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INSTITUTE OF LAND ADMINISTRATION

ASSESSMENT OF FARMERS' PERCEPTION ON LAND FRAGMENTATION TRENDS AND ITS IMPACT ON AGRICULTURAL ACTIVITIES IN FOGERA WOREDA, AMHARA REGION, ETHIOPIA

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN LAND ADMINISTRATION AND MANAGEMENT.

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July, 2025

Bahir Dar, Ethiopia

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ASSESSMENTS OF FARMERS' PERCEPTION ON LAND FRAGMENTATION TRENDS AND ITS IMPACT ON AGRICULTURAL ACTIVITIES IN FOGERA WOREDA, AMHARA REGION, ETHIOPIA

A Thesis Submitted to Bahir Dar University, Institute of Land Administration in Partial Fulfilment of the Requirement for the Degree of Master of Science in Land Administration and Management.

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Bahir Dar, Ethiopia

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Declaration

This is to certify that the thesis entitled "Assessment of Farmers' Perception on Land Fragmentation Trends and Its Impact on Agricultural Activities in Fogera woreda ,Amhara Region, Ethiopia", submitted in partial fulfillment of the requirements for the Degree of Master of Science in Land Administration and Management ,at The Institute of Land Administration, Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been duly acknowledged.

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Name of the candidate	Date	Place

Approval of Thesis for Defense

Bahir Dar University

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We hereby certify that we have supervised, read, and evaluated this thesis titled "Assessment of Farmers' Perception on Land Fragmentation Trends and Its Impact on Agricultural Activities in Fogera woreda, Amhara Region, Ethiopia", by Mr. Amare Genetu prepared under our guidance. We recommend the thesis be submitted for oral defense.

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As members of the board of examiners, we examined this thesis entitled "Assessment of Farmers' Perception on Land Fragmentation Trends and Its Impact on Agricultural Activities in Fogera woreda, Amhara Region, Ethiopia". We hereby certify that the thesis is accepted for fulfilling the requirements for the award of the degree of "Master of Science in Land Administration and Management".

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ACRONYMS

CSA	Central Statistical Authority
FAO	Food and Agricultural Organization
FDRE	Federal Democratic Republic of Ethiopia
FHM	Farm Household Model
GDP	Gross Domestic Product
HH	Households
FGD	Focus Group Discussion
LC	Land Consolidation
LF	Land Fragmentation
NRLAIS	National Rural Land Administration Information System
SLM	Sustainable Land Management
UN/ECE	United Nations/Economic Commission of Europe
UNDP	United Nation Development Program
USAID	United States Agency for International Development

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Abstract

Land fragmentation is a major significant challenge to sustainable agricultural development in Ethiopia, particularly in the Amhara Region where smallholder farming dominates. This study examines the perception of farmers on land fragmentation trends and its impact on agricultural activities, in Fogera Woreda. Using a mixed-methods approach, data were collected from 196 landholders through structured questionnaires, supplemented by focus group discussions and key informant interviews. Findings indicate that land fragmentation has intensified due to intergenerational inheritance, population pressure, and egalitarian land redistribution policies. A majority of farmers reported owning fragmented plots, with many indicating their landholdings were insufficient to meet household food needs. Key effects of fragmentation include reduced mechanization potential, higher production costs, boundary disputes, and diminished agricultural output. While awareness of these challenges was widespread, participation in land exchange initiatives remained limited. However, most farmers expressed willingness to engage in consolidation programs if supported by government interventions. Nearly all households held landholding certificates, reflecting strong tenure security but inadequate institutional mechanisms for consolidation. The study concludes that despite deep-rooted socio-cultural and demographic drivers of fragmentation, policy-led consolidation presents a viable solution. Recommendations include strengthening institutional frameworks, enhancing technical support, and improving rural infrastructure to address fragmentation challenges. Comprehensive land governance reforms, revised inheritance systems, and livelihood diversification strategies are essential for fostering sustainable agricultural development in the region.

Keywords: *Land fragmentation, Land consolidation, Agricultural productivity, Impacts, Tenure security, Farmer perception.*

CHAPTER ONE

1.INTRODUCTION

Land is a vital resource that supports agriculture, economic growth, and livelihoods especially in developing countries where the majority of the population depends on farming for survival. In Sub-Saharan Africa, land remains central to national economies, providing a significant share of employment, income, and food security (Place, 2021). However, agricultural productivity in the region continues to face challenges due to issues such as land fragmentation, which hampers modernization, limits economies of scale, and constrains the efficient use of inputs like labor and machinery (Ali et al., 2022).

Globally, land fragmentation has been a long-standing concern, especially as it relates to declining farm efficiency and persistent food insecurity. While fragmentation may sometimes offer risk-spreading benefits, it generally increases production costs, limits mechanization, and leads to small-scale, subsistence-level farming. The phenomenon is particularly prominent in countries with high population pressure, inheritance-based land distribution, and weak land markets (Holden & Otsuka, 2019). In this context, understanding the nature and impact of land fragmentation becomes essential for designing policies that promote sustainable and productive agricultural systems. Thus, this study examines the challenges of land fragmentation for agricultural activities, focusing on farmers' perceptions of this issue and how they manage their fragmented holdings.

1.1. Background

In Ethiopia, agriculture is the backbone of the economy, contributing about one-third of GDP and employing over 65% of the population (World Bank, 2022). Given this heavy reliance, land is more than just a productive asset; it is a foundation for livelihoods, cultural identity, and social status (Fenta & Ali, 2021). Yet, land fragmentation defined as the subdivision of a single landholding into multiple, non-contiguous plots remains a widespread and growing challenge.

Historical policies, population growth (currently around 2.5% annually), and customary inheritance practices have contributed to increasingly fragmented holdings (CSA, 2021). According to national survey data, about 81% of rural households operate on less than 1.5 hectares, often divided into three

or more separate plots. In the Amhara region, nearly 95% of rural household's farm on holdings averaging around 1.6 hectares, which are frequently scattered (Fentahun et al., 2023).

The consequences of land fragmentation are well-documented. It leads to increased costs related to labor movement, transportation, and equipment set-up across dispersed plots. The presence of numerous plot boundaries also causes land loss and restricts investment in irrigation or mechanization (Teklu & Lefore, 2023). Moreover, the dispersion of parcels complicates land governance and increases the risk of boundary disputes.

Despite the inefficiencies, fragmentation persists partly due to tenure insecurity, weak land markets, and the absence of effective land consolidation policies. Government-led land registration and certification programs have made progress in enhancing tenure security, but they have not addressed the root structural problem of fragmentation (Bezu & Holden, 2015; Ali et al., 2022).

This study is grounded in the recognition that farmers' perceptions and coping strategies are central to how land fragmentation affects agricultural activities. By understanding how farmers interpret and manage these challenges in specific local contexts, policymakers and stakeholders can design more targeted, context-sensitive interventions.

1.2. Statement of The Problem

Land fragmentation in rural Ethiopia, particularly the Amhara Regional State, poses a critical challenge to agricultural development, driven by the land tenure system, rapid population growth, and traditional inheritance practices (Teshome et al., 2016). Empirical evidence from Northwestern Ethiopia shows average farm sizes declining to 1.25 hectares, barely sufficient for basic household needs (Belay et al., 2021), with fragmentation in areas like Fogera Woreda manifesting as small (0.15-0.5 ha), irregular, and dispersed parcels that reduce farming efficiency (Alemu et al., 2017; GIZ, 2023). This fragmentation increases production costs through higher transport time and labor between plots, complicates management, limits adoption of modern technologies and mechanization, hinders economies of scale, restricts crop choice (especially high-value crops), discourages long-term investment, strains social relations by increasing land disputes, and deters credit access as fragmented holdings are poor collateral.

These challenges are acute in Amhara Region, where highly fragmented households experience 30% lower yields and greater climate vulnerability (Cholo et al., 2019), exacerbated by policies like the 1997 land redistribution which reduced average farms to 0.78 hectares (Deininger et al., 2008). While existing studies highlight the problem, key research gaps persist: a lack of empirical evidence quantifying the extent, drivers, and economic impacts in the region, specifically limited spatial/statistical data (e.g., parcel numbers, dispersion distances, landholding sizes), insufficient assessment of economic impacts (e.g., on yields, costs, incomes), and inadequate evaluation of past policy effectiveness (e.g., land consolidation, redistribution).

Furthermore, despite some government consolidation efforts, little is known about how farmers perceive and interpret these interventions or fragmentation itself. This study identifies a significant gap: the absence of comprehensive, localized data on farmers' perceptions regarding the extent and implications of land fragmentation in Fogera Woreda.

It hypothesizes that (a) farmers may lack awareness of fragmentation's underlying causes, (b) they may not fully perceive its impact on productivity and livelihoods, and (c) they may be unaware of possible solutions. Therefore, this research seeks to assess fragmentation levels and patterns, analyze farmers' perceptions and responses, and evaluate its impact on agricultural practices in Fogera Woreda, aiming to fill these knowledge gaps and inform policymakers on designing interventions responsive to farmers' needs and lived experiences.

1.3. Research Objectives

1.3.1. General Objective

This research aims to investigate the perception of farmers' regarding land fragmentation and its impact on agricultural activities.

1.3.2. Specific Objectives

- To assess the trend and magnitude of land fragmentation in the study area.
- To identify the factors that, contribute to land fragmentation in the study area.
- To investigate the impacts of land fragmentation on agricultural activities.

- To examine conflicts arising from land fragmentation.
- To evaluate the potential solutions to address land fragmentation problems.

1.4. Research Questions

- What were the trends and magnitude of land fragmentation in the study area?
- What are the factors contributing to land fragmentation in the study area?
- How far land fragmentation impacted agricultural activities in the study area?
- How farmers perceive land fragmentation in the study area?
- What were the potential solutions to overcome the challenges of farm land fragmentation?

1.5. Significance of The Study

The study is significant because land is currently Ethiopia's most significant economic, cultural, and political issue. This research adds empirical evidence on the effects of land fragmentation, which benefits both academic literature and practical agricultural policy. Policymakers, agricultural extension services, and farmers themselves will benefit from the findings, which provide strategies for enhancing agricultural sustainability and land use efficiency. Farmers' perspectives on land fragmentation offer a comprehensive understanding of its complex effects on agricultural operations, impacting social dynamics, policy choices, adaptive tactics, economic factors, environmental sustainability, and rural education initiatives. The academics, future research and students will benefit by reading the finding of this research.

1.6 .Limitations of The Study

The study faced limitations due to the lack of prior localized studies or readily available official data in the woreda. Time, budget, and security issues restricted the research to only two kebeles. Despite these challenges, the study provides a basis for future research on the topic in the region.

1.7. Scope/Delimitation of Study Area

This study examines farmers' views on land fragmentation and its agricultural impacts in Fogera Woreda, Amhara Region. The research is geographically limited to this specific area and centers on land fragmentation as its key focus.

1.8 .Thesis Structure

This thesis is structured into five chapters to systematically address the research problem and achieve the study's objectives. Chapter one provides the research background, problem statement, main objectives, sub-objectives, and guiding research questions. Chapter two existing scholarly works on key concepts such as land fragmentation, including its definitions, causes, effects, and potential solutions, while also presenting a conceptual framework. Chapter three justifies the selection of the study area and details the research design, data collection methods, sampling techniques, and data analysis approaches. The fourth chapter presents the findings from the fieldwork, analyzing them in relation to the research questions and sub-objectives. The final chapter summarizes the key findings, draws conclusions, and suggests areas for further research. This structured approach ensures a logical flow from theoretical foundations to empirical analysis and practical recommendations.

CHAPTER TWO

2. REVIEW OF LITERATURE

2.1. Overview of Land Fragmentation

Land fragmentation refers to the division of agricultural land into smaller, often scattered plots, which may hinder efficient farming operations. Scholars have varying interpretations of the concept, but three key dimensions emerge. First, fragmentation involves the subdivision of land into uneconomically small parcels that limit practical cultivation. Second, it implies that these parcels are non-contiguous and interspersed with other farms. Lastly, distance plays a critical role, as fragmented plots are often dispersed over wide areas, increasing travel time and reducing operational efficiency (Songoro et al., 2019). This phenomenon is prevalent in many agrarian economies, where inheritance laws, market transactions, and historical land distribution practices contribute to its persistence (Blarel et al., 1992; Danquah et al., 2019).

Any alteration of a land resource that impacts the current or potential range of land uses, either now or in the future(Rutledge et al., 2015). The term fragmentation is used in two different ways according to the literature. First, it often refers to dividing farm property into small units that are too small to be efficiently used. Fragmented land refers to the difficulty of acquiring connected and consolidated cultivated land, as shown by numerous small plots spread out over space. This pattern of land use does not align with large-scale management and has the potential to disrupt agricultural activities(Zhou et al., 2024).

The main issue facing Africa today, according to Jayne (2017), is the average farm size decreasing with time in the highly populated smallholder farming regions, where over half of rural farm families manage less than one hectare of land. Taking into account variables such as plot size, distance from farm buildings, and intervals between plots, and this idea incorporates many geographically separated parcels (Ciaiana et al., 2018; Kiplimo and Ngeno, 2016).

There are two opposing points of view in discussions on land fragmentation. Arguments against fragmentation that obliquely advocate land consolidation and associated policies draw attention to issues with labor monitoring, longer travel times, greater border waste, and restrictions on larger-scale investments. Additionally, although this may help to lessen soil erosion, fragmented parcels

generate a complicated border network that results in uncultivated land at parcel edges (Dhakal and Narendra, 2018).

On the other hand, there are benefits associated with land fragmentation. Its supporters emphasize how it lowers crop risks and encourages varied output (Mon Chuck et al., 2010). Research conducted in Albania indicates that more diversification results from divided ownership, especially for households who prioritize self-consumption above output geared toward the market (Ciaiana et al., 2018). Farmers in Ethiopia grow food for both domestic use and export. Therefore, while thinking about land consolidation, a balance needs to be achieved. It is also said that fragmentation has ecological advantages since it produces a naturally occurring mosaic of crop types and parcel shapes that mix in better with the surroundings, particularly in semi-mountainous locations. Furthermore, it is thought that smaller land areas are less vulnerable to agricultural diseases, wind damage, and soil erosion (Demetrious, 2014).

Due to the firmly ingrained custom of allocating landholdings among household successors, when eligible heirs choose to live apart, land portions of varying quality are distributed equally among them in emerging nations. This results in a smaller landholding area as well as a more dispersed distribution of land units. Each small holding is typically divided into several little portions dispersed across a large region, ranging in distance from the farmhouse. This hinders agricultural growth in multiple ways. (Tessema, 2011b).

2.2. Factors That Causes Land Fragmentation

The fragmentation of agricultural land is driven by a complex interplay of socio-economic, institutional, and environmental factors. Political systems, inheritance laws, and historical land distribution patterns play a significant role in perpetuating fragmentation (King & Burton, 1982). Additionally, high transaction costs in land markets discourage consolidation, while urban expansion policies and individual land valuation preferences further exacerbate the issue (Danquah et al., 2019). In Ethiopia, customary inheritance practices, population pressure, and land tenure systems have historically contributed to the subdivision of farmland into smaller and more dispersed holdings (Tessema, 2011a). These factors collectively sustain land fragmentation, posing challenges to agricultural productivity and rural development.

Land fragmentation is a widespread issue globally, with various causes depending on the country and region. Experts agree that land fragmentation is primarily triggered by inheritance, population growth, land markets, and historical/cultural perspectives (Thapa, 2005; Tan et al., 2006; Van Hung et al., 2007). Additional situational factors include social and administrative decrees (Bentley, 1987), long-established cultivation (Binns, 1950), shortages of land and nucleated settlement (Papa Georgiou, 1956), and the conversion of forest lands to arable land (Grigg, 2015).

Although it is thought to be most closely associated with Europe, land fragmentation is a concern that affects everyone. Numerous studies on land fragmentation in various nations worldwide have been published. For example, studies in Bangladesh (Rahman & Rahman, 2009), South Asia (Niroula & Thapa, 2005), China (Tan et al., 2006), Vietnam (Sundqvist & Andersson, 2006), India (Manjunatha et al., 2013), Nepal (Dhakal & Khanal, 2018), and Rwanda (Ntihinyurwa et al., 2019),have determined that changes in government policy, inheritance, population growth, and the land market are the primary causes of land fragmentation(Zam, 2020).

Partially divided land holdings are thought to be a crucial component of less advanced agricultural systems. Land markets, population growth, inheritance, and historical and cultural context are the primary causes of land fragmentation (Niroula and Thapa, 2005; Tan et al., 2006; Van et al., 2007). Land fragmentation, according to Shuhao (2005) and Jha et al. (2005), increases travel times between fields, which has the effect of lowering labor productivity and raising input and output transportation costs. (Dhakal & Khanal, 2018).

The phenomenon of agricultural land fragmentation, which is prevalent worldwide, arises from the intricate interaction of multiple factors that include institutional, political, historical, and sociological aspects, as will be discussed in the following sections. Two widely accepted theories have been put forth in the literature to explain the beginning and continuation of land fragmentation: the supply-side theory and the demand-side theory (Bentley, 1987; Blarel et al., 1992). While the supply-side argument views land fragmentation as an external imposition on farmers driven by factors like population pressure, inheritance norms, and land scarcity, the demand-side perspective views it as a conscious decision made by farmers. According to the demand-side perspective, farmers make voluntary decisions and see fragmentation as a reasonable response when costs may be outweighed by benefits (Blarel et al., 1992; Di Falco et al., 2010).

Things to think about Biophysical: topography, networks of rivers, networks of transportation – Property Rights: Zones, Overlays, Ownership, Regulations, etc. Ownership: decision-making varies from one (easier) to many (harder). (Rutledge et al. 2015).

For example, it implies that farmers might choose to work on scattered plots to reduce production risks when faced with different land qualities or to effectively distribute labor when there is no official labor market. Divided lands also make it easier to diversify crop cultivation in times of commodity market failure, ensuring household consumption. Similar to this, farmers use fragmentation to maximize production by growing a variety of crops when economies of scale are unfavorable for specific crop productions across individual parcels. This practice is particularly notable in the highlands of Ethiopia where mixed farming is prevalent.

Conversely, the supply-side explanation emphasizes how farmers are forced to fragment their land involuntarily as a result of outside forces. Due to population pressure and policies promoting equitable land distribution, there is often a need for fragmented holdings as communal lands are divided into smaller parcels. This phenomenon is influenced by a number of factors, including the cheap labor that is common in many African and Asian nations, the legal protections for partible inheritance, and the scarcity of off-farm employment opportunities. Furthermore, external factors contributing to land fragmentation include unfavorable land markets, stringent laws governing land transactions, and inadequate credit facilities. (Blarel et al., 1992; Tan et al., 2006).

Inheritance is the most common reason for land fragmentation in most nations. The land is divided among all heirs in an inheritance. This type of land transfer allows for the physical division of the land among the heirs or the addition of new heirs to the group of co-owners (Sklenicka, 2016). Parcel division during a sale or change of use is another frequent cause of fragmentation; this is primarily because of land conversion brought on by development pressure (Sklenicka, 2016).

Although informal land transactions in Ethiopia play a role in land fragmentation, Solomon Assefa (2013) argues that two main factors population pressure and progressive egalitarian land reforms are primarily responsible for land fragmentation. Recognizing Solomon's points, Yigremew (2002) argues that land inheritance is a significant contributing factor to Ethiopia's fragmented land. The explanations above show that in order to create policy interventions that could help stop land

fragmentation and open the door for land consolidation, a thorough understanding of the causes of land fragmentation is fundamentally necessary.

2.3. The Multidimensional Impacts and Challenges of Land Fragmentation

Land fragmentation, where farming households own multiple non-contiguous plots often dispersed across large areas, is a global phenomenon prevalent in Europe, Asia, Africa, and the Americas (e.g., Taiwan, Kenya, USA, Peru). Historically associated with Europe, it now significantly impacts developing economies and is widely perceived as a barrier to agricultural modernization. No universal standard exists to objectively measure "excessive" fragmentation, complicating cross-country comparisons (Dang, 2006). Drivers include supply-side factors (e.g., inheritance laws, population pressure) that impose fragmentation exogenously, and demand-side factors where farmers voluntarily retain fragmented plots for risk diversification or access to varied resources (Ali et al., 2019).

Land fragmentation has diverse effects on agricultural productivity, labor efficiency, and farm profitability. Studies employing production function analysis, such as those by Wan and Cheng (2001), indicate that fragmentation reduces crop output by increasing operational inefficiencies. Conversely, Sundqvist and Andersson (2006) found that fragmentation can enhance land productivity in certain contexts by promoting diversified cropping and better resource use. However, challenges such as increased labor costs, difficulties in mechanization, and reduced economies of scale often outweigh potential benefits (Tessema, 2011a). Additionally, fragmented plots are typically located at varying distances from homesteads, leading to higher transportation costs and lower input application efficiency (Gavin & Fafchamps, 1996).

Fragmentation impedes agricultural efficiency through increased transportation needs, labor time, and management complexity (Nath & Narendra, 2018). Boundaries, paths, and fences consume arable land (Demetrious, 2014), while small plot sizes restrict cultivation of high-value crops (e.g., fruits), forcing reliance on less profitable alternatives. This inefficiency in labor/capital use raises production costs, obstructs mechanization (Jansen, 1986), and signals suboptimal production systems. Consequently, fragmented landscapes reduce farm incomes and constrain modernization.

Socially, fragmentation strains community relations through boundary disputes and fencing conflicts (Jha et al., 2005; Assefa, 2013; Tenna et al., 2017), while hindering collective action for irrigation, soil conservation, or shared infrastructure (Ali et al., 2019). Environmentally, scattered plots complicate water management (irrigation/drainage), increase construction costs, and obstruct landscape-level conservation strategies. Furthermore, small, fragmented plots are often unacceptable as loan collateral, restricting farmers' access to credit for improvements (Dang, 2006). These interconnected challenges diminish farmers' adaptive capacity and exacerbate resource degradation.

Land consolidation emerges as a key solution to boost yields per hectare—critical for food security amid limited arable land. It reduces travel time/boundary disputes, enables economies of scale and mechanization, and simplifies infrastructure development (e.g., roads, irrigation networks). However, successful implementation requires significant financial/institutional support, voluntary household participation, and coordinated provision of amenities (Abubakkor Siddik & Rahman, 2022). Despite limited empirical validation (Ali et al., 2019), governments frequently invoke fragmentation's collective action problems to justify consolidation policies, underscoring its significance in global agricultural development strategies.

2.4. Negative Effects of Land Fragmentation

Land fragmentation significantly reduces agricultural productivity by increasing transportation costs, complicating land management, and limiting farmers' ability to adopt high-yielding crops. Dispersed plots lead to wasted time and higher expenses for supervision, security, and infrastructure like roads and fences. Additionally, small and fragmented land holdings hinder mechanization, economies of scale, and infrastructure development (e.g., irrigation and drainage). Farmers may also face difficulties securing credit, as banks often reject small, scattered plots as collateral (Dang, 2006). These factors collectively constrain agricultural efficiency and profitability, making land consolidation a potential solution for improving productivity.

2.5. Benefit of Land Fragmentation

While often viewed as a constraint, land fragmentation can offer certain advantages under specific conditions. Sundqvist and Andersson (2006) observed that fragmented holdings encourage crop diversification, reducing risks associated with weather variability and market fluctuations. Similarly,

small, dispersed plots may allow farmers to exploit microclimatic variations, enhancing resilience (Ellis, 1988). In some cases, fragmentation also facilitates labor-intensive farming systems by distributing work across multiple plots, thereby optimizing seasonal labor use (Blarel et al., 1992). However, these benefits are context-dependent and may be offset by inefficiencies in mechanization and input management.

There is disagreement among policymakers regarding whether fragmentation is only a bad thing, despite the fact that they frequently highlight its disadvantages. Bentley contends that policymakers frequently disregard the opinions of farmers and that the harm caused by fragmented land holdings is overstated (Dang, 2006).

The diversity of soil and growing conditions that land fragmentation offers farmers lowers the chance of a crop failing entirely by providing a range of growing conditions. Farmers can access land with varying qualities, such as soil, slope, microclimatic variations, etc., thanks to the availability of numerous plots. Many plots of the same crop help spread out the risk because fields that yield well one year may produce much lower yields the next. A holding with multiple plots also makes it easier to rotate crops and leave some land fallow.

Using different eco zones is another advantage of land fragmentation. Farmers can cultivate a greater variety of crops by using different plots. Farmers can prevent household labor bottlenecks by spreading out agricultural tasks like harvesting and sawing over a longer period of time. This is because crops ripen at different times when plots are at different altitudes. This is particularly crucial in situations where the crop's short growing season readily results in periods of high labor demand.

In cases where there are size-related diseconomies, farmers may also favor fragmented land holdings. The failure of the labor market could be the cause of this phenomenon. It's possible that the farmers won't be able to hire enough people to handle seasonal peak production on big lots. 14 Because they have a low opportunity cost, many unproductive family members may work on the farm as a result of labor market failure, or the lack of off-farm job opportunities. Because of the high labor to land ratio that result, there is high productivity per acre of land. This could provide an explanation for why diseconomies of scale exist (Dang, 2006).

2.6 .Historical Evolution and Current State of Land Fragmentation in Ethiopia

Ethiopia's agricultural sector has long been characterized by fragmented landholdings due to historical land tenure systems, population growth, and inheritance customs. The Derg regime's land redistribution policies in the 1970s further exacerbated fragmentation by allocating small, scattered plots to households (Tessema, 2011a). Despite recent efforts to promote land consolidation, fragmentation remains widespread, with smallholder farmers operating multiple non-contiguous parcels. Current studies highlight that this fragmentation continues to constrain agricultural modernization, limits access to credit, and reduces farm profitability (Berhanu, 1992). The persistence of fragmented holdings underscores the need for policy interventions that balance customary land rights with consolidation incentives.

Land tenure in Ethiopia encompasses institutional frameworks governing resource access and social relations (Bruce & Adholla, 1993). Historically, pre-1974 Imperial rule featured regionally fragmented systems: the *rist* tenure in northern highlands emphasized collective family ownership, prohibiting land sales and triggering subdivision into micro-plots as families expanded. Conversely, southern regions operated under the *gebar* system, where private ownership and sharecropping perpetuated land division to accommodate tenants. Both systems, coupled with progressive taxation on underutilized land, institutionalized fragmentation as a primary barrier to agricultural productivity (Deninger et al., 2008; Yigremew, 2002).

The 1975 Derg regime's radical land reform nationalized holdings, abolishing landlord-tenant structures to pursue equity. However, egalitarian redistribution paradoxically intensified fragmentation by drastically reducing farm sizes—evidenced in regions like Gojam (Ofcansky & Berry, 1991, cited in Knippenberg et al., 2017). Post-1991, the EPRDF regime-maintained state ownership under the 1995 Constitution (FDRE, 1995) but imposed limits on redistribution and introduced minimum parcel sizes for irrigated/rain-fed land. Despite these measures, fragmentation persisted, hindering agricultural growth and reflecting deep-rooted systemic challenges (Knippenberg et al., 2017).

Population pressure (2.6% annual growth), environmental degradation, and poverty now accelerate fragmentation, pushing cultivation onto marginal slopes and shortening fallow periods (Dasgupta &

Maler, 1994; Yeshaneh, 2018). Pre-1975 data revealed 58% of holdings were <1 ha (covering 18% of cropland), while post-reform surveys show average highland farms fragmented into 2.3 plots of 0.35 ha each—with 33% split into ≥3 plots (MOA, 1989; CSA, 2004). This micro-fragmentation shifts agriculture toward nonviable subsistence, undermining livelihoods and intensifying soil erosion (Desta et al., 2000; Melese, 2017).

Farmers' lack of land ownership rights, coupled with extreme fragmentation, exacerbates food insecurity and poverty particularly among smallholders (Yimer, 2014). Unchecked population growth and potential land redistribution threaten to worsen productivity losses (Melkamu et al., 2010; Demissie et al., 2009). Sustainable resolution requires strategies that prioritize tenure security and phased land consolidation, addressing fragmentation's legacy across regimes to enable agricultural intensification (Knippenberg et al., 2017; Di Falco et al., 2010).

Ethiopia combats land fragmentation, driven by population growth, inheritance customs, and past policies, through its evolving legal framework. The cornerstone is the Federal Proclamation No. 1324/2024, which explicitly targets fragmentation as a barrier to sustainable agriculture. It sets legally binding minimum landholding sizes (varying by agro-ecology), prohibits subdivisions below these limits, and regulates inheritance transfers to prevent uneconomical plots. Crucially, the law shifts towards proactive land consolidation, promoting voluntary schemes, cooperatives, and reallocation to improve efficiency and sustainability, supported by regional laws like Amhara's Proclamation No. 252/2017.

However, implementation faces significant challenges: Customary inheritance practices persist, creating sub-legal plots due to weak enforcement, limited awareness, socio-economic pressures, and widespread informal transfers. Bridging this gap requires strengthening local institutions, integrating land use planning, incentivizing consolidation (e.g., credit, inputs), and harmonizing statutory laws with customs through community engagement. While the legal framework is mature and strategic, its success depends on overcoming these enforcement hurdles and aligning with rural realities.

2.7. Land Fragmentation in the Amhara Region.

Land fragmentation in the Amhara Region of Ethiopia is a critical issue driven by historical land redistribution policies, population pressure, and customary inheritance practices. The 1997 egalitarian land redistribution, as noted by Holden and Yohannes (2002), aimed to address inequality but inadvertently reduced average farm sizes and exacerbated fragmentation. Deininger et al. (2003) further highlight how population growth and patrilineal inheritance traditions—where land is divided among heirs have led to smaller, scattered plots, hindering agricultural productivity and mechanization.

The impacts of fragmentation are multifaceted. Teshome et al. (2016) found that smaller, dispersed plots limit farmers' ability to adopt sustainable land management (SLM) practices, such as terracing. Conversely, Di Falco et al. (2010) argue that fragmentation may promote crop diversification by spreading risk across agro-ecological zones. Despite this, Mekuria et al. (2022) report that Amhara farmers overwhelmingly view fragmentation as a barrier to climate adaptation, worsened by tenure insecurity under Ethiopia's state-owned land system.

Policy responses remain contentious. Rahmato (2009) critiques the lack of land markets, which stifles consolidation efforts, while Mayele et al. (2024) advocate for community-based land-use planning. Bezu and Holden (2014) stress that future policies must balance equity and efficiency, integrating customary practices with modern agricultural needs to ensure sustainability in Amhara.

2.8. Summary of Farmland Fragmentation

Empirical research underscores that farmland fragmentation is a multifaceted issue with both positive and negative implications. While factors such as inheritance laws, land markets, and historical policies drive fragmentation (Danquah et al., 2019), its impacts vary by region and farming system. Studies using production function models (Wan & Cheng, 2001; Tessema, 2011a) highlight reduced productivity in highly fragmented systems, whereas others note potential benefits like risk diversification (Sundqvist & Andersson, 2006). In Ethiopia, persistent fragmentation remains a critical challenge, necessitating policy measures that support controlled consolidation without undermining smallholder livelihoods

The problem of agricultural land fragmentation has been a significant area of study for development anthropologists, rural spatial planners, and agricultural economists for a number of decades. Regarding the effects of agricultural land fragmentation on productivity and efficiency, analysts are divided, though (Gashaw et al., 2017:5).

One of the main factors that have directly or indirectly contributed to subdivision and fragmentation is the traditional system of land inheritance (inherited laws, which divide a family's land among all the remaining sons). This system ensures that, as the population increases, not only do holdings fall in size, but they are also increasingly fragmented into small plots, scattered over a wide area:(Ayoola et al., 2022).

According to some researchers, farmers are under undue pressure to reduce the amount of time it takes to travel between geographically separated parcels and to pay extra for the transportation of inputs and products to and from residential areas. In fact, according to our study, 75% of farm households mentioned the negative effects of fragmentation. Longer travel times to reach the scattered parcels and the increased expenses associated with farm monitoring due to fragmentation are frequently mentioned causes for this. (Gashaw et al., 2017:5).

Time allocation and labor constraints for agricultural operations become even more critical as more and more old farmers operate farms in Africa and youth in Ethiopia tend to leave agriculture in search of other livelihoods (see Sosina and Holden, 2014). However, it is claimed that the fragmentation of land and farmers' employment of irregular fields work against the advancement of better mechanical technologies and effective irrigation practices (Demetrious, 2014: 13–15). Accordingly, "... the effects of fragmentation [on the cost of cultivation] vary with farm size and that fragmentation-induced increases in the unit cost of production are largest for marginal farmers" (Deininger et al., 2014: 2), according to a highly regarded study that used case materials from various scales of wheat and paddy rice farms in India. Similarly, land fragmentation is a common aspect of agricultural landholding in three woredas (i.e., districts) in northwest Ethiopia, where a recent study of subsistence farmers found that "... land fragmentation hurts yield and leads to the small and uneconomic size of operational holdings." (Gashaw et al., 2017: 5).

On the other hand, some analysts see fragmentation of agricultural land as a good thing. Some Ethiopian researchers stress that crop fragmentation allows farmers to pursue crop diversification and take advantage of the various microenvironments within which farming is practiced, which is

consistent with the findings of previous studies conducted in other countries. Because it lessens the chance of total crop failure, fragmentation is also thought of as an insurance policy (see Fassil, 1980; Desalegn, 1985). A recent World Bank study conducted in Rwanda claims that the practice of growing a variety of crops on disparate plots of land, and thus land fragmentation, has reduced the frequency of crop shocks and even improved yields and productive efficiency. (Daniel et al., 2015).

A nuanced examination of agricultural land fragmentation in recent literature warns against taking a broad view of the productivity effects of agricultural land fragmentation, regardless of how positive or negative; rather, it emphasizes the need to evaluate the context in which fragmentation occurs (Daniel et al., 2015; Deininger et al., 2014; Paul and Githinji, 2017). The issues surrounding the productivity effects of agricultural land fragmentation were briefly summarized by Paul and Githinji (2017: 14): costs are influenced by distance and management, while benefits are associated with plot variety. Because of this, it's critical to assess the impact of fragmentation and distinguish between circumstances in which dispersed holdings enhance yields and those in which they act as a barrier. There may not be much evidence to suggest that yields in smallholder agriculture are negatively impacted by the distance to a plot when labor is typically plentiful and supplied by family members (Gashaw et al., 2017: 5).

Table 2.1.Structural Summary Table Providing an Over View of Key Literature on Land Fragmentation.

Authors	Area	Effect on	Method	Indicator	Result	Conclusion	Recommendation
Akalu Teshome	Ethiopia (Amhara)	SLM & LF	Multivariate profit (MVP)model	A, N, D	SLM (-)	Farmers' investments in sustainable land management are affected by LF.	Prevent further fragmentation of cultivated land.
Blarel et al. (1992) Di Falco et al. (2010)	Ghana & Rwanda	Production	Pooled OLS	SI, ND, A	Yield (-), Cost (+)	Productivity gains from LC may not be significant.	Minimize causes of LF; promote land & non-land market factors.
	Bulgaria	Agro-biodiversity; Profit	2SLS	N, D, A	Profit (-)	Policies must balance agro-biodiversity and profitability.	Improve land, labor, credit, and tech markets instead of focusing only on LC.
Jordan	Jordan	Production Cost; Efficiency	GLS	A	Cost (+), Efficiency (-)	LF hinders wheat production efficiency.	Improve education, credit access, and land consolidation.
Nguyen et al. (1996) Parikh & Shah (1994)	China Pakistan	Production Cost; Productivity Production Efficiency	Production Function SPFA (MLE)	A N	Cost (+), Productivity (+) Negative relationship (no causality)	Potential productivity loss due to LF. LF may result from inefficiency rather than cause it.	Minimal govt. intervention; enhance land, grain, and credit markets. Improve education, credit access, and land consolidation.
Rahman & Rahman (2009)	Bangladesh	Production Efficiency	SPFA (MLE)	N	Productivity & Efficiency (-)	LF negatively impacts productivity and efficiency.	Address root causes (inheritance laws, agricultural economics).
Solomon Assefa (2013)	Ethiopia (Tigray)	Productivity, Efficiency	Stochastic Frontier	A, N, I	Productivity & Efficiency (-)	LF reduces productivity and efficiency in Tigray.	Implement land consolidation policies.
Tan et al. (2008) Van Hung et al. (2007)	China Vietnam	Cost Efficiency Labor Efficiency; Land Productivity	FHHM Frontier Regression	A, D, SI N	Cost (-) Production (-), Labor use (+)	LF's effect on production costs is not substantial. Benefits of livestock for female-headed households depend on farm labor value.	LC can boost tech adoption but may reduce agri-employment. Create off-farm jobs and shift labor to other sectors for consolidation.
Van Hung et al. (2007)	Vietnam	Labor Efficiency; Land Productivity	Standard FHHMF rontier Regression	N, Labor	Production (-) Labor use (+)	The true advantages of livestock consumption for female-headed households may not be evident until the actual value of farm labor becomes apparent.	By generating new employment opportunities outside of agriculture and transitioning agricultural workers to other industries, we can consolidate and strengthen the economy.

A=Average Plot size Management; D = Average Plot Distance; FHHM = Farm Household; HH=Household; LC = Land Consolidation; LF = Land Fragmentation; MVP = Multivariate profit. N = Number of Plots; SI = Simpson Index; TC=Transaction Cost;

2.9. Conceptual Framework of The Study

The literature review served as the basis for its design. Although Fogera woreda has seen an increase in land fragmentation, little thought has been given to comprehending the causes and effects of this phenomenon. By examining the definition, primary causes, and consequences of land fragmentation in Fogera woreda, this study aims to close this gap. The steps to stop additional land fragmentation will also be examined, which will assist policymakers in developing potential plans of action. Fogera woreda as the primary study focus, the researcher attempted to learn how farmers perceived land fragmentation and evaluate its effects on agricultural activities. The research will conceptualize how land fragmentation affects agricultural activities. Numerous socioeconomic factors and other traits of the farmers may interact to influence and affect it. In a schematic Figure 2.1, a conceptual framework has been presented to make the process clearly interpretable**.**

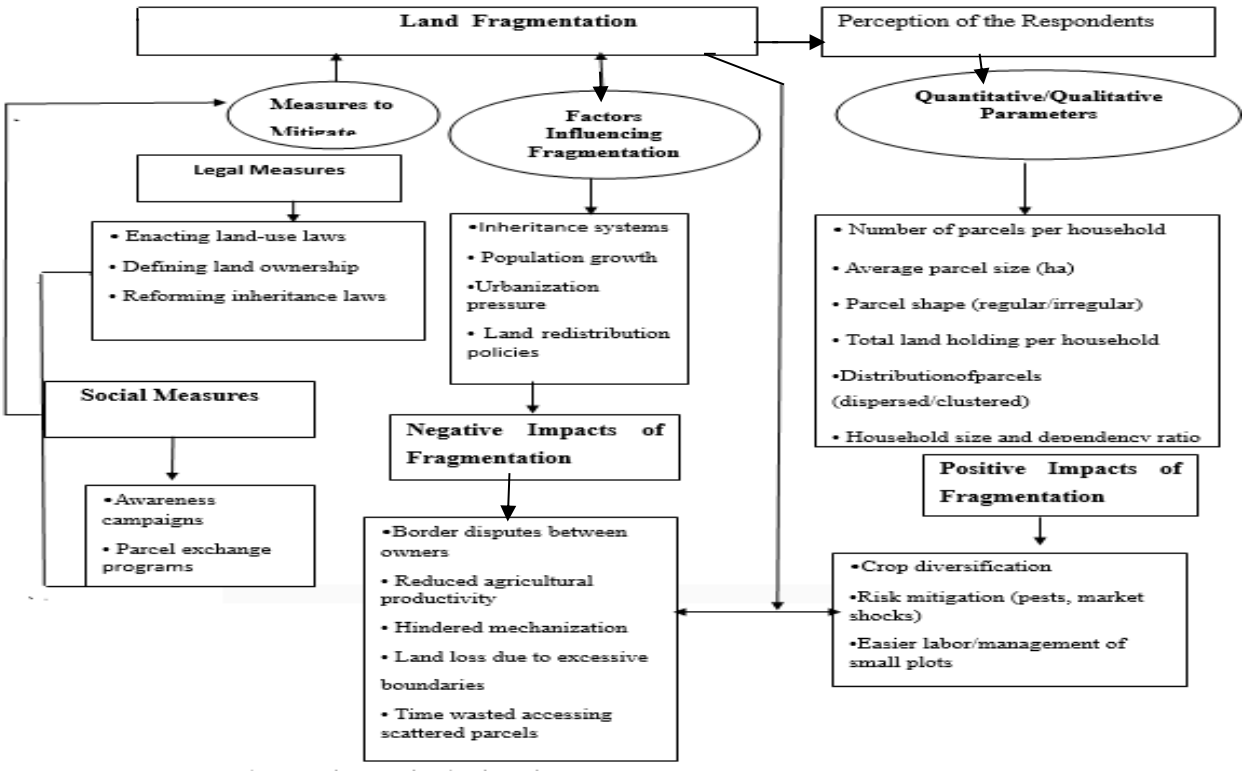


Figure 2.1. Conceptual Framework of The Stud Area.

Source: F*rom field survey findings ,2025*

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1 Description of The Study Area

This study was conducted in Fogera Woreda, South Gondar Zone of the Amhara National Regional State, Ethiopia. Fogera woreda is bounded to the east by Farta Woreda, to the west by Lake Tana, to the north by Libo Kemkem Woreda, and to the south by Dera Woreda. The geographic coordinates of the study area range approximately from 11.80°N to 12.10°N latitude and 37.55°E to 37.85°E longitude**,** covering an area near Lake Tana's eastern shore. The administrative center, Woreta town, is situated at approximately 11.92°N latitude, 37.70°E longitude**.** The woreda comprises thirty rural kebeles (Figure 3.1).

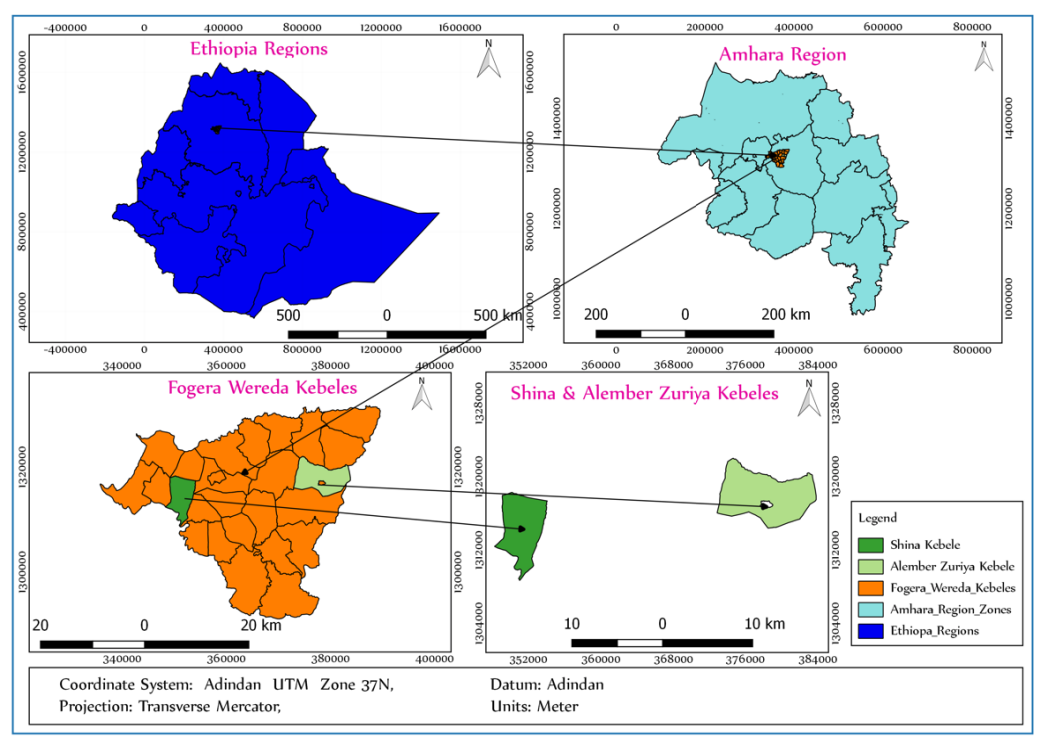


Figure 3.1 .Location Map of The Study Area.

Source: Field Survey, 2025

The woreda covers a total area of 117,414 hectares, of which 26% is composed of mountains, 4% is composed of undulating landforms, and 70% is plain topography (Woreda Agricultural Office, 2025). The attitude varies between 1500 and 2500 meters above sea level (Woreda Agricultural Office, 2025). The area's soil types are covered: soil that is 65% black, 20% brown, 12% red, and 3% gray. The summer months, which run from May to mid-September, are when most rain falls. The woreda's average annual temperature is 19.39 ^{0}C, and its mean annual rainfall is 1216ml and the climate is conducive for agriculture (Woreda Agricultural Office, 2025).

The woreda is home to 231,086 people, of which 225,761 (115,627 men and 110,134 women) work primarily in agriculture and related fields in rural areas, and the remaining 5,325 (2,468 men and 2,857 women) live in urban areas (Woreda Agricultural Office, 2025). This indicates that there are 47,328 male-headed and 9,112 female-headed rural households in all of the kebeles, for a total of 56,440 people living in these areas. Around 96.7 percent of Woreda's total population, on average, resides in rural areas (Woreda Administration Office, 2025).

The varied farming system is the woreda's primary source of income. The community's primary sources of revenue are agriculture, animal husbandry, and other related activities. The land use pattern shows that out of the total area coverage of the woreda (117,414 hectares), 64,828 ha (55.2%) is for Agriculture land where as 8,140 ha (6.9%) is for grazing land, 7,644 ha (6.5%) forest land, 9,643 ha (8.2%) is for settlement purpose 4,375 ha (3.7%) is non-arable land 1,698 ha (1.4%) covered by wetland and other land covers 21,086 ha (17.9%) is water body of the total area respectively (Worda land office 2025) .From the total area 64,828 ha (55.2%) of the woreda's total area are used for the production of annual crops like teff, maize, millet, rice, barley, beans, and other cereal and oil crops are the principal crops that are extensively harvested in the woreda, the total farm households in the woreda and the numbers of parcels operated by farmers are 49,464 and 228,115 respectively (Worda land office 2025).

3.2. Research Approach

This study employed a mixed-methods approach, integrating structured quantitative data collection and statistical analysis of numerical measurements with qualitative analysis of interview transcripts, observational notes, and documentary sources to comprehensively clarify and elaborate upon the

empirical findings, thereby leveraging the explanatory depth of qualitative insights to contextualize and clarify the patterns identified in the quantitative data.

3.3 Research Design

It is stated that a research design is the arrangement of conditions for the collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure (Kothari, 2004). As this research examined the perceptions and attitudes of farm households on the trends of farm land fragmentation and how it is affecting their farm activities and also their opinions on how to curb land fragmentation, a cross-sectional research design/survey design was used to generate appropriate data. Vanderstoep and Johnston (2009) stated that cross-sectional design requires gathering information from a single group of respondents at a single point in time without any attempt to follow-up over time.

Generating reliable data for analysis demands identifying the appropriate research method and techniques for data generation and collection. Taking note of this and considering the nature of this research, broad-based information was required to address the stated research objectives.

Qualitative research methods were used to collect data on the perception of communities practicing customary land tenure, and government staff working on rural land administration. Vanderstoep and Johnston (2009) stated that qualitative research helps to understand, in depth, the viewpoint of a research participant. The study also employed quantitative research methods to investigate variables related to household variables, land holdings, livestock and other assets owned, off-farm economic activities, urban expansion, etc. To capture the qualitative and quantitative data, the researcher collected primary data from multiple sources of evidence, such as survey questionnaires, semi-structured interviews (focus group discussions and in-depth interviews with rural land administration experts, and Agriculture development staff).

The data acquired in the study area was strengthened through triangulation. According to Bryman (2012), triangulation helps to avoid the problem of relying too much on any single data source or method that tends to undermine the validity and credibility of findings due to the weakness of any single method. Similar issues that had great value for the study were treated across data generation methods (i.e. semi-structured interviews and group discussions) to validate data coming from different sources and also to cross-check differences and similarities of ideas reflected by different

discussion groups. The overall data collection methods and procedure practiced are indicated in the following sections.

3.4 Data Types and Source of Data

The study employed both primary and secondary data in order to meet its goals. Preparing interviews and conducting field observations were used to gather primary data for a survey. The study's target population included land holders. Secondary data was gathered from governmental organizations at the woreda and kebele levels.

3.5. Selection of The Study Kebeles , Population and Sampling

The study's target populations for the questionnaire survey were primarily land holders. In the study woreda there are 30 rural kebeles. Of these two kebeles namely Alember Zuria and Shina rural kebele administrations were selected purposely considering their topography. Thus, this study considered one rural kebele with mostly rugged topography (Alember Zuria) and the other one with relatively flat topography (Shina), so that comparisons could be made between the two kebeles.

Data from the Fogera Woreda Land Administration Office indicates that within the two studied kebeles, Shina and Alember Zuria, there are a combined total of 4,930 landholders (2,352 in Shina and 2,578 in Alember Zuria). While Shina kebele has a larger total land area (2,508.25 hectares) and significantly more parcels (13,795) compared to Alember Zuria (2,355.75 hectares and 10,022 parcels), a comparison reveals distinct landholding patterns. Land in Shina is more fragmented, with holders averaging 5.87 parcels each, significantly higher than Alember Zuria's average of 3.89 parcels. Despite this fragmentation, the average landholding size in Shina (1.07 hectares) is slightly larger than in Alember Zuria (0.91 hectares). Overall, combining both kebeles, the average landholder manages approximately 4.83 parcels totaling 0.99 hectares, confirming that landholdings in the area are generally small, averaging less than one hectare. Land fragmentation in both Shina and Alember Zuria kebeles is highly severe, primarily evidenced by the excessive number of very small parcels and small average parcel sizes per holder.

The land registration book in the woreda land office was used to determine the sampling frame of the two kebeles (Alember Zuria and Shina). The sample farm households were selected using

probability sampling and each sample in the sampling frame was selected using a stratified random sampling method.

This research determined the sample size using the statistical formula in order to meet the research objectives. The study made assumptions about the degree of population variation and the acceptable 93% degree of confidence (or 7% number of errors) in the statistical method of determining sample size (Neumann, 2007). Based on this, the sample sizes were ascertained using Yamane's (1967) formula. Yamane offers a condensed formula for figuring out samples.

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

Where N is the total number of rural land holders in those two kebeles, e is the desired level of precision (e = 7%), and n is the required sample size. Applying this formula to the total households having land in the two rural kebeles mentioned above yields:

$$n = \frac{4930}{1+4930\,(0.07)\text{^}2} = 195.96\ \text{"}\approx\text{"}196$$

Based on the number of rural landholders in each kebele, the 196 sample landholders were allocated proportionately between the study kebeles. Accordingly, 102 sample farm households were from Alember zuria kebele and the remaining 94 sample farm households were from Shina kebele. stratified random sampling was applied to fix the sample households using the list of farm households in each kebele as a sampling frame.

To determine the sample size of each kebele we usually follow stratified sampling techniques (proportional) that is the sample size from each stratum is proportional to the size of the stratum.

nj= $N(j/N)$ n

Where nj = size of the sample from each kebele

Nj = total target population in each kebele

N= total target population size

Therefore, K=25.Thus, it selected the required sample size with every 25th item from the list of rural land holders.

Table 3.1.Sample Size for Each Target Keble.

S/N	Name of Kebeles	Total Target Population(N)	Sub Sample(n) nj= Nj/N ∗n	Sampling Interval(K) =N/n
1	Alember Zuria	2578	(2578/4930) *196 = 102	25
2	Shina	2352	(2352/4930) *196=94	25
	Total Sample Size	4930	(4930/4930) *196=196	

3.6. Method of Data Collection

3.6.1 Data Collection Tools

This study requires both primary and secondary data sources in order to uphold the study's objective. The secondary data was secured from relevant published materials including books, and office reports and to establish the average farm land holding per household and the degree of land fragmentation in the study woreda and specifically in the study kebeles, the National Rural Land Administration Information System (NRLAIS) database introduced in the ANRS Land Bureau was used, while the primary data acquisition was conducted using a variety of data collection instruments. As indicated in the previous sections, the research aimed to generate both quantitative and qualitative data. To generate appropriate data, data collection tools such as questionnaires, focus group discussions, key informant interviews, and field observation were used. The description of each data collection tool is indicated below.

3.6.1.1. Questionnaires

The purpose of the carefully designed questionnaires is to decrease uncertainty and promote a greater number of responses. To collect primary data from rural landholders, a questionnaire with both closed- and open-ended questions was used. These minimize ambiguity and bias and ensure acquisition of reliable information. In order to determine the ease of response, the significance of

the questions, and the approximate time needed to complete a questionnaire; the questionnaires were translated into Amharic and pre-tested on 15 non-sample households with comparable socioeconomic backgrounds prior to the actual data being distributed. The questionnaires were addressed to respondents by enumerators, who were trained and closely monitored during data collection.

3.6.1.2. Key Informant Interview

In qualitative research, key informant interviews are a crucial technique for gathering data as they enable researchers to obtain a range of viewpoints from study participants.Without restricting their views with time and information, the informants were provided with open-ended questions. According to Gray (2004), open-ended questions have advantages in providing rich information. It is applied by face-to-face interaction through an in-depth interview using a checklist of structural questions. Interviews were conducted with 6 key informants (three from each study kebele) involving elderly and knowledgeable farm households who could provide the needed information and ideas. In addition, 2 senior experts from the Woreda land office, another 2 experts from the Woreda agricultural development office and one expert from the Environmental Protection office were included as key informants.

3.6.1.3 Focus Group Discussion

Focus groups with open-ended questionnaires allow researchers to delve deeper and explore new areas of investigation. Data on the effects of land fragmentation on agricultural activities and associated trends were gathered using this methodology. In order to gather data using this method, one FGD was carried out in each study kebele and the participants were 6 farm households and 3 members of the kebele leadership as they are in charge of agricultural and other development activities. The discussion was conducted with the help of a note taker while the researcher chiefly acted as a facilitator or moderator of the discussion. The focus group discussions were held in Amharic, the local language, to get around language barriers. The data is then translated into English for analysis and interpretation.

3.7. Methods of Data Presentation and Analysis

In this research, a mixture of qualitative and quantitative data was collected. Hence, a combination of data analysis methods was employed. The qualitative data that was gathered from group discussions was summarized on the same day the discussion was held with the help of an assistant note taker. Efforts were made to screen key issues that were repeatedly raised during the discussion. The qualitative data collected from farm households, key informants and FGD discussants were subject to thematic analysis. Belotto (2018) argues that thematic analysis looks at patterns of meaning in the data set secured through interviews or focus group discussions. Thematic analysis takes bodies of data and groups them according to similarities. The content of the themes helps to filter issues and derive meaning from each theme.

The study used basic descriptive statistics means, medians, and percentages to summarize and present quantitative data on landholding patterns. These helped in understanding the distribution and central tendencies of key variables related to farmland and parcel holdings. Additionally, qualitative data was analyzed thematically, while inferential statistics (Likert scale analysis) were used for perception-based correlations. SPSS version 20 statistical software was used for analysis. Prominent views expressed by participants in the FGDs and KI interviews on particular issues were used to confirm the findings in the descriptive analysis. In other words, the responses coming from different data sources were triangulated to check convergent and divergent views coming from the different sources as described by Bryman (2012).

The average farm land holding and the average number of parcels held by farm landholders in the woreda were analyzed. Likewise, the average farm land holding and the percentage of farm households in different land holding categories (i.e. farmers having up to one hectare, 1.25 to 1.5 ha, above 1.5 ha) and the average number of parcels held per household and the percentage of farmers in different parcel holding categories (i.e. farmers having 1–2 parcels, 3–4 parcels, 5–6 parcels and more than 6 parcels were extracted from the NRLAIS database for the selected kebeles. These systems of measurement provide a baseline understanding of land distribution, though fragmentation analysis would require additional spatial and productivity data.

The perceptions of land fragmentation and its impact on framing activities were analyzed using inferential statistics. For this analysis, the study used the Likert scale. This approach helped in

analyzing the correlation between land fragmentation and various social, economic, and environmental factors.

3.8. Data Presentation

The data is presented using a combination of summary tables and figures to clearly illustrate key survey results and highlight proportional responses. A single comprehensive table summarizes the core survey findings and allows for quick interpretation of percentage-based data. Additionally, supporting information from interviews and office-level data is organized in tables with percentage representations to facilitate the formulation of conclusions and recommendations.

3.8.1. Data Quality Management

Reliability

Reliability refers to how consistently a respondent provides the same answers (Burns & Bush, 2001), meaning the extent to which repeated measures yield identical results over time and among different observers. To maintain reliability, this research utilized two methods for data collection: questionnaires and interviews. The information gathered from various sources was cross-verified. Reliability ensures that data collection methods yield consistent results over time. To achieve this, the following approaches were implemented: -

A small-scale test survey was conducted to refine questionnaires and interview guides, identifying and addressing potential ambiguities or issues before full deployment. Researchers and enumerators underwent training to ensure a uniform understanding of survey questions, minimizing variations in data collection. These measures enhanced the consistency and dependability of the collected data.

Validity

Validity refers to the extent to which data accurately represents the real-world construct it is intended to measure. It ensures that data collection methods, measurements, and analyses align with the intended purpose. Validity ensures that the data accurately measures the intended variables. The following methods were applied to assess validity: -

Evaluated whether survey questions fully captured key concepts such as land fragmentation and its agricultural impacts. Verified if indicators (e.g., farm size, productivity) correctly represented land fragmentation. Cross-checked findings with existing reports and office records to ensure alignment and accuracy. These steps confirmed that the data reliably measured the intended variables.

Ethical Consideration

According to Bricki & Green (2007), consent and confidentiality are essential to be considered during any research. It is important to make the respondents adequately aware of the type of information that will be collected (Kumar, 2011). Hence, the respondents were briefed on the objective of the study. Verbal consent was sought from each respondent in meeting them and recording the interview. They were informed about maintaining confidentially about their identity and the data collected because it is considered unethical to ignore it (Kumar, 2011). The researcher obtained consent from the local authority to interview the village representatives and the HHs before going to the field. The data collected was used only for academic purpose and not for any other purpose. Ethical compliance protects respondents and ensures unbiased data collection: participants were briefed on the study's purpose and consent was obtained. Generally, by implementing reliability checks, validity assessments, and ethical safeguards, this study ensures that findings on land fragmentation and agricultural impacts in Fogera Woreda are credible, accurate, and ethically sound. These measures enhance the study's usefulness for policymakers and researchers addressing land management challenges in Amhara region.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

4.1.Socio Economics Characteristics of Respondents

The study has a predominant male participation, as 82.7% of respondents were men. This result could reflect male-dominated social systems decision making, and agricultural activities, as relates to the study area. Greater proportions (83.7%) of respondents were married, indicating that household-based land management is likely common. In regard to religion, a vast majority (98%) reported being Orthodox Christian; hence, the dominant Christian faith might contribute to a tradition of land inheritance leading to subdivision, which in turn results in a pattern of fragmented or less systematically organized ("random") farming practices across the community (Table 4.1).

The age distribution (predominantly middle-aged and older people, with 80.7% aged 31-60) closely matches the reported predominance of bigger family sizes. The great majority of households (92.4%) have four or more people, which have implications for land inheritance, resulting in the partition of agricultural plots throughout generations. The low presence of young adults (18-30: 17.3%) and seniors (60+: 2.0%) is also associated with the rarity of extremely small (1-3 members: 6.6%) or very big (>10 members: 1.0%) homes.

About 95.9% of the sample respondents reported residing in the study area for more than 16 years the durations of residence suggests that the respondents have a good knowledge of their locality and potentially, a greater amount of exposure to the cumulative impacts of its fragmentation.

According to the results, educational attainment among respondents is notably low, with 84.3% reported as either completely illiterate or possessing only basic literacy skills. This suggests a significant barrier to the adoption of modern agricultural practices and limits effective participation in formal land policy processes.

Table 4.1 Household Socio Economics Data.

Variable	Categories	Frequency	Percentage (%)
Age	From 18 to 30	34	**17.3**
	From 31 to 45	68	**34.7**
	From 46 to 60	90	**46**
	Above 60	4	**2.0**
Sex	Male	162	82
	Female	34	17
Marital Status	Married	164	83
	Unmarried	6	3.1
	Divorced	14	7.1
	Widowed	12	6.
Religion	Christian	192	98
	Muslim	4	2
Family Size	1–3 members	13	6.6
	4–6 members	137	70
	7–10 members	44	22.4
	>10 members	2	1.0
Educational Level	Illiterate (non reader)	84	43
	Read and write	81	41.3
	Elementary	28	14.3
	Secondary	4	2.1
Years of residence in the Kebele	6–10 years	1	0.5
	11–15 years	7	3.6
	>16 years	188	95.9

Source: Field Survey, 2025

In terms of economic activities conducted by the sampled respondents indicated, crop farming is the main source of income for 90.3% of the households, demonstrated their heavy reliance on agriculture. Livestock husbandry was the second main source of income, with 89.3% ranking it second, suggesting its supportive role in the mixed farming systems. Petty trade and daily labor were income sources that mattered very little to our respondents, with more than 80% and 88% of households reporting no involvement respectively, demonstrating little diversification of livelihoods. The study results related in part to land fragmentation is a ubiquitous problem, interrelated with both size of family and inheritance of property as well as limited diversification of income. The problems are likely to affect larger family sizes and older households due to repeated subdivisions of land, and limited off-farm employment and education may children will exacerbate current issues.

4.2 Way of Land Acquisition

The data indicates that government allocation is the most common individual method of land acquisition, cited by 26% of respondents. When combined with other methods, such as inheritance or gifts, it plays a role in the majority of cases (60.2%). Inheritance also emerges as a major pathway, serving as the primary acquisition method for 25% of respondents and featuring in nearly half of all reported cases. Gifts, by contrast, are a less common route to land access (Table 4.2).

The significant presence of combined acquisition methods most notably the category of "Inherited and Government," which accounts for 21.9% of cases highlights the complexity of land transfer histories in the study area. These findings suggest that many households obtain land through a mixture of formal state distribution and informal or familial mechanisms.

Table 4.2.Way of Land Acquisition.

Types of Acquisition	Frequency	Percent
Inherited	49	25
Gift	29	14.8
Government	51	26
Inherited and Government	43	21.9
Gift and government	24	12.3
Total	196	100.0

Source: Field Survey, 2025

4.2.1.Land Transfers to Children or Relatives and Size of Land Transferred

In the areas of study, land transfers from parents to children or other family members are rather frequent, motivated mostly by customary inheritance systems and the demand to offer family social security. These exchanges are vital in preserving family ties and guaranteeing intergenerational access to land. Still, they also help to permanently divide landholdings. While just 23% (45 respondents) claimed they had not made such transfers, 77% of respondents (151 out of 196) said they had transferred a portion of their land to children or family members. This great rate of intra-family land reallocation highlights its cultural and social significance.

Most properties fell in the mid-sized range of 0.25 to 0.5 *ha* in terms of land handed over (Table 4.6). This points to a preference for equal inheritance among children. Although this custom guarantee equity, it causes already restricted landholdings to be subdivided, thereby lowering the average farm size and worsening problems with agricultural productivity and land management efficiency.

Table 4.3 . Summary of Transfer and Parcel Size.

Transfer Status	Frequency	Percent (%)	Typical Size of Land Transferred (Timad)	
Yes	151	77.0	(0.25–0.5ha)	Reflects inheritance norms; promotes equity but leads to fragmentation
No	45	23.0	N/A	No land transferred
Total	196	100.0	—	

Source: Field Survey, 2025

These results indicate that even while land transfers are still an essential cultural and social tool, they create long-term obstacles to agricultural sustainability because of their fragmented and shrinking nature.

4.3. Land Access Information in Different Regime

The study examines landholding patterns under three political regimes Haile Selassie, Derg, and the Current regime highlighting shifts in land access, fragmentation, and agricultural productivity. Key findings reveal how policies and inheritance systems influenced land distribution, with implications for household viability and farming efficiency. The data underscores persistent challenges in balancing equitable access with sustainable agricultural development.

Under the Haile Selassie regime, landholdings were initially larger due to low population density, but the *rist* inheritance system led to progressive fragmentation. Table 4.4 shows that 93.87% of households were not yet established, while only 2.55% held up to 1.0 hectare.

The Derg regime implemented land redistribution, increasing access: 29.59% of households owned up to 1.0 hectare, 19.90% held 1.25–1.5 hectares, and 15.31% possessed above 1.5 hectares. However, redistribution also accelerated fragmentation.

In the current regime, land access is universal but highly fragmented: 57.65% of households own ≤1.0 hectare, 25.51% hold 1.25–1.5 hectares, and 16.84% have >1.5 hectares. The data indicates worsening land fragmentation over time, influenced by inheritance practices and population growth. While equitable access improved, smaller plots hinder mechanization and crop specialization, reducing productivity. Future policies must address fragmentation while maintaining fair distribution to ensure sustainable agricultural growth. As shown in (Table 4.3) below, during the Haile Selassie and Derg Regime, 184 and 69 of the respondents had not yet established a household. The "not yet established" category was significant in earlier regimes but phased out in the current system.

Table 4.4. Landholding Size Across Different Regime and Household Establishment.

Not yet established a household and Land Size (ha)	Haile Selassie Regime		Derg Regime		Current Regime	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Not yet established a household	184	93.87	69	35.20	-	-
Up to 1.0 ha	5	2.55	58	29.59	113	57.65
1.25 to 1.5 ha	5	2.55	39	19.90	50	25.51
Above 1.5 ha	2	1.02	30	15.31	33	16.84
Total	**196**	100	**196**	100	**196**	100

Source: Field Survey, 2025

4.4 Distribution of Average Farm Land Holdings and Parcel Numbers Among Landholders.

This description analyzes severe land fragmentation in Shina and Alember Zuria kebeles of Fogera Woreda. Comparative data reveals critically small average holdings (<1 ha) combined with excessive parcel numbers (avg. 4.83/holder), significantly worse in Shina. This fragmentation poses a fundamental threat to agricultural viability and rural livelihoods across both communities.

4.4.1.Key Finding on Fragmentation Severity and Patterns

The data reveals stark differences in land fragmentation patterns between Shina and Alember Zuria kebeles. While Shina possesses a larger total land area (2,508.25 ha vs. 2,355.75 ha) and significantly more parcels (13,795 vs. 10,022), its fragmentation is markedly more severe. Shina landholders average 5.87 parcels each, substantially higher than Alember Zuria's average of 3.89 parcels. This fragmentation occurs despite Shina landholders having slightly larger average total holdings (1.07 ha vs. 0.91 ha in Alember Zuria). The critical finding is that both kebeles exhibit severe fragmentation characterized by an excessive number of very small parcels per holder, resulting in overall small average farm sizes below one hectare (0.99 ha combined).

4.4.2. Dominance of Smallholders and Parcel Fragmentation

The fragmentation observed in Shina and Alember Zuria directly mirrors the broader pattern across the study area. A dominant 57.6% of all households cultivate one hectare or less, confirming the prevalence of very small, fragmented holdings seen in the specific kebeles. Parcel fragmentation is similarly acute: 65% of farmers manage three or more parcels, and a critical 42.4% manage five or more parcels. This high incidence of numerous small plots per farmer, evident in both kebeles and the wider area, significantly increases labor requirements, complicates farm management, and escalates transportation costs, undermining agricultural efficiency.

4.4.3. Drivers, Impacts, and Structural Challenges

Key informants consistently identified inheritance practices and rapid population growth as the primary drivers of increasing fragmentation across the study area, including Shina and Alember Zuria. Both key informants and Focus Group Discussions (FGDs) participants acknowledged the severe negative impacts: fragmented land becomes economically unviable, directly threatening rural livelihoods. Legal frameworks governing inheritance and land tenure are noted to exacerbate the problem. The coexistence of extremely small total holdings (often <1 ha) with multiple dispersed parcels per farmer creates a fundamental structural challenge. This pattern, confirmed in both kebeles, severely undermines farm efficiency, hinders productivity improvements, and acts as a major barrier to adopting mechanization.

4.4.4. Confirmed Overall Severity and Conclusion

The comparative data conclusively demonstrates that landholdings in both Shina and Alember Zuria kebeles, and the broader study area, are characterized by severe dual fragmentation: a high number of parcels per holder coupled with very small total holding sizes. The combined average of 4.83 parcels per holder owning only 0.99 hectares is the defining statistic, confirming extreme fragmentation. Shina exhibits the highest parcel fragmentation (5.87 parcels/holder), while Alember Zuria, though slightly less fragmented in parcel count (3.89 parcels/holder), still suffers from critically small average holdings (0.91 ha). Ultimately, land resources across the area are distributed across a vast number of exceedingly small, scattered parcels, posing a significant threat to agricultural sustainability and rural livelihoods in both kebeles and the wider region.

Thus, the vast majority of surveyed households (71.4%, or 140 out of 196) reported that the land they own is insufficient to produce enough food to feed their families. Only a small minority (28.6%, or 56 households) indicated their land holdings were adequate to meet their family's food needs. This highlights a significant challenge in achieving food self-sufficiency within this population.

A key factor explaining this widespread inadequacy is land fragmentation the division of holdings into smaller, non-contiguous plots. This fragmentation directly contributes to the problem by making the effective holding size too small to support a family's food requirements.

Additional contributing factors include the inherent small size of many plots, low agricultural productivity, ineffective farming practices, and increasing family sizes that place greater demands on food production without a corresponding increase in available land. Often, the land is simply not sufficiently fertile or extensive enough to simultaneously meet basic subsistence needs and generate surplus income.

In essence, the division of land through fragmentation results in holdings that are not large or efficient enough to provide adequate food for the families that own them. This finding underscores the critical impact of land structure on household food security

4.5. Distribution of Plot Areas and Patterns of Plot Shapes

The study area exhibits pronounced land fragmentation, characterized by a high prevalence of irregularly shaped plots and uneven parcel sizes, which collectively constrain agricultural productivity. The geometric irregularity of these plots hinders mechanization efforts, increases operational inefficiencies, and raises labor costs, thereby undermining farm-scale economies. Furthermore, the variability in plot dimensions complicates land-use planning and reduces the feasibility of large-scale, technology-driven farming practices. These structural inefficiencies highlight the critical need for land consolidation initiatives aimed at standardizing plot shapes and reducing fragmentation. Policy measures promoting plot reorganizing and adjusting land parcels (plots) could enhance agricultural accessibility, optimize resource allocation, and improve overall farm output. Addressing these spatial constraints is essential for fostering sustainable land management and advancing agricultural modernization in the study area.

4.5.1. Distribution of Plot Areas

The study reveals a declining trend in land access beyond primary holdings among the surveyed households. All 196 households (100%) possess a first plot, each ≤1 hectare, indicating a baseline level of land ownership. However, subsequent plots become progressively scarcer, suggesting land scarcity, inheritance-based subdivision, or uneven redistribution. On average, households own four plots; though distribution is unequal some control up to six parcels, while others possess only one or two. Additional plots tend to be smaller, more fragmented, and less productive, exacerbating land fragmentation.

This fragmentation restricts economies of scale, complicates land management, and raises logistical costs. Dispersed micro-holdings hinder mechanized farming, reducing agricultural productivity and income potential. The findings underscore the challenges posed by unequal land distribution and its adverse effects on sustainable farming practices.

4.5.2. Patterns of Plot Shapes

The study highlights that irregular plot shapes, alongside land fragmentation, significantly hinder agricultural efficiency by reducing arable land use, limiting mechanization, and

increasing labor demands. Most households (61.4%) own irregularly shaped plots, exacerbating management challenges and lowering productivity. Addressing these issues requires land consolidation and spatial planning reforms to optimize plot configurations, enhance farming efficiency, and support sustainable rural livelihoods. Policymakers should prioritize integrated land management strategies that consider both plot size and shape to improve agricultural performance.

4.6. Land Parcel Distance From Homestead and Households' Perception

The summarized data draws attention to some important problems regarding domestic perceptions in the study area as well as land parcel features. The majority of the respondents (62.2%) stated that their plots are located 4 to 7 kilometers from their homestead, so adding to longer travel times and lower labor productivity (Table 4.5). This geographic scattering probably limits efficient cultivation, which reduces output and raises operational costs.

Moreover, a significant majority of households (61.7%) say they find discomfort with fragmented land parcels, highlighting the operational challenges fragmentation presents, including worker inefficiency and greater complexity in managing dispersed plots. This pain might cause more management difficulties and poor agricultural output.

On a good angle, widespread holding of Second-Level Landholding Certificates (95.9%) implies a great level of formal land tenure security. Reducing conflicts and fostering land development and agricultural productivity investment depend on such formalization**.**

Still, the trend of shrinking landownership, reported by 77% of those surveyed presents major long-term problems. This fall is brought on by elements including population pressure, inheritance practices, and land transfers, therefore endangering agricultural sustainability. This trend emphasizes the need for policy efforts including land consolidation initiatives to help sustainable agriculture practices and feasible farm sizes**.**

Generally, these results show complicated interaction among land fragmentation, distance, tenure security, and landholding size that influences the agricultural landscape and the means of existence

of the families examined. Solving these problems may help the area's efficiency, productivity, and sustainability.

Table 4.5.Summary Of Land Parcel Location And Household Perception.

Indicator	Category	Frequency	Percent
Parcel Distance from Homestead	0.5 – 3 km	73	37.2
	4 – 7 km	122	62.2
	Above 7 km	1	0.6
Comfort with Fragmented Parcels	Comfortable	75	38.3
	Not Comfortable	121	61.7
Second-Level Landholding Certificates	Have Certificate	188	95.9
	No Certificate	8	4.1
Landholding Size Trend	Yes Decreasing	151	77.0
	No Decreasing	45	23

Source: Field Survey, 2025

An example illustrating the distribution of land parcels for two households are presented in (Figure 4.1), highlighting the severity of land fragmentation and the spatial distance between parcels relative to the homestead. The map shaded in green represents Mr. X's landholdings, comprising 12 separate parcels, while the map shaded in blue shows the distribution of another household's 9 parcels, located in different kebeles. The household with 12 parcels travels an average distance of 5.528 kilometers to access and manage their farmland, whereas the household with 9 parcels travels approximately 4.416 kilometers. These examples demonstrate the extent to which fragmented landholdings increase travel distance, time, and labor requirements, thereby reducing operational efficiency in agricultural activities.

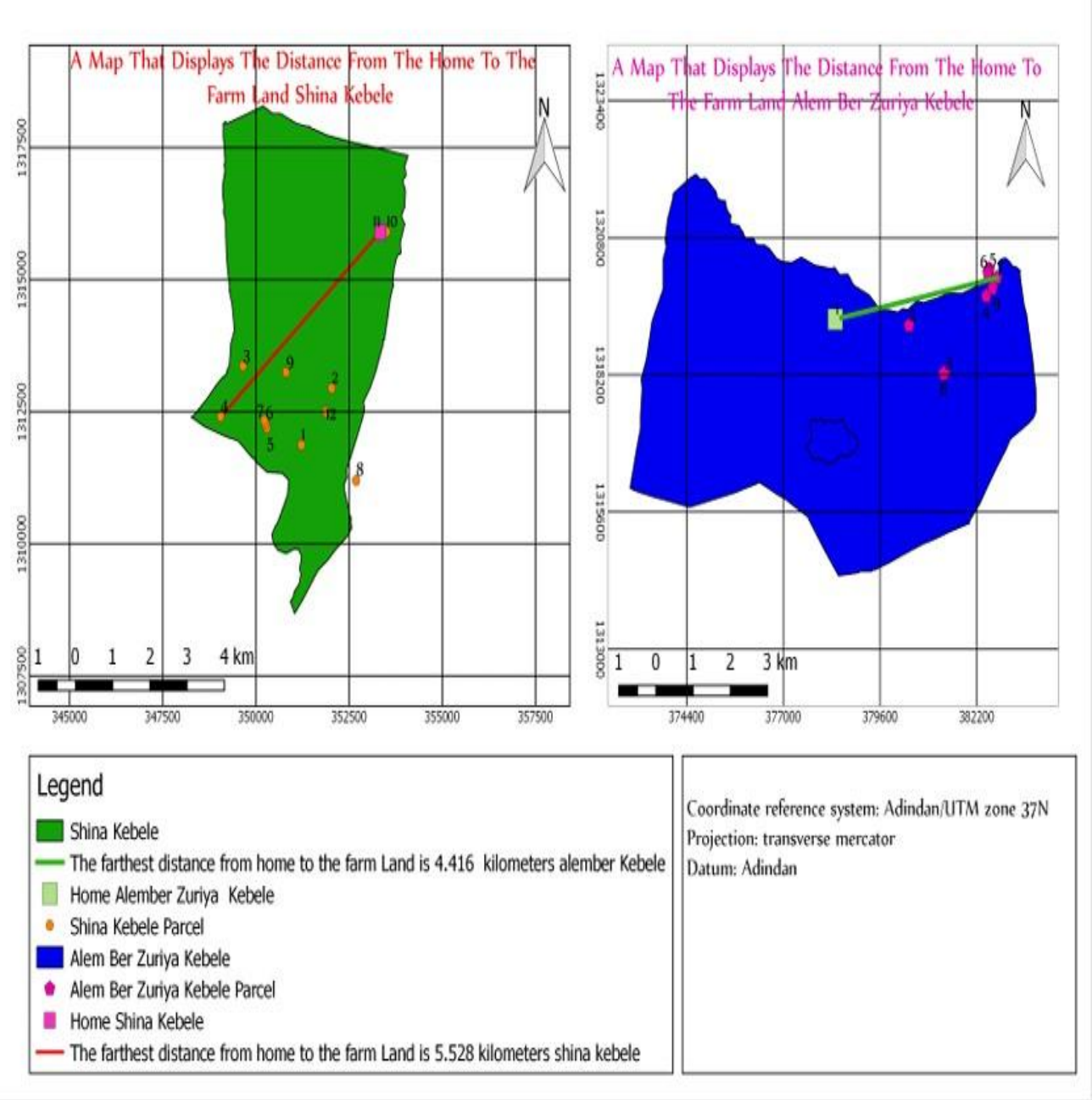


Figure 4.1. Spatial Severity and Farm Access Distance

Source: Field Survey, 2025

4.7. Occurrence and Frequency of Farmland Boundary Conflicts

The results show that 100% of participants say they have had farmland boundary conflicts, (Table 4.7) hence highlighting a common problem in the research area. Among the main causes driving this widespread occurrence are obscure property lines, partition of landholdings, and the growing worth of farmland, which all exacerbate tensions and conflicts on land ownership.

Still, the rate with which these confrontations happen varies greatly. The statistics show that areas with strong land law enforcement, clear cadastral maps, and strong legal land title systems tend to have less frequent boundary disputes. These elements help to define ownership and boundaries, therefore lowering ambiguity and possible conflicts.

Conversely, boundary disputes grow more frequent and difficult when land laws are uncertain, enforcement is poor, or land is especially rare or valuable.

Table 4.6 .Occurrence And Frequency Of Land Boundary Conflicts.

Boundary Conflict Occurrence	Frequency	Percent (%)	
- Yes	196	100	All of respondent's experience boundary conflicts.
- No	0	0	-
Frequency of Problem Faced			
- Rarely	129	65.8	Conflicts occur less often in areas.
- Frequent	67	34.2	Conflicts are more frequent in areas with unclear laws or scarce/valuable land.

Source: Field Survey, 2025

4.8. Perceptions Of Respondents on Land Fragmentation and Its Implication to Farming

The statement summarizes perceptions of land fragmentation and related variables based on a 2025 field survey. A majority of respondents (65.3%) acknowledged land fragmentation as an issue, with 66.8% confirming they owned fragmented plots. While 44.9% saw crop diversification as an advantage, over half (55.1%) did not. Similarly, most respondents disagreed that fragmentation helps avoid risks from natural hazards (59.2%) or pest damage (58.7%), suggesting limited perceived benefits.

The primary problems linked to fragmentation included border disputes (11.2%), decreased production (8.2%), and obstacles to mechanization (10.2%). Notably, 38.3% reported experiencing all listed issues, while 29.1% cited a combination of disputes, production drops, and mechanization challenges. These findings highlight fragmentation as a significant concern, with productivity and land-use efficiency being major casualties.

Overall, the data reveals a mixed perception: while fragmentation is widely recognized, its disadvantages outweigh its benefits for most respondents. The prevalence of disputes and productivity losses underscores the need for policies addressing land consolidation or improved management practices to mitigate these challenges.

Table 4.7.Perception on Land Fragmentation and Associated Variables.

Question	Response Options	Frequency	Percent (%)
Perception of Land Fragmentation	Yes	128	65.3
	No	68	34.7
Feeling of Having Fragmented Plots	Yes	131	66.8
	No	65	33.2
Crop Diversification Advantage	Yes	88	44.9
	No	108	55.1
Avoid Risk from Natural Hazards	Yes	80	40.8
	No	116	59.2
Avoid Insect Pest Damage	Yes	71	41.3
	No	125	58.7
Problems Due to Fragmentation	Border dispute	22	11.2
	Decrease in production	16	8.2
	Obstacle to mechanization	20	10.2
	Loss of land (many boundaries)	1	0.5
	Loss of productive time	2	1.0
	Access issues	3	1.5
	Disputes, production drop, mechanization)	57	29.1
	All problems listed	75	38.3

Source: Field Survey, 2025

4.9. Perceptions of Respondents on The Causes of Land Fragmentation

The report highlights the primary causes of land fragmentation, with inheritance systems and population growth being the most significant factors. Inheritance alone accounts for 7.7% of cases, while population increment is the sole cause in 20.9% of instances. Other factors like land sales (1.0%), urbanization (2.6%), and land redistribution (1.0%) play minor roles. However, the combination of inheritance and population growth emerges as the dominant cause, contributing to 40.8% of land fragmentation cases, followed by the interplay of inheritance, population growth, and urbanization at 26.0%.

The data underscores that land fragmentation is predominantly driven by overlapping factors rather than isolated causes. While population growth and inheritance systems individually have notable impacts, their combined effect is far more substantial, suggesting that addressing these intertwined issues is critical for mitigating land fragmentation. Urbanization, though less influential on its own, exacerbates fragmentation when paired with other factors, highlighting the need for integrated land management strategies.

Table 4.8. Perceptions Of Respondents On Causes Of Land Fragmentation.

Question	Response Options	Frequency	Percent (%)
Causes of Land Fragmentation	**Inheritance system**	**15**	**7.7**
	Population increment	**41**	**20.9**
	Land sale	**2**	**1.0**
	Urbanization	**5**	**2.6**
	Land redistribution	**2**	**1.0**
	Inheritance and population increment	**80**	**40.8**
	Inheritance, population & urbanization	**51**	**26.0**

Source: Field Survey, 2025

4.10. Experiences in Farm Land Consolidation

This study indicated that only 37.8% of farmers went through parcel exchange to consolidate their land. This shows that these strategies have had a poor adoption rate despite the benefits. Of the parcel exchange participants, 56.6% updated land records, signifying moderate adherence to administrative procedures (Table 4.9).

About 25% of the respondents have confirmed that land administration experts did raise awareness concerning the problems of land fragmentation. Furthermore, 66.8% of respondents said they were advised on parcel consolidations. These results clearly show that land experts have made good outreach, keeping within the land policy objectives.

The majority of the respondents (80.6%) said they would agree to land consolidation if requested by the government. This set of constituencies represents a favorable environment to host any Government-led land consolidation activities, for as long as such activities stand on transparent and equitable grounds.

Most respondents (86.3%) reported being medium to highly aware (Rank 1 or Rank 2) of land consolidation issues, and a slightly higher share (89.3 percent) ranked high in awareness of the issues caused by land fragmentation. These points to a strong basis for motivating behavioral change. Only 10.7% strongly approve of fixing a minimum parcel size for ownership or certification. In fact, 69.4% put this in Rank 3, which suggests concerns about how it might be implemented or maybe just experience a lack of knowledge about its benefits. This requires focused education and policy communication needs to be considered (Table 4.9).

Land fragmentation has indeed always been a problem affecting agricultural efficiency and rural development. This study aims to investigate present practices, awareness, and willingness of farmers to consolidate land with a special interest in parcel exchange and evaluate support from land administration experts.

The study has established that while land consolidation through parcel exchange is not well practiced yet, there is good awareness of the negative effects of fragmentation and an equally committed willingness to engage in consolidation practices, especially with expert support and government intervention. Emphasis should, therefore, be placed on increasing actual participation in parcel

exchange, updating records, and educating stakeholders on the technical policy instruments' benefits, such as minimum parcel sizes.

Table 4.9. Summary of Responses on Land Consolidation and Related Issues.

No.	Survey Question	Response Categories	Frequency	Percent (%)
1	Involvement in parcel exchange for consolidation	Yes	74	37.8
		No	122	62.2
2	Updated land holding data after exchange	Yes	111	56.6
		No	85	43.4
3	Know other farmers practicing parcel exchange	Yes	124	63.3
		No	72	36.7
4	Experts provide awareness on land fragmentation	Yes	142	72.4
		No	54	27.6
5	Experts advise on land consolidation	Yes	131	66.8
		No	65	33.2
6	Willing to consolidate land if requested by government	Yes	158	80.6
		No	38	19.4
7	Awareness on importance of land consolidation (Ranking)	Rank 1	65	33.2
		Rank 2	104	53.1
		Rank 3	27	13.8
8		Rank 1	123	62.8

	Awareness on problems of land fragmentation (Ranking)	Rank 2	52	26.5
		Rank 3	21	10.7
9	Support for defining minimum parcel area (Ranking)	Rank 1	21	10.7
		Rank 2	39	19.9
		Rank 3	136	69.4

Source: Field Survey, 2025

4.11. Summary and Discussion of Inferential Statistical Results on Farmers' Perceptions, Causes, and Solutions to Land Fragmentation

4.11.1. Hypothesis 1: Perception Of Land Fragmentation's Impact On Agricultural Productivity

- Null Hypothesis (H_0)**:** Farmers do not perceive land fragmentation as having impacts on agricultural productivity.
- Alternative Hypothesis (H_1)**:** Farmers perceive land fragmentation as having impacts on agricultural productivity.

The study analyzed survey responses from 196 farmers using Likert-scale questions, One-Sample T-Tests, and One-Way ANOVA to assess perceptions of land fragmentation, its causes, and potential solutions. Results revealed a strong consensus among farmers that land fragmentation significantly hinders agricultural productivity, with T-test findings (Mean = 1.85, $t = 36.97$, $p < .001$) indicating widespread agreement on its negative effects. ANOVA results ($F = 7.282$, $p < .001$). These findings led to the rejection of the null hypothesis (H0), confirming that farmers perceive land fragmentation as a major barrier to productivity due to challenges such as inefficient land use, higher labor costs, and reduced mechanization. These results align with existing literature suggesting that fragmented land reduces operational efficiency and economies of scale in farming (e.g., Niroula & Thapa, 2005).

The data underscores that land fragmentation not only limits farm efficiency but also affects long-term agricultural sustainability. Farmers identified key issues, including difficulties in scaling production, lower crop yields, and increased operational costs all statistically validated through the

analysis. These impacts highlight the need for targeted interventions, such as land consolidation policies or adaptive farming techniques, to mitigate fragmentation's adverse effects. However, while the study provides robust quantitative evidence, a deeper breakdown of demographic factors (e.g., farm size, regional differences) could further refine understanding and policy recommendations.

In conclusion, the statistical results firmly establish that farmers view land fragmentation as detrimental to productivity, with measurable impacts on agricultural performance. The study's findings emphasize the urgency of addressing fragmentation through structural and policy measures while suggesting that future research explore localized variations in greater detail. By integrating perceptions, causes, and solutions, this analysis provides a comprehensive foundation for developing strategies to enhance farming efficiency in fragmented landscapes.

4.11.2. Hypothesis 2: Recognition Of Factors Contributing to Land Fragmentation

- *Null Hypothesis (H_0): Farmers do not recognize the factors that contribute to land fragmentation problems.*
- *Alternative Hypothesis (H_1): Farmers recognize the factors that contribute to land fragmentation problems.*

The study's findings support the alternative hypothesis (H_1), indicating that farmers recognize the factors contributing to land fragmentation, with inheritance and population growth being clearly identified as major causes, while government policy was less prominently acknowledged. Consequently, the null hypothesis (H_0) is rejected, confirming farmers' awareness of these contributing factors, as detailed in section 4.8. This finding is consistent with studies highlighting the role of inheritance systems in subdividing agricultural land over generations (Van Dijk, 2003)

4.11.3. Hypothesis 3: Understanding of Impact And Potential Solutions For Land Fragmentation

- *Null Hypothesis (H_0)**:*** Farmers do not understand the impact potential solutions to land fragmentation.
- *Alternative Hypothesis (H_1): Farmers understand the impact potential solutions to land fragmentation.*

The findings support the rejection of the null hypothesis (H0), confirming that farmers in Fogera Woreda understand the impacts of land fragmentation and potential solutions such as land consolidation and legal measures. However, while they recognize these solutions, they emphasize the need for autonomy in decision-making rather than externally imposed interventions. This suggests that awareness exists, but successful implementation requires participatory approaches that respect farmers' intervention. This preference aligns with participatory agricultural development models that stress the need for local stakeholder involvement (Chamberlin et al., 2020).

While the study effectively utilized One-Sample T-Tests and ANOVA to assess perceptions and group differences. Additionally, including detailed statistical tables in appendices would enhance transparency.

In conclusion, the study demonstrates that farmers perceive land fragmentation as a major constraint on productivity, recognize its primary causes, and support collaborative solutions. These findings underscore the need for policy interventions that promote land consolidation while respecting farmers' autonomy in decision-making. Addressing fragmentation through inclusive and legally supported measures could enhance agricultural efficiency and long-term sustainability.

Empirical data from Fogera Woreda highlight the severity of land fragmentation, with 66.8% of households owning fragmented plots and 71.4% unable to achieve food self-sufficiency. These results underscore the strong correlation between land fragmentation and reduced agricultural productivity, reinforcing the urgency for context-sensitive solutions that align with farmers' preferences and local realities. The study thus validates the alternative hypothesis (H1) while emphasizing the need for inclusive and adaptive strategies.

These findings align with recent research from the upper Lake Tana Basin, where Fentahun et al. (2023) reported a Simpson Index of 74% for land fragmentation demonstrating significant obstacles to sustainable land management (SLM) practices due to scattered and small plots (Fentahun et al., 2023, Cogent Economics & Finance]. Similarly, Alemu et al. (2017) confirmed that in Northwestern Ethiopia, fragmentation reduces input efficiency and complicates irrigation and mechanization efforts (Alemu et al., 2017).

This study reinforces the view that the key drivers of fragmentation are intergenerational inheritance and population growth both of which were recognized by over 66% of surveyed respondents. These causes are widely supported in the literature (e.g., Blarel et al., 1992; Sklenicka, 2016), and more recently echoed by Obayelu et al. (2019) in Nigeria, who found that demographic pressures and cultural norms perpetuate micro-holdings and subdivision (Obayelu et al., 2019, Journal of Agribusiness and Rural Development).

Additionally, the findings on irregular parcel shapes, extended distances from homesteads, and high boundary conflict rates (88.3%) mirror recent results by Yeshaneh (2018), who emphasized that fragmented topographies reduce plot productivity and escalate social tensions. Although 44.9% of farmers in Fogera acknowledged some benefits of fragmentation such as crop diversification and risk mitigation, this duality is well-documented in the international literature. The World Bank (Ali et al., 2019) and studies from Vietnam (Rahman & Rahman, 2009) acknowledge that fragmentation may reduce climate or pest risks but predominantly limits economic potential and mechanization. This nuanced understanding reflects the global shift toward context-sensitive land consolidation approaches, particularly in densely populated agrarian economies. Crucially, the findings show that while only 37.8% of farmers had practiced parcel exchange, a promising 80.6% expressed willingness to engage in consolidation initiatives if facilitated by the government. This aligns with recent pilot land consolidation projects in Ethiopia documented by GIZ (2023), where farmer participation increased significantly when supported by legal clarity, technical advice, and access to updated cadastral systems. As such, Ethiopia's policy landscape must now prioritize voluntary, locally driven consolidation models backed by legal frameworks and participatory land administration.

These results collectively underscore that land fragmentation is not merely a historical or cultural challenge but a pressing development constraint with measurable impacts on productivity, tenure security, and rural livelihoods.

By validating the theoretical constructs with local empirical evidence and global literature, this study contributes to both academic debate and the shaping of policy frameworks that can sustainably transform Ethiopia's agricultural sector.

The study conducted in Fogera district provides detailed insight into the patterns and effects of land fragmentation, based on descriptive and inferential statistical analysis. It was discovered that most agricultural homes have male-dominated (82.7%) and mainly illiterate or semi-literate (84.3%), which limit their engagement with modern land management practices. Most houses are large, with more than 86.7% of the four members, which accelerate pressure on land through heritage-powered subdivisions. 90.3% of the primary source of income for respondents is crop cultivation, followed by livestock closely, while income from petty trade and daily labor is negligible, which reflects the lack of economic diversification.

Further descriptive analysis showed that 71.4% of respondents considered their land inadequate to meet the needs of family food, indicating prevalent food insecurity. Land parcels are often away from homesteads, 62.2% are located 4-7 kilometers away - leading to low efficiency in farm management. Most land parcels are less than one hectare and irregular in size, making mechanization difficult. Despite these challenges, 95.9% of families have second -level landholding certificates, reflecting the protection of high level of land tenure. A striking 77% of the farmers noted the tendency to reduce landholding sizes over time, while 66.8% reported fragmented plots. A significant ratio 65.3% -land fragmentation as a serious issue. In addition, 77% of the respondents had transferred land to children or relatives, usually in small parts (0.125to 0.5ha), contributed to further fragmentation. The border conflict is a major concern, in which 88.3% reporting is related to demarcation of land with controversies

From an inferential statistics perspective, the data suggests that fragmentation is not a random phenomenon, but a structural issue, which is primarily inspired by inheritance traditions and population growth. In both these factors, more than 66% fragmentation reasons are reported alone. There is a clear negative correlation between land fragmentation and agricultural productivity, as is done by 71.4% respondents who report food insecurity and report the operational difficulties tied to

small, scattered land parcels. Additionally, 61.7% of the respondents expressed inconvenience with the management of fragmented holdings, emphasizing their inability. Although a portion of farmers (44.9%) accepted benefits such as crop diversification, and 40.8% believe that the fragmentation reduces the risk from environmental shocks, most did not see them as advantages, indicating that the alleged benefits are highly reference dependent.

There is strong awareness and desire to address fragmentation among farmers, in which 86.3% of land consolidation and 80.6% express their desire to participate in government-supported programs. However, the actual implementation is low, only 37.8% of parcel exchanges are engaged. Even though 66.8% of farmers received specialist advice on land consolidation, the slow adoption of adoption highlights a difference between awareness and practice. These findings show that while land fragmentation is deeply inherent in socio-cultural practices, effective policy, institutional support and infrastructure development awareness is required to infection in action from development awareness and ultimately to improve agricultural efficiency and rural livelihood.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

5.1. Conclusions

The findings of this study clearly highlight that land fragmentation in Fogera woreda represents a significant and growing challenge within the broader Amhara region. Historical analysis of political and socio-economic dynamics reveals a continuous reduction in average landholding sizes, primarily driven by rapid population growth and entrenched inheritance customs. Presently, most households cultivate highly fragmented plots of between 0.25 to 0.75ha, a substantial decline compared to holdings in previous generations.

Comparative evidence of Land fragmentation in Fogera Woreda presents distinct challenges based on topography. Shina's flatter terrain experiences more intense parcel subdivision, while Alember Zuria's rugged landscape worsens land scarcity. Effective solutions require adapted approaches land consolidation for Shina and Alember Zuria. The study approves that fragmentation critically threatens agricultural sustainability across both kebeles, calling for immediate policy action to support woreda's smallholder farmers.

This research confirms that customary inheritance practices and increasing family sizes are the primary drivers of farmland subdivision and land redistribution policies playing contributing roles. Consequently, a substantial majority of farmers indicate that their current landholdings are inadequate to fulfill their household food needs. The findings highlight the critical impact of these factors on land fragmentation and food security, underscoring the need for targeted interventions to address land use challenge.

The adverse consequences of land fragmentation are multifaceted. It hampers mechanization, restricts the application of modern agricultural techniques, elevates labor costs, wastes productive

time, and increases the likelihood of boundary disputes. Awareness on these challenges among farmers is notably high, and many have expressed willingness to engage in land consolidation initiatives, such as voluntary parcel exchange programs.

While institutional efforts, including widespread land certification and awareness campaigns, have been commendable, these have not yet led to significant behavioral or structural transformations. The persistent nature of land fragmentation, its deep socio-cultural roots, and its broad economic repercussions call for urgent, coordinated policy responses and sustainable community-based interventions.

If left unaddressed, land fragmentation will continue to undermine agricultural productivity, compromise rural livelihoods, and threaten the long-term viability of smallholder farming systems in Ethiopia.

5.2 Recommendations

Based on the findings and discussions made the following interventions are suggested as potential solutions to curb further land fragmentation.

- Align land fragmentation solutions with Ethiopia's Agricultural Transformation Agenda and integrate indicators into national monitoring systems.
- Expand digital land registries and provide legal aid to reduce conflicts and resolve disputes efficiently. Focus on digitization, legal support, and community engagement to minimize conflicts and enhance land governance.

- Strengthen Legal and Inheritance Frameworks**:** Review and reform inheritance laws to establish minimum viable land parcel sizes. Legal provisions should discourage unsustainable subdivision practices and ensure land transfers are justified and properly regulated.
- Expand Land Consolidation Programs**:** Voluntary land consolidation through parcel exchange and boundary adjustment, already started by farmers, should be prioritized to accommodate local preferences and reduce resistance. More importantly there is a need to

promote the scaling-up of land consolidation initiatives using participatory, community-led approaches, supported by government facilitation.

- Invest in Infrastructure to Support Consolidated Farming: Develop essential rural infrastructure including all-weather roads, irrigation systems, and agricultural mechanization hubs, particularly in areas where land consolidation is being pursued. Such investments will enhance the efficiency and attractiveness of consolidated farming systems.

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APPENDIX

APPENDIX 1: Data Collection Instruments

Bahir Dar University, Institute of land administration, Post Graduate Program in Land Administration and Management.

Dear respondent this questionnaire is prepared to gather data for the research project titled'' *"Assessment of Farmers' Perception on Land Fragmentation Trends and Its Impact on Agricultural Activities in Fogera woreda Amhara Region"* The research is intended to generate data on the level of farmers' perception on land fragmentation and its impact on their farming practices and ultimately indicate strategies that will curb land fragmentation and consolidation. Your prudent response is pivotal to address the objectives of this research. Your responses will be kept confidential and will be used for academic purpose only, so please feel free in responding to the questions below. We thank you for your time and interest to give tangible and honest information.

APPENDIX 1.1 : Questionnaire for farm land holders

Land holders level Questionnaire to the Assessment of Farmer's Perception on Trends in Land Fragmentation and its Impact on Agricultural Activities.

1. Date of interview ……
2. Name of Enumerator ……... Signature ……...
3. Location: Name of study area: Zone ……. Woreda…….....
   Kebele…….
4. Household Name. ……..……..
5. Age of household head: 1. From 18to 30 2. From 31 to 45
   3. From46 to 60 4. Above 60
6. Sex of households' head: 1. Male 2. Female
7. Marital status: 1. Married 2. Unmarried 3. Divorced 4. Widowed
8. Religion: 1. Orthodox Christian 2. Muslim 3. Others (specify) ……
9. Family size Female …...Male ……. ….. Total …… ……
10. Literacy level of the respondent household:
    1. Illiterate
    2. Only read and write
    3. Elementary education - grade 1 – 8

4. Secondary education -grade 9 – 12
5. College and above

11. Number of years you have lived in your Kebele ……. Years.

12. Major source of income of the respondent:

S/N	Major livelihood activities to generate income	Rank 1st, 2nd, 3rdetc.
1	Livestock Husbandry	
2	Crop framing	
2	Petty trade	
4	Daily labour	
5	Other	

13. When did you establish the household?

1. Before 1966 E.C 2. Between 1967- 1976 E.C
3. Between 1977- 1982 E.C 4. After 1983 E. C

14. What is the area a of your land holding during the establishment of the household?

1. One timad 2. Two timad 3. Three timad 4. Four timad
5. Other (specify) ----------

15. What is the total area of your current land holding?

1. One timid 2. Two timad 3. Three timad 4. Other (specify) --------

16. What was the area of the land you ‘’owned’’ during subsequent regime?

1. During Haile Selassie regime----------timad 2. During Derg regime----------timad
3. During the current regime---------- timad

17. How did you get the land you currently own?

1. Bought 2. Inherited 3. Given by government
4. Gift 5. Others (specify) ----

18. Is the land that you have enough to feed your family?

Yes ☐ No ☐

19. Are the parcels far away from your house or not?

A. Up to 3 Km and takes …minute/ hours walk
B. From 4-7 Km and takes …minute/ hours walk

C. Above 7 km and takes …minute/ hours walk

20. Distribution of Plot Areas and Patterns of plot shapes

1.Plot No.

2.Shape ; regular, not regular

21. Are you comfortable because you have fragmented parcels?

Yes ☐ No. ☐

22. If yes write/tell your reasons:

…….

23. Are you provided with second level land holding certificate? Yes/No

24. If yes what are the benefits of the land holding certificate? ……

25. If no, what are the problems you faced on your land rights……. …

…….

26. Have your land holding decreased over the Years? 1. Yes 2. No

27. If yes for question No. 26: Reason……...

28. Have you given part of your land to your children or any other relative or friend?

1. Yes 2. No

29. If yes to question No. 28:

1. From 1- 3 timad

2. From 4 - 6 timad

3. Above 7 timad

4. No

30. Have you ever faced farmland boundary conflict? 1. Yes 2. No

31. If yes to question No. 30, how frequent you faced the problem? 1. Rarely 2. Frequently

32. What do you think are the causes of boundary conflict and how do you solve the conflict?

……..

33. Do you perceive that there is farm land fragmentation in your Kebele? Yes/No

34. Do you feel that you have fragmented plots? Yes/No

35. What are the causes of land fragmentation? (You can choose more than one answer)

A. Inheritance system (Yes/No/

B. Population increment (Yes/No/

C. land sale (Yes/No/

D. Urbanization (Yes/No/

E. Land Redistribution (Yes/No/

F. Inheritance, population

G. Inheritance, population and urbanization

36. What advantage/s has land fragmentation in your livelihood?

S/N	Advantages	Yes	No
1	Crop diversification		
2	Avoiding risks from natural hazards such as flooding and soil erosion		
3	Avoiding insect pest damage		
4	Other		

37. What problems do you face due to land fragmentation? (You can choose more than one answer)

A. Parcel/plot border dispute: Yes/No

B. Decrease in agricultural production: Yes/No

C. Obstacle to mechanization: Yes/No

D. Loss of land due to many boundaries for one plot: Yes/No

E. Loss of productive time: Yes/No

F. Lack of easy access to parcels/Plots: Yes/No

G. Others, please specify……

38. Please indicate your level of agreement with the following statements:

Section1: Perception on attributes of land fragmentation

S/N	Perception on attributes of land fragmentation	Strongly agree (1)	Agree (2)	Neutral (3)	Do not agree (4)
1	Land fragmentation an urgent issue to be addressed				
2	Land fragmentation is not an important issue to be addressed				
3	Land fragmentation is a hindrance to agricultural productivity				
4	Land fragmentation is principally cause by inheritance				
5	The farming community has good awareness on the negative effects of land fragmentation				
6	Halting further land fragmentation is a sole responsibility of farmers				
7	Land fragmentation can be stopped by enacting a law that prohibits further land fragmentation				
Other					

Section 2: Perceptions on Land Fragmentation

S/N	**Perception onLand Fragmentation**	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Do not agree (4)**
1	Land fragmentation has increased over the years in your area.				
2	You are satisfied with the current size and distribution of your land parcels.				
3	Managing multiple small parcels is a significant challenge.				
4	Land fragmentation negatively affects your agricultural productivity.				
5	You believe land consolidation would improve your farming efficiency.				
6	Government policies on land use contribute to land fragmentation in your area.				
7	You think population growth contributes to increase in land fragmentation.				

Section 3: Impact and potential solutions for land fragmentation problems on Agricultural Activities

S/N	**Perception on Impact and potential solutions for land fragmentation problems on Agricultural Activities**	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Do not agree (4)**
1	Land fragmentation increases the time and cost needed for transportation between parcels.				
2	Fragmented land limits your ability to use agricultural machinery efficiently.				
3	Fragmentation affects your choice of crops, restricting to less profitable options.				
4	Managing fragmented parcels results in higher labor costs.				
5	Land fragmentation has led to disputes with neighbouring farmers.				
6	The physical distance between your parcels makes it harder to monitor and manage crops.				
7	Land fragmentation has no negative effect on agricultural practices				
8	Land fragmentation reduces crop failure due to pest, frost or flood				
9	Land fragmentation enables to cultivate different types of crops				

39. How do you think further land fragmentation can be prevented in future? (Please express your idea in order of importance)

S/N		Rank
1	Creating awareness on the importance of land consolidation	
2	Creating awareness on farmers about the problems associated with land fragmentation	
3	Clearly defining the minimum parcel area that can be owned and land holding certificate could be prepared	

40. Have you exchanged parcel for parcel to consolidate/make closer your land holding?

1. Yes 2. No

41. If yes to question No. 39, how did you make the agreement on land size because the land quality may not be the same…….……...

42. If you have exchanged parcels what was the reason for exchanging the parcels? ……..

43. Have you updated your land holding data at woreda or kebele level after the parcel exchange?

1. Yes 2. No

44. Do you know other farmers practicing land exchange for consolidation? 1. Yes 2. No

45. If yes how many farmers? …….. Farmers.

46.. Do the land administration experts provide awareness on land fragmentation issues? Yes/No

47. Do the land administration experts advise you to consolidate your parcels? 1. Yes 2. No

48. If the government requests you to consolidate your land, are you willing to do so?

……

1. Yes 2. No

49. If yes to question No 47, give reason: ……...

……..

50. If no to question No 48, give reason …….

…..…….

APPENDIX 1.2: Checklist of questions for FGDs in the study area

Interviewee Name……

Kebele: ……

Date**…….…….**

1. How would you define land fragmentation in your view?

   ……

   ……

2. What are the impacts of land fragmentation on agricultural activities in the study area?

   ……

   ……

3. What is the current level of fragmentation in the study area?

   ……

   ……

4. What are the contributing factors for land fragmentation in the study area?

   ……

   ……

5. How do you evaluate the trend of land fragmentation/increasing, decreasing/

   ……

   ……

6. Do you think that land fragmentation will continue or stop in the future?

   ……

   ……

7. Do you think that land fragmentation is a hindrance to productive farming? If yes what are the problems?

   ……

   ……

8. Do you feel that land fragmentation has benefit to farmers? If yes what are the benefits?

   ……

   ……

9. Do you agree that land fragmentation should stop? Give reason for your answer.

……

……

10. If you agree land fragmentation should stop what actions should be taken?

……

……

11. Are you given any awareness on the negative effects of land fragmentation and on the importance of land consolidation? If yes who gave the awareness?

……

……

12. Are there any laws enacted by the local government to stop land fragmentation?

……

……

13. Do farmer\s exchange land to make their parcel s closer to each other?

……

……

14. If yes to the above question what criteria they use in the parcel exchange process?

……

……

15. Whattraditionalpracticesareinplacetohelpaddresstheeffectsoflandfragmentation in the study area?

……

……

16. As community members, what other measures would you recommend to prevent land fragmentation?

……

……

17. What are the government's roles in the controlling of fragmented land holdings?

……

……

APPENDIX 1.3: Check lists of questions for Key Informants in the land, agricultural and environmental protection offices.

1. How do you understand the terms land fragmentation and land consolidation?

   ……

   ……

2. Is land fragmentation given consideration by your offices?

   ……

   ……

3. Do you think that farmers appreciate the problem of land fragmentation?

   ……

   ……

4. Is land fragmentation a hindrance to agricultural activities? If yes give your reasons

   ……

   ……

5. How do you evaluate the trend of land fragmentation in the woreda?

   ……

   ……

6. Are there measures taken to make awareness in farmers about land fragmentation and its negative impact on agricultural practices?

   ……

   ……

7. Were there any activities made to initiate land consolidation?

   ……

   ……

8. Do you agree that land consolidation is a feasible intervention?

   ……

   ……

9. What challenges do you foresee/predict if the government initiates land consolidation?

   ……

   ……

10. Is there any legal framework prohibiting land fragmentation and initiating land consolidation?

    ……

    ……

11. Are there actions taken by farmers to exchange land to make their plots closer?

    ……

    ……

12. What criteria do farmers use to exchange plots?

    ……

    ……

13. What actions do you suggest to be taken by the government to stop land fragmentation and enhance land consolidation?

    ……

    ……

    ……

    ……

14. As an expert, what other measures would you advise to prevent land fragmentation the study area?

    ……

    ……

15. Landconsolidationissaidtoreducelandfragmentation.Whatdoyouthinkaboutit?
    Will it be feasible for Fogera Woreda?

    ……

    ……

Appendix 2: Photos from data collection in the field



Focus group Discussion Respondents



Key- Informant Respondent

Appendix 3:Descriptive Result

Section1: Perception on attributes of land fragmentation Hypo1. SPSS Res.

S/N	Perception on attributes of land fragmentation	Strongly agree (1)	Agree (2)	Neutral (3)	Do not agree (4)
1	Land fragmentation an urgent issue to be addressed	139	46	9	2
2	Land fragmentation is not an important issue to be addressed	5	21	19	151
3	Land fragmentation is a hindrance to agricultural productivity	56	123	8	9
4	Land fragmentation is principally cause by inheritance	31	81	32	52
5	The framing community has good awareness on the negative effects of land fragmentation	4	45	39	108
6	Halting further land fragmentation is a sole responsibility of framers	17	94	25	60
7	Land fragmentation can be stopped by enacting a law that prohibits further land fragmentation	39	137	9	11

Section 2: Perceptions on Land Fragmentation Hypo2. SPSS Res.

S/N	**Perception on Land Fragmentation**	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Do not agree (4)**
1	Land fragmentation has increased over the years in your area.	37	135	22	2
2	You are satisfied with the current size and distribution of your land parcels.	12	24	24	136
3	Managing multiple small parcels is a significant challenge.	63	53	77	3
4	Land fragmentation negatively affects your agricultural productivity.	61	117	12	6
5	You believe land consolidation would improve your farming efficiency.	138	38	4	16
6	Government policies on land use contribute to land fragmentation in your area.	29	68	75	24
7	You think population growth contributes to increase in land fragmentation.	146	46	3	1

Activities Hypo.3 SPSS Res.

S/N	**Perception on Impact of Land Fragmentation on Agricultural Activities**	**Strongly agree (1)**	**Agree (2)**	**Neutral (3)**	**Do not agree (4)**
1	Land fragmentation increases the time and cost needed for transportation between parcels.	74	118	2	2
2	Fragmented land limits your ability to use agricultural machinery efficiently.	144	39	9	4
3	Fragmentation affects your choice of crops, restricting to less profitable options.	45	129	10	12
4	Managing fragmented parcels results in higher labor costs.	59	133	3	1
5	Land fragmentation has led to disputes with neighbouring farmers.	149	45	1	1
6	The physical distance between your parcels makes it harder to monitor and manage crops.	122	64	5	5
7	Land fragmentation has no negative effect on agricultural practices	5	80	26	85
8	Land fragmentation reduces crop failure due to pest, frost or flood	7	50	29	110
9	Land fragmentation enables to cultivate different types of crops	14	116	23	43

Appendix 4:Descriptive Output

Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Land fragmentation is not an important issue to be addressed	Strongly agree	139	3.81	.632	.054	3.71	3.92	1	4
	Agree	46	3.17	.902	.133	2.91	3.44	2	4
	Neutral	9	3.00	.866	.289	2.33	3.67	2	4
	Do not agree	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	196	3.61	.780	.056	3.50	3.72	1	4
Land fragmentation is a hindrance to agricultural productivity	Strongly agree	139	1.67	.557	.047	1.58	1.76	1	4
	Agree	46	2.13	.653	.096	1.94	2.32	1	4
	Neutral	9	2.89	1.167	.389	1.99	3.79	1	4
	Do not agree	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	196	1.85	.699	.050	1.75	1.95	1	4
Land fragmentation is principally cause by inheritance	Strongly agree	139	2.73	1.026	.087	2.56	2.91	1	4
	Agree	46	2.20	.980	.145	1.90	2.49	1	4
	Neutral	9	1.44	.527	.176	1.04	1.85	1	2
	Do not agree	2	1.50	.707	.500	-4.85	7.85	1	2
	Total	196	2.54	1.049	.075	2.39	2.68	1	4
The farming community has good awareness on the negative effects of land fragmentation	Strongly agree	139	3.42	.892	.076	3.27	3.57	1	4
	Agree	46	2.89	.767	.113	2.66	3.12	2	4
	Neutral	9	3.33	.866	.289	2.67	4.00	2	4
	Do not agree	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	196	3.28	.887	.063	3.16	3.41	1	4
Halting further land fragmentation is a sole responsibility of farmers	Strongly agree	139	2.49	.981	.083	2.32	2.65	1	4
	Agree	46	2.96	1.010	.149	2.66	3.26	1	4
	Neutral	9	3.33	.707	.236	2.79	3.88	2	4

	Do not agree	2	4.00	.000	.000	4.00	4.00	4	4
	Total	196	2.65	1.009	.072	2.51	2.80	1	4
Land fragmentation can be stopped by enacting a law that prohibits further land fragmentation	Strongly agree	139	1.91	.665	.056	1.80	2.03	1	4
	Agree	46	1.93	.533	.079	1.78	2.09	1	4
	Neutral	9	2.33	1.000	.333	1.56	3.10	1	4
	Do not agree	2	4.00	.000	.000	4.00	4.00	4	4
	Total	196	1.96	.686	.049	1.86	2.06	1	4
Land fragmentation has increased over the years in your area.	Strongly agree	139	1.83	.537	.046	1.74	1.92	1	4
	Agree	46	2.13	.582	.086	1.96	2.30	1	4
	Neutral	9	2.78	.441	.147	2.44	3.12	2	3
	Do not agree	2	2.00	.000	.000	2.00	2.00	2	2
	Total	196	1.94	.583	.042	1.86	2.03	1	4
You are satisfied with the current size and distribution of your land parcels.	Strongly agree	139	3.60	.882	.075	3.46	3.75	1	4
	Agree	46	3.13	.957	.141	2.85	3.41	1	4
	Neutral	9	2.89	.928	.309	2.18	3.60	2	4
	Do not agree	2	2.50	.707	.500	-3.85	8.85	2	3
	Total	196	3.45	.930	.066	3.32	3.58	1	4
Managing multiple small parcels is a significant challenge.	Strongly agree	139	2.17	.940	.080	2.02	2.33	1	4
	Agree	46	1.89	.567	.084	1.72	2.06	1	3
	Neutral	9	2.22	1.093	.364	1.38	3.06	1	4
	Do not agree	2	1.50	.707	.500	-4.85	7.85	1	2
	Total	196	2.10	.877	.063	1.98	2.23	1	4
Land fragmentation negatively affects your agricultural productivity.	Strongly agree	139	1.71	.619	.053	1.60	1.81	1	4
	Agree	46	1.96	.698	.103	1.75	2.16	1	4
	Neutral	9	2.67	.866	.289	2.00	3.33	1	4
	Do not agree	2	2.00	.000	.000	2.00	2.00	2	2
	Total	196	1.81	.679	.049	1.72	1.91	1	4
You believe land consolidation would improve your farming efficiency.	Strongly agree	139	1.33	.793	.067	1.20	1.46	1	4
	Agree	46	1.85	1.053	.155	1.54	2.16	1	4
	Neutral	9	2.00	.707	.236	1.46	2.54	1	3
	Do not agree	2	1.00	.000	.000	1.00	1.00	1	1
	Total	196	1.48	.886	.063	1.35	1.60	1	4

Government policies on land use contribute to land fragmentation in your area.	Strongly agree	139	2.46	.879	.075	2.31	2.61	1	4
	Agree	46	2.37	.903	.133	2.10	2.64	1	4
	Neutral	9	3.22	.667	.222	2.71	3.73	2	4
	Do not agree	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	196	2.48	.891	.064	2.35	2.61	1	4
You think population growth contributes to increase in land fragmentation.	Strongly agree	139	1.11	.311	.026	1.06	1.16	1	2
	Agree	46	1.74	.648	.095	1.55	1.93	1	4
	Neutral	9	1.67	.707	.236	1.12	2.21	1	3
	Do not agree	2	1.00	.000	.000	1.00	1.00	1	1
	Total	196	1.28	.514	.037	1.21	1.35	1	4
Land fragmentation increases the time and cost needed for transportation between parcels.	Strongly agree	139	1.63	.567	.048	1.54	1.73	1	4
	Agree	46	1.78	.513	.076	1.63	1.93	1	3
	Neutral	9	1.44	.527	.176	1.04	1.85	1	2
	Do not agree	2	1.00	.000	.000	1.00	1.00	1	1
	Total	196	1.65	.557	.040	1.57	1.73	1	4
Fragmented land limits your ability to use agricultural machinery efficiently.	Strongly agree	139	1.12	.401	.034	1.05	1.18	1	4
	Agree	46	1.83	.739	.109	1.61	2.05	1	4
	Neutral	9	2.56	1.014	.338	1.78	3.33	1	4
	Do not agree	2	1.50	.707	.500	-4.85	7.85	1	2
	Total	196	1.35	.667	.048	1.26	1.45	1	4
Fragmentation affects your choice of crops, restricting to less profitable options.	Strongly agree	139	1.75	.512	.043	1.66	1.83	1	4
	Agree	46	2.20	.719	.106	1.98	2.41	1	4
	Neutral	9	3.44	1.130	.377	2.58	4.31	1	4
	Do not agree	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	196	1.94	.725	.052	1.84	2.05	1	4
Managing fragmented parcels results in higher labor costs.	Strongly agree	139	1.69	.509	.043	1.61	1.78	1	4
	Agree	46	1.78	.554	.082	1.62	1.95	1	3
	Neutral	9	1.89	.333	.111	1.63	2.15	1	2
	Do not agree	2	2.00	.000	.000	2.00	2.00	2	2
	Total	196	1.72	.512	.037	1.65	1.80	1	4
	Strongly agree	139	1.15	.416	.035	1.08	1.22	1	4

Land fragmentation has led to disputes with neighboring farmers	Agree	46	1.46	.546	.080	1.29	1.62	1	3
	Neutral	9	1.67	.500	.167	1.28	2.05	1	2
	Do not agree	2	2.00	.000	.000	2.00	2.00	2	2
	Total	196	1.26	.482	.034	1.19	1.32	1	4
The physical distance between your parcels makes it harder to monitor and manage crops.	Strongly agree	139	1.29	.580	.049	1.19	1.39	1	4
	Agree	46	1.78	.629	.093	1.60	1.97	1	3
	Neutral	9	2.33	1.000	.333	1.56	3.10	1	4
	Do not agree	2	1.50	.707	.500	-4.85	7.85	1	2
	Total	196	1.45	.674	.048	1.36	1.55	1	4
Land fragmentation has no negative effect on agricultural practices	Strongly agree	139	2.80	.994	.084	2.63	2.97	1	4
	Agree	46	3.37	.799	.118	3.13	3.61	1	4
	Neutral	9	3.67	.500	.167	3.28	4.05	3	4
	Do not agree	2	3.00	1.414	1.000	-9.71	15.71	2	4
	Total	196	2.97	.974	.070	2.84	3.11	1	4
Land fragmentation reduces crop failure due to pest, frost or flood	Strongly agree	139	3.47	.862	.073	3.32	3.61	1	4
	Agree	46	2.80	.934	.138	2.53	3.08	1	4
	Neutral	9	2.11	.782	.261	1.51	2.71	1	4
	Do not agree	2	2.00	.000	.000	2.00	2.00	2	2
	Total	196	3.23	.953	.068	3.10	3.37	1	4
Land fragmentation enables to cultivate different types of crops	Strongly agree	139	2.40	.890	.075	2.25	2.54	1	4
	Agree	46	2.83	.973	.143	2.54	3.12	1	4
	Neutral	9	2.22	.667	.222	1.71	2.73	2	4
	Do not agree	2	2.00	.000	.000	2.00	2.00	2	2
	Total	196	2.48	.914	.065	2.36	2.61	1	4

Appendix 5: Anova Output

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Land fragmentation is not an important issue to be addressed	Between Groups	20.285	3	6.762	13.214	.000
	Within Groups	98.245	192	.512		
	Total	118.531	195			
Land fragmentation is a hindrance to agricultural productivity	Between Groups	20.525	3	6.842	17.542	.000
	Within Groups	74.883	192	.390		
	Total	95.408	195			
Land fragmentation is principally cause by inheritance	Between Groups	23.638	3	7.879	7.916	.000
	Within Groups	191.112	192	.995		
	Total	214.750	195			
The farming community has good awareness on the negative effects of land fragmentation	Between Groups	10.811	3	3.604	4.847	.003
	Within Groups	142.755	192	.744		
	Total	153.566	195			
Halting further land fragmentation is a sole responsibility of farmers	Between Groups	15.761	3	5.254	5.523	.001
	Within Groups	182.647	192	.951		
	Total	198.408	195			
Land fragmentation can be stopped by enacting a law that prohibits further land fragmentation	Between Groups	9.905	3	3.302	7.753	.000
	Within Groups	81.768	192	.426		
	Total	91.673	195			
Land fragmentation has increased over the years in your area.	Between Groups	9.754	3	3.251	11.023	.000
	Within Groups	56.629	192	.295		
	Total	66.383	195			
You are satisfied with the current size and distribution of your land parcels.	Between Groups	12.646	3	4.215	5.193	.002
	Within Groups	155.844	192	.812		
	Total	168.490	195			
Managing multiple small parcels is a significant challenge.	Between Groups	3.591	3	1.197	1.570	.198
	Within Groups	146.368	192	.762		
	Total	149.959	195			
Land fragmentation negatively affects your agricultural productivity.	Between Groups	9.196	3	3.065	7.282	.000
	Within Groups	80.820	192	.421		
	Total	90.015	195			
	Between Groups	12.207	3	4.069	5.552	.001
	Within Groups	140.712	192	.733		

You believe land consolidation would improve your farming efficiency.	Total	152.918	195			
Government policies on land use contribute to land fragmentation in your area.	Between Groups	6.113	3	2.038	2.629	.051
	Within Groups	148.805	192	.775		
	Total	154.918	195			
You think population growth contributes to increase in land fragmentation.	Between Groups	15.315	3	5.105	27.039	.000
	Within Groups	36.251	192	.189		
	Total	51.566	195			
Land fragmentation increases the time and cost needed for transportation between parcels.	Between Groups	2.072	3	.691	2.273	.081
	Within Groups	58.336	192	.304		
	Total	60.408	195			
Fragmented land limits your ability to use agricultural machinery efficiently.	Between Groups	31.220	3	10.407	36.008	.000
	Within Groups	55.489	192	.289		
	Total	86.709	195			
Fragmentation affects your choice of crops, restricting to less profitable options.	Between Groups	30.734	3	10.245	27.453	.000
	Within Groups	71.648	192	.373		
	Total	102.383	195			
Managing fragmented parcels results in higher labor costs.	Between Groups	.710	3	.237	.901	.442
	Within Groups	50.413	192	.263		
	Total	51.122	195			
Land fragmentation has led to disputes with neighboring farmers	Between Groups	6.005	3	2.002	9.793	.000
	Within Groups	39.240	192	.204		
	Total	45.245	195			
The physical distance between your parcels makes it harder to monitor and manage crops.	Between Groups	15.771	3	5.257	13.862	.000
	Within Groups	72.815	192	.379		
	Total	88.587	195			
Land fragmentation has no negative effect on agricultural practices	Between Groups	15.795	3	5.265	5.979	.001
	Within Groups	169.077	192	.881		
	Total	184.872	195			
Land fragmentation reduces crop failure due to pest, frost or flood	Between Groups	30.472	3	10.157	13.291	.000
	Within Groups	146.732	192	.764		
	Total	177.204	195			
Land fragmentation enables to cultivate different types of crops	Between Groups	7.552	3	2.517	3.110	.028
	Within Groups	155.402	192	.809		
	Total	162.954	195			