasing soil erosion and increasing SOM when combined with surface residue retention (Turmel et al., 2015).

6. Using contour farming

Growing crops across a slope rather than up and down is known as contour farming. It involves field operations such as planting, harrowing, plowing, and furrowing along the contours of the soil. Contour farming reduces soil erosion, enhances infiltration, and decreases runoff velocity by capturing rainfall in the furrow area (Liu et al., 2014). By holding onto soil moisture, this method can also increase crop productivity in arid and semi-arid regions. Although contour farming greatly reduces soil erosion and runoff, it can be even more effective when combined with other conservation tillage methods, such as minimal or no tillage (Faharani et al., 2016).

7 . Crop Residues Management

According to Salem et al. (2015), crop residues serve as a source of soil organic matter, a physical barrier that prevents soil erosion, a way to hold onto soil moisture at the soil's surface, and a deterrent to weed germination. To help prevent soil erosion and preserve moisture, crop wastes such as sugar cane waste, banana leaves, straw, dry grass, and dry leaves can be put over the exposed soil surface.

Thus, appropriately spreading agricultural wastes can significantly improve the soil's biological activity, structure, water infiltration, and workability while also preventing compaction and erosion.

8. Crop Rotation

Crop rotation is the process of producing many commercially significant crops in the same area during successive seasons (Bruns, 2012). Since it is the primary means of creating healthy soils, it is an essential component of all organic cropping systems (Mohler, 2009). Rotation schedules that are carefully thought out improve soil fertility, help control pests, distribute labor requirements over time, and lower market-related hazards. Crop rotation has historically included the use of green manure and legumes to restore nitrogen in succession with cereals and other crops.

By alternating between deep-rooted and short-rooted plants, we can improve the fertility and structure of the soil. Other limiting factors, such as crop type, plant root dispersion and depth, and soil fertility level, should be considered when developing a crop rotation program. We can increase the soil's fertility and structure by switching up the deep-rooted and short-rooted plants. However, when creating a crop rotation schedule, other limiting criteria should be taken into account, including crop type, plant roots depths and distribution, and soil fertility level.

2.7. Conceptual Framework of the study

A conceptual framework functions as a theoretical guide that shapes the research process by identifying the core concepts, variables, assumptions, and interrelationships underpinning the study. It helps researchers to organize their ideas, refine research questions, and design an appropriate methodology that supports the theoretical perspective regarding the causes and impacts of soil degradation. In this way, the framework provides a structured approach for analyzing how soil degradation emerges and what consequences it brings.

2.7.1. Independent Variables (Causes of Soil Degradation):

1. Man-made causes: These are factors that lead to soil degradation as a result of human activities.

Population pressure: The demand for land increases as the population rises.

Excessive grazing: by cattle results in plant loss and soil erosion.

Over cultivation: Extensive farming practices that deplete the soil's nutrients and structure.

Bad farming practices are unsustainable farming practices that degrade the quality of the soil.

2. Organic factors: Environmental factors are the cause of soil degradation.

The quantity and force of precipitation that leads to erosion is known as rainfall intensity.

Topography: The physical features of the earth, such as slope, that affects water flow and erosion.

The inherent characteristics of the soil that dictate its vulnerability to deterioration identify the varieties of soil.

2.7.2. Dependent Variables (Consequences of Soil Degradation):

1. Socioeconomic repercussions: How soil deterioration affects both the economy and human society.

Hunger: Inadequate food availability brought on by lower agricultural output.

Food insecurity is the condition of not having consistent access to an adequate supply of reasonably priced, nutrient-dense food.

Extreme poverty is a condition that is frequently made worse by a shortage of arable land.

2. Agricultural consequence: How farming and food production are affected by soil deterioration.

Diminished crop productivity: A decline in the amount of crops produced on farmed land.

3. Ecological consequences: How soil degradation affects the environment.

Loss of biodiversity is the decline in an ecosystem's diversity of life forms, such as bacteria, plants, and animals.

Depletion of Organic Matter: reduction of the soil's degraded plant and animal matter, which is essential for soil fertility

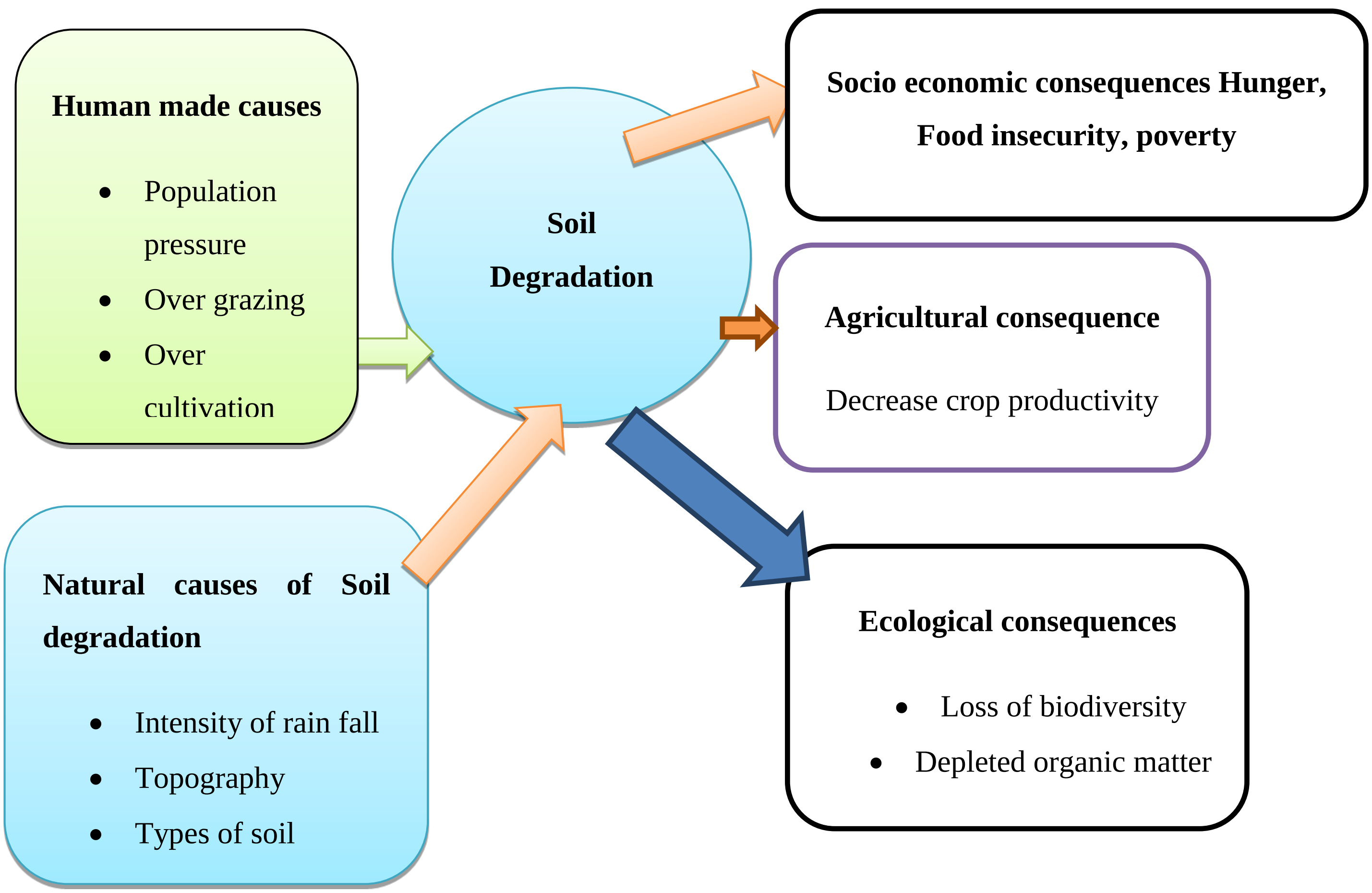

Figure 2.1. Conceptual Framework of the Study

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND RESEARCH METHODOLOGY

3.1 Description of the Study Area

3.1.1 Location and size

The research was carried out in Lay Armachiho Woreda, which is part of the Central Gondar Zone in the Amhara National Regional State. The woreda is located about 23 km from Gondar Town, the administrative center of the zone, 203 km from Bahir Dar, the capital of the Amhara Regional State, and roughly 743 km north of Addis Ababa, Ethiopia’s capital city. It is bordered by Dembiya district in the south, Chilga in the west, Tach Armachiho in the north, Wogera in the east, and Gondar Zuria in the southeast. Geographically, the woreda is positioned around 10.5°N latitude and 37.5°E longitude (Lay Armachiho Woreda Agricultural Office, 2025).

The total land area of Lay Armachiho Woreda covers 106,533.65 hectares. Land use distribution within the woreda includes 31,396 hectares of cultivated land, 23,849 hectares of grazing land, 11,922 hectares of woodland, 16,625 hectares of scrublands, 11,541.65 hectares allocated for settlements and roads, and 11,200 hectares classified as underutilized ,Source (LAWAO, 2025).

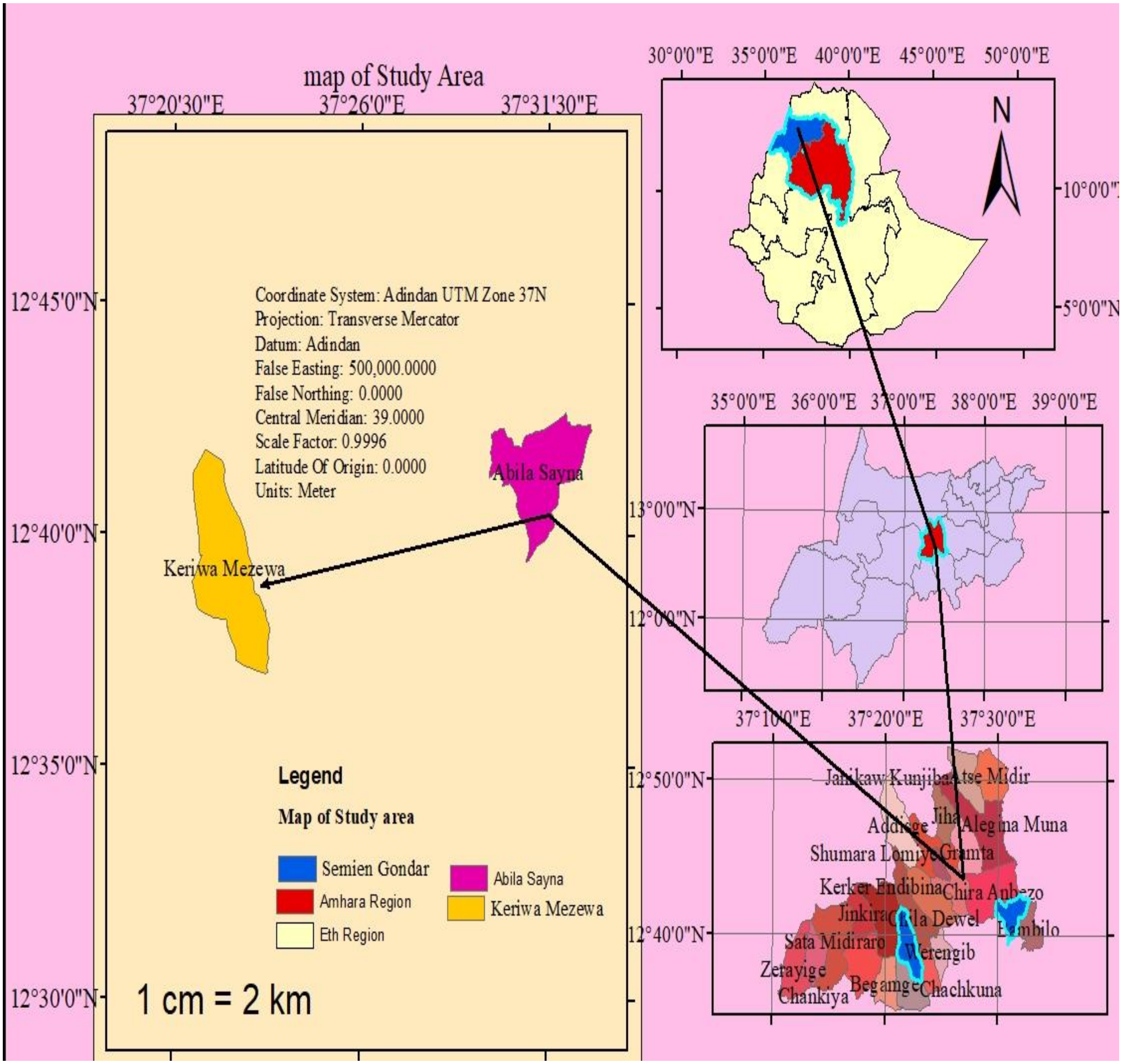

Figure 3. 1 Map of the study area

Source: Author's construct based on ETHIO GIS (2025)

Source: Geospatial

3.1.2 Topography and Climate

The study area is characterized by diverse topography, consisting of valleys (10%), plains (15%), undulating lands (50%), and mountainous areas (25%). The altitude ranges from a minimum of 980 meters to a maximum of 3,200 meters above sea level. Geographically, the woreda lies within the northwestern Ethiopian highlands, where the climate varies: 53% of the land falls under the warm temperate zone (*Kola*), 33% under the cold temperate zone (*Dega*), and 14% under the cool temperate zone (*Woinadega*). The area receives an average annual rainfall between 1000–1200 mm, with the rainy season stretching from early June to late September. The average annual temperature ranges from 22.5°C to 25°C Source (LAWAO, 2025).

3.1.3 Soil and Natural Vegetation

Livelihoods in Lay Armachiho Woreda are diverse, mainly based on crop farming, livestock rearing, and off-farm activities. Livestock are primarily raised for household consumption. Agriculture is predominantly subsistence-based, although both traditional and modern soil conservation techniques are employed to improve productivity. Major crops include teff, maize, barley, wheat, sorghum, millet, potatoes, peas, and beans. Common livestock types include cattle, sheep, goats, and poultry; however, their productivity remains low due to weak breeding systems, limited veterinary and marketing infrastructure, and poor integration between crop and livestock production. The natural vegetation of the woreda is composed of scattered bushes and woody trees. Dominant species include *Eucalyptus* (Bahirzaf), *Acacia* (Grar), *Shola*, *Wanza*, *Tid*, *Bisana*, *Kitkta*, *Olea africana*, and *Rhamnus* (Buckthorn), along with smaller shrubs and grasses, Source (LAWAO, 2025).

3.1.4 Population and Religious Composition

According to recent estimates, Lay Armachiho Woreda has a population of approximately 156,230 people, comprising 76,472 males and 78,758 females. Among them, 5,642 men and 5,873 women reside in urban centers, while the remaining 70,830 men and 72,885 women live in rural areas. The religious composition is highly homogenous: about 97% of the population adheres to the Ethiopian Orthodox Tewahedo Church, while around 3% practice Islam ,Source (LAWCO, 2025).

3.1.5 Economic Activities and Sources of Livelihoods

The residents of Lay Armachiho depend mainly on mixed farming, including crop production, animal husbandry, and some non-farm activities. Livestock is kept primarily for domestic needs rather than for commercial purposes. Farming is mainly subsistence-oriented, though soil conservation practices both indigenous and modern are widely used to sustain productivity. The principal crops cultivated are teff, barley, wheat, maize, millet, potatoes, peas, and beans. Livestock types include cattle, poultry, goats, and sheep, but their productivity is constrained by weak breeding services, inadequate disease prevention and market infrastructure, and a lack of integration between crop and livestock enterprises ,Source.(LAWAO,2025)

3.2 Research Methodology

This study adopted a mixed-methods approach, integrating both **qualitative and quantitative** techniques to meet its objectives. The descriptive survey design was the primary strategy, as it was appropriate for assessing the current status of soil degradation and related management practices. The mixed approach was selected to capture a more holistic understanding of the problem, ensuring greater reliability and validity than a single-method approach could provide.

3.2.1 Data Types and Sources

The study employed both primary and secondary data. Utilizing multiple sources minimized the weaknesses of relying on a single method (Kothari, 2006).

- **Primary data** were collected from farmers through surveys, key informant interviews, direct observations, and structured questionnaires. Additional input was obtained from kebele administrators and woreda-level agricultural experts.

- **Secondary data** were drawn from books, journal articles, research papers, government and NGO reports, websites, and other published and unpublished sources. This range of materials offered valuable background and enhanced the analysis.

3.2.2 Data Collection Methods

Data collection involved both field-based and document-based techniques:

1. **Household Survey:** Structured questionnaires with both open- and closed-ended questions were used. The tool was initially prepared in English and later translated into Amharic to ensure clarity for respondents. Trained enumerators administered the survey to randomly selected household heads.
2. **Farmer Interviews:** To capture perspectives of illiterate farmers, structured face-to-face interviews were conducted in Amharic and later translated into English for analysis.
3. **Observation:** Field visits enabled the researcher to directly observe soil degradation indicators farming practices, and soil conservation measures. Both traditional and modern techniques were documented, and some observations were photographed for record purposes.

3.2.3 Sampling Procedures and Techniques

The target population comprised household heads in Lay Armachiho Woreda. Out of the 29 rural kebeles, two Abela Sayna and KerewaMezewa were **purposively selected** due to their relatively higher levels of soil degradation. Within these kebeles, households were selected using **a simple random sampling method**. The total household population in the two kebeles was 1,050. From this, a sample of 150 households was chosen proportionally: 101 from Kerewa Mezewa and 49 from Abela Sayna. The sample size was determined using Kothari's (2006) statistical formula, which ensures representativeness while balancing resource and time constraints. This sample provided a reliable cross-section of households for examining soil management practices and levels of degradation.

In order to achieve representativeness, the study employed a total sample size of 150 households, which corresponds to 14% of the entire household population ($0.14 \times 1050 = 150$). The sample was distributed proportionally across the two kebeles, and households were selected using a systematic random sampling technique.

The sample size was determined using the formula developed by Kothari (2006) and cited in Tilahun (2010), which is expressed , The formula is given as:

I = n x pi, & pi = $\boldsymbol{Ni}/_{\boldsymbol{N}}$, Where:

Pi = proportion of population included in the stratum (sample)

Ni = total population in the stratum

N = total population in the study area (sample frame)

n = sample size

Table 3.1 Households' Distribution in Sample *Kebeles*

No	Name of kebele	pi	Calculation n $(\boldsymbol{Ni}/_{\boldsymbol{N}})$	n
1	Abela sayna	340	$150((^{340}/_{1050})$	49
2	Kerewa Mezewa	710	$150((^{710}/_{1050})$	101
Total		1050		150

The sampling interval was calculated using the formula cited in **Endale (2011)**: as follows:

I = $^{N}/_{n}$,where:

I = sampling interval, N = total population, n = sample size

I = $^{1050}/_{150}$ = 7

This implies that every 7th household was selected for inclusion in the sample (i.e., households numbered 7, 14, 21, 28, 35, 42, 49, 56, 63, 70 ⋯ up to 1050). The procedure ensured equal chances of selection and avoided bias in the sampling process. As a result, a total of 49 households were drawn from *Abela Sayna* kebele and 101 households from *KerewaMezewa* kebele, thereby making up the required 150 representative households for the study.

3.2.4 Method of Data Analysis

In this study, both **qualitative and quantitative** data analysis techniques were employed to adequately address the research objectives and provide answers to the research questions. According to Creswell (2014), the integration of qualitative and quantitative methods enhances the validity of social research by allowing a more holistic interpretation of the data.

The quantitative data gathered from the household survey was coded, tallied, and analyzed using **descriptive statistical tools**. This involved the use of frequencies, percentages, tables, and charts to organize and present the results in a clear and understandable manner. As Kothari (2006) emphasizes, descriptive statistics are useful for summarizing large sets of data into a manageable form without distorting the original information.

Meanwhile, the qualitative data, which consisted of farmers' views, experiences, and perceptions obtained from interviews and field observations, was analyzed through thematic analysis. This process involved identifying recurring themes, categorizing responses, and interpreting meanings within the broader context of community-based practices. Thematic analysis, as noted by Braun and Clarke (2006), allows researchers to systematically capture patterns across qualitative datasets, thereby providing depth and context to the numerical findings.

By combining these approaches, the analysis produced a comprehensive picture of the study results, linking numerical trends with in-depth qualitative insights. This mixed-methods strategy ensured that the findings were both statistically reliable and contextually rich, thereby strengthening the overall validity of the research conclusions.

CHAPTER FOUR: ASSESSMENT OF CAUSES AND CONSEQUENCES OF SOIL DEGRADATION

This chapter presents the analysis, interpretation, and discussion of the collected data. It is organized into three main parts. The first section outlines the socioeconomic and demographic characteristics of the respondents. The second section examines the causes of soil degradation, while the third focuses on the consequences of soil degradation in the study kebeles.

4.1 Socio-Economic Characteristics of Respondents

4.1.1 Sex and Age Composition

Gender plays a significant role in shaping the causes and impacts of soil degradation. As noted by Samandari (2017), in addition to physical differences that may influence land use practices, gender-based inequalities and social norms also affect access to and control over natural resources, which in turn determines land management practices.

As shown in Table 4.1, among the respondents, 122 (81.3%) were male and 28 (18.7%) were female, indicating that the majority of the household heads surveyed were men. Age distribution is also an important factor in understanding land use and soil degradation patterns. According to Table 4.1, 48 respondents (32%) were between 20–34 years, 57 (38%) between 35–49 years, 30 (20%) between 50–64 years, and 15 (10%) were above 65 years. The largest proportion of respondents falls within the 35–49 age group, which is considered the most economically active segment. Older age groups are often associated with practices such as deforestation and overgrazing, which are linked to soil degradation (Duraiappah, 2002).

Table 4. 1. Respondents by Sex and Age

Sex	Frequency	Percent	Age	Frequency	percent
Male	122	81.3	18-34	48	32
Female	28	18.7	35-49	57	38
Total	*150*	*100.0*	54-64	30	20
			≥65	15	10
			Total	150	100

Source, own survey result, 2025

4.1.2 Educational and Marital Status

Education is a key determinant in shaping awareness and responses to environmental problems. According to Tesfahunegn (2019), education enhances farmers' capacity to recognize both the causes and impacts of soil degradation, while Smith (2006) highlights that knowledge transfer through education promotes the adoption of sustainable agricultural practices. As indicated in Table 4.2, 81 respondents (54%) were illiterate, 26 (17.3%) had completed primary school, 32 (21.4%) completed secondary education, and 11 (7.3%) had attained college level or above. This suggests that a significant proportion of respondents lacked formal education, which may affect awareness and adoption of soil conservation practices.

Marital status also influences household decisions on land use and resource management. As presented in Table 4.2, the majority of respondents, 132 (88%), were married, while 9 (6%) were single, 5 (3.3%) divorced, and 4 (2.7%) widowed. According to Mutuku (2019), larger household sizes, often linked with marriage, can increase pressure on land resources due to higher demand for agricultural land, grazing areas, and housing. Consequently, married households may contribute more to soil degradation as they expand cultivation and grazing areas to meet family needs.

Table 4. 2 Respondents by Educational and Marital Status

Educational status	Frequency	Percent	**Marital status**	Frequency	Percent
Illiterate	81	54	Single	9	6
Primary school complete	26	17.3	Married	132	88
Secondary school complete	32	21.4	Divorce	5	3.3
College diploma& above	11	7.3	Widow	4	2.7
Total	150	100	Total	150	100

Sources: own survey result, 2025

4.1.3 Family Size of Respondents

The size of the household is another important factor influencing land use and its associated impacts on soil resources. As presented in Table 4.5, 9 respondents (6%) were single, 99 (66%) reported having 2–5 family members, 34 (23%) had 6–9 family members, and 8 (5%) had 10 or more family members. This indicates that the majority of households fall within the medium family size range (2–5 members), although a considerable proportion also reported larger families.

Household size has been widely recognized as a critical driver of environmental pressure. According to Blaikie and Brookfield (2015), larger families tend to exert greater demands on land and natural resources, leading to activities such as expansion of farmland, deforestation, and settlement growth. These activities contribute to soil erosion, habitat loss, and depletion of forest cover. Similarly, Davis et al. (2017) note that households with more members often depend heavily on agriculture as their primary livelihood source. In such cases, the need to increase food production places additional strain on land resources.

The responses from the field survey also suggest that population pressure at the household level intensifies the demand for farmland, grazing areas, and natural resources such as firewood and water. When these needs are not accompanied by sustainable land management practices, problems such as soil compaction, erosion, and nutrient depletion may occur, ultimately reducing soil fertility and long-term agricultural productivity.

Table 4. 3 Respondents by family size

Numbers of family size	Frequency	Percentage
Single	9	6
2-5	99	66
6-9	34	23
10 and above	8	5
Total	150	100

Source: own survey result, 2025

4.1.4 Landholding Size of Respondents

The size of landholdings is a critical factor influencing agricultural practices and the extent of soil degradation. In rural areas, where farming is the primary livelihood, the availability of land directly determines the intensity of cultivation and the sustainability of resource use. According to FAO (2017), small landholdings often result in overutilization of soil resources, since households attempt to maximize production from limited plots, which can accelerate erosion, nutrient depletion, and land degradation. As presented in Table 4.4, among the respondents, 21 households (20%) reported landholdings of less than 0.5 hectares, 47 households (36.3%) owned 0.5–1 hectare, 52 households (28.7%) possessed between 1–2 hectares, and 30 households (15%) had more than 2 hectares. The data shows that the majority of respondents (66%) cultivated less than 2 hectares of land, indicating that land scarcity is a common challenge in the study area.

Households with smaller plots tend to intensify cultivation without allowing adequate fallow periods, which undermines soil fertility and structure. On the other hand, households with relatively larger landholdings have more flexibility to rotate crops As observed during fieldwork, respondents with limited farmland were more likely to engage in practices such as continuous cropping and encroachment into nearby forest areas, thereby contributing to soil degradation.

The results suggest that landholding size is directly related to soil degradation, as smaller plots force households to overexploit available land,. This finding aligns with earlier studies that link land scarcity with increased vulnerability to soil erosion and declining soil productivity (Teklewold et al., 2019).

Table 4. 4: Respondents by Landholding Size

Land holding size (ha)	*Frequency*	*Percentage*
<0.5	*21*	*20*
0.5-1.0	*47*	*36.3*
1.1-2.0	*52*	*28.7*
>2.0	*30*	*15*
Total	*150*	*100*

Source: Survey data, 2025

4.1.5 Occupational and Income Characteristics of Respondents

Occupation and household income are important socio-economic variables that influence both the causes and consequences of soil degradation. The type of occupation determines how households interact with natural resources, while the level of income affects their capacity to adopt soil conservation technologies and sustainable land management practices. According to Ellis (2000), rural households with low and agriculture-dependent incomes often exploit land resources intensively, which accelerates degradation, whereas households with diversified or higher incomes are better positioned to implement conservation measures.

As shown in Table 4.5, the majority of respondents, 112 households (74.7%), reported farming as their primary occupation. A smaller proportion, 21 respondents (14%), were engaged in petty trade, while 10 respondents (6.7%) reported daily labor as their main source of livelihood. The remaining 7 households (4.6%) were employed in government or private sectors. This indicates that agriculture is the predominant livelihood activity in the study area, reflecting heavy dependence on land resources.

In terms of income, most households reported relatively low earnings. Table 4.5 further reveals that 53 respondents (35.3%) earned less than 500 ETB per month, 61 households (40.7%) earned between 501–1,000 ETB, and 24 households (16%) earned between 1,001–1,500 ETB. Only 12 households (8%) reported a monthly income greater than 1,500 ETB. The dominance of low-income categories illustrates the limited economic capacity of households to invest in improved land management practices.

Table 4.5 Respondents by Occupation and Monthly Income

occupation	frequency	percentage	Monthly income(ETB)	frequency	percentage
farming	112	74.7	<500	53	35.3
Petty trade	21	14	501-1000	61	40.7
Daily labor	10	6.7	1001-1500	24	16
Government /private job	7	4.6	>1500	12	8
Total	150	100	Total	150	100

Source Survey data, 2025

4.2 Factors (causes) Contributing to Soil Degradation

To identify the drivers of soil degradation in the study area, respondents were asked to indicate the major contributing factors. The results, summarized in Table 4.6, show that over-cultivation was reported as the leading cause, accounting for 23.3% of responses, followed by overgrazing (18.7%) and rapid population growth (16%). Traditional farming practices (14%), heavy rainfall (12%), deforestation (8.7%), and cultivation on steep slopes (7.3%) were also identified as important contributors.

These findings indicate that soil degradation in the area is mainly human-induced, particularly through agricultural activities. Population pressure plays a direct and indirect role by creating a shortage of cultivable and grazing land, forcing farmers to intensify land use beyond its carrying capacity. During interviews, many respondents emphasized that agriculture is both their primary livelihood and a major source of soil erosion, as unsustainable practices reduce soil fertility and increase erosion risk. Similar to observations by **Hurni (1993)**, soil erosion and fertility decline remain the most visible manifestations of land degradation in Ethiopia.

Table 4.6: Major Causes of Soil Degradation as Perceived by Respondents

No.	Major causes of soil degradation in the study area?	Frequency	Percent
1	Overgrazing	28	18.7
2	Rapid Population growth	24	16
3	Over cultivation	35	23.3
4	Heavy rainfall	18	12
5	Traditional farming system	21	14
6	Cultivation of steep slope	11	7.3
7	Deforestation	13	8.7
Total		150	100

Source: own survey result, 2025

4.2.1 Deforestation

Deforestation is considered one of the key drivers of soil degradation because the removal of vegetation exposes the soil to erosion by wind and water (**Kouassi, 2021; Borrelli et al., 2017**). In the study area, respondents identified tree cutting for fuelwood, charcoal production, construction materials, and agricultural expansion as the main drivers of forest clearance. The absence of adequate vegetative cover leaves the soil unprotected, accelerating erosion and fertility loss.

As shown in **Table 4.7**, the majority of respondents (**60.6%**) reported that the rate of deforestation is *moderate*, while **21.3%** perceived it as *high*. Only a small proportion considered it *very high (4.7%)*, *low (10.7%)*, or *very low (2.7%)*. This suggests that while deforestation is ongoing, its intensity is perceived to be moderate compared to other factors such as over-cultivation and overgrazing. Deforestation in the study area occurs at both household and community levels. At the household level, small-scale clearance for cultivation, settlement, and fuel wood collection is common, while at the community level, large-scale agricultural expansion and unsustainable logging contribute significantly (**Duguma et al., 2019**). The survey results also suggest that population growth is an indirect driver, as the demand for farmland and household energy has increased over time.

These findings align with **Teketay (2001)**, who noted that agricultural expansion and reliance on biomass fuel are among the main causes of deforestation in Ethiopia, ultimately leaving the soil exposed to erosion. Although respondents in this study perceived the effect of deforestation on soil degradation as moderate compared to other drivers, its contribution cannot be overlooked given the cumulative impacts on land productivity and ecological balance.

Table 4.7: Perceived Rates of Deforestation in the Study Area

What is the rate of deforestation on soil degradation in the study area?	Frequency	Percentage
Very high	7	4.7
High	32	21.3
Moderate	91	60.6
Low	16	10.7
Very low	4	2.7
Total	150	100

Source: own survey result, 2025

4.2.2 Overgrazing

Overgrazing is a key factor contributing to soil degradation, occurring when livestock graze beyond the carrying capacity of the land. It refers to the situation where the number of grazing animals significantly affects the growth, quality, or composition of vegetation in an area (Statutory Instrument, 1996). Globally, overgrazing is recognized as a major cause of soil deterioration, responsible for approximately 35.8% of all forms of land degradation (Oldeman et al., 1991). Prolonged grazing by cattle often leads to soil deterioration and the formation of rills.

In this study, most respondents identified overgrazing as a significant concern. Specifically, 40% reported the rate as high, and 15.3% as very high. About 32.7% considered it moderate, while 10% and 2% stated it was low and very low, respectively (Table 4.8). Interviews with local residents also indicated that overgrazing is a major contributor to soil degradation in the area, which aligns with observations made during field visits.

Table 4.8 Respondents' perceptions of overgrazing as a cause of soil degradation

What is the rate of overgrazing in the study area?	Frequency	Percentage
Very high	23	15.3
High	60	40
Moderate	49	32.7
Low	15	10
Very low	3	2
Total	150	100

Source: own survey result, 2025

4.2.3 Population Growth

Population growth can increases demand for natural resources such as land, water, and forest products. Expanding households often require more land for housing and agriculture, which can exacerbate soil degradation when land-use practices are not sustainable (Brookfield & Blaikie, 2015).

In this study, 44.6% of respondents reported high population growth, 36.7% moderate, 10.7% very high, and 8% low (Table 4.9). Interviews with community members confirmed that population increase is a significant factor in soil degradation.

Table 4.9 Respondents' perceptions of population growth as a cause of soil degradation

The rate of population growth in the study area?	Frequency	Percentage
Very high	16	10.7
High	67	44.6
Moderate	55	36.7
Low	12	8
Very low	0	0
Total	150	100

Source: own survey result, 2025

4.2.4 Rainfall Intensity

The intensity of rainfall is another factor influencing soil degradation. Frequent and heavy rainfall can lead to severe flooding, especially in areas with steeper terrain, resulting in soil erosion. In this study, 20% of respondents reported very high rainfall intensity, 28% high, 36.7% moderate, 11.3% low, and 4% very low (Table 4.10). These findings indicate that rainfall intensity significantly contributes to soil degradation in the study area, a pattern confirmed by field observation.

Table 4.10 Respondents' perceptions of rainfall intensity as a factor in soil degradation

What is the intensity of rainfall in the study area?	Frequency	Percentage
Very high	30	20
High	42	28
Moderate	55	36.7
Low	17	11.3
Very low	6	4
Total	150	100

Source: own survey result, 2025

4.2.5 Traditional Farming Practices

Traditional farming methods are another contributor to soil degradation in the study area. These practices, such as plowing steep slopes, over-cropping, and over-cultivation, expose the soil to erosion. Respondents indicated that the prevalence of traditional farming was very high (8.7%), high (44%), moderate (29.3%), low (14.7%), and very low (3.3%) (Table 4.11). Key informants explained that farmers rely on these methods due to the nature of the land, their farming experience, and literacy levels. Field observation confirmed that farmers tend to plow closely along their plot boundaries to avoid encroachment on neighboring lands, further increasing vulnerability to soil degradation.

Table 4.11 Respondents' perceptions of traditional farming practices

What is the status of traditional farming practice in the study area?	Frequency	Percentage
Very high	13	8.7
High	66	44
Moderate	44	29.3
Low	22	14.7
Very low	5	3.3
Total	150	100

Source: own survey result, 2025

4.2.6 Steepness of Slope

Slope steepness strongly affects soil vulnerability. Steeper slopes are more prone to erosion and less suitable for agriculture. In the study area, 42.2% of respondents described slopes as moderately steep, 29.2% as steep, 18.6% as less steep, and 10% as highly steep (Table 4.12). Observations of the kebeles revealed that much of the land are steep, contributing to soil erosion and lower productivity. A key informant noted: "Most areas in these kebeles are steep; because of this, the topsoil erodes easily and the land becomes less productive."

Table 4.12 Respondents' perceptions of slope steepness in the study area

What is the degree of steepness of slope in the study area?	Frequency	Percentage
Highly steeper	15	10
Steeper	44	29.2
Moderately steeper	63	42.2
Less steeper	28	18.6
Total	150	100

Source: own survey result, 2025

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Figure 4. 1 Extent of steepness of slope in the study area (Abila Sayna)

Source: photo by author, 2025

4.3 The extent of Soil Degradation

4.3.1 Soil Degradation Status in the Study Area

The assessment of soil condition in the study area revealed that a majority of the land is severely degraded. Specifically, about 52.6% of the soil was classified as highly degraded, 26.7% as very highly degraded, and 22.7% as moderately degraded, as presented in Table 4.13. These findings indicate that soil deterioration is widespread in the area. Moreover, the responses from the majority of interviewees confirmed the perception of a high level of degradation.

Table 4.13 the respondents' response about the degree of soil degradation

What is the extent of soil degradation in the study area?	Frequency	Percentage
Very highly degraded	40	26.7
Highly degraded	76	52.6
Moderately degraded	34	22.7
Total	150	100

Source: own survey result, 2025

Figure 4. 2 Extent of soil degradation in the study area (Kerewa Mezewa)

Source: photo by author, 2025

4.3.2 Extent of Soil Productivity in the Study Area

Respondents’ perception of soil productivity in the study area varied, with 50.7% describing it as poor, 24% as moderate, 22.6% as good, and only 2.7% as very good, as shown in Table 4.14. These results indicate that most respondents view the soil productivity as low. Both natural processes and human activities contribute to this decline. If the current trend continues, the soil may completely lose its fertility in the coming years.

Table 4.14 Respondents’ perception of soil productivity

What is the soil productivity status in the study area?	Frequency	Percentage
Very good	4	2.7
Good	34	22.6
Moderate	36	24
Poor	76	50.7
Total	150	100

Source: own survey result, 2025

4.4 Environmental and Socio-Economic Consequences of Soil Degradation

4.4.1 Increased Vulnerability to Natural Disasters

Soil degradation can heighten an area's susceptibility to natural hazards such as droughts, floods, and landslides (Pravalie, 2021). This increased risk may result in property damage, loss of life, and displacement of populations. Table 4.15 indicates that 37.3% of the respondents perceived a high level of vulnerability to natural disasters due to soil degradation, while 25.3% reported a medium level of vulnerability. These findings suggest that soil deterioration substantially contributes to the risk of natural disasters in the study area.

4.4.2 Agricultural Impacts (Soil Erosion and Nutrient Loss)

Respondents reported varying levels of soil erosion in the area: highest (38.7%), very high (18%), moderate (28.7%), low (12.7%), and very low (2%), as shown in Table 4.15. This indicates that soil degradation has considerably affected agricultural productivity. According to Musa et al. (2024), soil degradation can lead to nutrient depletion, negatively affecting crop growth. Similarly, Issaka&Aqueel (2017) noted that soil erosion and nutrient loss are major consequences of soil degradation that reduce agricultural yields. Key informants further highlighted that floods wash away topsoil annually, leading to reduced harvests and the inability of farmers to sustain their livelihoods, unlike ten to fifteen years ago when crop yields were sufficient for both sale and household consumption.

4.4.3 Socio-Economic Impacts

Soil degradation has a pronounced effect on the socio-economic conditions of the community. As shown in Table 4.15, 72% of respondents reported a high impact on socio-economic aspects, 12.6% reported a moderate impact, 8.7% indicated an extremely high impact, and 6.7% considered it low. Reduced agricultural productivity directly diminishes farmers' income and contributes to poverty and food insecurity (Wassie, 2020). Additionally, soil degradation may force population displacement, placing stress on local infrastructure and community resources.

4.4.4 Ecological Impacts

Soil degradation negatively affects ecosystems, reducing biodiversity and altering ecological balance (Pravalie, 2021). Table 4.15 shows that 66% of respondents perceived a moderate level of ecological damage, while 16.6% reported high impact, 6.7% very high, 6.7% low, and 4% very low. These findings indicate that soil degradation moderately affects ecological integrity in the study area.

Table 4.15 consequences of soil degradation in the study area

No	What are the Consequences of soil degradation in the study area?	Very high		High		Moderate		Low		Very low		Total	
		Frequency	%	frequency	%	frequency	%	Frequency	%	Frequency	%	frequency	%
1	Vulnerability of natural disaster	22	15	56	37.3	38	25.3	23	15.3	11	7	150	100
2	Agricultural Impact	27	18	58	38.6	43	28.7	19	12.7	3	2	150	100
3	Socio-economic impacts	13	8.7	108	72	19	12.6	10	6.7			150	100
4	Ecological impacts	10	6.7	25	16.6	99	66	10	6.7	6	4	150	100

Source: own survey result 2025

4.5 Soil Management Practices Implemented to Mitigate Soil Degradation

Various soil management strategies are practiced in the study area to reduce soil degradation, as summarized in Table 4.16. Approximately 34 respondents (23%) use conservation tillage, 29 respondents (19%) practice crop rotation, 26 respondents (17.3%) apply the appropriate amount of fertilizers, 22 respondents (15%) adopt contour farming, and 17 respondents (11.1%) use terrace farming. Key informants noted that although fertilizer application is essential where organic manure or compost is unavailable, most farmers rely on traditional soil conservation techniques, including fallowing, crop rotation, and terracing, which involve alternating crop types annually.

Conservation tillage, such as reduced tillage or no-till, helps retain soil moisture, increase organic matter, and slow down soil degradation. Crop rotation enhances soil fertility, breaks pest and disease cycles, and minimizes nutrient depletion (Kogut, 2024). Implementing these soil management measures ensures long-term sustainability of land resources, supports biodiversity, and contributes to climate change mitigation by storing carbon in soils (Nunes F.C. et al., 2020). Field observations confirmed that farmers in selected kebeles actively practice crop rotation, fertilizer application, terracing, and contour farming to control soil erosion.

Table 4.16 soil management practices in the study area

What are the Management and mitigation of soil degradation in the study area	Rank	Frequency	Percentage
tillage techniques	1	34	23
crop rotation	2	29	19
Alternate crops using strip cropping	6	11	7.3
Apply the right amount of fertilizers	3	26	17.3
Aim for organic farming	6	11	7.3
Adopt contour farming	4	22	15
Practice terrace farming on the slope	5	17	11.1
Total		150	100

Source: own survey result, 2025

Figure 4.3 contour farming and terracing as traditional soil conservation practices in the study area (Abila Sayna)

Source (photo by author 2025).

CHAPTER FIVE: CONCLUSIONAND RECOMMENDATION

5.1 Conclusion

The primary engine of Ethiopia's economy is agriculture. However, a major ecological issue facing the nation is soil degradation, or a drop in soil quality that endangers both the terrestrial ecology and agricultural output. This study shows that over-cultivation, overgrazing, and population growth are the main causes of soil degradation in the research area; improper irrigation management, deforestation, and land misuse accelerate soil degradation. Due to very limited land, over-cultivation is the most important cause. A reduction in agricultural production, nutrient depletion, food shortages, migration, poverty, starvation, and biodiversity loss are only a few of the many social, economic, ecological, and agricultural repercussions of soil degradation. Unsustainable land use is both a cause and an impact of soil deterioration.

Crop rotation, conservation tillage, fertilizer application, terracing, and contour farming are among the soil management techniques used by local farmers. The uneven adoption of these methods, however, emphasizes the need for further technical assistance, education, and awareness. Sustainable land management, erosion prevention, prudent fertilizer and pesticide usage, a forestation, crop residue management, cover crops, and the application of a combination of organic and inorganic fertilizer are some of the integrated techniques needed to address soil degradation. Crop rotation, conservation tillage, cover crops, crop residue management, combined applications of organic and inorganic fertilizers, stone and soil bunds, etc. are all crucial for boosting crop yields and enhancing soil health. Therefore, to increase crop yield, sustain biodiversity, improve soil fertility, and help mitigate climate change, ongoing monitoring of soil resources is required.

5.2 Recommendations

1. **Promote Sustainable Farming Practices**: Encourage farmers to adopt conservation tillage, crop rotation, terracing, contour farming, and integrated fertilizer management.

2**. Enhance Awareness and Education**: Conduct training programs for farmers and local communities on soil degradation causes, impacts, and mitigation strategies.

3. **Diversify Livelihoods**: Support non-agricultural income sources to reduce pressure on degraded lands.

4**. Policy and Regulatory Measures**: Develop and enforce policies to prevent soil degradation and incentivize sustainable land management practices.

5. **A forestation and Reforestation**: Expand tree planting initiatives to reduce soil erosion, improve fertility, and enhance ecosystem resilience.

6. **Research and Monitoring**: Establish continuous soil monitoring programs and promote research on soil ecosystem services and adaptive land management strategies.

By implementing these measures, soil health can be preserved, agricultural productivity improved, and socio-economic and ecological resilience strengthened, ensuring sustainable development for the community and future generations.

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APPENDICES

Questionnaires to Be Completed by House Holds

ADDIS ABABA UNIVERSITY

COLLEGE OF SOCIAL SCIENCES

DEPARTMENTOF GEOGRAPHY AND ENVIRONMENTAL STUDIES

Appendix-I Questionnaire

Dear respondents

My name is Abuye Tsehay Ademe. I am conducting research titled as **'*Assessment of Causes and Consequences of Soil Degradation in Lay Armachiho Woreda, Central Gondar Zone, Amhara Region, Ethiopia'*** for master of art degree in Geography and Environmental studies. The purpose of this questionnaire is to capture firsthand information on Assessment of causes and consequences of soil degradation in the case of *Lay Armachiho woreda*. There is no need to write your name. Your individual answers will be kept strictly confidential. Therefore, please feel free to respond to the questions to the best of your knowledge so as to realize the objective of the study.

Thanks for your Cooperation!

Part I: Demographic and Socio-Economic Information

1. Gender: I. Male ☐ II. Female ☐
2. Age: I. 20-34 ☐ II. 35-49 ☐ II. 50-64 ☐ IV. 65 and above ☐
3. Status of education:
   I. Illiterate ☐ II. Primary school (1-8) ☐ III. Secondary Schoo☐
   IV. College Diploma and above ☐
4. Marital status: I. Single ☐ II. Married ☐ III. Divorced ☐ IV. Widow ☐
5. Numbers of family size: I. Single ☐ II. 2-5 ☐ III. 6-9 ☐ IV. Above 10 ☐

Part II: Causes of Soil Degradation

1. **What is the causes of soil degradation in your area?**

   I. Overgrazing ☐ II. Over Population ☐

   III. Over cultivation ☐ IV. Expansion of agricultural land ☐

7. How is about your Land productivity?

   I. Very good ☐ II. Good ☐ III. Moderate ☐ V. Poor ☐

8. What is the extent of soil degradation in your area? I. Very highly degraded ☐

II. Highly degraded ☐ III. Moderately degraded ☐ IV. Low ☐ V. Very low ☐

9. How much did agricultural development extension workers create awareness about soil degradation to the local farmers?

   I. All the time ☐ II. Usually ☐ III. Occasionally ☐ IV. Never ☐

10. How much did people perception about soil degradation?

   I. High ☐ II. Moderate ☐ III. Low ☐

11. Major causes of soil degradation:

(Mark your agreement level: 1 = Very High, 2 = High, 3 = Moderate, 4 = Low, 5 = Very Low)

No	**Items/ Causes of soil degradation**	**1**	**2**	**3**	**4**	**5**
1	Overgrazing					
2	Deforestation					
3	Population size					
4	Steepness of slope					
5	Traditional farming practice					
6	Intensity of rain fall					

Part III: Consequences of Soil Degradation

- Main consequences of soil degradation:

  (Mark your agreement level: 1 = Very High, 2 = High, 3 = Moderate, 4 = *Low, 5 = Very Low)*

No	**Items/Consequences of soil degradation**	**1**	**2**	**3**	**4**	**5**
1	Vulnerability of natural disaster					
2	Agricultural Impact					
3	Socio-economic impacts					
4	Ecological impacts					

Appendix II: Interview Guide

A. Personal Information

4 Name: ________________________

5 Sex: __________________________

6 Age: __________________________

7 Marital Status: ________________

8 Education: _____________________

B. Causes and Consequences of Soil Degradation

- Do you believe soil degradation exists in the study area?
- If yes, what are the major causes of soil degradation?
- What is the slope of your farmland?
- Is your farmland susceptible to erosion?
- What is the main source of income of the local community?
- What are the major consequences of soil degradation?
- What impacts do you expect from soil degradation?

Appendix III: Observation Checklist

Observation of Causes of Soil Degradation

S/N	Causes	1(yes)	2(no)
1	Rapid population growth		
2	Over grazing		
3	Over cultivation		
4	Heavy rain fall		
5	Cultivation of steep slope		
6	Traditional farming system		
7	Deforestation		

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INTERVIEW QUESTIONS

1. What is the causes of soil degradation in your area?

2 What is the rate of deforestation on soil degradation in the study area?

3 What is the rate of overgrazing in the study area?

4 How the rate of population growth in the study area?

5 What is the intensity of rainfall in the study area?

6 What is the status of traditional farming practice in the study area?

7 What is the degree of steepness of slope in the study area?

8 What is the extent of soil degradation in the study area?

9 What is the soil productivity status in the study area?