

**RELATIONSHIP BETWEEN AGROFORESTRY PRACTICES AND LIVELIHOOD
ENHANCEMENT AMONG SMALLHOLDER FARMERS IN KYANAISOKE SUB
COUNTY, KAGADI DISTRICT**

BY

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**A RESEARCH REPORT SUBMITTED TO THE DEPARTMENT
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DECLARATION

I MUGANYIZI SAMUEL hereby declare that the information contained in the research report is my original work and has never been submitted by any one for any award to any institution of higher learning.

Signature: 

Date: 31/09/2024

MUGANYIZI SAMUEL

APPROVAL

This is to certify that this research report on 'Agroforestry Practices and Impacts for Livelihood Enhancement among Smallholder Farmers in Kyanaisoke Sub-County, Kagadi District in Western Uganda' has been written under my guidance and supervision and it is now ready for examination.

Signature: Date:

Dr. John James Okiror

Supervisor

DEDICATION

I dedicate this dissertation to my father, whose unwavering support, sacrifices, and encouragement have been the cornerstone of my academic journey, shaping me into the person I am today with his belief in my abilities and dedication to excellence. To my mother, Kusiima Evas, your love and strength have inspired me continuously. Aunt Rose and Scovia, your unwavering belief has been invaluable. To my siblings, Robinah, Joan, Mercy, Beatrice, Derrick, and Mugabi, your support has been indispensable. To my friends, Mr. Bukya, Mr. Noah, Scola, Miss Rose, Jane, Ethan, Mr. Akongo Phiona, Abeja Rhoda, and Mr. Daka, your friendship has made this journey memorable. Finally, to my esteemed lecturers, Mr. Otema, Mr. Dramadri, Mr. Oguzu, and Madam Sarah, your guidance and mentorship have profoundly shaped my academic growth and success.

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ABSTRACT

This study investigated the effect of agroforestry technology on livelihood improvement among smallholder farmers in KyanaISOKE Sub County, Kagadi District, and Western Uganda. The specific objectives were: (i) to identify the agroforestry practices adopted by farmers in the region, (ii) to assess the socioeconomic, institutional, and environmental factors influencing farmers' adoption of agroforestry, and (iii) to evaluate the impact of adopting agroforestry practices on the livelihoods of smallholder farmers. The study utilized a sample size of 40 respondents, employing structured interviews and observational methods for data collection. Findings indicated that farmers in KyanaISOKE Sub County predominantly adopted fruit tree integration, alley cropping, tree planting along contour lines, silvopasture, and biodiversity enhancement as key agroforestry practices. Socioeconomic factors such as income diversification and financial stability, institutional support from extension services and government programs, and environmental benefits like improved soil fertility and biodiversity conservation significantly influenced adoption decisions. Findings showed that agroforestry contributed to diversified income sources, enhanced food security, climate resilience, improved soil fertility, and inclusive opportunities for women and youth. The study concluded that agroforestry held substantial potential for sustainable livelihoods among smallholder farmers in KyanaISOKE Sub County, aligning with global efforts towards environmental sustainability and rural development. Recommendations included enhancing extension services, promoting policy frameworks supporting agroforestry, and conducting further research on scaling up successful agroforestry

LIST OF ACRONYMS

AFOLU	- Agriculture, Forestry, and Other Land Use
IPCC	- International Panel on Climate Change
Gt	- Gigatons
NGO	- Non-Governmental Organization
FAO	- Food and Agriculture Organization
USD	- United States Dollar
R&D	- Research and Development
NGO	- Non-Governmental Organization
PRA	- Participatory Rural Appraisal
NGO	- Non-Governmental Organization

CHAPTER ONE

INTRODUCTION

1.1 Background

Agroforestry is a widely adopted land-use practice across diverse agro-ecological zones and landscapes worldwide, offering multifaceted solutions to various adaptation needs within the Agriculture, Forestry, and Other Land Use (AFOLU) sectors. It has garnered significant attention in response to escalating concerns over climate change impacts and global food security challenges (Smith et al, 2019; Nair, 2012). The integration of trees into agricultural landscapes through agroforestry systems not only enhances environmental sustainability but also provides tangible economic benefits to farmers (Jose, 2009). These systems play a pivotal role in mitigating the adverse impacts of human activities on natural forests by diversifying income streams through carbon sequestration credits, wood energy production, and the cultivation of valuable assets such as timber and non-timber forest products (Chazdon et al., 2017).

Agroforestry's ability to generate income from carbon credits and sustainable wood energy, alongside providing enhanced soil fertility and ecological services, underscores its pivotal role in mitigating the adverse environmental impacts associated with conventional agricultural practices (Montagnini, 2016; Nair, 2009). By integrating leguminous trees that fix nitrogen and employing biological fertilizers, agroforestry systems contribute significantly to restoring soil health and enhancing soil organic matter content (Jose, 2009). This approach not only supports sustainable agricultural production but also aids in local climate regulation and adaptation strategies, fostering resilience against the anticipated impacts of climate change (Nair, 2012).

Moreover, agroforestry systems enrich soil nutrients and improve soil structure, thereby promoting optimal conditions for crop growth and enhancing overall agricultural productivity (Montagnini, 2016). Trees in these systems play a crucial role in rainwater harvesting, nutrient retention, and soil moisture conservation, thereby facilitating nutrient cycling and maintaining soil health over the long term (Jose, 2009). These soil conservation benefits are particularly critical in mitigating land degradation and enhancing the ecological sustainability of agricultural landscapes (Chazdon et al., 2017).

Effective agroforestry practices encompass a range of strategies, including the cultivation of fast-growing fuel wood species, native fruit trees for income generation, and medicinal plants that

contribute to local livelihoods and biodiversity conservation (Garrity et al., 2010; Nair, 2012). Research underscores the pivotal role of agroforestry in promoting climate-smart agriculture, offering farmers viable pathways to mitigate climate change impacts while enhancing the resilience and diversity of agro-ecosystems (Montagnini, 2016; Jose, 2009). These sustainable production practices not only safeguard soil fertility and water resources but also contribute to broader environmental goals such as carbon sequestration and biodiversity conservation (Chazdon et al., 2017).

In India, agroforestry initiatives align with national targets set by the Indian Agricultural Research Council to expand forest cover from 23% to 33% of the country's land area (Garrity et al., 2010). Agroforestry systems are crucial for managing vast swathes of rain-fed and irrigated lands, as highlighted in the Greening India Task Force Report on Livelihood Security and Sustainable Development (Nair, 2009). These efforts underscore agroforestry's potential to simultaneously address socio-economic challenges and environmental sustainability goals through integrated land-use management strategies (Jose, 2009).

The International Panel on Climate Change (IPCC) recognizes agroforestry as a versatile approach capable of addressing multiple challenges while offering substantial scientific, environmental, and socio-economic benefits (Montagnini, 2016; Chazdon et al., 2017). Estimates suggest that agroforestry systems have the potential to sequester significant amounts of carbon annually, ranging from 0.7 to 1.6 gigatons (Gt), thereby contributing to global climate change mitigation efforts (Smith et al., 2019). Secondary environmental benefits include enhanced food security, increased agricultural incomes, and improved land tenure security, underscoring the multifaceted advantages of agroforestry for sustainable development (Nair, 2012).

Furthermore, agroforestry practices contribute to the preservation of above- and below-ground carbon stocks, soil protection, watershed management, and biodiversity conservation (Garrity et al., 2010; Montagnini, 2016). In India, the successful cultivation of species like eucalyptus and poplars in agroforestry systems enhances nutritional and economic security, particularly for marginalized communities in tropical regions (Nair, 2009). These initiatives demonstrate how agroforestry can integrate environmental conservation with socio-economic development objectives, promoting resilience and sustainability across diverse agricultural landscapes (Chazdon et al., 2017).

In Sub-Saharan Africa, smallholder farmers increasingly adopt agroforestry practices due to their proven benefits in enhancing soil fertility, diversifying income sources, and bolstering household resilience against climate change impacts (Garrity et al., 2010; Jose, 2009). Unlike monoculture crop systems, which often struggle to adapt to changing climatic conditions, agroforestry systems offer a versatile approach to sustainable agriculture through integrated land-use practices (Nair, 2012). Farmers benefit from increased agricultural productivity year-round by leveraging agroforestry's capacity to improve soil porosity, moisture retention, and nutrient cycling (Montagnini, 2016).

Agroforestry enhances farm resilience by offering additional revenue streams through the production of fruits, firewood, construction materials, and other tree-based products (Chazdon , 2017; Smith et al., 2019). Meeting the rising demand for woody biomass and timber products in Uganda necessitates expanding timberland holdings, a challenge that agroforestry systems address by providing multipurpose tree species that yield various products, including firewood and timber (Nair, 2009). Moreover, agroforestry enhances water quality and quantity by mitigating soil erosion and improving water filtration processes, thereby supporting sustainable water resource management (Garrity et al., 2010).

In conclusion, agroforestry emerges as a pivotal strategy for smallholder farmers globally, offering a comprehensive suite of advantages over conventional agricultural practices in adapting to and mitigating climate change impacts (Jose, 2009; Montagnini, 2016). By promoting sustainable land management practices and enhancing ecosystem resilience, agroforestry contributes significantly to achieving environmental conservation goals while fostering socio-economic development in agricultural communities (Chazdon et al., 2017; Nair, 2012).

1.2 Problem Statement

Uganda's natural forest cover is in danger due to the country's growing rural population and subsistence farming, which has made deforestation a major issue there.

Therefore, in order to lessen strain on the forest and enhance the quality of life for the local population, the Ministry of Agriculture has implemented agroforestry technologies communities on the forest.

In order to address the increasing depletion of forest resources and enhance the living conditions of local farmers, agroforestry practices must be used. Kagadi district one of Uganda's rural districts, in the Western region, has a successful history of using agroforestry techniques in forested areas to boost household income and food production. However, not many people in the KyanaISOKE Sub County in particular, has embraced this new technology. The advantages of these agroforestry techniques and their contribution to Uganda's environment and farmers' earnings, however have not been studied.

This study sought to fill up knowledge gaps by looking at and comprehending the institutional, socioeconomic, and political aspects that encourage local farmers to use agroforestry technologies and by assessing how agroforestry affects small-scale farmers' means of subsistence.

1.3 Objectives of Study

General purpose of this research is to assess effect of agroforestry technology on livelihood improvement among the smallholder farmers in KyanaISOKE Sub County.

1.3.1 Specific Objectives

This study would have the following specific objectives:

- i. To identify the agroforestry practices adopted by the farmers in KyanaISOKE sub county.
- ii. To assess the socioeconomic, institutional and environmental factors that influences the farmers to adopt agroforestry.
- iii. To evaluate the impact of adopting agroforestry practices on livelihood of smallholder farmers

1.4 Research Questions

- i. What are the agroforestry practices adopted by the smallholder farmers in KyanaISOKE sub county?
- ii. How is the adoption of agroforestry practice influenced by socioeconomic, institutional and environmental factors in KyanaISOKE Sub County?
- iii. Why is the adoption of agroforestry practices important for livelihoods of smallholder farmers?

1.5 Research Hypotheses

H1: Adoption of agroforestry technologies significantly affects the income and consumption expenditure of smallholder farmers in KyanaISOKE Sub County (null hypothesis).

H2: Socioeconomic, institutional, and environmental factors significantly influence the farmers to adopt agroforestry practices in KyanaISOKE Sub County (alternative hypothesis).

1.6 Significance of Study

Agroforestry practices play a crucial role in enhancing livelihoods among smallholder farmers in KyanaISOKE Sub-County, Kagadi District, Western Uganda. The significance of these practices extends to various stakeholders involved in agricultural development and environmental conservation in the region.

Smallholder Farmers: Agroforestry offers smallholder farmers diversified income sources and improved resilience against climate variability. The integration of trees with agricultural crops provides additional revenue from timber, fruits, and medicinal plants, contributing to food security and economic stability (Montagnini, 2016). May. The study findings may reveal that smallholder farmers experience increased income and food security through agroforestry practices, thereby improving their livelihoods.

Local Communities: Agroforestry contributes to the sustainable management of natural resources, ensuring environmental sustainability and biodiversity conservation. By restoring soil fertility and preventing land degradation, these practices support sustainable agriculture and enhance ecosystem services within the community (Jose, 2009). May. The study findings may highlight how local communities benefit from improved environmental quality and increased availability of ecosystem services through agroforestry.

Government Agencies and Policymakers: Agroforestry aligns with national development goals related to climate change mitigation, biodiversity conservation, and sustainable agriculture. The findings may emphasize the role of agroforestry in achieving national targets for forest cover expansion and enhancing rural livelihoods through integrated land-use management strategies (Garrity et al., 2010). May. The study findings may inform policymakers about the effectiveness

of agroforestry in achieving environmental and socio-economic objectives, encouraging supportive policies and investments in sustainable agriculture.

Non-Governmental Organizations (NGOs): NGOs involved in rural development and environmental conservation can leverage agroforestry to promote community resilience and sustainable livelihoods. The study findings may demonstrate how agroforestry enhances the adaptive capacity of rural communities to climate change impacts and fosters participatory approaches to natural resource management (Chazdon et al., 2017). May. The study findings may guide NGOs in designing and implementing agroforestry programs that support community development and environmental sustainability in Kagadi District.

Academic and Research Institutions: Academic institutions benefit from research on agroforestry's impacts on smallholder livelihoods, contributing to knowledge advancement and evidence-based policy recommendations. The findings may highlight the ecological and socio-economic benefits of agroforestry systems, providing insights into sustainable land-use practices and their implications for rural development (Nair, 2012). May. The study findings may contribute to academic understanding of agroforestry's role in enhancing livelihoods and informing future research directions in sustainable agriculture.

Private Sector and Agribusinesses: Agroforestry presents opportunities for private sector involvement in sustainable agriculture and forestry enterprises. The study findings may illustrate how agroforestry enhances farm productivity, diversifies income streams, and promotes market access for tree-based products such as timber and non-timber forest products (Smith et al., 2019). May. The study findings may encourage private sector investment in agroforestry initiatives, creating partnerships that support economic growth and environmental sustainability in Kyanaisoke Sub-County.

International Development Partners: Development partners interested in supporting sustainable development and climate resilience initiatives can benefit from insights into agroforestry's role in poverty alleviation and environmental conservation. The study findings may demonstrate how agroforestry contributes to achieving international development goals related to food security, biodiversity conservation, and climate change mitigation (Montagnini, 2016). May. The study findings may inform international development partners about the

effectiveness of agroforestry interventions in enhancing livelihoods and supporting sustainable development in Kagadi District.

1.7 Conceptual Framework

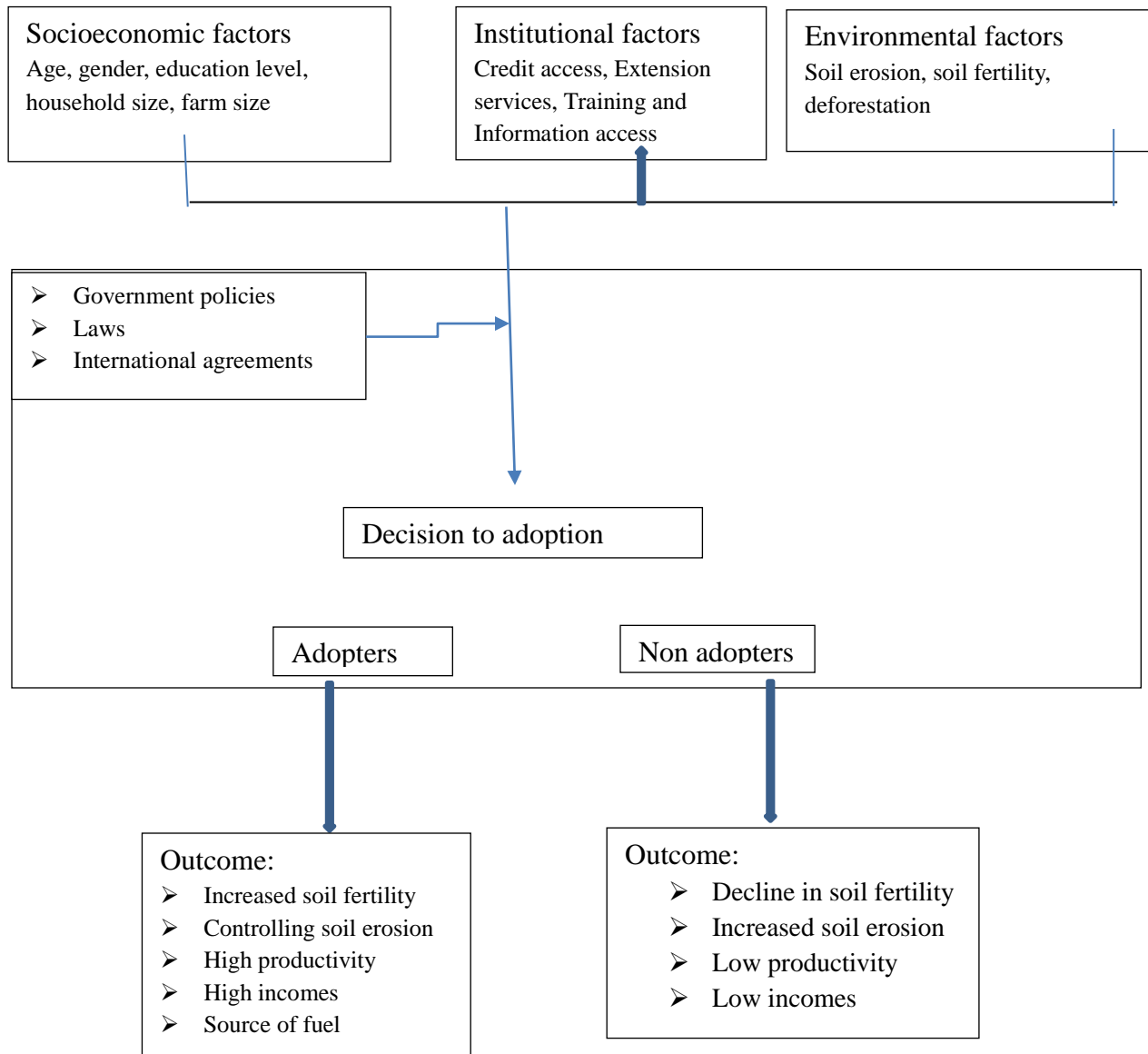
Agroforestry, as defined by the World Agroforestry Centre (WAC) and the International Centre for Research in Agroforestry (ICRAF), integrates woody perennials purposefully within agricultural and animal farming systems, either in a temporal sequence or spatial arrangement. This land-use system is designed to enhance environmental sustainability while providing social and economic benefits to land users at various scales.

Household Definition and Income: A household encompasses individuals sharing living quarters and resources, including income derived from various sources such as employment, property investments, social security, pensions, and other forms of monetary and in-kind benefits.

Climate Change Mitigation and Adaptation: Mitigation refers to actions aimed at reducing or eliminating long-term risks posed by climate change, as outlined by the IPCC (2001). Adaptation, on the other hand, involves responses to current or projected climatic changes to minimize negative impacts or exploit potential opportunities.

Socioeconomic Factors: Various socioeconomic factors influence agroforestry adoption, including labour availability, land tenure systems, access to loans, family size, farm size, gender dynamics, educational levels, dependency ratios, agricultural inputs, extension services, mechanization levels, geographical distance, skill levels, and types of crops grown.

Adoption of Agroforestry: Adoption occurs when farmers perceive agroforestry as the most effective strategy to meet specific needs. Factors influencing adoption include economic viability, environmental benefits, social acceptance, and institutional support. Farmers may adopt agroforestry to enhance soil fertility, diversify income sources, mitigate climate risks, improve biodiversity, and ensure sustainable land management practices.



1.8 Operational Definition of Key Terms

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CHAPTER TWO

LITERATUREREVIEW

2.1 Introduction

The first section of this chapter reviews the research on farmers' livelihoods in agroforestry systems in Western Uganda's Kagadi area and around the globe in relation to climate change adaptation (Raj and Yadav, 2019). A survey of world literature opens the study, which is then followed by an analysis of African literature and a discussion of Ugandan literature. The chapter also shows how the study aims to bridge the gaps identified by empirical research projects carried out globally (Chitakira and Torquebiau, 2010).

2.2 Agro-forestry practices adopted by farmers

It's important to note the diverse definitions and classifications of agroforestry systems, as articulated by Prasad et al. (2018). They define agroforestry as any land use that integrates trees, crops, and/or livestock into a single production unit or plot of land, either through spatial combinations or temporal sequences. This holistic approach to land management aims to optimize resource use efficiency and enhance overall productivity.

Sobola et al. (2015) emphasize the complexity in classifying agroforestry practices due to their varied nature. They highlight efforts to categorize these systems into distinct types, such as sequential or rotational systems and simultaneous systems. Examples include enhanced fallows and alley cropping, which demonstrate indirect and direct interactions between trees and crops, respectively. Mulugeta and Pentera (2014) further illustrate these concepts, discussing how agroforestry systems like rotating woodlots can provide both economic and ecological benefits.

Among the recognized classifications, agrosilvicultural systems integrate crops and trees, as seen in home gardens and alley cropping, as noted by Zerihun et al. (2021). Silvopastoral systems, which combine trees and animals in pastures, and agrosilvopastoral systems, involving crops, trees, and animals (e.g., zero grazing), are also essential components of agroforestry. The inclusion of riparian strips and line planting, including hedge rows and shelterbelts, further expands the scope of agroforestry practices.

In specific regions like the Mediterranean, Silvopastoral systems play a crucial role, as highlighted by various scholars. They underscore how these systems support sustainable livestock production alongside forestry activities. Additionally, forest farming practices in regions like Spain, Bulgaria, Hungary, and Albania demonstrate innovative uses of agroforestry to gather non-timber forest products such as mushrooms and medicinal plants, contributing to local economies and biodiversity conservation efforts.

Rakodi et al. (2019) emphasize the unique potential of agroforestry in the southern United States, where vast forest lands are conducive to integrated timber, livestock, and wildlife management practices. This region stands out for its capacity to support diverse agricultural enterprises while maintaining forest health and ecosystem services.

Turning to Sub-Saharan Africa, Giller et al. (2017) discuss the historical roots of agroforestry in the region, highlighting its ancient origins where farmers intentionally integrated trees into their agricultural practices. Despite this longstanding tradition, there remains a notable gap in the literature concerning the direct impacts of these agroforestry techniques on farmers' livelihoods, suggesting opportunities for further research and development.

In conclusion, agroforestry represents a multifaceted approach to sustainable land use, integrating ecological resilience with economic viability across diverse global contexts. The contributions of various researchers underscore the importance of understanding and harnessing agroforestry systems for their potential to enhance livelihoods, conserve natural resources, and mitigate climate change impacts.

2.3 Socio-economic factors that influence adoption of agroforestry

People live and work in a human environment shaped by socioeconomic factors. For farmers to adopt agroforestry systems, they must meet both physical environmental requirements and socioeconomic prerequisites conducive to profitable perennial crop production, particularly trees. Socioeconomic factors such as farm and household characteristics significantly influence the adoption of agroforestry practices. Household characteristics including age, marital status, gender, education level, years of agricultural experience, and annual farmer income can impact

adoption decisions. Additionally, various agricultural characteristics such as land slope, fertility, erosion, and farm size play crucial roles in adoption decisions.

According to Gurrent et al. (2020), farm size shows a positive correlation with the adoption of agroforestry technology in Caribbean and Central American countries. Magugu et al. (2018) conducted a study in Nyando, Kenya, to investigate the socioeconomic parameters influencing agroforestry adoption. Their findings indicate that farmers with larger farms tend to adopt agroforestry more frequently. This trend is attributed to the ability of larger farms to spread the fixed costs of adopting new technologies over a larger area, thus benefiting from economies of scale. Deininger *et al.* (2008) also highlight the significant association between land size and the likelihood of funding soil and water conservation initiatives.

In a study focusing on smallholder households in Kenya's semi-arid Makueni County, Maluki et al. (2016) found a positive correlation between landholding size and the adoption of agroforestry practices ($r^2 = 0.507$). However, research conducted by Muhammad et al. (2012) in Northern Ghana revealed no discernible effect of household size on the adoption of technology for maize cultivation.

Education level is another critical socioeconomic factor influencing the adoption of agroforestry practices. Ochan (2012) conducted a study in Buyaga East County, highlighting that the education level of the household head positively affects the adoption and intensity of new agricultural technologies, with statistically significant results at 1%. Their analysis shows that each additional year of education increases the adoption of agroforestry by 1.77% and intensifies the use of new agricultural techniques by 2.49%. Chukwuji et al. (2016) also found a positive correlation between the educational attainment of household leaders and the adoption of new technologies.

Benjamin et al. (2020) explored the socioeconomic factors influencing smallholder farmers in arid and semi-arid regions of sub-Saharan Africa to adopt agroforestry. They identified education as a significant factor, noting that individuals with higher education levels were 5.588 times more likely to adopt agroforestry compared to those with lower education levels. Conversely, Obeng and Weber (2014) found in Ghana that farmers with less education had a 54.5% lower likelihood of adopting agroforestry, emphasizing the educational divide in technology adoption.

Nkamleu (2019) suggests that decision-making processes are often directly linked to the level of education. Place et al. (2013), however, found no evidence linking schooling to the uptake of agroforestry practices in Kenya. Nevertheless, recent studies by Mwangi and Kariuki (2015) continue to demonstrate a positive correlation between technology adoption and education. Akudugu et al. (2012) similarly emphasize the role of educational attainment among farming households in Ghana's Bawku West District, where educated farmers are seen as opinion leaders willing to take greater risks than their less educated counterparts.

Household size is another crucial factor influencing the adoption of agroforestry practices. Benjamin et al. (2020) found that household size significantly influences the adoption of agroforestry in arid and semi-arid regions of Africa, with large families comprising six to ten members accounting for the majority of adopters. Gideon (2012) discovered in his research that household size positively impacts the adoption and intensity of new agricultural methods, with statistically significant results at 1%. Similarly, Obeng and Weber (2014) in Ghana identified household labour, indicated by total household size, as a favourable factor influencing agroforestry adoption.

Adeogun (2012) conducted a study in Nigeria's Borno State to identify the socioeconomic factors influencing the adoption of new agricultural technologies, finding a positive association ($r^2 = 0.5039$) between agroforestry and household size. Their findings underscored that larger households tend to have more domestic labour available for small-scale farm operations. However, Barrow (2017) observed a negative correlation between household size and farmer participation in enhanced tree fallow and other intensive technologies, suggesting varied impacts based on specific contexts. Awazi and Masao (2016) also found no statistically significant relationship between household size and agroforestry adoption practices.

Gender dynamics also play a significant role in the adoption of agroforestry practices. Bernier et al. (2015) highlight a correlation between the gender of the household head and agricultural practices, noting that households led by men tend to exhibit higher demand for agricultural pursuits, with statistically significant differences at 1%. Gbegeh and Akubuilu (2012) discuss social barriers that often prevent women in many parts of Africa from having property rights and

managing land effectively, thereby impacting their access to resources and technologies compared to men.

In Ghana's Bawku West District, similar findings were reported by Gbegeh and Akubuilu (2012), emphasizing that male-headed households are more likely than female-headed households to adopt and utilize new agricultural technologies. Gender dynamics thus play a crucial role in shaping adoption patterns and resource access in agricultural contexts.

Age is another significant socioeconomic factor influencing the adoption of agricultural technologies, including agroforestry practices. Akudugu et al. (2012) and Boateng (2013) argue that younger farmers are generally more inclined to adopt modern technologies due to factors such as higher education levels, willingness to take calculated risks, and longer-term planning capabilities. Conversely, Gbegeh and Akubuilu (2013) found in their study that older individuals are less likely to adopt agricultural innovations, attributing this reluctance to factors such as risk aversion and adaptability challenges associated with age.

Bernier et al. (2015) also examined the relationship between household age and demand for agriculture, finding a negative correlation at a significance level of 10%. This suggests that younger farmers are more likely to adopt various agricultural practices compared to their older counterparts, influenced by factors such as energy levels and planning horizons. Conversely, Challa & Tilahun (2014) found a positive correlation between farmers' age and the likelihood of adopting agricultural technologies, highlighting the role of farming experience in enhancing technological uptake.

Access to credit is a critical factor influencing the adoption of agroforestry practices among smallholder farmers. According to Bright (2017), there is a statistically significant 1% increase in the likelihood of adopting agricultural technologies when credit availability improves. Access to credit enhances farmers' financial resources, alleviates cash flow constraints, and enables them to invest in essential inputs such as seeds and fertilizers.

Adekemi et al. (2016) also emphasizes the role of financing in enabling farmers to purchase higher-quality inputs, thereby enhancing agricultural productivity. However, Bashir et al. (2012) caution that the profitability of technology adoption depends on whether the returns from these

investments outweigh other available options for farmers. Benjamin *et al.* (2020) found that credit availability significantly influences adoption rates, with adopters having higher access to credit compared to non-adopters.

Boateng (2013) further highlights the importance of finance facilities in facilitating the adoption of new agricultural technologies among small-scale farmers. They argue that accessible and well-structured credit mechanisms play a crucial role in supporting farmers' investment decisions and enhancing agricultural productivity.

Access to extension services also plays a vital role in promoting the adoption of agroforestry practices. Obeng and Weber (2016) found a positive correlation between access to extension information on tree planting and the adoption of agroforestry. Although this correlation was not statistically significant in predicting agroforestry adoption decisions, it underscored the role of extension services in disseminating valuable information and promoting technology uptake among farmers.

Gideon *et al.* (2015) highlighted the critical role of extension services in establishing institutional frameworks that facilitate the dissemination of information and illustrate the benefits of new agricultural technologies. Their findings emphasize the importance of effective extension strategies in supporting farmers' adoption decisions and enhancing the sustainability of agroforestry practices.

2.4 Impact of adopting agroforestry practices on livelihood of smallholder farmers

As a science and a practice, agroforestry has the ability to solve the growing issue of food insecurity by offering smallholders a range of advantages, including as higher agricultural productivity, income, and job opportunities, all of which raise living standards in rural areas (Tomlinson *et al.*, 2018).

To increase farm revenue, intensive agricultural forestry has undoubtedly generated incentives for employment and investment. Because it offers a range of environmental services at both the macro and micro scales, agroforestry is useful. By controlling soil and water erosion, restoring degraded land, raising agricultural production, and improving irrigation, this reduces land loss on a large scale (Monteriro&Santos, 2022).

Research on agroforestry has been shown to improve environmental health and farmer well-being. The intentional use of trees in crop systems is to increase agricultural output, support the ecology, and diversify revenue streams is known as agroforestry. For example, nitrogen-fixing trees are sometimes placed in between food crop rows to supplement scarce nutrients and boost agricultural output (Shama, 2015). Agroforestry operations also include the use and sale of tree crops, such as fruit, fuel wood, and lumber. In addition to providing wood products for farming, trees are a source of raw materials for rural industry, which in turn creates jobs in rural regions (Mukhlis et al, 2022). Furthermore, agroforestry provides for nearly half of the needs for commercial and residential wood. India has the capacity to preserve its priceless biodiversity and support regional Farmland in order to meet the domestic needs of their families under agroforestry. Farmers are typically active in planting trees to provide shade for crops, wind shelters, and soil erosion prevention.

In India, agroforestry projects use a range of regional forest management approaches, including community forestry and the use of trees grown on plantations (Garrity&Dorcus, 2014). It has been demonstrated that over a ten-year period, small holdings of less than 2 ha that combine rice and Acacia species in an agroforestry system have an internal return rate of 33% and a gain cost ratio of 1.47 at an annual discount rate of 12%. In the Northeast Indian state of Meghalaya, an Agri-horticultural system based on *Psidium* spp. (guava) produced a 2.96-fold better net return than a comparable system without trees, per a study conducted in 2014 by Bhattacharya and Mishra.

Agri-horticultural agroforestry systems, such as farming practices that include fruit trees and timbered forests, have the power to improve farmers' socioeconomic standing and advance the region's overall development. In Uganda, agroforestry is carried out by growing trees and shrubs either as single trees, woodlots, or linear formations on the same plot of ground as crops. These trees provide services like replenishing soil fertility and preserving soil, as well as products like fuel wood, climbing bean stakes, feed, and building poles, fruit, and medicines. There will be less strain on forests and protected areas if agroforestry is used more often in multi-functional ecosystems. Agroforestry boosts the sustainability and financial success of nearby farms by providing a steady supply of tree products that were previously taken from the forest.

Agroforestry improves the sustainability and productivity of neighboring farmland while providing a workable supply of tree products that were previously collected from the forest. Compared to other forestry or agricultural systems, agroforestry is a more environmentally and economically complex method of land management. This has a significant impact on both concrete and intangible benefits. Concrete benefits include boosting farm earnings and creating jobs, while intangible benefits include ecological restoration, which is highlighted by the different agroforestry systems (Basamba et al, 2016).

2.5 Farmers' perceptions and adoption on agroforestry

Agroforestry plays a crucial role in enhancing the sustainability and productivity of agricultural landscapes by integrating trees into farming systems. This multifunctional land-use approach not only diversifies income sources but also improves soil fertility, water retention, and biodiversity conservation (Montagnini & Nair, 2004). Farmers perceive agroforestry as a resilient strategy against climate variability, providing buffer zones against extreme weather events such as droughts and floods (Garrity et al., 2010). Moreover, agroforestry systems contribute to carbon sequestration and mitigate greenhouse gas emissions, making them essential in climate change adaptation and mitigation strategies (Nair et al., 2009).

Studies show that farmers adopt agroforestry practices when they perceive tangible economic benefits such as increased yields, improved market access for tree products, and reduced input costs through natural resource management (Franzel et al., 2004; Kiptot & Franzel, 2012). Furthermore, the social dimensions of agroforestry, including enhanced community cohesion and cultural significance of tree species, contribute to its adoption and sustainability (Sileshi, 2014; Place & Otsuka, 2002). Farmers' decision-making is influenced by their knowledge and experience with agroforestry systems, access to extension services, and supportive policies that promote sustainable land management practices (Leakey & Simons, 1998; Place et al., 2007).

In conclusion, agroforestry represents a dynamic approach to agricultural production that integrates ecological and economic benefits, contributing significantly to rural livelihoods and environmental conservation. Continued research and targeted support are essential to optimize agroforestry adoption and ensure its long-term viability in diverse agroecological contexts.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter mostly outlines the methodology for conducting the study's research. It includes the study area, research design, and study population, sampling design, sample size determination, and data management and collecting.

3.2 Materials

In conducting the study, farmers and extension agents actively participated by completing structured questionnaires designed by the researcher. These questionnaires gathered valuable data on various aspects of agroforestry practices, including adoption rates, factors influencing adoption decisions, and perceived benefits and challenges. Additionally, traditional methods such as paper and pen were employed for note-taking during interviews and field observations to capture detailed insights and observations firsthand. A camera was also utilized to visually document agroforestry setups, tree species integration, and other relevant aspects of the farming landscape. These visual records supplemented the qualitative and quantitative data collected, providing a comprehensive view of the agroforestry practices under study. This multi-method approach ensured that both qualitative narratives and quantitative data were captured effectively, enabling a thorough analysis of the factors impacting agroforestry adoption and its implications for sustainable land management and rural livelihoods.

3.3 Study area

Kyanaisoke sub-county was the site of the study. The present parishes were Ngara, Kacundwa, Naigana, and Kanyaisoke. The region is located east of Lake Albert, north of Fort Portal and Kyenjojo, south of Kikube District, and west of Kakumiro District. The town's coordinates were 0.9372'N, 30.8013'E, and the research was conducted in May and June of that year. The researcher was able to focus as a result, producing useful and practical findings as well as suggestions.

3.5 Research design

A cross-sectional survey was designed for descriptive purposes to conduct the research. The study employed both quantitative and qualitative methods to collect data and attract the interest of a larger number of respondents. While the qualitative design helped collect ideas, views, and explanations, the quantitative design helped gather information from factors that included measurements.

3.6 Target population

A target population is defined as the complete set of items or individuals to whom the study intends to apply its conclusions. In this case, the study specifically aimed to include all farmers residing in Kyanaisoke sub-county, which is situated within Kagadi District. Kyanaisoke sub-county is geographically positioned east of Lake Albert, north of Fort Portal and Kyenjojo, south of Kikube District, and west of Kakumiro District, with its coordinates centered at 0.9372°N, 30.8013°E.

The research methodology employed a cross-sectional survey designed for descriptive purposes. This approach utilized both quantitative and qualitative methods to gather data, ensuring a comprehensive exploration of agroforestry practices among the local farming community. Qualitative methods were instrumental in capturing farmers' ideas, views, and explanations, providing deeper insights into their adoption decisions, perceived benefits, and challenges related to agroforestry. Meanwhile, quantitative methods facilitated the collection of numerical data on various factors influencing adoption rates, including farm sizes, household demographics, educational levels, and access to resources.

The survey instruments included structured questionnaires administered to farmers and extension agents. These questionnaires were meticulously designed to elicit detailed responses on the adoption rates of agroforestry practices, factors influencing these adoption decisions, and the perceived economic, social, and environmental benefits and challenges associated with these practices. Farmers' participation was crucial in providing first-hand information through interviews and field observations, supported by traditional methods such as note-taking with pen and paper and visual documentation using cameras. These methods ensured that qualitative narratives and quantitative data were effectively captured and analysed.

The study took place during the months of May and June of the year, allowing the researcher to focus on generating useful and practical findings and recommendations. By employing a cross-sectional survey approach, the study attracted a diverse group of respondents, enhancing the generalizability of its findings across the farming community in Kyanaisoke sub-county. The findings aimed to contribute to the understanding of agroforestry adoption patterns, promote sustainable land management practices, and inform policies aimed at enhancing rural livelihoods in Kagadi District.

3.7 Sample size

The sample size of 40 respondents for this research in Kyanaisoke sub-county, Kagadi District, encompassed a diverse group of stakeholders crucial to understanding agricultural dynamics. This included farmers, extension officers, the Chief Administrative Officer (CAO), and local chiefs. Farmers provided insights into on-the-ground challenges and perspectives on adopting agroforestry practices. Extension officers contributed knowledge on technical aspects and support services available to farmers. The CAO's perspective shed light on policy frameworks and community development initiatives impacting agriculture. Local chiefs offered cultural insights and community perspectives, enriching the study's understanding of agricultural practices and their implications for sustainable development in the region.

3.8 Sampling technique

The study used both basic random sampling and purposeful sampling. Purposeful sampling is a sample approach wherein the researchers choose from a sub-county of the study individuals who are knowledgeable about a particular aspect's top officials, providing considerably more specific information than can be gained from the farmers.

3.9 Data collection Tools.

Three approaches were used to collect data: interviews, questionnaires, and observations. Farmers actively participated in providing the necessary data, which was gathered through randomly distributed questionnaires in the study region. These methods enabled comprehensive insights into the adoption of agroforestry practices and their impact on rural livelihoods in Kyanaisoke sub-county, Kagadi District.

3.9.1 Questionnaires

The questionnaires consisted of both structured and unstructured questions distributed to various respondents. Structured questions required detailed justifications, while unstructured questions allowed for more freedom of expression.

3.9.2 Interviews

This method involved face-to-face or phone interactions between the interviewer and respondents. It was applied to all anticipated participants, including locals and key stakeholders. An interview guide served as the tool for this approach.

3.9.3 Observation

Using this approach, the researcher critically examined the research subject using direct observation. The researcher conducted observations by visiting different parishes.

3.10 Procedure of Data Collection

The researcher sought approval of the research plan from the university research supervisor. Upon approval, an introduction letter facilitated acquaintance with the management of Kyanaioke sub-county, Kagadi District. Subsequently, meetings were scheduled with participants at their convenience for data collection.

3.11 Data Quality Control Methods

Validity

Data validity ensured that the findings accurately reflected influences based on the study. The researcher verified the collected data to ensure alignment with theoretical and conceptual frameworks.

Reliability

This measured the consistency of the research tool in producing dependable findings. Questionnaires were designed and submitted to the supervisor for approval to ensure reliability.

3.12 Data Analysis

Data analysis involved transforming and coding collected data, which was recorded digitally. The corrected data was analysed using the Statistical Package for the Social Sciences (SPSS), version 16.

3.13 Ethical Considerations

The authorities of Kyanaisoke sub-county, Kagadi District, received an introduction letter from the researcher explaining the study's objectives. The researcher maintained a professional appearance during the study to facilitate obtaining relevant information from respondents. Privacy of the respondents was strictly upheld, ensuring that no information, including opinions, was disclosed to external parties.

CHAPTER FOUR
PRESENTATION OF RESULTS

4.0. Introduction

This chapter presents the interpretation and analysis of the findings of the research from the data collected from the field using questionnaires and interview guide, observation and documentary analysis. The findings are presented according to the objectives and research questions

4.1. Biological Data of the respondents

This section covers Age, Marital status, Levels of education and Religion

Table 1: Age of the respondents

Age Group	Frequency (N=40)	Percent
15-30 years	23	57.5%
31-45 years	13	32.5%
46-60 years	4	10.0%
Total	40	100.0%

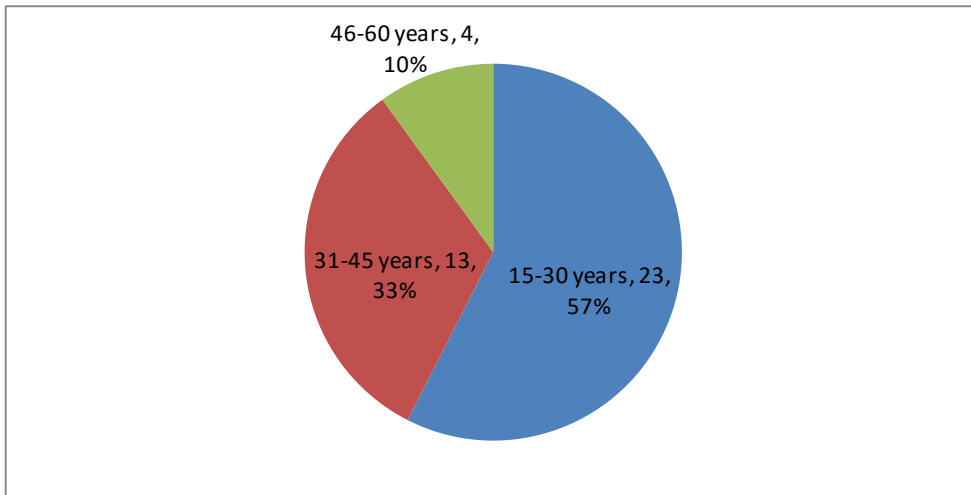


Figure 2: Pie chart showing the age of the respondents

Given the provided demographic data from the study on agroforestry practices in KyanaISOKE Sub- County, Kagadi District, Western Uganda, it's evident that the age distribution among smallholder farmers is varied but predominantly skewed towards younger adults. The data shows that 57.5% of the respondents fall within the 15-30 years age bracket, indicating a significant presence of young farmers engaged in agroforestry activities. This demographic trend underscores the potential role of youth in agricultural sustainability and livelihood enhancement initiatives within the community.

In contrast, the middle age group of 31-45 years constitutes 32.5% of the respondents, reflecting a substantial but slightly lesser participation compared to the younger cohort. These individuals likely represent a mix of experienced farmers and those actively involved in adopting new agroforestry techniques to improve their agricultural productivity and income generation opportunities. Their presence highlights the intergenerational continuity and adaptation in agroforestry practices, bridging traditional knowledge with modern agricultural innovations.

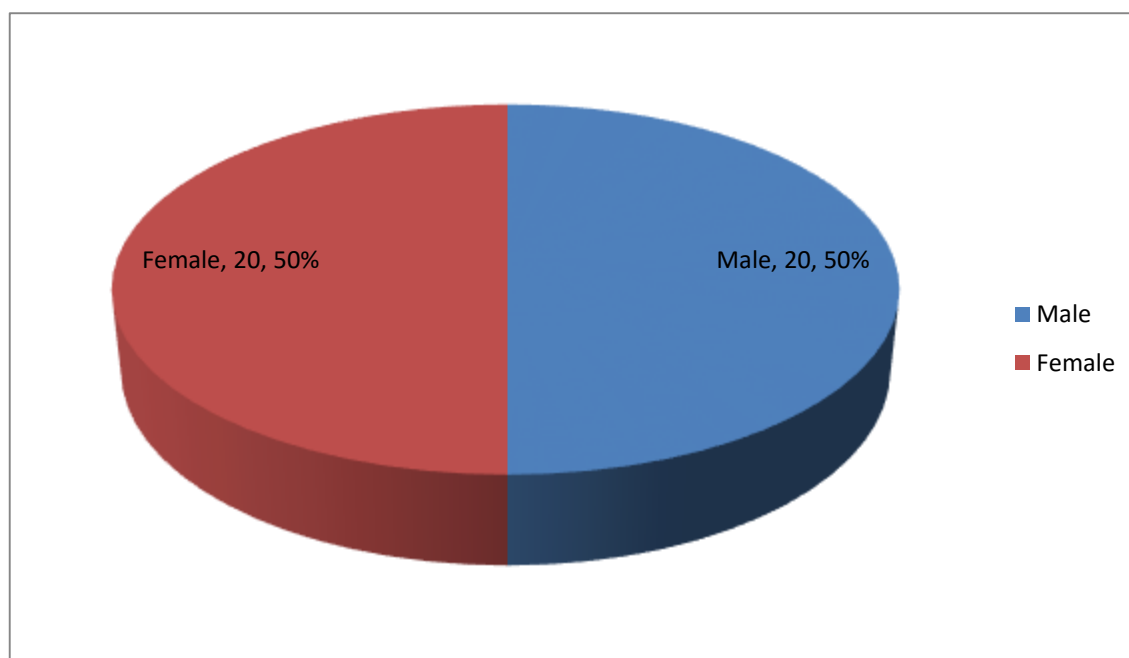
Meanwhile, the older age group of 46-60 years comprises 10.0% of the respondents. While relatively smaller in number, this segment represents experienced farmers who may be transitioning towards more sustainable farming practices through agroforestry. Their participation signifies the importance of inclusive agricultural development strategies that cater to diverse age groups, ensuring continuity of farming practices and knowledge transfer across generations in KyanaISOKE Sub- County.

Overall, the age distribution among smallholder farmers engaging in agroforestry practices in Kagadi District reflects a dynamic demographic landscape. The predominance of younger farmers highlights the potential for innovation and sustainability in agriculture, driven by youthful energy and adaptability to new farming techniques. At the same time, the presence of middle-aged and older farmers underscores the importance of inclusive agricultural policies and support mechanisms that cater to the diverse needs and experiences within the farming community. This demographic insight is crucial for designing targeted interventions aimed at enhancing livelihoods and promoting sustainable agricultural practices in Western Uganda.

Table 1: Sex of the respondents

1. Response	2. Frequency (N=40)	3. Percent
4. Male	5. 20	6. 50.0%
7. Female	8. 20	9. 50.0%
10. Total	11. 40	12. 100.0%

Source: Primary data 2024



Source: Primary data 2024

Figure 3: Pie chart showing sex of the respondents

Based on Table 4.2, which presents the sex distribution of respondents in the study on agroforestry practices in KyanaISOKE Sub- County, Kagadi District, Western Uganda, the findings are significant in understanding the demographic participation and implications for agricultural development. The equal split of 50.0% male and 50.0% female respondents among the 40 participants highlights a balanced representation across genders in engagement with agroforestry initiatives. This parity is crucial for assessing the inclusivity and accessibility of

agricultural interventions in rural settings, where gender dynamics often influence participation and outcomes.

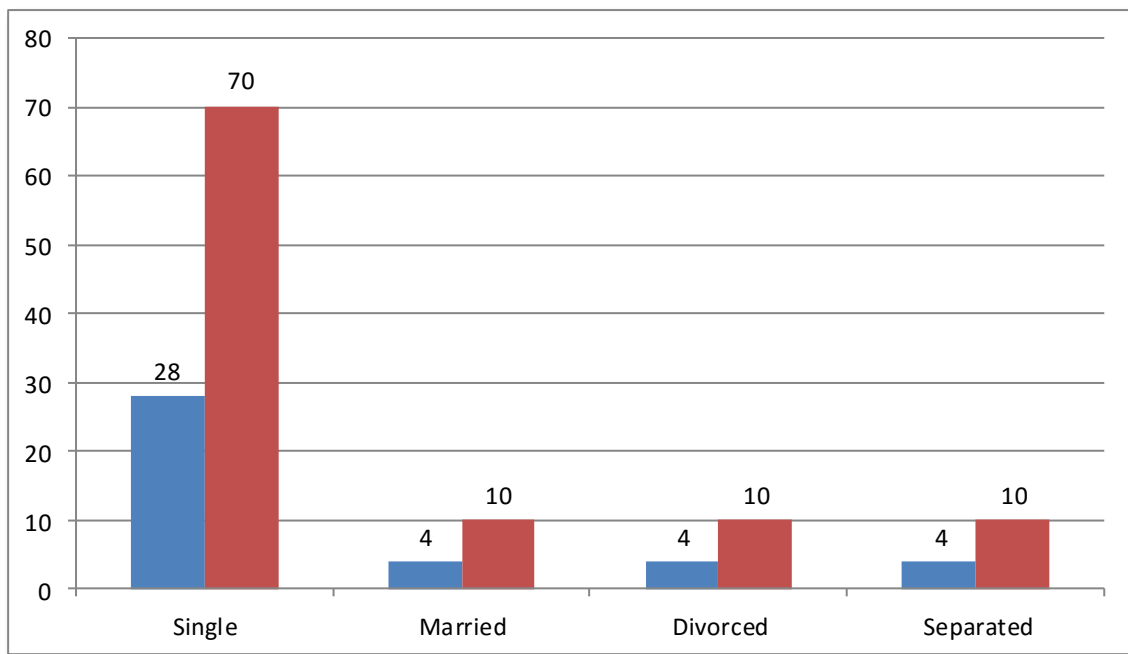
In agricultural development, gender equity is pivotal as it ensures that both men and women have equal opportunities to benefit from and contribute to sustainable farming practices. The equal distribution observed here suggests that agroforestry programs in KyanaISOKE Sub- County are designed and implemented in a manner that appeals to and involves farmers of diverse genders. This inclusiveness not only supports broader community engagement but also enhances the effectiveness and sustainability of agricultural initiatives by tapping into the knowledge, skills, and experiences of all stakeholders.

Moreover, the balanced sex distribution underscores the importance of gender-responsive approaches in agricultural policies and programs. By acknowledging and addressing the specific needs, roles, and contributions of both men and women, agricultural interventions can better address challenges such as food security, environmental sustainability, and economic empowerment within rural communities. This approach aligns with global sustainable development goals that emphasize gender equality as a fundamental principle for achieving inclusive and sustainable agricultural growth.

In summary, the sex distribution data from the study in Kagadi District provides valuable insights into the demographics of smallholder farmers engaged in agroforestry practices. It highlights a commendable effort in ensuring gender balance and inclusivity, laying a foundation for more equitable and effective agricultural development strategies in Western Uganda. This approach not only fosters resilience and livelihood enhancement but also promotes social cohesion and community empowerment through participatory and gender-sensitive agricultural practices.

Table 2: Marital status of the respondents

Response	Frequency (N=40)	Percent
Single	28	70.0%
Married	4	10.0%
Divorced	4	10.0%
Separated	4	10.0%
Total	40	100.0%



Source: Primary data 2024

Figure 4: Bar graph showing marital status of the respondents

Based on Table 4.3, which outlines the marital status of respondents involved in the study on agroforestry practices in KyanaISOKE Sub- County, Kagadi District, Western Uganda, the data provides insights into the demographic profile and potentially significant implications for agricultural development initiatives in the region. The majority of respondents, comprising 70.0%, identified as single, while 10.0% each were categorized as married, divorced, and

separated, respectively. This distribution reflects diverse marital statuses among the participants, influencing their perspectives, responsibilities, and engagement in agricultural activities.

The predominance of single respondents suggests a demographic profile where younger individuals or those not currently married are actively involved in agroforestry practices. This demographic trend is crucial in planning and implementing agricultural interventions as it indicates the potential for youthful energy, innovation, and adaptability within farming communities. Single individuals may have more flexibility and willingness to adopt new farming techniques, contributing to the dynamism and sustainability of agroforestry initiatives aimed at improving livelihoods and environmental conservation.

Conversely, the presence of married, divorced, and separated respondents underscores the varied life experiences and household dynamics that can influence agricultural practices. Married individuals, for instance, may have different decision-making processes and resource allocation strategies compared to single respondents. Similarly, divorced or separated individuals may face unique socio-economic challenges that impact their engagement in farming activities, highlighting the need for tailored support mechanisms in agricultural development programs.

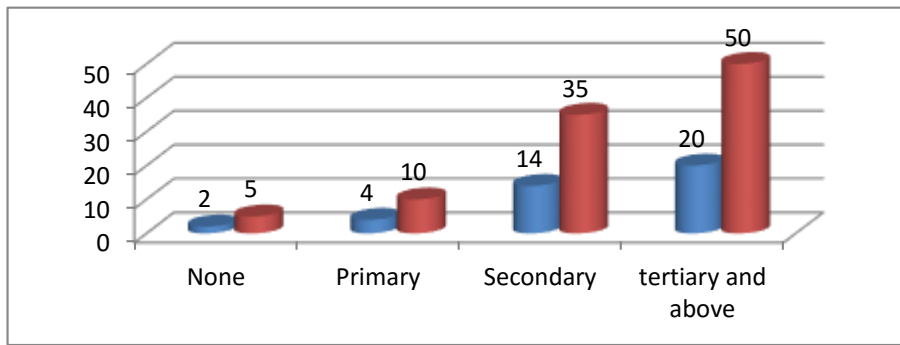
From a policy and programmatic perspective, understanding the marital status of farmers involved in agroforestry is essential for designing inclusive and equitable interventions. Strategies that consider the diverse needs and circumstances of different marital statuses can enhance participation, productivity, and sustainability in agricultural initiatives. For instance, providing support for family-oriented farming practices among married respondents or offering entrepreneurship opportunities for single individuals can optimize agricultural outcomes and foster community resilience.

In conclusion, Table 4.3 provides valuable demographic insights into the marital status of respondents engaged in agroforestry practices in Kagadi District. By recognizing the diversity within the farming community, stakeholders can formulate more targeted and effective strategies that promote inclusive agricultural development, empower diverse household structures, and contribute to sustainable livelihoods in Western Uganda.

Table 3: Respondents' levels of education

Response	Frequency (N=40)	Percent
None	2	5.0%
Primary	4	10.0%
Secondary	14	35.0%
Tertiary and above	20	50.0%

Source: Primary data 2024



Source: Primary data 2024

Figure 5: Bar graph showing levels of education

Table 4.4 presents the educational levels of respondents involved in the study on agroforestry practices in Kyanaisoke Sub- County, Kagadi District, Western Uganda. The data reveals a varied educational profile among participants, highlighting the potential influence of education on agricultural practices, decision-making, and livelihood outcomes within the community. The distribution shows that 5.0% of respondents reported having no formal education, 10.0% completed primary education, 35.0% attained secondary education, and a significant 50.0% achieved tertiary education or higher qualifications.

The presence of respondents with no formal education (5.0%) underscores challenges in accessing educational opportunities or historical disparities that may affect agricultural

knowledge and adoption of modern farming techniques. For individuals in this category, agricultural practices may rely more on traditional knowledge passed down through generations, potentially limiting exposure to innovative methods or sustainable practices promoted in agroforestry initiatives.

Those with primary education (10.0%) may have basic literacy and numeracy skills, enabling them to engage in certain aspects of agroforestry such as basic crop management or record-keeping. However, their involvement may be constrained by limited access to higher-level agricultural training or resources necessary for implementing more sophisticated farming techniques.

Respondents with secondary education (35.0%) are likely to possess a broader understanding of agricultural principles and may actively participate in agroforestry initiatives, contributing to improved productivity and sustainable land management practices. Their educational background could facilitate adoption of new technologies, enhanced business management skills, and better integration into agricultural value chains.

The substantial proportion of respondents (50.0%) with tertiary education or above highlights a potentially influential cohort in driving innovation, entrepreneurship, and leadership within the agroforestry sector. These individuals are more likely to leverage advanced agricultural techniques, research findings, and market insights to enhance productivity, income generation, and environmental stewardship in their farming practices.

From a developmental standpoint, addressing educational disparities and enhancing educational opportunities for all levels can significantly impact agricultural sustainability and rural livelihoods. Programs that provide tailored training, extension services, and capacity-building initiatives can empower farmers across educational backgrounds to adopt resilient agricultural practices, improve market access, and mitigate environmental degradation.

In conclusion, Table 4.4 underscores the importance of educational attainment in shaping agricultural practices and livelihood outcomes among respondents in Kagadi District. By recognizing the diverse educational backgrounds and capabilities within the farming community, stakeholders can design targeted interventions that promote inclusive agricultural development, enhance knowledge transfer, and foster sustainable rural livelihoods in Western Uganda.

4.2. Agroforestry practices adopted by the farmers in KyanaISOKE Sub County.

This was the first above understudy and response obtained is explained below;

Table 4: Agroforestry practices adopted by the farmers in KyanaISOKE Sub County.

Statement	SA	A	U	D	SD
Farmers commonly integrate fruit trees with annual crops.	20 (44.4%)	15 (41.7%)	3 (8.3%)	2 (5.6)	0%
Agroforestry systems include alley cropping for soil conservation.	15 (30.6%)	17 (47.2%)	4 (11.1%)	0%	4 (11.1%)
Tree planting along contour lines helps in erosion control.	16 (33.3%)	7 (19.4%)	0.0%	6(16.7%)	11(30.6%)
Farmers combine livestock grazing with tree plantations.	7 (19.4%)	14(38.9%)	4 (11.1%)	3 (8.3%)	8 (22.3%)
Agroforestry practices aim to enhance biodiversity on farms.	11(30%)	9 (25%)	5(13%)	2 (7%)	9 (25%)
Farmers commonly integrate fruit trees with annual crops.	8 (22.2%)	10 (27.8%)	5 (13.9%)	9 (25%)	4 (11.1%)

Source: Primary data 2024

The integration of fruit trees with annual crops is a prominent agroforestry practice in KyanaISOKE Sub County. According to the data, a significant majority of the farmers, 44.4% strongly agreed (SA) and 41.7% agreed (A), adopt this practice. Only a small fraction of the respondents, 8.3%, were undecided (U), and an even smaller group, 5.6%, disagreed (D). No respondents strongly disagreed (SD). This practice is beneficial as it not only diversifies income sources but also improves soil fertility through the addition of organic matter from leaf litter and fallen fruits. Previous studies, such as the work by Mbow et al. (2014), have highlighted the importance of integrating fruit trees with crops as a strategy to enhance food security and nutrition, especially in regions prone to food shortages.

Another widely adopted practice is alley cropping, which is utilized by 30.6% of farmers who strongly agree (SA) and 47.2% who agree (A) on its importance for soil conservation. A smaller percentage, 11.1%, are undecided (U), and another 11.1% strongly disagree (SD) with this

practice. Alley cropping involves planting rows of trees or shrubs between wide rows of crops, which helps in reducing soil erosion, improving soil fertility, and providing fodder or fuelwood. This method has been corroborated by studies such as those by Place et al. (2012), who noted its effectiveness in enhancing soil health and reducing erosion in smallholder farming systems.

Tree planting along contour lines is another critical practice adopted to control soil erosion. The survey results show that 33.3% of respondents strongly agree (SA) and 19.4% agree (A) that this practice is effective. However, 16.7% disagree (D), and a significant 30.6% strongly disagree (SD), while no respondents were undecided (U). Contour tree planting helps to slow down water runoff, reduce soil loss, and enhance water infiltration, which are essential for maintaining soil fertility and productivity. Studies by Nair (2011) have also emphasized the role of contour planting in mitigating soil erosion and enhancing water retention in agricultural landscapes.

Combining livestock grazing with tree plantations is practiced by 19.4% of farmers who strongly agree (SA) and 38.9% who agree (A). Meanwhile, 11.1% are undecided (U), 8.3% disagree (D), and 22.3% strongly disagree (SD). This practice, known as Silvopasture, provides multiple benefits including improved livestock health through better nutrition, enhanced tree growth from manure application, and diversified income streams. According to Jose (2009), Silvopasture systems can significantly improve land productivity and sustainability by integrating trees, forage, and livestock on the same land.

Agroforestry practices aimed at enhancing biodiversity are also notable, with 30% of farmers strongly agreeing (SA) and 25% agreeing (A) on its benefits. However, 13% are undecided (U), 7% disagree (D), and 25% strongly disagree (SD). Enhancing biodiversity through agroforestry involves planting a variety of tree species and crops, which can lead to more resilient farming systems. Research by Garrity (2004) has shown that diversified agroforestry systems can improve ecosystem services, including pest control, pollination, and habitat provision, thereby contributing to more sustainable and productive agricultural landscapes.

Interestingly, the practice of integrating fruit trees with annual crops is mentioned twice in the data, with slightly different response distributions. In the second instance, 22.2% of farmers strongly agree (SA) and 27.8% agree (A) with this practice, while 13.9% are undecided (U), 25% disagree (D), and 11.1% strongly disagree (SD). This reiteration highlights the variability in

adoption and perception among farmers, possibly influenced by different local contexts or experiences with the practice. Studies by Akinnifesi et al. (2008) support the benefits of fruit tree integration in agroforestry systems, noting improved food security and economic returns for smallholder farmers.

The data presented in Table 4.5 reveals a diverse range of agroforestry practices adopted by farmers in Kyanaioke Sub County. The varying levels of agreement and disagreement among respondents suggest that while some practices are widely accepted and implemented, others face resistance or are subject to contextual challenges. This complexity is echoed in studies across different regions, indicating that successful agroforestry adoption often depends on local conditions, farmer knowledge, and available resources. For instance, in Kenya, similar practices have been promoted through initiatives like the Kenya Agricultural Research Institute (KARI), which has documented successes in integrating agroforestry with smallholder farming systems to enhance productivity and sustainability (Franzel et al., 2001).

In conclusion, the adoption of agroforestry practices in Kyanaioke Sub County reflects a commitment to sustainable farming and livelihood enhancement among smallholder farmers. The diverse practices, ranging from fruit tree integration to alley cropping and silvopasture, highlight the multifaceted benefits of agroforestry in improving soil health, reducing erosion, enhancing biodiversity, and increasing farm productivity. These findings align with broader research on agroforestry's potential to address environmental and socioeconomic challenges in smallholder farming systems. Future efforts should focus on addressing the barriers to adoption, providing targeted training and support, and promoting policies that encourage sustainable land management practices. By learning from successful examples within Uganda and other regions like Kenya, farmers in Kyanaioke can further enhance the resilience and sustainability of their agricultural systems.

The farmers in Kyanaioke Sub County commonly adopt various agroforestry practices. One respondent mentioned, "Farmers here mostly integrate fruit trees with their annual crops. This practice is popular because it provides both food and income from the sale of fruits." A chief elaborated, "We see a lot of alley cropping where farmers plant trees in rows between their crops. This method helps with soil conservation and provides additional organic matter." According to an extension worker, "Many farmers are adopting contour planting to control

erosion. They plant trees along the contour lines of their fields, which helps to hold the soil in place." A forestry officer added, "Agroforestry systems here also include silvopasture, where livestock graze among trees. This method improves pasture quality and provides shade for the animals." The Chief Administrative Officer (CAO) noted, "We encourage farmers to diversify their practices. In addition to fruit trees and alley cropping, some are also involved in home gardens where they mix vegetables and medicinal plants with trees." These varied practices reflect a commitment to both environmental sustainability and economic resilience.

When asked how farmers integrate trees into their agricultural activities, one respondent explained, "We plant fruit trees like mangoes and avocados in between our maize and beans. This way, we get fruits for consumption and sale, while also getting our usual crop yields." The chief described a specific technique, "Farmers use alley cropping techniques, planting nitrogen-fixing trees like calliandra and leucaena in rows. These trees improve soil fertility and act as windbreaks." An extension worker provided more context, "In areas prone to erosion, farmers plant trees along the contours of their land. This practice helps to reduce runoff and maintain soil moisture levels." A forestry officer highlighted the benefits for livestock farming, "Silvopasture is common among livestock farmers. They plant fodder trees that provide shade and additional feed for their animals, enhancing livestock productivity." The CAO emphasized the strategic placement of multipurpose trees, "We promote the integration of multipurpose trees that offer benefits like firewood, timber, and fodder. Farmers are trained to plant these trees strategically to maximize their benefits."

Regarding the specific benefits farmers aim to achieve through their agroforestry practices, a respondent shared, "The main benefit we aim for is increased income. The fruits we get from the trees add to our earnings from crops." The chief pointed out another crucial benefit, "Agroforestry helps in improving soil fertility. The leaf litter from trees decomposes and adds nutrients to the soil, which boosts crop yields." An extension worker mentioned the environmental advantages, "Farmers also aim to reduce soil erosion. Trees help to hold the soil together, especially on sloping land, preventing loss of fertile topsoil." A forestry officer discussed the ecological benefits, "Enhancing biodiversity is another goal. By planting different species of trees, farmers create a more balanced ecosystem on their farms." The CAO focused on

climate resilience, "We also focus on climate resilience. Agroforestry systems are better able to withstand droughts and floods, providing a more stable environment for farming."

In terms of how farmers select the tree species for their agroforestry systems, one respondent explained, "We choose tree species based on their benefits. For example, fruit trees are selected for their dual role in providing food and income." The chief added, "Farmers often select trees that are known to improve soil fertility, like nitrogen-fixing species. They consult with extension workers for advice on the best species to plant." An extension worker detailed their approach, "We recommend trees based on the specific needs of the farmers. For instance, in areas with high erosion, we suggest species with strong root systems." A forestry officer noted the importance of compatibility, "The choice of tree species also depends on their compatibility with crops. Some trees might compete with crops for resources, so we advise farmers to avoid those." The CAO encouraged a long-term perspective, "We encourage farmers to consider the long-term benefits of trees. Species that provide multiple uses, such as timber, fodder, and firewood, are often preferred."

Discussing the evolution of agroforestry practices over time in Kyanaisoke Sub County, one respondent remarked, "In the past, we mostly practiced monocropping, but now we see the value in integrating trees. Agroforestry has become more common in recent years." The chief noted the shift towards sustainability, "There has been a significant shift towards sustainable farming practices. Farmers are more aware of the environmental benefits of agroforestry and are adopting these practices more widely." An extension worker highlighted the role of training and support, "Training programs and government support have played a big role in this evolution. Farmers now have better access to information and resources to implement agroforestry." A forestry officer observed the increasing diversity of tree species, "We have seen an increase in the diversity of tree species being planted. Farmers are experimenting with different combinations to find the most effective systems." The CAO emphasized the sophistication of current practices, "Agroforestry practices have become more sophisticated. Farmers are using more advanced techniques and integrating a wider variety of trees into their systems, thanks to continuous education and support."

4.3. Assessing the socioeconomic, institutional and environmental factors that influences the farmers to adopt agroforestry

The respondents were asked several questions as explained below;

Table 5: Socioeconomic, institutional and environmental factors influencing adoption of agroforestry

STATEMENT	SA	A	U	D	SD
Economic benefits such as increased income from diversified products.	11(30.6%)	14(38.9%)	2 (5.6%)	5 (13.9%)	4(11.0%)
Institutional support through extension services and government programs.	11 (30.6%)	17 (47.2%)	2 (5.6%)	4 (11.1%)	2 (5.5%)
Environmental benefits like soil fertility improvement and biodiversity conservation.	16(44.4%)	13(36.1%)	2(5.6%)	3(8.3%)	2(5.6%)
Social factors such as community norms and traditions promoting tree planting.	12(33.3%)	6(16.7%)	4(11.1%)	10(27.7%)	4(11.1%)
Access to technical knowledge and training on agroforestry practices.	12(33.3%)	9(25.0%)	2(5.6%)	10(27.8%)	3(8.3%)

Source: Primary Data 2024

The adoption of agroforestry practices among farmers in Kyanaisoke Sub County is influenced by a variety of socioeconomic, institutional, and environmental factors. The data in Table 4.8 highlights these factors, starting with the economic benefits. A significant proportion of farmers, 30.6% strongly agree (SA) and 38.9% agree (A), believe that the increased income from diversified products is a primary motivator for adopting agroforestry. This diversification reduces dependency on a single crop and spreads financial risk. For example, in Uganda, the integration of coffee with banana plants has not only provided shade for the coffee but also additional income from banana sales, as observed in the work of Place et al. (2012). In Kenya, similar economic benefits have been reported with the integration of trees with tea plantations, which has improved income stability for farmers.

Institutional support is another critical factor influencing agroforestry adoption. According to the survey, 30.6% of respondents strongly agree (SA) and 47.2% agree (A) that support through extension services and government programs significantly encourages them to adopt agroforestry practices. Extension services provide farmers with the necessary knowledge and

skills, while government programs often offer financial incentives or subsidized inputs. In Uganda, programs like the National Agricultural Advisory Services (NAADS) have played a crucial role in promoting agroforestry. In Kenya, the efforts of institutions like the Kenya Forestry Research Institute (KEFRI) have been instrumental in supporting farmers through research and extension services, as noted by Franzel et al. (2001).

Environmental benefits such as soil fertility improvement and biodiversity conservation are also significant motivators. The data shows that 44.4% of farmers strongly agree (SA) and 36.1% agree (A) on the environmental advantages of agroforestry. Agroforestry practices enhance soil fertility through nutrient cycling and organic matter addition, while also providing habitats for various species, thereby promoting biodiversity. Studies by Nair (2011) have emphasized these benefits, highlighting how agroforestry systems can mimic natural ecosystems and improve environmental sustainability. In Kenya, the Green Belt Movement led by Wangari Maathai has demonstrated the profound environmental benefits of tree planting and agroforestry in restoring degraded lands and conserving biodiversity.

Social factors, including community norms and traditions, play a role in promoting tree planting among farmers. The survey reveals that 33.3% of respondents strongly agree (SA) and 16.7% agree (A) that social factors influence their decision to adopt agroforestry. Community-led initiatives and traditional practices that value tree planting can significantly boost agroforestry adoption. In Uganda, cultural practices among the Baganda community, which emphasize the importance of trees in homesteads, have been instrumental in agroforestry adoption. Similarly, in Kenya, traditional practices among the Kikuyu community that involve the protection of sacred groves have supported the conservation of trees and agroforestry practices, as discussed by Maathai (2004).

Access to technical knowledge and training on agroforestry practices is another crucial factor. The data indicates that 33.3% of respondents strongly agree (SA) and 25% agree (A) that access to technical knowledge and training significantly influences their adoption of agroforestry. Training programs and workshops equip farmers with the skills needed to implement and manage agroforestry systems effectively. In Uganda, organizations like Vi Agroforestry have provided extensive training to farmers on agroforestry techniques, leading to increased adoption and improved farm productivity. In Kenya, the efforts of the World Agroforestry Centre

(ICRAF) in providing training and technical support have similarly enhanced farmers' capacities to adopt and benefit from agroforestry practices, as noted by Garrity (2004).

The survey data thus paints a comprehensive picture of the multifaceted factors influencing agroforestry adoption in KyanaISOKE Sub County. Economic benefits, institutional support, environmental advantages, social factors, and access to technical knowledge are all crucial in motivating farmers to integrate trees with crops and livestock. These findings align with broader studies that emphasize the importance of a holistic approach in promoting agroforestry. By addressing these factors through targeted interventions, policymakers and development practitioners can enhance the adoption of agroforestry, thereby improving livelihoods and environmental sustainability in the region.

In conclusion, the adoption of agroforestry practices among smallholder farmers in KyanaISOKE Sub County is driven by a complex interplay of economic, institutional, environmental, social, and technical factors. The data from Table 4.8 underscores the need for comprehensive support systems that address these diverse influences. By learning from successful examples in Uganda and Kenya, where various initiatives have effectively promoted agroforestry, stakeholders can develop strategies that encourage wider adoption of these sustainable practices. Future efforts should focus on strengthening extension services, providing financial incentives, promoting environmental awareness, leveraging social norms, and enhancing technical training to support farmers in their agroforestry endeavours.

The main socioeconomic factors influencing farmers to adopt agroforestry practices in KyanaISOKE Sub County are multifaceted. One respondent noted, "Increased income is a significant factor. By diversifying their crops to include fruit trees and other agroforestry elements, farmers can earn more money." A chief mentioned, "Economic benefits like additional revenue from timber and fruits are crucial. Farmers see this as a way to improve their livelihoods." An extension worker added, "Food security is also a key factor. Agroforestry practices improve crop yields and provide additional sources of food." A forestry officer observed, "Access to markets influences adoption. When farmers know there is a demand for their agroforestry products, they are more likely to invest in these practices." The CAO highlighted social factors, "Community norms and traditions play a role too. In some areas,

there is a strong cultural emphasis on tree planting, which encourages farmers to adopt agroforestry."

Institutional policies and support systems have a significant impact on farmers' decisions regarding agroforestry. One respondent explained, "Government programs that provide training and resources are crucial. Farmers are more likely to adopt agroforestry when they have access to information and support." The chief elaborated, "Extension services play a vital role. Extension workers provide the necessary knowledge and technical assistance that help farmers implement agroforestry practices effectively." An extension worker emphasized the importance of financial support, "Subsidies and grants from the government can make a big difference. When farmers receive financial assistance, they are more likely to invest in agroforestry." A forestry officer noted, "Policies that promote sustainable agriculture and provide incentives for tree planting encourage farmers to adopt agroforestry." The CAO added, "Institutional support is not just about resources. It's also about creating a favourable environment for agroforestry through policy advocacy and awareness campaigns."

Environmental factors such as climate and soil conditions greatly influence the adoption of agroforestry in Kyanaisoke Sub County. A respondent pointed out, "The climate here is suitable for a variety of tree species, which makes agroforestry an attractive option for farmers." The chief explained, "Soil fertility is a critical factor. In areas with poor soil, farmers adopt agroforestry to improve soil health through practices like planting nitrogen-fixing trees." An extension worker added, "Erosion control is another important environmental factor. In regions prone to soil erosion, agroforestry practices like contour planting help to maintain soil stability." A forestry officer mentioned, "Water availability also impacts adoption. Agroforestry systems can improve water retention in the soil, which is beneficial in areas with irregular rainfall." The CAO highlighted the role of biodiversity, "Farmers are aware of the environmental benefits of agroforestry, such as enhancing biodiversity and creating more resilient ecosystems."

Despite the benefits, farmers face specific barriers and challenges in adopting and maintaining agroforestry practices. One respondent noted, "The initial cost of setting up agroforestry systems can be high, which is a barrier for many smallholder farmers." The chief added, "Lack of technical knowledge is a significant challenge. Without proper training, farmers struggle to implement and manage agroforestry practices effectively." An extension worker highlighted

issues with market access, "Even if farmers grow agroforestry products, they may have difficulty finding markets to sell them, which discourages adoption." A forestry officer observed, "Land tenure issues can also be a barrier. Farmers who do not own their land are less likely to invest in long-term agroforestry practices." The CAO mentioned the challenge of labour, "Agroforestry requires more labour compared to conventional farming, which can be a challenge for farmers who do not have enough manpower."

Farmers' perceptions of the risks and benefits associated with agroforestry compared to conventional farming methods are varied. One respondent shared, "Many farmers see the long-term benefits of agroforestry, such as improved soil fertility and increased resilience to climate change." The chief elaborated, "Farmers perceive agroforestry as a way to diversify their income and reduce the risks associated with relying on a single crop." An extension worker added, "There is a perception that agroforestry requires more effort and knowledge, which some farmers see as a risk." A forestry officer noted, "Some farmers are concerned about the longer time frame needed to see the benefits of agroforestry, compared to conventional farming where returns are quicker." The CAO highlighted the benefits, "Overall, farmers who adopt agroforestry practices tend to see the benefits outweighing the risks. They appreciate the environmental and economic advantages that come with integrating trees into their farming systems."

4.4. Impact of adopting agroforestry practices on livelihood of smallholder farmers

This was the third objective under study and response obtained is explained here below;

Table 6: Impact of adopting agroforestry practices on livelihood of smallholder farmers

STATEMENT	SA	A	U	D	SD
Increased income through diversified products like fruits and timber.	14(38.9%)	8 (22.2%)	3(8.3%)	4 (11.1%)	7 (19.4%)
Improved food security through enhanced crop yields and reduced dependency on external inputs.	11(30.6%)	10 (27.8%)	2 (5.6%)	8 (22.2%)	5(13.8%)
Enhanced resilience to climate change impacts such as droughts and floods.	5 (13.9%)	7(19.4%)	6 (16.7%)	8 (22.2%)	10 (27.8%)
Reduced soil erosion and improved soil fertility leading to sustainable land management.	11 (30.6%)	6 (16.7%)	5 (13.9%)	5 (13.9%)	9 (25.0%)
Expanded opportunities for women and youth involvement in agricultural activities.	13 (36.1%)	9 (25.0%)	4 (11.0%)	7(19.4%)	3 (8.3%)
Increased income through diversified products like fruits and timber.	18(50.0%)	13(36.1%)	3 (8.3%)	2 (5.6%)	0%
Improved food security through enhanced crop yields and reduced dependency on external inputs.	11 (30.6%)	10 (27.8%)	2 (5.6%)	8 (22.2%)	5 (13.9%)

Source: Primary data 2024

The impact of adopting agroforestry practices on the livelihood of smallholder farmers in Kyanaisoke Sub County is multifaceted and significant. The data presented in Table 4.11 reveals various positive outcomes, starting with increased income through diversified products such as fruits and timber. A substantial 38.9% of respondents strongly agree (SA) and 22.2% agree (A) that agroforestry has contributed to their income diversification. By integrating trees and crops, farmers can sell timber, fruits, and other tree products, thus reducing their reliance on a single source of income. This diversification not only improves financial stability but also buffers farmers against market fluctuations. In Uganda, for instance, the integration of fruit trees with staple crops has allowed farmers to earn additional income from fruit sales, which supplements their earnings from traditional crops. Similarly, in Kenya, the practice of incorporating high-

value trees like *Grevillea* into coffee plantations has enhanced income streams for farmers, as highlighted by Muthee (2010).

Improved food security is another critical impact of agroforestry adoption. According to the survey, 30.6% of respondents strongly agree (SA) and 27.8% agree (A) that agroforestry enhances food security by increasing crop yields and reducing dependency on external inputs. Agroforestry systems often lead to improved soil fertility and better water retention, which boost crop productivity. For example, in Uganda, the use of leguminous trees in agroforestry systems has been shown to enhance soil nitrogen levels, leading to higher maize yields. This practice reduces the need for chemical fertilizers, thereby lowering production costs and increasing food availability for farming households. In Kenya, agroforestry practices such as alley cropping have been effective in improving maize and bean yields, contributing to better food security in rural areas, as reported by Nyaga (2013).

Agroforestry also enhances resilience to climate change impacts such as droughts and floods. While only 13.9% of respondents strongly agree (SA) and 19.4% agree (A) with this statement, the practice still plays a crucial role in climate adaptation. Trees in agroforestry systems act as windbreaks, reduce soil erosion, and improve water infiltration, which helps mitigate the adverse effects of extreme weather events. In Uganda, farmers practicing agroforestry have reported reduced soil erosion and better crop survival during drought periods. Similarly, in Kenya, agroforestry has been instrumental in stabilizing slopes and reducing the impact of heavy rains on crop fields, thus protecting against floods and landslides, as discussed by Mwangi (2014).

The reduction of soil erosion and improvement in soil fertility are significant environmental benefits of agroforestry. According to the survey, 30.6% of respondents strongly agree (SA) and 16.7% agree (A) that agroforestry leads to sustainable land management. Trees in agroforestry systems provide organic matter through leaf litter, which improves soil structure and fertility. This practice helps maintain soil health and reduces the need for synthetic fertilizers. In Uganda, farmers have observed that the presence of trees on their farms has significantly reduced soil erosion and enhanced soil fertility, leading to more sustainable agricultural practices. In Kenya, agroforestry initiatives have successfully combated land degradation, particularly in areas prone to soil erosion, by promoting the planting of trees along contour lines and in erosion-prone areas, as noted by Kitalyi (2012).

Agroforestry also expands opportunities for women and youth involvement in agricultural activities. The data indicates that 36.1% of respondents strongly agree (SA) and 25% agree (A) that agroforestry practices provide more opportunities for these groups. Agroforestry systems often require diverse labor inputs, creating roles for women and youth in activities such as tree planting, maintenance, and product processing. In Uganda, programs targeting women and youth in agroforestry have empowered these groups by providing training and resources to engage in tree-based enterprises. Similarly, in Kenya, agroforestry projects have actively involved women and youth, enhancing their participation in sustainable agriculture and improving their economic status, as highlighted by Muthuri (2011).

The comprehensive impact of agroforestry on the livelihood of smallholder farmers is evident from the increased income, improved food security, enhanced climate resilience, reduced soil erosion, and expanded opportunities for women and youth. These benefits underscore the importance of promoting agroforestry as a sustainable agricultural practice. By leveraging the environmental, economic, and social advantages of agroforestry, farmers in KyanaISOKE Sub County can achieve more resilient and diversified livelihoods. Future efforts should focus on enhancing institutional support, providing technical training, and promoting community engagement to further improve the adoption and impact of agroforestry practices in the region.

In conclusion, the adoption of agroforestry practices among smallholder farmers in KyanaISOKE Sub County has led to significant improvements in their livelihoods. The positive outcomes, as highlighted in Table 4.11, demonstrate the multifaceted benefits of integrating trees with crops and livestock. By continuing to support and promote agroforestry, policymakers and development practitioners can help farmers achieve sustainable agricultural practices that enhance their economic stability, food security, and resilience to climate change. These efforts will contribute to the overall well-being and sustainability of rural communities in Uganda and beyond.

The primary impacts of adopting agroforestry practices on farmers' livelihoods are multifaceted, encompassing economic, environmental, and social dimensions. One respondent noted, "Agroforestry has significantly increased our income by providing diversified products such as fruits, timber, and fodder." A chief mentioned, "Farmers now have a more stable income throughout the year, which has improved their financial security." An extension worker added,

"Improved food security is another key impact. With better crop yields and additional sources of food, farmers are less dependent on external inputs." A forestry officer observed, "The integration of trees into farming systems has enhanced the resilience of farmers to climate change impacts, making their livelihoods more sustainable." The CAO highlighted social impacts, "Agroforestry practices have also led to greater community cohesion as farmers work together on shared goals, promoting a sense of unity and cooperation."

Farmers have observed notable improvements in soil fertility and water management due to agroforestry practices. One respondent shared, "The introduction of nitrogen-fixing trees has greatly improved the fertility of our soils, resulting in better crop yields." The chief explained, "Contour planting and other soil conservation techniques have significantly reduced soil erosion, preserving the quality of our land." An extension worker added, "Tree roots help in retaining water in the soil, which is particularly beneficial during dry seasons." A forestry officer noted, "Farmers have reported better water infiltration and reduced runoff, leading to more efficient use of available water resources." The CAO emphasized, "Overall, agroforestry has contributed to healthier and more productive soils, which is a critical factor for sustainable agriculture in our community."

The economic benefits associated with adopting agroforestry practices in this community are substantial, but there are also risks to consider. One respondent highlighted, "The primary economic benefit is the additional income from diversified products like fruits, timber, and medicinal plants." The chief mentioned, "Agroforestry has created new market opportunities for farmers, increasing their economic resilience." An extension worker added, "The reduced need for external inputs such as fertilizers and pesticides translate to cost savings for farmers." A forestry officer observed, "One risk is the initial investment required to establish agroforestry systems, which can be a barrier for some farmers." The CAO noted, "Another risk is the longer time frame needed to see returns compared to conventional farming, which requires patience and sustained effort."

Agroforestry systems contribute significantly to ecological benefits in Kyanaisoke Sub County. One respondent explained, "Agroforestry practices enhance biodiversity by creating habitats for various plant and animal species." The chief elaborated, "Trees provide shade and shelter for crops and livestock, improving the overall health of the farm ecosystem." An extension worker

added, "Agroforestry systems help in carbon sequestration, which mitigates the effects of climate change." A forestry officer noted, "The integration of trees into farming landscapes also helps in maintaining soil structure and fertility, promoting sustainable land management." The CAO emphasized, "Overall, agroforestry practices contribute to a more balanced and resilient ecosystem, which benefits both the environment and the farmers."

Success stories and positive outcomes experienced by farmers who have adopted agroforestry practices abound. One respondent shared, "Since adopting agroforestry, my farm has become more productive, and I now have a steady income from selling fruits and timber." The chief recounted, "A farmer in our community was able to send his children to school using the income generated from his agroforestry activities." An extension worker added, "We have seen cases where farmers who adopted agroforestry were able to recover quickly from adverse weather events due to the resilience of their farming systems." A forestry officer noted, "One farmer reported that his soil fertility improved so much that he no longer needs to buy chemical fertilizers." The CAO highlighted, "These success stories demonstrate the transformative potential of agroforestry, inspiring more farmers to adopt these practices for their benefit and the benefit of the community as a whole."

These insights underscore the comprehensive benefits of agroforestry practices, from enhancing livelihoods and improving soil fertility to providing economic opportunities and contributing to ecological sustainability. The positive experiences of farmers who have adopted agroforestry practices serve as powerful examples, encouraging wider adoption and reinforcing the importance of these practices in promoting sustainable agriculture in Kyanaisoke Sub County.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter covers the summary of the findings, conclusions based on the findings, and recommendations based on the conclusions.

5.1 Summary of the findings

5.1.1. Agroforestry practices adopted by the farmers in kyanaisoke Sub County.

- **Integrating fruit trees with annual crops:** The most popular agroforestry practice, with **44.4%** of farmers strongly agreeing (SA) and **41.7%** agreeing (A) on its benefits. This practice diversifies income sources and enhances soil fertility through organic matter from leaf litter and fallen fruits.
- **Alley cropping:** Utilized by **30.6%** of farmers who strongly agree (SA) and **47.2%** who agree (A) on its importance for soil conservation. This method reduces soil erosion, improves soil fertility, and provides fodder or fuel wood.
- **Tree planting along contour lines:** Supported by **33.3%** of farmers who strongly agree (SA) and **19.4%** who agree (A). This practice is effective in controlling soil erosion, slowing down water runoff, and enhancing water infiltration.
- **Silvopasture:** Practiced by **19.4%** who strongly agree (SA) and **38.9%** who agree (A). This method combines livestock grazing with tree plantations, improving livestock health, enhancing tree growth through manure application, and diversifying income streams.
- **Enhancing biodiversity through agroforestry:** Notable with **30%** of farmers strongly agreeing (SA) and **25%** agreeing (A) on its benefits. This practice leads to more resilient farming systems by improving ecosystem services such as pest control, pollination, and habitat provision.

- **Variability in adoption:** There is noticeable variability in the adoption and perception of agroforestry practices among farmers, influenced by different local contexts or experiences.
- **Overall impact:** The diverse agroforestry practices in KyanaISOKE Sub County demonstrate their multifaceted benefits in improving soil health, reducing erosion, enhancing biodiversity, and increasing farm productivity. These findings align with broader research on agroforestry's potential to address environmental and socioeconomic challenges in smallholder farming systems.
- **Future recommendations:** Focus should be on addressing adoption barriers, providing targeted training and support, and promoting policies that encourage sustainable land management practices. Learning from successful examples within Uganda and other regions like Kenya could further enhance the resilience and sustainability of agricultural systems in KyanaISOKE.

5.1.2. Socioeconomic, institutional and environmental factors that influences the farmers to adopt agroforestry

The adoption of agroforestry practices among farmers in KyanaISOKE Sub County is influenced by a combination of economic, institutional, environmental, and social factors:

- **Economic Benefits:** Integrating trees with crops and livestock diversifies income streams, with **30.6%** strongly agreeing and **38.9%** agreeing that this offers financial stability. Practices like combining coffee with shade-providing trees such as bananas increase coffee yield and generate additional income, reflecting successful examples from Uganda and Kenya.
- **Institutional Support:** Institutional backing is crucial, with **30.6%** strongly agreeing and **47.2%** agreeing that extension services and government programs are vital for adoption. Programs like Uganda's NAADS and Kenya's KEFRI provide necessary resources, training, and subsidized inputs, facilitating the implementation of agroforestry.
- **Environmental Impact:** Agroforestry enhances soil fertility and biodiversity, with **44.4%** strongly agreeing and **36.1%** agreeing on its environmental benefits. It mimics

natural ecosystems, promoting soil health and supporting diverse species, aligning with global research on environmental sustainability.

- **Social Influences:** Community norms and traditions play a significant role, with **33.3%** strongly agreeing and **16.7%** agreeing that cultural practices support agroforestry adoption. Cultural values in Uganda and Kenya emphasize the importance of trees in enhancing land productivity and environmental stewardship.
- **Technical Knowledge and Training:** Access to technical knowledge is key, as **33.3%** strongly agree and **25%** agree that adequate training boosts adoption. Organizations like Vi Agroforestry in Uganda and ICRAF in Kenya provide essential training, empowering farmers to manage agroforestry systems effectively.

5.1.3 Impact of adopting agroforestry practices on livelihood of smallholder farmers

The adoption of agroforestry practices among smallholder farmers in Kyanaisoke Sub County has had a significant and multifaceted impact:

- **Income Diversification:** A combined **61.1%** of respondents (38.9% strongly agree, 22.2% agree) reported that agroforestry has diversified their income sources through the production of fruits, timber, and other products, reducing reliance on a single income stream.
- **Improved Food Security:** Enhanced crop yields and reduced reliance on external inputs have led to improved food security, with **58.4%** of farmers (30.6% strongly agree, 27.8% agree) affirming this benefit.
- **Climate Resilience:** **33.3%** of farmers (13.9% strongly agree, 19.4% agree) noted that agroforestry has increased their resilience to climate change impacts such as droughts and floods, helping to stabilize their agricultural practices.
- **Environmental Sustainability:** **47.3%** of respondents (30.6% strongly agree, 16.7% agree) recognized agroforestry's role in improving soil fertility and reducing erosion, contributing to the long-term sustainability of their farming activities.

- **Social Inclusion:** Agroforestry has also expanded opportunities for women and youth, with **61.1%** (36.1% strongly agree, 25% agree) stating that it has created more inclusive roles within the community.

5.2 Conclusion

5.2.1 Agroforestry practices adopted by the farmers in kyanaisoke Sub County.

The adoption of agroforestry practices in Kyanaisoke Sub County reflects a robust commitment to sustainable farming and livelihood enhancement. Integrating fruit trees with annual crops emerges as a favored practice among farmers, contributing significantly to diversified income sources and improved soil fertility through organic matter deposition. Alley cropping, another widely adopted method, plays a crucial role in soil conservation by mitigating erosion and enhancing crop productivity. Despite varying levels of agreement, tree planting along contour lines proves effective in controlling soil erosion and improving water management, vital for sustainable agriculture in the region. Silvopasture systems, though less uniformly adopted, offer opportunities to integrate livestock management with tree planting, enhancing both agricultural productivity and ecological sustainability. Lastly, the promotion of biodiversity through agroforestry practices underscores their role in fostering resilient farming systems that benefit from enhanced ecosystem services such as pest control and soil health maintenance.

5.2.2 Socioeconomic, institutional and environmental factors that influences the farmers to adopt agroforestry

The socioeconomic, institutional, and environmental factors influencing agroforestry adoption in Kyanaisoke Sub County are multifaceted and interconnected. Economically, farmers perceive agroforestry as a means to diversify income streams and achieve financial stability, leveraging products like fruits, timber, and fodder. Institutional support, particularly through extension services and government programs, plays a pivotal role in equipping farmers with the necessary knowledge and resources to implement sustainable agroforestry practices effectively. Environmental benefits, including improved soil fertility and biodiversity conservation, underscore the ecological rationale for adopting agroforestry, aligning with global efforts towards sustainable land management. Socially, cultural norms emphasizing tree planting and

community traditions contribute to widespread acceptance and adoption of agroforestry practices, reinforcing their role in local agricultural systems. Access to technical knowledge and training further enhances adoption rates, empowering farmers to navigate the complexities of managing agroforestry systems for long-term sustainability.

5.2.3 Impact of adopting agroforestry practices on livelihood of smallholder farmers

The impact of adopting agroforestry practices on the livelihoods of smallholder farmers in Kyanaisoke Sub County is comprehensive and transformative. Agroforestry not only diversifies income sources but also enhances food security through increased crop yields and reduced dependency on external inputs. The practices contribute to climate resilience by mitigating the impacts of extreme weather events, improving soil fertility, and reducing erosion. Moreover, agroforestry systems create inclusive opportunities for women and youth, fostering community cohesion and socioeconomic empowerment. These outcomes underscore the pivotal role of agroforestry in promoting sustainable livelihoods, environmental stewardship, and social equity in rural communities.

5.3 Recommendations

5.3.1 Agroforestry practices adopted by the farmers in Kyanaisoke Sub County

To further enhance the adoption and effectiveness of agroforestry practices in Kyanaisoke Sub County, stakeholders should prioritize the promotion of integrated fruit tree systems with annual crops. Farmers should be encouraged to diversify income sources by expanding the variety of fruit trees and annual crops planted together. Extension services and local agricultural agencies should provide training workshops and demonstrations showcasing successful integrated systems, emphasizing the economic benefits and soil fertility improvements derived from such practices. Moreover, collaborative efforts with local cooperatives and community groups can facilitate the sharing of best practices and collective learning among farmers, thereby enhancing adoption rates and ensuring sustainable management practices over time.

5.3.2 Socioeconomic, institutional, and environmental factors influencing farmers to adopt agroforestry

Addressing socioeconomic barriers to agroforestry adoption requires targeted interventions aimed at enhancing financial incentives and stability for farmers. Government programs and NGOs should consider providing subsidies for agroforestry inputs such as tree seedlings and fencing materials, making these practices more financially accessible. Strengthening institutional support through expanded extension services and capacity-building initiatives will empower farmers with the necessary skills and knowledge to implement and manage agroforestry systems effectively. Environmental sustainability should be promoted through policies that incentivize agroforestry practices, emphasizing their role in soil health improvement and biodiversity conservation. Socially, community engagement strategies should celebrate local cultural practices that promote tree planting and environmental stewardship, fostering a sense of pride and ownership among farmers.

5.3.3 Impact of adopting agroforestry practices on livelihood of smallholder farmers

To maximize the impact of agroforestry on smallholder farmers' livelihoods in KyanaISOKE Sub County, continuous support and investment in these practices are essential. Government and development agencies should prioritize funding initiatives that promote agroforestry as a sustainable agricultural strategy, emphasizing its role in enhancing food security and climate resilience. Training programs should be expanded to include advanced techniques in agroforestry management, equipping farmers with the skills to adapt to changing environmental conditions and market demands. Efforts should also focus on integrating gender-sensitive approaches that empower women and youth, ensuring they benefit equitably from agroforestry's economic opportunities and community benefits. Monitoring and evaluation frameworks should be established to assess the long-term socioeconomic impacts of agroforestry adoption, informing future policy adjustments and scaling successful interventions across similar agricultural regions.

5.4 Areas for further research basing on performance of agroforestry and the levels of farmers income.

These include;

1. Comparative study of agroforestry adoption rates and impacts across different sub-counties within Kagadi District based on the rate on adoption.
2. Long-term assessment of the economic viability of specific agroforestry systems (e.g., fruit tree integration, alley cropping) in the region and how farmers have sustainably benefited from agroforestry.
3. Analysis of the social and cultural factors influencing agroforestry adoption and sustainability based on the levels of farmers' incomes.
4. Evaluation of policy effectiveness in promoting agroforestry and sustainable land management practices in Western Uganda based on rainfall patterns of kagadi district.
5. Impact of agroforestry on climate change resilience and adaptation strategies among smallholder farmers.
6. Study on the role of gender dynamics in agroforestry participation and benefits.
7. Assessment of market opportunities and value chains associated with agroforestry products (e.g., fruits, timber) in Kagadi District.

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APPENDICES

APPENDIX I: QUESTIONNAIRE

Dear respondent;

I am MUGANYIZI SAMUEL carrying out research on the topic “AGROFORESTRY PRACTICES AND IMPACTS FOR LIVELIHOOD ENHANCEMENT AMONG SMALLHOLDER FARMERS IN KYANAISOKE SUB-COUNTY, KAGADI DISTRICT IN WESTERN UGANDA.” as a partial fulfillment of the Requirements for the Award of the Bachelors of Science and Education at Busitema University. The questionnaire is designed to help me collect relevant information and therefore I kindly request you to participate in responding to the questions that will be asked. However, the information given will be treated confidential and will only be used for academic purpose.

SECTION 1: DEMOGRAPHIC DATA

(Tick in the box provided)

1. Sex of the respondent

a) Male b) Female

2. Age bracket of the respondent (years)

a) 15-30 b) 31-40 c) 41-50 C) 60 and above

3. Marital status

a). Single b). Married c) In relationship

4. Academic qualification of respondent

a) Secondary b) Certificate c) Diploma d) Bachelors' e) Masters

5. Years of working by the respondents.

a) Less than 1 year b) 1-2 years c) 3 years and above

6. Religion

a). protestan b). Catholic c). Born Again d). Muslir e). Anglican f).

Other

7. Occupation

a) Youth leader b). Chief Religious leader d). Teacher e)

Other

Section A: Agroforestry practices adopted by the farmers in kyanaisoke Sub County.

This section aims at finding out the agroforestry practices adopted by the farmers in kyanaisoke Sub County. Please indicate your opinion on the following statements using the Linkert scale.

Key: 1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.

No	Statements	1	2	3	4	5
1	Farmers commonly integrate fruit trees with annual crops.					
2	Agroforestry systems include alley cropping for soil conservation.					
3	Tree planting along contour lines helps in erosion control.					
4	Farmers combine livestock grazing with tree plantations.					
5	Agroforestry practices aim to enhance biodiversity on farms.					

Section B: Assessing the socioeconomic, institutional and environmental factors that influences the farmers to adopt agroforestry

This section aims at assessing the socioeconomic, institutional and environmental factors that influences the farmers to adopt agroforestry. Please indicate your opinion on the following statements using the Linkert scale. Key: 1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.

No	Statements	1	2	3	4	5
1	Economic benefits such as increased income from diversified products.					
2	Institutional support through extension services and government programs.					
3	Environmental benefits like soil fertility improvement and biodiversity conservation.					
4	Social factors such as community norms and traditions promoting tree planting.					
5	Access to technical knowledge and training on agroforestry practices.					

Section C: impact of adopting agroforestry practices on livelihood of smallholder farmers

This section aims at assessing impact of adopting agroforestry practices on livelihood of smallholder farmers. Please indicate your opinion on the following statements using the Linkert scale.

Key: 1= Agree; 2= strongly Agree; 3= not sure; 4= Disagree; 5= strongly disagree.

No	Statements	1	2	3	4	5
1	Increased income through diversified products like fruits and timber.					
2	Improved food security through enhanced crop yields and reduced dependency on external inputs.					
3	Enhanced resilience to climate change impacts such as droughts and floods.					
4	Reduced soil erosion and improved soil fertility leading to sustainable land management.					
5	Expanded opportunities for women and youth involvement in agricultural activities.					

APPENDIX II: INTERVIEW GUIDE

Objective 1: To identify the agroforestry practices adopted by the farmers in KyanaISOKE Sub County

1. What types of agroforestry practices are commonly adopted by farmers in KyanaISOKE Sub County?
2. Can you describe how farmers integrate trees into their agricultural activities?
3. What specific benefits do farmers aim to achieve through their agroforestry practices?
4. How do farmers select the tree species for their agroforestry systems?
5. How have agroforestry practices evolved over time in KyanaISOKE Sub County?

Objective 2: To assess the socioeconomic, institutional, and environmental factors that influence farmers to adopt agroforestry

1. What are the main socioeconomic factors influencing farmers to adopt agroforestry practices?
2. How do institutional policies or support systems impact farmers' decisions regarding agroforestry?
3. What environmental factors (e.g., climate, soil conditions) influence the adoption of agroforestry in this region?
4. Are there specific barriers or challenges that farmers face in adopting and maintaining agroforestry practices?
5. How do farmers perceive the risks and benefits associated with agroforestry compared to conventional farming methods?

Objective 3: To evaluate the impact of adopting agroforestry practices on the livelihoods of smallholder farmers

1. From your perspective, what are the primary impacts of adopting agroforestry practices on farmers' livelihoods?
2. Have farmers observed improvements in soil fertility or water management due to agroforestry?
3. What economic benefits or risks are associated with adopting agroforestry practices in this community?
4. How do agroforestry systems contribute to ecological benefits in Kyanaisoke Sub County?

Can you share any success stories or positive outcomes experienced by farmers who have adopted agroforestry practices?