DETERMINANTS OF SUSTAINABLE LANDMANAGEMENT: FOCUSING ON LAND CERTIFICATION AND LANDHOLDING SIZE: CASE OF DUNA DISTRICT, HADIYA ZONE, SOUTHERN ETHIOPIA

MSc. THESIS

BY

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Determinants of Sustainable Land Management: Focusing on Land Certification and Landholding Size:Case of DunaDistrict, HadiyaZone, Southern Ethiopia

MSc. Thesis

By

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DEDICATION

This thesis manuscript is dedicated to my father AbebeSawoand my motherZenebechKelbamo, for their committed companion to my success throughout my life.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my honest work and all sources of materials used for the thesis have acknowledged. This thesis has been submitted in partial fulfillment of the requirements for MSc. degree at Jimma University and is deposited at the University Library to be made available to users under Library principles. I seriously declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or certificate.Brief citations from this thesis are acceptable without special permission provided that accurate acknowledgement of source is made. Requests permission for extended reference from this manuscript in whole or in part may be granted by the head of the major department or the Dean of the School of Graduate Studies when in his judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

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BIOGRAPHIC SKETCH

Henock was born on January 12, 1990 from his father AbebeSawo and his mother ZenebechKelbamoinDuna District, Hadiya Zone, SNNPR,Ethiopia. He attended his primary education at WagebetaSt.Catholic Primary school and his Secondary and Preparatory high school at Gimibichu. After completing his Secondary high school education, he joined WolaitaSodo University in November 2012 and graduated first degree in Natural Resource Management on July 2015. After his graduation, he was employed at DunaWoreda Agriculture and Rural Development Office since 2016. In September 2017, he joined the School of Graduate Studies of Jimma University to pursue his MSc. studies in Soil Science.

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LIST OF ABBREVIATIONS

DAs	Developments Agents
DWARDO	Duna Woreda Agriculture and Rural Development Office
EEA	Ethiopian Economic Association
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
HHs	Households
IFPRI	International Food Policy Research Institute
IIED	International Institute for Environment and Development
KLAC	Kebele Land Administration Committee
LMPs	Land Management Practices
MOFED	Ministry of Finance and Economic Development
RLRCP	Rural Land Registration and Certification Program
SLMPs	Sustainable Land Management Practices
SNNPR	Southern Nation Nationalities and People Region
SPSS	Statistical Package for Social Sciences
SWC	Soil and Water Conservation
USAID	United States Agency for International Development

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Determinants of Sustainable Land Management: Focusing on Land Certification and Landholding Size:TheCase of Duna District, Hadiya Zone, Southern Ethiopia

ABSTRACT

Land tenure insecurity, poor extension services, physical land characteristics, demographic and institutional factors contributed to poor land management. This study was conducted to assess determinants of sustainable land management: focusing on land certification and land size in Duna District; Hadiya Zone, SNNPR, Ethiopia. Systematic random sampling technique was used and selects 144 households for questionnaire.About 18 key informants and 8 focus group discussion members were selected purposively. The chi-square (χ2) analysis was used to test the relationship between land certification and landholding sizewith land management practices.The binary logistic regression analysis was employedtoidentify factors influencing land management practices.The result showed that farmers' confidence on tenure security was increased after certification and the majorities (92%) of the farmers feel more secured on land rights. Land certification increases land management practices (91%), reduce boarder conflicts (82%), promote gender equality (87%) and used as collateral to get farm inputs (95%).As shown fromχ2 analysis, a significant and positive relation was found between land certification and land management practices. Similar resultfromχ2 indicatesthat land management practices weresignificantlyinfluenced by land size and decrease as land size becoming small ($p<0.05$) except crop rotation and organic manure application.As shown from binary logit regression analysis, land certification, land size and education level($p<0.05$), farmers' contact with extension agents,farmland slope, farmers' perception of land degradation and farming experiences were significantly and positively determine land management practices($p<0.1$)while farmland distance negatively($p<0.05$).Therefore,the government should expand land certification in study area to increaseland tenuresecurity, develop cadastral mapping system to update landregistration records, provide training for extension planners and create awareness to farmers to increase sustainable land use.

Key words: LandTenure Security;Land Certification; Land Size, Land Management.

1. INTRODUCTION

1.1. Background and justification of the study

Land is important limited natural resource throughout the world that plays substantial role for rural poor whose life is basically depends on agriculture (USAID, 2007). Nowadays; there is an increasing demand on land due to increase in population growth. The ability of the land to support such increasing demand is highly determined by resilience of agricultural land (FAO, 2011). In most developing countries including Ethiopia, land tenure insecurity, limited access to credits,population pressure and education are the major factors contributes to unsustainable land management (IFPRI, 2005;Hagos and Holden,2006). About 85% of Ethiopia populations are directly supported by agricultural economy (Berry *et al*., 2003).But this economy is being serious threat due to poor land management. Land tenure has been critical and sensitive political issue in Ethiopian history (Hussein, 2004). Land redistribution especially during the Derg period and change in land tenure system with the change in government made farmers to be insecure of land resulting in unsustainable land management practices (Giri, 2010).

In Ethiopia, there have not been appropriate land policies and practices dealing with proper allocations, utilization and management of the land (Rahmato, 2004). Such poor land policies forced farmers to extract more land resources rather than investing. Accordingly, farmland distribution and land transfer have not been carried out properly (Adal, 2002). Landholding size that farmers own and level of security affects farmers' income, reduce incentives to work and land investments. Hence, the government of Ethiopia started the process of Rural Land Registration and Certification Program (RLRCP) since 1998/99 to provide tenure security (Teshome, 2006). The RLRCP was one of the fundamental concernsfor sustainable land use (Gebremedhin and Swinton, 2003). RLRCP was expected to enhance land tenure security, provide land right, promote land management and reduce land disputes (Marquardt, 2006). As to Rahmato (2004) rural land certification and landholding size determine land use efficiency, sustainable land use, cropping pattern and productivity. The more secured the farmers, the more they are interested in making land management practices (EEA, 2002).

Several researches show the relationship between land tenure security and land management (Deininger*et al*., 2011; Placea, 2009; Gebremedhin and Swinton, 2003; Holden *et al*., 2009).

Farmers' perceptions about land tenure security determine the ways at which the land to be managed (Bromley, 1989;Deininger& Jin, 2006; Holden &Yohannes, 2002). According to Nega*et al.*(2003) study in different regions of Ethiopia, landholding is not uniform. Highly populated highland regions of Amhara and Southern Nations Nationalities and Peoples' Region (SNNPR) have an average holding of 0.33ha whereas Oromia has 0.40ha (Nega*et al.*,2003). Considering this, Duna woreda is characterized by various landssizeof which most of ranged below or similar with that of regional average that imposes huge influence on land use. Though RLRCP was started from 2005 in study area, there are no studies conducted regarding farmers' perception of tenure security and landholding size including their potential impact on land management. Thus, this research is designed to assess the effect of landholding size and rural land certification on land management to provide basic information for researchers and fill knowledge gap for local communities to ensure sustainable land use.

1.2. Statement of the problem

Lack of tenure security and others land related issues are serious problems resulting land degradation, land fragmentation and poor land management (Zerfu, 2006). The government of Ethiopia introduces land certification policy to improve tenure security (Gebremedhin, 2003). Different studies found strong relationship between land tenure security and land management (Deininger, 2003; Tenaw*et al*., 2009; Tsegaye*et al*., 2012). Farmers have been granted land certificates since 2005 in Duna Woreda. Nevertheless, changes in land management resulting from land certificates are not well documented. Thus, it is important to assess the effect of land tenure security on land management after certification. Although land certificates increase tenure security, land size limits improved land management. Land degradation with static land tenure and rapid population growth contributes to declining of landsize in Ethiopia (Rahmato, 1998).Moreover, land size determines land security level and exerts considerable pressure on intensity of land use (West, 1986). The same phenomenon appears with clear gap in holdings in Duna Woreda. However, there have been no studies carried out to show the effects of holding size on land management, it is important to assess its major consequences. Thus, this study tried to assess the effect of land certification and landholding size on sustainable land management.

1.3. Objectives of the study

1.3.1. General objective

The general objective of the study is to assess the effect of land certification and landholding size on sustainable land management practices in Duna district.

1.3.2. Specific objectives

1) To examine the effect of land certification on land management practices.
2) To assess the effect of existing landholding size on land management practices.
3) To identify factors determining land management practices.

1.4. Hypothesis

The following hypotheses were tested during the study

1) There is relationshipbetweenland certification and land management practices.
2) There is no relationship between landholding size and land management practices.
3) Land management practicesdonot determined by physical land characteristics, demographic and institutional factors.

1.5. Research questions

- ✓ Does land certification influences land management practices?
- ✓ How does the existing landholding size influence land management practices?
- ✓ What are the factors determining land management practices?

1.6. Significance of the study

The information generated from this study has significant importance to government policy makers, public and non-governmental organizations, private sectors and extension workers that need information to develop suitable land management that aim at attaining household food security through integrated holistic rural development approaches.In addition, this study would provide micro level information on sustainable land management at different levels as a source of information. Likewise,the study increases farmers' awareness on tenure security and encourage making better investments on land to enhance agricultural productivity.

1.7. Scope of the study

Due to budget and time constraints for further investigation, this study has been limited in four rural kebeles. The data was collected from certain farmers who hold the first-level land certificates with various landholdings. All necessary information was collected from sampled households, focus group discussants and key informants.

1.8. Limitation of the study

As land tenure is politically sensitive issue, it was very difficult to figure out all real feelings of farmers. Hence, due to time and financial constraints, the findings were based on what the farmers directly responded to the questions forwarded. Moreover, absence of related research works in the area for comparison purpose was the most critical challenge.

2. LITERATURE REVIEW

2.1. Land tenure and tenure systems in Ethiopia

Land tenure is the relationship whether legally or customarily among the people, individuals or groups with respect to land (Yao, 2000; FAO, 2002). Rules of land tenure clearly define how land property rights to be allocated within the communities, access is granted to use, control and transfer the land. Land tenure has different concepts for different people (ECA, 2003). According to Waiganjo and Ngugi (2001) property rights include right to build and use, right to transfer and mine the land. Similarly, Teshome (2009) indicated land tenure is closely related to land property rights. Land tenure and property rights influences application of land management technologies for agricultural and natural resource management (Tenaw*et al*., 2009). Study by Arko-Adjei (2011) land tenure cover how land is managed; how land rights are transferred within the groups and other persons outside the group. Land tenure systems are always at the heart of community and play a significant role in determining how society functions (FAO, 2002). All the above arguments show that secured land property rights give sufficient incentives to farmers and increase efficiencies and ensure environmental sustainability.

Generally, well defined legal framework of the relationship between people and the land with respect to property rights such as right to hold, transfer, use and lease are determining factor as secure land rights and provide incentives to invest on land which in turn contributes to sustainable use of land resources.Land tenure systems exercised in Ethiopia described into three regimes and each tenure systems have its own respective characteristics about its focus on land right and land management aspects. In Ethiopia, land is major socio-economic asset and the way its rights defined influences land resources and contributes to economic growth (Adenew and Abdi, 2005). They further explain the struggle over who controls the land has played a substantial role in Ethiopian history. The pattern of land tenure system and property rights of farmers basically dependent on policy exercised by three different political regimes of Imperial regime‘s land tenure system, the rule of the Derg until 1991 and the current land tenure system since 1991 as each of discussed below:

2.1.1. Land tenure system during the imperial regime

Land tenure system of Ethiopia during this regime was highly complex due to geographical, ethnic, cultural diversity, history of governance systems and land ownership (Adenew and Abdi ,2005; Yirga,2008; Tenaw*et al*.,2009). The major form of ownership was the communal system in which all descendants of individual could a share and had the right to use a family land (Adenew and Abdi, 2005). However, no user of any piece of land could sell his/her share and neither of them could mortgage nor bequeath the share as a gift outside the members of the family. In general, the major criticisms of the imperial government as further stated by Gebremedhin (2003) land was concentrated in few hands and tenure insecurity in the tenant landlord relations was the bottle neck of farmers' incentives to invest on various land management practices. As it was summarized by Yirga (2008) the tenure system during this regime has resulted land concentrations in few individual's hands which exposed farmers to threats of arbitrary eviction and an exploitative land lord-tenant relationship.

Further, this tenure system did not provide enough incentives for the cultivators to manage the land in more efficient and sustainable manner. This indicated that land tenure arrangement in Ethiopia prior to 1975 was under high land tenure insecurity, unfair land distribution and inappropriate landholding size by individuals which left majority of the peasants landless. This situation highly affects farmer's initiatives towards land related investments; they had no any property right and security for the land they cultivate. Moreover, land tenure system neglect land management aspects except focusing on immediate land income and the political motives to use the land as a means to run state functionary.

2.1.2. Land tenure system during the derg regime

The 1975 land reform in Ethiopia has brought a radical change that abolished tenant landlord relationship; increases agricultural production and provide basis for agricultural expansion (Teshome, 2009). Derg enacted a proclamation that nationalized all rural land and transferred same to state ownership. The proclamation No. 31/1975 abolished the old land property system and allowed all the peasants and tenant to maintain and held the land which used to farm and freed from any obligation to landlords. As further stated by Adenew and Abdi (2005)tenure system during this regime was restricted land transactions by prohibiting land

sales, mortgages and share cropping. According to Tenaw*et al.* (2009) although the Derg regime enhanced land redistribution, the reform failed to increase agricultural productivity. During this regime, land diminution and land fragmentation was found to be a serious issue in the country. As an individual's landholding is more fragmented, the more times it takes to manage which in turn has a negative effect on agricultural productivity. As stated by Belay (2010) the land reform in this regime results frequent land redistribution that contributes to further land fragmentation and tenure insecurity. Moreover, he argued that land improvement measures such as tree plantation, terracing, fencing, manure application and others were not carried out by farmers because of the fear that they would not be compensated for the investments. As the process of land redistribution continued, it resulted in overusing of steep lands, disturbs traditional land management practices, eroded tenure security and discourages farmers to undertake land-improving practices. Land redistribution encourages farmers to focus on immediate returns as they are not sure of keeping same lands for the coming crop years. The harmful effect of insecurity is more pronounced in practical implementation of land management practices such as manure application; tree plantation, terracing and other conservation measures (Teshome, 2009).Regarding land policy towards land management practices Dessalegn (2009) argued that the failure of state ownership and state intervention was very important lesson in this regime. He further argued that peasants had little incentives to invest on lands and fail to manage properly since the land they cultivate could be given to others at any time during redistribution.

2.1.3. The current land tenure system

Current land tenure system of Ethiopia is mainly characterized by state ownership (Hussein, 2004). According to Crewett and Korf (2008) transitional government of Ethiopia announced the continuation of land policy of the Dergeand declared issue of private versus public land ownership in new federal constitution. As to Tenaw*et al.* (2009) the current land policy is like that of the Derg and 1995 Ethiopia constitution approved and confirmed that land to be under the state ownership. Other authors like Teshome (2009) argued that even though some policies of the Derg regime have a negative effect on land use such as prohibition of transfer rights and lease/rent rights are halted, it seems that the overall effects of the present rural land policy have remained more or less the same to that of the Derg regime. According to Daniel

(2012) tenure insecurity due to state ownership provides little incentives to improve land management through long-term investments. Rahmato (2004) argued that farmers could not feel secure on their holdings since the government has the power to take the land at any time for any developmental purpose. As Tenaw*et al*. (2009) land tenure and property rights affect application of technologies for natural resource management. Secured property rights give sufficient incentives and enhance productivity and ensure environmental sustainability. This means land tenure plays vital roles in shaping farmers' land-use decisions for sustainable land use. Insecure land tenure or lack of land ownership also restricts the farmers' access to credit that are required for improved land management practices. If property rights are absent and land tenancy is insecure, farmers do not care much about the land use and concentrate on short-term profit maximizing at the cost of accelerating land degradation (Tenaw*et al*., 2009).

In current land tenure system, even though land shall not be subject to sale (Ahmed, 2002), farmers can rent their lands for short period of time (Giri, 2010). As stated in Sub Article 4 "Ethiopian peasants have the right to obtain land without payment." In addition, Sub Article 7 states that "Every Ethiopian shall have the full right to land." This land right shall include the right to bequeath, transfer and maintain compensation"(Nega*et al*., 2003) and farmers can rent land for short term.Study by Deininger*et al*. (2008) confirmed that land registration and certification program in Ethiopia provides tenure security. This improved tenure security increase long-term land investments such as terracing (Deininger*et al*., 2003; Gebremedhin and Swinton, 2003). Study by Holden *et al*. (2011) shows that well-devised property right reduces border conflicts and increases quality of property right that could lead to productivity enhancement and poverty reduction (Deininger*et al*.,2008). Regarding rural land certification program in Ethiopia, the most important conclusions derived are: (a) almost all the studies argued that land certification program in Ethiopia regarded as a success and (b) the program brought a significant sense of tenure security among farmers.

Thus, secured tenure plays crucial role in shaping farmers' appropriate land-use, effective land management decisions, increases their motivation towards land investments, enhance land productivity and ensure environmental sustainability.

2.2. Rural land certification program in Ethiopia

Land certification is a process of locating, measuring and registering the land under holding and issued as legally secured land right evidences in Ethiopia (Sosina and Stein, 2014). Rural land registration and certification program (RLRCP) is the current policy move in Ethiopia (Enyew*et al*.,2014). As necessary component to enhance agricultural productivity, Ethiopian government recognized the importance of land tenure security (Teshome, 2006). To increase tenure security and long-term land use rights to farmers, the "first-level" certification program was designed since 1998/99and has been implemented in four populous regions of Ethiopia: Tigray, Amhara, Oromiya and Southern Nations Nationalities and Peoples' Region (SNNPR) and has now been extended to all regions of the country(Adenew and Abdi, 2005). In Tigray region, land registration and certification process was started in 1998/99 and followed by Amhara region in 2003, Oromiya and SNNPR in 2004 (Holden *et al.*, 2009; Solomon, 2006; Holden and Gebru, 2016). According to Sosina and Stein (2014) more than 90% of farming households in these regions received rural land certificates through the first-stage registration. To reduce women risk of losing their land rights in the event of divorce or becoming widowed, a joint titling including both husband and wife's names on a land certificate was introduced in 2003.The certificate is issued in the name of husband and wife contain list of measured plots and names of family members (Giri, 2010).

The nationwide certification program is intended to be highly participatory and decentralized through Land Use and Administration Committees comprised of community members. However, there were regional variations in certification and began at different dates across the regions that affect evenness of implementation. Except Tigray region, rural land certification program mandate joint titling in Amhara, SNNP and Oromia regions. Both Amhara and SNNP regions required photographs of both husband and wife on certificates while Oromia region only required husband's photograph (Girma and Giovarelli, 2013). According to Hailu (2016) final report of land governance assessment framework implementation in Ethiopia, out of 11.5 million rural households, 9.4 million (82%) have received the "first level" landholding certificates, among 79% are male and 21% are female's households (Table 1).

Table 1: Final achievements in "first level" land registration and certification in Ethiopia

Regions of Ethiopia	Total Rural Households	Rural households received first level land certificates		
		Total HHs	Male HHs	Female HHs
Amhara	3,500,000	3,325,000*(95%)*	2,191,047*(66%)*	1,133,953*(34%)*
Oromia	4,014,500	3,091,165*(77%)*	2,598,027*(84%)*	493,138*(16%)*
SNNPR	2,979,851	2,289,571*(77%)*	1,991,927*(87%)*	287,644*(13%)*
Tigray	695,000	688,050*(99%)*	598,604*(87%)*	89,446*(13%)*
Harari	13,543	1,125*(8.3%)*	817*(72.6%)*	308*(27.4%)*
Dire Dawa	21,000	500*(2.4%)*	No record	No record
Gambela	53,000	2,000*(4%)*	No record	No record
Somali	101,554	No record	No record	No record
Afari	25,765	No record	No record	No record
BenshangulGumiz	125,175	No record	No record	No record
Total	11,529,388	9,397,411*(82%)*	7,380,422*(79%)*	2,004,489*(21%)*

Source: Hailu, 2016

To specify the location of the parcels, the names of the landholders to the north, east, south and west are recorded including the description of fertility and present land use. Moreover, land certificates list responsibilities of land users and how to use lands in sustainable manner. According to Kanji *et al.* (2005) land rights include those concerning land access and use such as right to use the land at a time, rights to transfer the land. However, a sale of land remains illegal (Holden *et al.*, 2007). This land certification program was the most successful and low-cost in Africa and else in the world (Deininger*et al.*,2011; Holden *et al.*,2009; Holden *et al.*,2011; Holden and Ghebru,2013) with its estimated cost of approximately US$1 per parcel (Alemu,2006;Deininger*et al.*,2008).Generally, "first level" certification program increases tenure security and certify long-term land use rights for rural households with most successful low-cost registration, provide positive and potentially important impacts on farmers access to credit and female empowerment, reduce land disputes and increases farmers participations towards LMPs.Despite the well-documented benefits, "first-level" certification program was

also perceived to have limitations that rendered it unlikely to be a viable long-term solution for securing land rights. In particular, the process did not map individual plots and provide sufficient spatial detail around boundary documentation to allow for the development of cadastral maps to improve land use management and administration. Moreover, the lack of computerized registries under first-level certification did not enable effective management and updating of registration records.

2.3. Land certification and land management practices

In Ethiopia, several studies suggest that first-level land certification programeincreased agricultural investment at both individual and community levels (Deininger*et al*., 2008; Holden *et al*., 2009) and that farms with certified land tended to be more productive than those that were not (Ghebru and Holden, 2015). Moreover, the land certification programs in Ethiopia induced better land management practices (e.g., tree planting, construction of stone terraces) and ultimately improved land productivity (Deininger*et al*., 2011; Holden *et al*., 2009).Land tenure system related with land certification programeis also considered as milestone for sustainable land management practices and shape farmers' land use decisions. That is why policy makers, government, private sector and researchers given major attention on tenure insecurity issues (EEA, 2002). Although land investments provide higher benefit for farmers, land tenure insecurity obstructs LMPs(Deininger and Jin, 2006). Secure property rights increase incentives to invest on land(Deininger, 2003). Land rights enhance gender equality and empower women, improve governance and reduce conflict potential (Deininger*et al*., 2008). The lack of property rights and insecurity of tenure often made farmers not to care much about the land use, investments on SLM and use of input efficiently and focus mainly on short-term profit which may result in land degradation (Tenaw*et al*., 2009). Many studies are carried out to show the link between tenure security and investments in terms of land management. Study made by Deininger and Jin (2006) revealed that transfer rights to land tenure security enhanced farmers to make investments on land. Similar studies in African countries showed that stronger land rights and presence of land titles are often linked with positive impact in making land investments such as tree plantation, fencing and manuring (Placea, 2009).

In Amhara region of Ethiopia, land certificates has increased the perception of tenure security among farmers which improved tree plantation and other SLM practices and incidence of land disputes has declined due to appropriate land demarcation (Palm, 2010). Gebremedhin and Swinton (2003) found in northern Ethiopia, farmers' perceived tenure security was positively linked with investments on long-term durable soil conservation structures like stone terraces. Long-term investments in stone terraces are associated with secure land tenure, whereas short-term investments in soil bunds are strongly linked to insecure land tenure. In the same way, study made by Holden *et al*. (2009) to know the farmers' perceptions about the low-cost land certification program which was implemented in Tigray region of Ethiopia showed that the program increases tenure security and reduces land disputes among the households. Another study made in Tigray region of Ethiopia also showed that people having certificates are more interested in making long term land-related investments and high use of chemical and organic fertilizers (Ghebru and Holden, 2008). Study in Kenya show tenure security plays important role for use of soil conservation practices (Kabubo-Mariara, 2007). In contrast to these, there are other results which do not show the positive link between tenure security and land related investments in Zimbabwe (Zikhali, 2008). Holden and Yohannes (2002) found no evidence of tenure insecurity having negative effect on tree investments in southern Ethiopia. Similarly, the survey conducted in Ghana, Rwanda and Kenya also showed that land registration didn't play major role on productivity, land improvements and access to credits.

Study by Neef (2001) in Niger, Benin, Thailand and Vietnam suggested tenure insecurity does not always led to decreasing investments in land. The main reason behind this is farmers' belief that if they make these types of investments, then it will help to obtain tenure rights as such increase long-term land tenure security (Neef, 2001). However, in context of Ethiopia, it is more likely that land security promotes investments rather than investments are made to increase tenure security (Negatu, 2006). In Ethiopia, most of the studies done in Amhara and Tigray regions showed land titling due to certificates provide tenure security among farmers which motivate them to make different kinds of sustainable land management practices.

2.4. Land management practicesand landholding size

Land management practices (LMPs) areadoption of appropriate management practices that enables land users to maximize economic and social benefits (FAO, 2009). According to

Muhammad *et al*. (2014) use of suitable land management practices to improve and maintain productive capacity of the land is considered as land management. Agricultural economy in Ethiopia is being seriously eroded by unsustainable land management (Berry *et al*., 2003). Land management practices which have been developed and still being used by majority of the farmers include terracing, traditional ditches, fallowing, crop rotation, application of manure and agro-forestry which play significant role in production of subsistence agriculture (Nedessa*et al*.,2005). As to Taye (2006) poor land management is global concern that determines soil fertility, sustainability of natural resource and economic development of the country. Unsustainable use of resources can threaten individuals' livelihoods and local to international economies. Particularly in study areaanimprovement in land productivity through sustainable resource management is critical concerns to sustain human wellbeing. Land management practices determine sustainability of natural resource, soil fertility and quality of the environment (Emmanuel, 2014). Lack of land tenure security is the chief obstacle to improve agricultural production in Ethiopia (Rahmato,1984).

Farmers with lack of land tenure security have given insufficient incentives for sustainable land management. This is because; tenure insecurity has potential impact on land investments and adoption of new land management technologies (Deininger*et al*.,2008; Tsegaye and Bekele, 2010; Belay, 2010). Similarly, Gonzalez *et al*. (2007); Demetriou*et al*.(2013) argued that sustainable land use is influenced by landholdings, its shape and dispersion which may directly or indirectly related with land tenure security. Land use efficiency, sustainable land use and cropping pattern determined by landholding size (Rahmato,2004). Thus, farmers with larger landholdings can invest more on land management practices such as tree plantation, soil bund construction, fallowing practices, application of fertilizers and diversify more crops than farmers with less landholding size (Nkonya*et al.*,2008). According to Demeke *et al.*(1998) and Negatu (2006) landholdings shortens fallowing cycles and influences crop rotation with consequences of declining in soil quality and fertility and determine quantity of fertilizer to be applied.

2.5. Determinants of land management practices

There are numerous factors determine implementation of land management practices (Tolera, 2011).Social and demographic characteristics such as age structures, education, gender and family size, physical land characteristics such as farmland distance, farmland slope, land fragmentation and institutional factors such as farmers' access to agricultural extension, farming experiences, access to training and contact with DAs are some factors play great role in influencing farmers' implementation of land management practices.According to Tadesse (2011) socio-economic and institutional factors, farmers' local knowledge, topography, soil type and climate are factors influencing LMPs. According to Aklilu (2006) study in Ethiopia age of a farmer, farmers' perceptions on new technology, slope and soil fertility influence use of stone terraces. Study by Habtamu (2006) found farmers' perceptions about soil erosion, farmers' attitude to use land management technologies and training have significant influence on land management structures.The literacy status of farmers has great impact on general awareness of the adverse effects of environmental degradation (Shibru, 2010).Education increases environmental understanding and enhances farmers' ability to identify alternatives and compare benefits and costs associated with each of the possible alternatives. Education also brought differences among farmers in practicing land management practices and better recognizing associated risks with the problem of land degradation and tends to spend more time and money on land management (Paulos, 2004). Farmers' local knowledge and practices are issues of land management. Farmers' local knowledge addresses information gaps and determines land management practices. The knowledge intensity of resource management of farmer centered development strategies. Land management practices are affected by farmers' decisions on agricultural production and land conditions including both private decisions made by farmers and collective decisions made by groups of farmers and communities.

Although the size of family members can be seen from different angles; if the household size is larger with many mouths to eat rather than to work, it have a negative consequence on land management(Wegayehu, 2006). When the majority of family members are capable of working (between 15 and 64 age), structural land management practices tend to positively related with larger family sizes. Access to new information is an important concern that shape farmers decision on land management and degradation problems. Farmers who had access to

new information were more aware of land degradation problems than those who did not. Information provision through extension channels increased farmers' awareness on land degradation (Aklilu, 2006). Access to agricultural extension and credit services also improve farmers' attitude towards land management practices. This is because farmers with access to extension services have better access togetnew information which could play significant role in improving land management practices (EEA, 2002). Agricultural extension has strongly promoted increased use of farm inputs such as fertilizer and improved seed. Access to formal credit is associated with greater use of fertilizer and other purchased inputs such as improved seeds (Taffa, 2009). Using results from community surveys in Tigray and Amhara, Pender *et al.* (2006) found that the impact of credit on land management depended on the source and terms of credit and type of technology promoted.Farmland slope is one of the factors and increases the probability of using improved land management technologies. It implies that farmers are inclined to invest conservation practices where their farm plots are located in higher slopes. This is due to expectation of more benefits from conservation and high rate of soil loss on steeper slope farm plots than the flats. This means that on sloppy plot the impact of soil erosion would be more visible to farmers and this forces them to use appropriate land management and take remedial action. This suggests that conservation efforts should target areas where expected benefits are higher, like on the steeper slopes to encourage conservation technologies (Assefa, 2009). The perception of farmers on soil erosion and measures to be taken to combat is highly related to the slope of the land. This shows that slope is determining factor to management decision (Tesfaye, 2003).

3. MATERIALS AND METHODS

3.1. Description of the study area

The study was conducted in Duna district, Hadiya Zone, Southern Nations Nationalities and Peoples'Region (SNNPR). The districts bordered on the East and South by the KambataTambaro Zone andNorth and West by SoroWoreda.

3.1.1. Location and size

Duna is one of the district in Hadiya Zoneand astronomically located between 7^0 15' N to 7^0 25' N Latitudes and between 37^0 32' E to 37^0 46' E Longitudes. It contains one urban and 31 rural kebeleslocated at 277 km Southwest of Addis Ababa, 211 km Northwest from Hawassa and 42 kms from Zonal capital of Hossana to the South direction from its main town Ansho (Figure 1). The total area of the district is estimated to 43,104 hectares (Assefa, 2017).

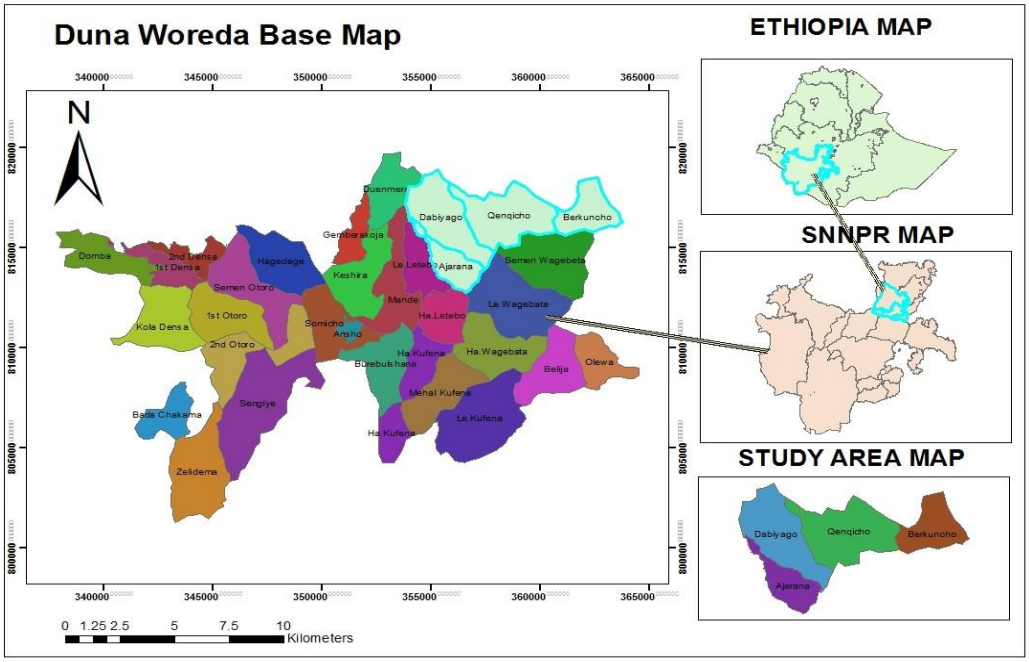

Fig1: Map of the study area

3.1.2. Climatic condition

According to DWARDO (2014) the district is divided in to three main agro-climatic zones: highland (*Dega*) midland (*Woina-Dega*) and lowland (*Qolla)*. Agro climatic zones of Woreda account 78% highland, 15% midland and 7% low-land. The district received adequate rainfall with two rain seasons: Summer (*Kiremt*) which is the main rain season from June to August while winter (*Belg*) is small rain season from September to November. The highest rainfall is recorded in July and August while the lowest is between December and February. The mean annual rainfall is ranges from 1001mm to 1400mm with maximum and minimum annual average temperature of 25^0c and 10^0c respectively.

3.1.3. Topography

Elevation of thedistrict ranges with maximum at Sengiye Mountain peak 2001 to 3000 meters above sea level at Awonda plane in Sanna river outlet (Assefa, 2017). According to the data from agriculture office (2014) the area is characterized by highly undulating and hilly topography intersected by valleys and gullies. The major relief feature (62%) is mountainous and (38%) is flat land.

3.1.4. Vegetation cover

Vegetation cover of the certain part of the area is mainly the result of climate distribution and human activities. Forest cover has been reduced from time to time due to domestic use, fire wood consumption, income generating activities, construction of house and house furniture's and agricultural expansion(DWARDO,2016). Eucalyptus tree (*Eucalyptus Camaldulensis*) is the dominant and widely planted tree species. Nowadays, most indigenous trees species such as *Ficusalicitolia* (Amharic *warka*),*Cordiaafricana* (Amharic *Wanza*), *Juniperusprocera*(Amharic *YabeshaTid*), Crotenmacrota-chy *(*Amharic *Bisana*), *Ficussure* (Amharic *Sholla*) and *Pedocarpusgracilor* (Amharic *Zigba*) are being replaced by Eucalyptus tree. Hence, the Eucalyptus tree is getting dominant mainly around residence areas and along river valleys (DWARDO, 2014).

3.1.5. Soil types

The most dominant soil types are Vertisols and Nitisols, but the alluvial soil is found along the riverbanks at downstream of the low-land and sandy textural soils are common (Dereje, 2015). Where the slope is steep, soil is highly eroded due to high rainfall and poor vegetation cover.

3.1.6. Population size and distribution

According to CSA (2013) population projection of Ethiopia for all regions at Woreda level from 2014–2017, total population of Duna is 141,457 of which 70,427(49.8%) are male and 71,030 (50.2%) are female. Majority of population 130,994(92.6%) live in rural and 10,463 (7.4%) are living in urban settings (CSA, 2013). In terms of religions, majority of populations (84.92%) are Protestants, (8.32%) Orthodox, (5.76%) are Catholic and (1%) of Muslims Christianity followers. Almost all the people in the Woreda speak Hadiyisa language.

3.1.7. Economic activity

Agriculture is the dominant sector and more than 95% of population depends on agriculture and the rest engaged in small trade and daily laborer. The livelihood of the community is depending on mixed farming system mainly on crop production and animal rearing. Crops and livestock's production are main economic sources. Cattle, goats, sheep and poultry are the major rearing livestock's. Farmers rear animals to generate income by selling bi-products and for source of labor (DWARDO, 2016).

3.1.8. Agriculture and land use system

Agriculture is mostly characterized by subsistence-based production system with mixed farming involving rainfed crop production. Small landholding size is main challenge to most farmers to grow enough food crops. Sometimes, these farmers are unable to secure their own food consumption. The study area is characterized by different land use types. Wheat, Barley, Maize, Bean and Peas are the major annual food crops while Enset (*Enseteventricosum*) is the dominant perennial root crops grown. Enset give multi-uses mainly as a source of food for human and animal. Oxen are important animals used for plowing and seed bed preparation for

annual food crops. Land is tilled three to six times before planting/sowing based on nature of farmland and crops need of land preparation.

3.2. Research design

To achieve the objectives of this study, descriptive research design specifically the survey method was used. The reason why descriptive research design was used is to describe data characteristics about what is being studied, collect qualitative information to describe the nature of problem under study in its status and to describe specific behavior as it occurs in the environment (Belay, 2010). Key informants and focus group discussion members were purposively selected while systematic random sampling method was used for household selection.

3.2.1. Types and source of data

The primary and secondary data sources were used to collect necessary information. Both formal and informal survey methods used to collect primary data with standard questionnaire designed to obtain available information from selected households and direct field observation was used for rechecking. The content of questionnaire has been prepared to interview sample households, livelihoods, issues related to land management practices and responses with the effect of landholding size and land certification on sustainable land management. FGD was made with selected model farmers and Land Administration Committee (LAC) to obtain available information based on their past experiences. Moreover, interview was carried out with selected DAs, experts and kebele administrators. Secondary data sources such as review of related literature and available information from kebeles and Woreda agriculture office were used.

3.2.2. Data collection procedures

3.2.2.1. Site selection

Among 10 rural districts in Hadiya Zone, Dunais the one which was purposively selected as study site. The reason behind its purposive selection was researcher familiarity with Woreda's culture and local language, and being an expert for more than four years. These opportunities

may possibly contribute to collect available data from the farmers. The district consist 31 rural administrative kebeles which are classified in five major cluster kebeles for evaluation and inspection purposes. Among the classified clusters, one cluster containing four rural kebeles (*Kenkicho*, *Berkuncho*, *Dabiyago* and *Ajarena*) were randomly selected. The total population inselectedcluster was14, 386 with (48.5%) male and (51.5%) females.

3.2.3. Sample size and sampling techniques

3.2.3.1. Household sampling

Land certification and landholding size were taken as criteria to select households. All the households who participated in the study hold certificates for the plots they cultivate. Total households of the selected cluster were 1,280 with (93%) male and (7%) female households. Out of total households, (12%) was selected using systematic random sampling techniques (Barlett*et al*., 2001). Total households of Berkuncho, Kenkicho, Dabiyago and Ajarenawere 268,342,386 and 284 with sample sizes of 30, 39, 43 and 32 respectively. Thus, the total respondents in this study were 144; those were selected based on total household size of each sampled kebele (Table 2). In addition, two agricultural experts (from office), 12DAs and four kebele administrators were purposively selected for interview. Moreover, eight focus group discussants from kebele Land Administration Committee and model farmers were selected using purposive sampling technique. Therefore, the total participants in this study were170 respondents (144 households and 26 concerned bodies for FGD and interview).

Table 2: Classification of certified households in terms of their landholding size

	Landholding size distribution (ha)					
Kebeles	0.25-0.75	0.76-1.26	1.27-1.77	>1.78	Total	Sampling Technique
Berkuncho	11	8	6	5	30	
Dabiyago	17	13	7	6	43	Random Sampling
Kenkicho	13	11	8	7	39	
Ajarena	12	9	6	5	32	
Total	53	41	27	23	144	

The total sample size for household interview was determined using probability proportional to sample size-sampling technique using (Barlett*et al*., 2001) formula as follows:

$$n_0 = Z^2 \frac{(p)(q)}{d^2} \qquad (1)$$

$$n_0 = 1.96^2 \frac{(0.12)(1-0.12)}{0.05^2}$$

$$n_0 = 162$$

Where; $n_{o=}$ desired sample size (valid if the calculated sample size is less than or equal to 5% of population size, unless there is need to use the formula with finite population correction)

Z = standard normal deviation (1.96 for 95% confidence level)

p = 0.12 (proportion of population to be included in sample i.e.12%)

q =is 1-p i.e. (1-0.12=0.88)

d =is degree of accuracy desired (5%)

In this case, the above formula is not valid because the computed sample size (n_0=162) is not less than 5% of total population size. Therefore, there is a need to apply the finite population correction formula because the sample size is greater than 5% of the population size. Hence, sample size is determined using finite population correction formula as:

$$n_1 = \frac{n_0}{1 + \frac{n_0}{N}} \qquad (2)$$

$$n_1 = \frac{162}{1 + \frac{162}{1{,}280}}$$

$$n_1 = 144$$

Where; n_1 = finite population correction factors, N= is total population, $_{no=}$sample size.

Basedonabove formula, 144 households were selected for interview using an error margin of 5% and the probability of sample size has a confidence interval of 95%. Systematically an interval was based on $k = \frac{N}{n}$where; N=total number of the households n=sample size. According to this sample, the interval between each household was 8.89. The total households selected based on the proportion of total population for each sample kebeles (Table 3).

Table 3: Distribution of total households and sample size

Kebeles	Total households			Total sample households			
	Male	Female	Total	Male	Female	Total	Sample size (%)
Berkuncho	251	17	268	28	2	30	21
Kenkicho	309	33	342	34	5	39	27
Dabiyago	365	21	386	37	6	43	30
Ajarena	269	15	284	27	5	32	22
Total	1,194	86	1,280	126	18	144	100

Source: DWARDO, 2016

3.2.4. Data collection instruments

3.2.4.1. Questionnaire

This instrument was selected to its appropriateness' and convinced to obtained quantitative information with low-cost and short period of time. Available data was collected through formal questionnaire based on HHs characteristics, family members, farming activities, institutional and demographic factors and land tenure security related questions with land certification and landholding size and their influence on LMPs. Regarding the household survey, structured questionnaires with both open and closed ended questions were designed to get detail information from respondents. Closed ended questions enabled respondents to select options that meet their reviews while open-ended questions were designed to give alternatives to express their feelings and responses concerning of the study objectives. To avoid language barriers the interview was conducted in ‘’Hadiyagna’’ language and finally translated to English for analysis and interpretation.

3.2.4.2. Key informant interview

This is one of the tools used to obtain more information and strength the responses that gained from the HHs questionnaire. In addition, this semi-structured interview was selected because of its flexibility when there was ambiguity and raise new questions based on responses. Due to financial and time constraints, it was difficult to involve all kebele administrators and experts. Thus, it was conducted with 18 informants and experts (Table 4). The data obtained

was described and presented qualitatively and the interview was undertaken in the form of person to person encounters to address the issue by their own words.

Table 4: Sample respondents for interview

Kebeles/Office	Experts	Administrators	DAs	Sample size	Sampling technique
Berkuncho	-	1	3	4	Purposive
Kenkicho	-	1	3	4	
Dabiyago	-	1	3	4	
Ajarena	-	1	3	4	
Experts/Office	2	-	-	2	
Total	2	4	12	18	

3.2.4.3. Focus Group Discussion (FGD)

The purpose of focus group discussion was to understand the issues which were identified as a problem in study area and make a possible guideline to get better solutions. As shown (Table 5), focus group discussants were selected from Model Farmers (MF) and KebeleLand Administration Committee (KLAC) based on better understanding, long experiences from initial land registration and certification process and individuals' farmers landholding size distribution including the present and past environmental conditions, social and economic status of the area.

Table 5: Sample size for focus group discussants

Participants	Berkuncho	Kenkicho	Dabiyago	Ajarena	Total	Sampling technique
KLAC	1	1	1	1	4	Purposive sampling
MF	1	1	1	1	4	
Total	2	2	2	2	8	

3.2.4.4. Direct field observation

Direct field observation was made as supportive technique to collect data and fully understand the realities and issues on the ground particularly the nature of land size distribution and types of land management practices implemented. Therefore, the investigator was conducted field observation in the study area by using checklists to support collected data.

3.3. Method of data analysis and presentation

The data for this study was collected from primary and secondary sources based on the nature of the questions. The collected data was categorized, coded and summarized into numeric value and analyzed quantitatively by entering in to the computer. The chi-square ($\chi 2$) analysis was used to see the relationship between land certification and landholding size with land management practices using computer program of Statistical Package for Social Sciences (SPSS) version 20software.To identify factors determining land management practices,the binary logistic regression model was employed.Qualitative data obtained from interviews and FGD were analyzed in the form of verbal/narrative information.

3.3.1. Multicollinearity among the explanatory variables

Prior to running the logistic regression analysis, the existence of multicollinearity among the explanatory variables were checked using variance inflation factor (VIF) using the (Gujarati, 2004) formula. VIF (x_i) =1/1-R^2. Where R^2 is multiple correlation coefficients between x and other explanatory variables.The VIF values for all the explanatory variables were found to be very small (much less than 10) indicating that absence of serious multicollinearity problem between the explanatory variables (Table 6). For this reason, all of the explanatory variables were included in the analysis. In general, when R^2 is one, tolerance value will be zero, and variable Xi is perfectly correlated with others. Where R^2 is zero, tolerance will be one and it indicates, Xi is not related to others.

Table 6: Multicollinearity test for explanatory variables

Variables	VIF	Tolerance
Age of the HHs	1.55	0.732
Sex of the HHs	1.04	0.916
Family size	1.57	0.593
Education level	1.93	0.621
Farming experience	1.57	0.624
Farmland distance	2.05	0.454
Slope of the farmland	1.32	0.531
Extension contact	2.52	0.374
Farmers' perception	1.44	0.633
Field days preparation	1.23	0.753
Land certification	1.31	0.609
Land fragmentation	2.04	0.563
Landholding size	2.33	0.534
Market distances	1.37	0.771
Training on LMPs	2.34	0.483
Off-farm activities	1.12	0.812
Mean VIF	1.65	

3.3.2. Specification of the econometrics model

Following Green (2008) and Gujarati (2004) the logistic distribution functions usedto analyze farmers' implementation of land management practices as following:

$$pi = \frac{1}{1+e-Z(i)} \qquad (1)$$

Where, Pi is the probability of being willing to use land management practices for the i^{th} farmer ranges from 0 to 1. e- Represents the base of natural logarithms and Zi is a function of m explanatory variables (Xi), and expressed as:

$$Zi = \beta o + \beta 1X1 + \beta 2X2 + \ldots\ldots. + \beta mXm \qquad (2)$$

Where, βo is the intercept and $\beta i^{S}$are the slope coefficients in the model. The slope tells how the log-odds in favor of being willing to exercise land management practices change as independent variable changes by one unit. Since the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean P(i),interpretation of the coefficient will be understandable if logistic model can be rewritten in terms of the odds and log of the odds (Gujarati, 2004).The odds to be used can be defined

as the ratio of the probability that a farmer exercises land management practice (*pi)*to the probability that he/she will not use (1-*pi).*

$$pi = \frac{1}{1+e+e^{z(i)}} (3)$$

$$\text{Therefore } \left[\frac{pi}{1-pi}\right] = \frac{1+e^{z(i)i}}{1+e^{-z(i)}} = e^{z}(i) (4)$$

$$\left[\frac{pi}{1-pi}\right] \frac{1+e^{z(i)i}}{1+e^{-z(i)}} e^{z}o \sum_{i=1}^{m} \beta i Yi (5)$$

Taking the natural logarithms of the odds ratio of equation (5) will result in what is called the logit model as indicted below.

$$\frac{pi}{1-pi} = ln[e^{z}o \sum_{i=1}^{m} \beta i Yi] e^{z}o(i) (6)$$

Z_i = the natural log of the odds ratio or logit

$\boldsymbol{\beta}_i$ = the slope, measures the change in L (logit) for a unit change in explanatory variables(X);

$\boldsymbol{\beta}_0$ = the intercept. The value of the log odd ratio, pi/1+pi, when x or explanatory variable is zero.Thus, if the stochastic disturbance term (u_i) is taken into consideration the logit model becomes:

$$Zi = \boldsymbol{\beta}_o + \boldsymbol{\beta}_I X_i + u_i \ (7)$$

Therefore, the above econometric model was used in this part of the study to identify factors influencing land management practices in study area.

Zi= (β0+β1AGE + β2SEX + β3EDU + β4FS + β5FEX + β6FDIS + β7SLOPLOT + β8 EXTCON + β9FPLD + β10TRING + β11LADF+ β12FDP +β13LC+ β14LHS)

Where, Age of household(AGE),Sex of the households(SEX), Education of household(EDU), Family size(FS), Farming experience (FEX), Farm land distance (FDIS), Slope of the Plot (SLOPLOT), Frequencies of extension contact(EXTCON),Training on land management (TRING),Land fragmentation(LADF) ,Field days preparation(FDP) and Farmers perceptions on land degradation(FPLD),Land certification(LC) and Landholding size(LHS).

3.4. Definition of variables and working hypothesis

Dependent variable: Theuse of land management practices is represented by a value of (1) if a farmer used one or more types of land management practices while who did not use such management practices was represented by the value (0).

Independent variables: They are variables of the study those which are hypothesized to have relationship with LMPs. Therefore, the explanatory variables those hypothesized to influence farmers' implementation of one or more types of LMPs are described as follows.

Age of the household: Is continuous variable measured by number of years of the household. Age of the farmer is hypothesized to influence implementation ofland management practices negatively. As the age increases, farmers' participation on new land management technologies decreases. Study by Gebremariam (2001);Taye (2006);Zelalem (2015) revealed that ages of farmers significantly affects land management.

Sex of the household: Sex is a dummy variable that takes a value of 1 if a household is male and 0 otherwise. Sex of the household influences access to information and perception of land degradation, willingness and ability to practice on new LMPs. Male households have better access to information than females that helps to decide anduseland conservation structures. Similarly, previous study by Zelalem (2015) showed successful land management practices are influenced by sex of households. Thus, sex was hypothesized that there is positive relation between sex of the households and land management practices.

Family size: Iscontinuous variable measured by number of active lobar force. It also refers to the number of people who live in the same familywhich has important role on use of labor-intensive agricultural technologies. Farmers with larger active family members would easily use one or more types of land management practices due to its labor-intensive practices. Study by Gebremariam (2001) indicates number of family members influence land management practices either positively or negatively. Hence, family size is hypothesized as it has positive influence on land management practices.

Education: It measures formal education of household. It is a dummy variable which takes a value of 1 if the household is literate and 0 otherwise.Education increases farmers' capacity to create. Farmers having good educational background are more open to use new

technology.Significant and positive relationship was found between education andLMPs (Habtemariam, 2004 and Habtamu, 2006). Blata (2010) argued that education played a great awareness on environmental degradation. Thus, education is hypothesized to correlate positively with land management.

Farming experiences: Is continuous variable measured in number of years of experience in farming.Effect of farmers' farming experience on land management practices shows positive relation. Fitsumand Holden (2003) reported experienced farmers in farming are more likely to manage lands better than less experienced farmers. Thus,it was hypothesized to influence land management practices positively.

Landholding size: Iscontinuous variable measured by the area of a plot in hectares owned by farmers at the time of the survey. Empirical studies shown a positive and significant effect of area of a plot on LMPs. Farmers having larger farm size can tolerate risk of loss of cultivation land from conservation structures and therefore expected to influence land management structures positively. Thus, land size of a farmer expected to influence LMPs positively.

Farmland distances: Is measured by distance of farm plots in km from farmer homesteads. It influences land management practices by limiting time and cost of farm inputs mobility. Farmers whose farms are found nearer to their residence are more likely to use different land management and conservation measures because the time and energy require is lesser than those farmers whose plots are found at far locations. Studies by Habtamu (2006); Jabessa (2008) and Fikru (2009) found farmland distances from homesteads negatively influence land management structures.Therefore,it is expected and hypothesized to influence farmers' use of LMPs negatively.

Farmland slope: Is categorical variable measured by flat, moderate and steep slope. Erosion is more serious on steeper farmlands than on flat lands. Farmers having farmlands on steeper location are more likely to use conservation practices than farmers on flat areas. Prior studies by Girmay*et al*. (2008) andTaye (2006) found slope has significant influence on type and intensity of LMPs. Therefore, slope of farmland was positively hypothesizedto influence land management practices.

Land certification: Isdummy variable take a value 1 if a farmeris certified 0 otherwise. This land tenure security related with land certification determines the household behavior in LMPs. Land certification also increases farmers' land tenure security which contributes to better land management. Certification is important variable in which the farmers decided to applyLMPs due to self-belongings in the fixed resources ownership and farmers feel that land belongs to him/her for at least his/ her life time. Therefore, this variable was hypothesized to influence farmers' use of LMPs positively.

Contact with extension agents: Iscontinuousvariable measured by the number of farmers' contacts with extension agent in a year. Agricultural extension service helps farmers to be aware of the problem of land degradation and acquire new knowledge and skill. Haileye and Zegeye (2001) and Habtemariam (2004) argued that farmers contact with DAs and access to extension services are expected to use better LMPs. Thus, extension service was positively hypothesized with LMPs.

Farmers' perception on land degradation: Is categorical variable measured by Sevier, medium and low by farmer's awareness and perception of land degradation. It is hypothesized to have positive influence on LMPs. Similar results were found by Tesfaye (2003) and Paulos*et al*.(2004). Farmers who perceived the problem of land degradation are more likely to use conservation practices than those who are not aware. Thus, level of perception waspositivelyhypothesizedwith land management and other conservation practices.

Farmers' participation in training: Training is one of the means by which farmers acquire new knowledge. Farmers who attend trainings can get new information and have better understanding aboutthe problem of soil erosion. Study by Haileye and Zegeye (2001) found that farmers acquire new knowledge and skill from training. Thus, farmers' participation in training is expected to positively influence LMPs.

Participation in field days preparation: It is continuousand measured by number of times a farmer has participated in field days.Farmers who participated in field days can get new idea and develop good understanding about LMPs. Farmers having access to participate infield days are expected more to employ land management practices. Study by Haileye and

Zegeye(2001) found farmers acquire new knowledge and skill from field days. Therefore, farmers' participation in field days has positive influence on LMPs.

Land fragmentation: Is continuous and measured by number of plots farmer operating two or more geographically separated farmlands. It results problems such as small land size, irregular shape and parcel dispersion. This spatial scattering of farmlands at varying distances influence LMPs and result uneconomic land use and makes difficulty in effective supervision. Niroula and Thapa (2005) andKakwagh*et al*. (2011) studies show such land with varying distances hampers agricultural development.Therefore, it was hypothesized to influence farmers' use of LMPs negatively.

Distance to market places: As farmers are nearer to urban areas he/she is expected to more likely participate in intensive farming activities and use new agricultural technologies. On the other hand, farmers near to urban area may participate more in off/non-farm activities than in farming activities which may reduce the attention given to farming activities. Therefore, the sign of this variable is a prior undetermined.

Off-farm activities: These are activities of the farmer particularly to create access to food by making income obtained from off-farm activities. Farmers' involvement in non-farm activities sources like daily labour employment to generate household income. Since these activities share most farmers' time, it was hypothesized that it affects decision of farmers to use LMPs negatively. On the other hand, access to such activities may enable farmer to get additional income that allow farmer to acquire purchased inputs. Therefore, this variable may influence LMPs positively or negatively. This variable takes a value of 1 if the farmer is participating in non-farm activities and 0, otherwise.

Table 7: Summary of independent variables

Variables	Definition of variable	Expected sign
Age of the HHs	Continuous variable measured by number of years	-
Sex of the HHs	Dummy variable measured by1 male 0 female	+
Family size	Continuous variable measured in mean equivalent	+
Education level	Continuous measured in number of school	+
Farming experience	Continuous measured by number of years	+
Land certification	Dummy variable take1 for certified 0 otherwise	+
Landholding size	Continuous measured by number of hectares	+
Farmland distance	Continuous variable distance measure in time	-
Slope of the farmland	Categorical measured by high, medium, low slop	+
Land fragmentation	Continuous variable measured in number of plots	-
Extension contact	Continuous measured byin number of days in year	+
Farmers' perception	Categorical measured as sevier, medium and low	+
Training on LMPs	Continuous measured in number of days /year	+
Field days preparation	Continuous measured by in number of days /year	+
Market distances	Continuous variable measured in Km	+/-
Off-farm activities	Dummy variable measured by1 male 0 female	+/-

4. RESULTS AND DISCUSSIONS

4.1. Rural land certification program in duna woreda

Certificates were issued as legally secured land right evidences for all registered landholders. All land certificates were issued jointly by husband & wife names containing the names and photos of both on the same page.All certificates were prepared, stamped and signed at district level while photos added and stamped at community (kebele) level. To specify the location of the land, names of the farmers to each direction of north, east, south and west were recorded. Land certificates also describe the present land use, soil fertility status, responsibilities of land users and land rights such as right to use and transfer. However, a sale of land remains illegal. According to DWARDO (2009) land registration and certification final report from 14,103 total households(85% male and 15% female),a minimum(5.5%) and maximum(38%) land certificates were distributed within five years(2005 to 2009)(Figure 2).

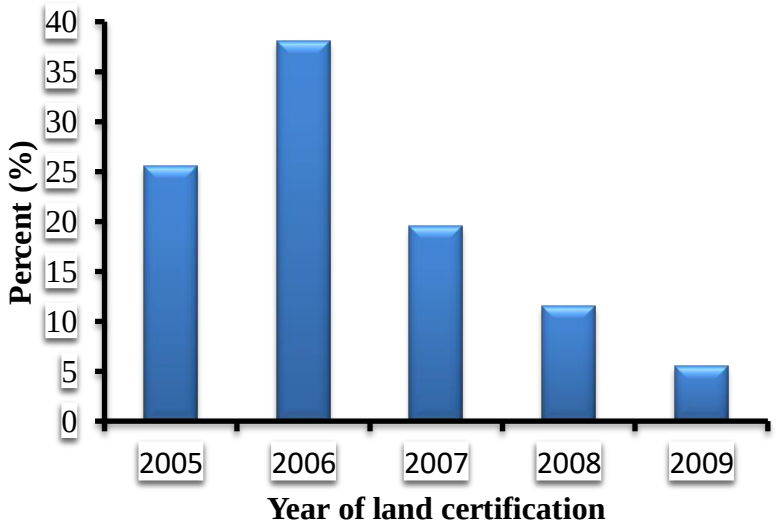

Fig2: Distribution of land certificates in DunaWoreda

Similarly, in study kebeles, land certificates were issued jointly by the name of husband and wife that mentioned the name of all family members and land sizes. As a summary report of DWARDO (2009), a maximum (49%) and minimum (6%) land certificates were distributed in Dabiyago and Ajarenakebelesfrom 2005 to 2009 respectively (Figure 3).

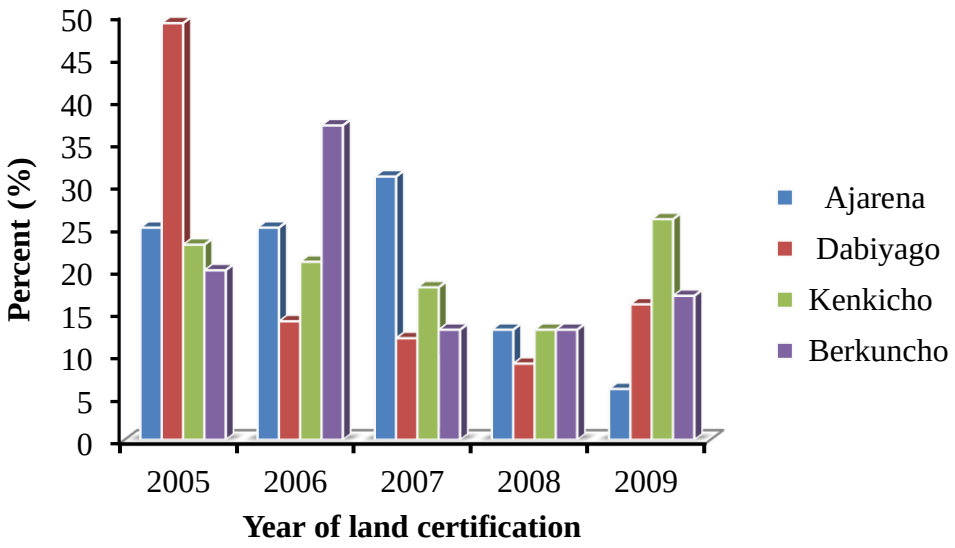

Fig3: Distribution of land certification in the study sites

4.2. Relationship betweenland certification and land management practices

Land tenure security is the way in which land rights are held that influences farmers' decision on land management. It is also a fundamental concern to enhance agricultural sustainability. The null hypothesis (H0) was stated as there is no relation between land certification and LMPs, while the alternative hypothesis (H1) was that there is relationship between land certification and land management practices. As shown from the result, the (H0) was rejected for majority of LMPs and show significant andpositive relationship with land certification and LMPs. Thus, certification programe encourage farmers to undertake different LMPs in study area.It was tried to know how farmers perceived about land certification from different views and each was discussed as follows:

4.2.1. Land tenure security and LMPs

As it was tried to know how farmers view after perceived land certification, more than 92% of farmers responded that land certification increases tenure security and contribute to land management practices (Table 8). This implies that farmers' involvement in one or more types of LMPswasincreased after land certification. Therefore,certification provides legally secured land rights and reduces tenure insecurity among the farmers and contributes to better LMP. Likewise, as shown from $\chi 2$ analysis, soil bund construction ($\chi 2=15.585;p=0.032$), organic

manure applications ($\chi 2 = 54.724$;p=0.041), chemical fertilizers ($\chi 2$=27.312;p=0.001) and tree plantation($\chi 2$=13.754;p=0.061) show a significant and positive relationwithlandcertification increases tenure security which contribute to better land management. In contrast to this, both fallowing practices and crop rotations do not show significant relation with land certification related with tenure security increases LMPs.This was because;crop rotation has no relation with land certification and farmers are doing it from long period of time for better production. With respect to fallowing practices, it was not land certificates but tenure insecurity related with land shortage greatly influences. This implies that farmers who holding larger land size have better opportunity to practices fallowing than those who holding smaller lands. Similarly, significant relationship was not found between crop rotation ($\chi 2$=1.349; p=0.509) and fallowing practices($\chi 2$=2.301; p=0.260).Study by Belay (2010) and Deininger*et al*. (2008) stated that land certification program in Ethiopia plays positive role on tenure security. Tsegaye*et al*.(2012) found land certification program improves tenure security. Study by Holden and Otsuka (2014) shows tenure security increases land investment and enhances agricultural productivity. Study by Gebremedhin and Swinton (2003) in northern Tigray of Ethiopia found tenure security is associated with long-term LMPs. Other studies suggested land certification program in Ethiopia induced improvedLMPs (Deininger*et al*.,2011; Holden *et al*.,2009). The majority of FGD in Berkuncho and Dabiyago replied that:

"We are not sure about what will happen in the future, we will never be completely secure of land because of land certificates. Certificate is not a "Bible" it can be changed anytime if there is change in Government.''

4.2.2. Provisions ofcompensation and LMPs

Before land certification programe, farmers have feared the government will take the land without compensation for any infrastructural purposes. After land certification, they believed that compensation will be provided for the land they may lose at any time. As indicated (Table 8) more than 63% of farmers were not fully confident that certification increases thelevel of confidence to get compensation.The reason behind was they were not got enough and comparable compensation for the land they lost. Still these farmers fear their land will be

taken again for any governmental purposes without compensation. This implies that although certificates are expected to encourage compensation,it don't provide enough and comparable compensation for the land they lost.This reduces farmers' interest towards LMPs.Similar result from chi-square ($\chi 2$) analysisshowsthere was no significant relationshipbetween crop rotation ($\chi 2$=0.446;p=0.504), tree plantation (χ=0.076;p=0.783),fallowing practices (χ=0.001; p=0.973) and soil bund construction($\chi 2$=2.425;p=0.119)with farmers' response of land certificatesencourage compensation.This implies that although land certificates are used as proof of land ownership, it does not provide available compensation particularly for long-term land management practices.Thus,majority of the farmers were not fully confident that land certificates provide adequate compensation in terms of soil fertility.

Similarly, FGD from Kenkicho replied as:

"Land certification couldn't enhance our land tenure security. Even we expect appropriate compensation when our land was taken and used for different developmental projects such as road, school and health centers construction, we don't receive enough and comparable compensation for the land we lost. We also fear our land will be taken again at any time for similar purposes without compensation."

In contrast to this, about 36.5% of farmers were responded landcertificates encourage andprovide compensation. With respect to this, a significant and positive relationship was found between organic manure application ($\chi 2$=17.593; p=0.001) and chemical fertilizers ($\chi 2$=7.119; p=0.08)with farmers' perceptions of land certificatesencourage compensation.

4.2.3. Gender equality and LMPs

One of the fundamental of land certification program in Ethiopia was women empowerment and promotes gender equality by issuing certificates with joint land ownership. This increase female's participation towards farming activities. More than 87% of farmers responded that females are more willing to work in farm fields and equally promoted with males after land certification (Table 8). This implies certificationprograme increases females' land ownership and their participation towards land investments. Surprisingly, all the female households in study area perceived that as their names mentioned on the certificates, they believed that they have equal land right with male and get equal land share in case of divorce. This increases

their willingness to work in farm fields than beforecertification period.Similar result was indicated from $\chi 2$ analysis and showsa significant and positive relationshipbetweenall LMPs and farmers' response of land certification promotes gender equality and increase female involvement in LMPs.

In the same way, the chi-square analysis shows a significant and positiverelationshipbetweentreeplantations ($\chi 2$=25.752;p=0.001),soilbundconstructions ($\chi 2$=83.368;p=0.001),fallowingpractices ($\chi 2$=8.915;p=0.003),organic manureapplications ($\chi 2$=59.924;p=0.041),applicationof chemical fertilizers($\chi 2$=36.059;p=0.001)andcrop rotations($\chi 2$=19.161;p=0.031)with landcertification promote gender equality and increase female participation towards LMPs. This implies land certification increases female motivation towards land investments.Similar finding by Deininger*et al*.(2011) shows land certification program promotes gender equity and motivate females to farming activities. Study by Holden *et al.* (2011) in Tigray region of Ethiopia show certification program enhanced female participation towards land management. Similarly, Galiani and Schargrodsky(2011) shows clear land rights increases productivity and farm earnings for females. The same finding was found by Holden and Tefera (2008) that land certification help women to have equal land rights and increase their participation on farming practices.During the interview, a woman at the age of 53 years old from Berkuncho replied as:

"Land certificate is important to have confidence on my landholding rights; I always give my land as contract for a fixed period of time. For last years, one farmer cultivates my land with three years agreement. Similarly, he told me he will pay the same amount of money for my land for this year. But, I refused the agreement due to its cheapness. But the farmer didn't want to accept my idea. At that time, I go to the Woreda land administration office. Finally, I made a new agreement for the coming two years with another farmer with a better payment. I made this agreement by using my land certificate. Thus, land certificate increases my land ownership and promotes gender equality."

4.2.4. Border conflicts reduction and LMPs

Land is the primary means of production and the main asset that farmers have to accumulate wealth and importantly transfer to future generations. Because of this; land-related issues

usually generate emotional reactions within and between farmers. Such kinds of conflicts are common in farm plots border before land certification. Similarly, more than 82% of farmers responded andquite confident that land certification reduce border conflicts and others land related issues among farmers by providing well-devised boundary (Table 8). This increases farmers' interest towards land investments. Similarly, significant and positive relationship was found between tree plantations($\chi2=4.908;p=0.027$),crop rotations($\chi2=11.778,p=0.082$),fallowing practices($\chi2=12.661;p=0.001$),soil bund construction($\chi2=6.552;p=0.011$),compost and organic manures($\chi2=19.615;p=0.001$) and chemical fertilizer ($\chi2=14.992;p=0.001$)withland certification reduces border conflicts among farmers. Similar study by Giri (2010) in Tigray region of Ethiopia shows land certificates reduce border conflicts with good border demarcation and plot size measurement.Study by Deininger and Ghebru (2011) show land certification reduces border conflicts and increases land property right. Reductionin border conflict can improve good governance and allows better functioning of land that enhances land productivity (Deininger*et al*., 2008). As toHolden *et al*.(2011)land certificates allow better governance between land holders which contribute to successful land use. Studies by Holden and Tefera(2008) and Giri (2010)in Ethiopia show land certification reduce conflicts arising from border and inheritance disputes that increasefarmers' interest towards better land use.Thus, land certificates used as proof of holdings and provide define boundary which increases farmers' implementation of various LMPs.

4.2.5. Land certificates as collateral and LMPs

Tenure insecurity increases farmers' uncertainty to get benefits from the land. This implies that land certification plays positive role in improving tenure security and encourages farmers towards better land management. With respect to application ofchemical fertilizers,they have been commonly used before and after land certification in study area. More than 95% of farmers responded that land certificates usedas collateral to get farm inputs (Table 8). This increases tenure security and have positive impact on agricultural outputs and agricultural investments. Similarly,the $\chi2$ analysis result show a significant and positive relation between application of chemical fertilizers ($\chi2=27.583;p=0.031$) andland certificates used as collateral to get farm inputs. Study conducted by Deininger*et al*. (2008) and Holden *et al*. (2009) found

land certification increase agricultural investments. Ghebru and Holden (2008; 2015) studies found farmers withcertifiedlands are more productive than those of not certified.This higher productivity was attributed to the use of better farm inputs using land certificates.According to Deininger(2003) finding use of land certificates as collateral to get farm inputs is one of the benefits of land certificates.

Table 8: Relationship between land certification andland management practices

Land certification	Responses (%)		LMPs	(χ2)
	Yes	No	Tree plantation	13.754*
Increases land tenure security	92.4	7.6	Crop rotation	1.349
			Fallowing practices	2.301
			Soil bund construction	15.585**
			Organic fertilizers	54.724**
			Chemical fertilizers	27.312***
Encourage compensation	Yes	No	Tree plantation	0.076
	36.5	63.5	Crop rotation	0.446
			Fallowing practices	0.001
			Soil bund construction	2.425
			Organic fertilizers	17.593***
			Chemical fertilizers	7.119*
Provide gender equality	Yes	No	Fallowing practices	8.915***
	87.5	12.5	Soil bund construction	83.368***
			Organic fertilizers	59.924**
			Chemical fertilizers	36.059***
			Tree plantation	25.752***
			Crop rotations	19.161**
Reduces land border conflicts	Yes	No	Soil bund construction	6.552**
	82.6	17.4	Organic fertilizers	19.615***
			Chemical fertilizers	14.992***
			Tree plantation	4.908**
			Crop rotation	11.778*
			Fallowing practices	12.661***
Used as collateral to get farm inputs	Yes	No	Chemical fertilizers	27.583**
	95.3	4.7		

***Significant at p<0.01, **p<0.05 and *p<0.1

4.3.Relationship betweenlandholding size and land management practices

As a source of asset and finite natural resource for human beings, landholding system in study area is not simply an economic issue; but it is very much intertwined with people's culture and

personality. Regarding landholdings, in the majority of highlands small holder farmers live on mini-plot of farmland (MOFED, 2010). Likewise, about 89% of farmers cultivate insufficient farmlands (<1.84ha); more than 54% farmers owned less than one hectare (between 0.22-0.75 ha) while 34.8% owned (>0.76 ha and <1.83 ha). The minimum and maximum landholding sizes were 0.22ha and 3.75ha respectively with average of 0.96ha.On the other hand, about 11% of farmers owned (between 1.84-3.75ha) of land (Figure 4). These farmers have better opportunity to allocate lands for various land management practices than those who owned small landholdings. The existing differences in landholdings and land management practices combined with lack of better land use among farmers living in the same locality and contribute to poor land management. Thus, majority of the farmers are challenged to diversify crops and allocate lands for different LMPs and they are forced to practice short-term LMPs rather than using long-term land investments.

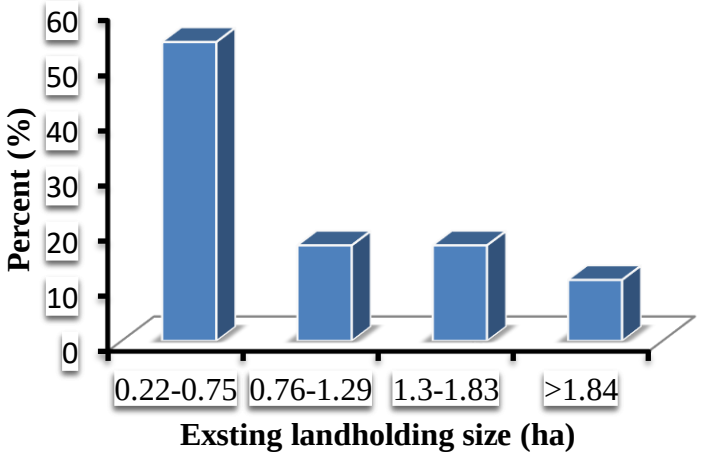

Fig4: Landholding size (ha) in the study area

As shown from $\chi 2$ analysis result, the null hypothesis was rejected for all land management practices except crop rotation. Particularly, a significant and negative relationship was found between application of compost and organic manures ($p<0.01$) and landholdings while tree plantation and soil bund construction($p<0.01$) and inorganic fertilizers and fallowing practices ($p<0.05$)show significant and positive relationship with landholding size. Farmers who have larger farms are likely to use LMPs than those who have lesser farm lands. This shows that as landholdings of the farmer increases the probability of him/her to exercise LMPs increases.

This implies holding size influences implementation of one or more types of LMPs(Table 9).Tree plantation is expected to be influenced by individual's land size. As indicated from the result, more than 86% of farmers were not entirely involved in tree plantation due to having small landholdings. Thistenure insecurity related with landholdingssignificantly influence long-term LMPs such as tree plantation. As it was shown from chi-square analysis,land shortage was one of the main constraintfor majority of farmers and significantly and positively influences tree plantation ($\chi2$=73.431; p=0.001). Thus, landholding sizes determine implementation of land management practices in study area.

Although more than 88% of farmers practiced crop rotation, it does not shows significant relationship with landholding size. This implies farmer practiced crop rotation on piece of land they have to maintain soil fertility and get better production. As ($\chi2$) analysisindicates, there was no statistically significant relationship between landholding size and crop rotation ($\chi2$=2.763;p=0.430). Thus, landholding sizes do not greatly determinecrop rotation. Unlike to crop rotation, more than 63% of farmers' landholdings largely influence fallowing practices. Farmers with larger landholdings better involved in fallowing practices. This means farmers' involvement in fallowing practices increases with increase inland sizes. Similar result from chi-square analysis shows significant and positive relationship between landholdings and fallowing ($\chi2$=113.044; p=0.021). Similar result by Negatu (2006) shows land size influences fallowing cycles and decline soil fertility. Study by Gonzalez *et al*. (2007) and Demetriou*et al*. (2013) revealed land sizes influence sustainable use of land. Thus, landholding size significantly influences farmers' involvement towards fallowing practices.

Landholdingsizes negativelyinfluences application of compost and organic manures. This implies, farmers cultivating smallerholdingsbetter involved in compost and organic manure application than thosewho cultivates larger holdings. This implies that farmers' involvementinorganic and manure application increases with decrease in landholding size. Likewise, significant and negative relationship wasfound between organic fertilizersapplications and landholdings ($\chi2$=-13.737; p=0.003). Thus, farmers who owned larger landholdings were less involved in organic manureapplication thanfarmers those who owned smaller land sizes.

Despite the land certificates used as collateral to get farm inputs, about 56% of farmers' landholdingsize influences quantity of chemical fertilizers to be applied. Farmers who have larger farms are likely to apply chemical fertilizers than those who have lesser farm lands. This is because; farmers can use land certificates as collateral to get inorganic fertilizers but due to having small landholding sizes they are limitedto use few fertilizers. This implies that farmers withlarger farmlandshave better opportunities to use chemical fertilizerthan those owned smaller holdings. Thus, the same significant and positive relationship has been found between land size and use of chemical fertilizers ($\chi 2=59.389;p=0.041$). Similarly, Demeke *et al. (*1998) found the quantity of fertilizers to be used influenced by land size. Studies by Dyer (2014); Nkonya*et al.*(2008); Chand *et al*.(2011) and Dev (2012) revealed farmers owned larger landsapplied more farm inputs than those owned larger holdings.

With respect to soil bund construction, although it is considered as land investments practices, because of small landholding sizes about 74% of farmers were not entirely participated. Farmers who have larger farms are likely to use soil bund construction and vice versa. This shows that as landholdings increases construction of soil bund also increases. Likewise, the result from chi-square analysis shows, significant and positive relationship between landholdings sizeand soil bund construction ($\chi 2=60.526;p=0.001$). Study conducted by Nkonya*et al. (*2008) show farmers with larger holding sizes more invest on long-term land management. Deininger*et al*. *(*2008) found uneven land distribution among farmers highly determined land management practices.

Table 9: Relationship between landholding size and land management practices

Land management practices	Responses (%)	Landholding Size(ha)				($\chi 2$)
		0.22-0.75	0.76-1.29	1.3-1.83	>1.84	
Tree plantation	Yes	54	17.4	11.8	3	
	No	0	0	5.5	8.3	73.431***
Crop rotation	Yes	5	2.1	3.5	1	
	No	43.3	25.4	14.3	5.4	2.763
Fallowing practices	Yes	54	8.3	1	0	
	No	0	9	16.7	11	113.044**
Organic manures	Yes	34.57	9	11	6	
	No	20.1	8.33	6	5	-13.737***
Chemical fertilizers	Yes	32	9	7	8	
	No	22	8	11	3	59.389**

Soil bund construction	Yes	53.5	11	5.5	4	
	No	1	6	12	7	60.526***

***Significant at p<0.01 and ** p<0.05

4.4. Determinants of land management practices

Econometrics analysis was carried out to identify factors influencing LMPs. The binary logistic regression model was used to address the third objective of the study. That is to identify the factors that affect land management practices in study area. As indicated from the logistic regression result, the likelihood ratio test statistic exceeds the chi-square value with 12 degrees of freedom. Another measure of goodness of fit used in logistic analysis is the Count-R^2, which indicates the number of sample observations correctly predicted in the model. Count-R^2 is based on the principle that if the estimated probability of the event is less than 0.5, the event will not occur and if it is greater than 0.5 the event will occur (Malla, 1989). Out of sixteen hypothesized explanatory variables influencingLMPs, eight were found to be statistically significant. Level of education, land certification and landholding size($p<0.05$), extension contact, farmland slope, farmers' perception of land degradation and farming experiences($p<0.1$) are significantly and positively influencesLMPs while farmland distance affects negatively($p<0.05$).On the other hand, the coefficients of eight explanatory variables such as sex, family size, age, training,field days preparation,off-farm activities,market distancesand land fragmentation were less powerful in influencing LMPs.All the eight significant variables are discussed and shown in (Table 10) below.

Education level: education enhances capacity of individuals to obtain and utilize information disseminated from different sources. This implies literate farmers are in a better position to get new information and contributes in implementation of LMPs. As hypothesized, education level of farmer was found to be significant ($p<0.05$). This may be explained by the fact that farmers who were more educated are likely to use introduced land management practices than non-educated in study area. This is because; educated farmers have better understanding on land degradation problem and easily come to decision to take part in conservation practices. This is attributable to education reflects acquired knowledge of the environment and tends to spend more time and money on land management (Bekele and Holden, 1998; Tegegne, 1999;

Paulos*et al*.,2004). The marginal effect value for education shows that keeping all factors constant increase in education by one year increases the probability of LMPs use by 11.7%.

Contact with extension agents: extension contact is found to have a significant andpositive influence on farmers' participation of LMPs ($p<0.1$). This may be explained by the fact that information/message that farmer gain from extension agents initiate to use newly introduced land management practices to reduce soil erosion and improve its fertility. Therefore, contact between a farmer and development agent with the new information gained increase farmers' attitude towards better use of LMPs. As indicated from different studies the failure and low implementation of water harvesting structures was due to lack of extension services (Mitiku and Sorsa, 2002;Ngigiand Stephen,2003). The marginal effect value for extension services shows that keeping all factors constant an increase in extension contact by one year increases the probability of land management practices use by 11.2%.

Farmland distance: farmland distance is found to have negative influence on LMPs ($p<0.05$) probability level. This seems acceptable particularly in land management practices as a farmer is nearer to farmstead. Thus, farmland distance significantly and negatively influences use of land management practices. This implies that the more the farmer residence is far from the farmland the more he/she do not participate on LMPs and vice versa. This is because; farmers who are closer to farmstead spent more time on land and exercise different conservation measures and maintain soil fertility. In the same way Jabessa (2008) reported that resident distance negatively influences agricultural management practices. Similarly, Pender *et al*. (2006) found application of manure and compost are substantially more common closer to the residence due to difficulty in transporting over a long distance. Therefore, farmland distance from the homestead negatively affects farmers' use of one or more types of land management practicesby limiting time and cost of farm inputs mobility. The marginal effect value for farmland distance shows that keeping all factors constant reduction of farmland distance in one km increases the probability of LMPs use by 14.6%.

Landholding size: As hypothesized, landholding size of a farmer was found to be significant ($p<0.05$). This implies LMPs require relativity larger landholding size to implement different structures and farmers who have larger farms are likely to use LMPs than those farmers who have lesser farm lands. This shows that as farmland holding size of the farmer increases use of LMPs also increases. Study by Chand *et al*.(2011) and Dev (2012) showed a positive and

significant relationship between farmland size and farmers' owned larger lands practiced more LMPs than those owned larger holdings. The marginal effect value for farm size shows that keeping all factors constant an increase in farmland size by one hectare increases the probability of LMP use by 38.2%.

Farming experiences: it was found to be positively significant ($p<0.1$). This implies that the number of years a farmer has spent farming influences use of land management technologies positively. Therefore, farmers who were more experienced are likely to use land management practices than less experienced farmers. This may be because experienced farmers have better perception on land degradation problem and could easily decide to use conservation practices. Fitsum and Holden (2003) reported that experienced farmers in farming are likely to manage lands in better way than less experienced farmers. Thus, farming experience positively and significantly affects LMPs.The marginal effect value for farming experiences shows keeping all factors constant an increase in farming experiences by one year increases the probability of LMPs use by 18.3%.

Land certification: This variable was found to significantly and positively influences LMPs ($p<0.05$). Farmer's feeling about the land belongs to him/her will have a positive effect on his/her decision to implement LMPs. Lack of land property right is one of the factor affecting LMP because lack of land tenure means that people are unwilling to invest in LMPson a land which they do not formally own. For farmers to be able to carry out LMPs, they require land tenure security. This is because to implement land management practices first there should be feeling of ownership so that farmer can take care of his/her land. The marginal effect for this variable shows that keeping all factors constant tenure security related with land certification increases the probability of LMPs use by 43.6%.

Farmland slope: Slope is found to have positive influence on LMPs ($p<0.1$). This is because slope indicates soil loss from the land. This implies that use of land management technology is positively influenced by slope. Thus, farmers cultivating sloping fields perceived the threat of soil loss more than farmers who cultivate flat fields. This implies that farmers cultivating vulnerable farmlands are more likely to use land management practices than those cultivating less vulnerable lands. Prior research studies by Girmay*et al*. (2008); Taye (2006) found slope has significant influence on types and intensity of land management technologies. Therefore, farmland slope was positively influenced farmers' use of LMPs.The marginal effect value for

farmland slope shows keeping all factors constant indication of soil loss due to slopincreases the probability of LMPs use by 33.4%.

Farmers' perception on land degradation: this factor influences use of land management practices positively ($p<0.1$). This implies that farmers who have perceived land degradation as a serious problem were willing to participate in conservation strategies. Farmers who have better perception on land degradation can develop good initiations towards land management practices. Similar results were found by (Tesfaye, 2003 and Paulos*et al.*, 2004). The marginal effect value shows keeping all factors constant having good perception on land management technology increases the probability of its use by 33.2%.

Table 10: Determinants of land management practices

Variables	Coef.	Std. Err.	Z	P>z	Marginal effect
Age of the HHs	0.135	3.422	0.120	0.974	0.012
Sex of the HHs	0.103	1.203	1.030	0.291	0.213
Family size	0.766	0.932	2.130	0.160	0.143
Education level	1.563**	0.911	2.350	0.021	0.117
Farming experience	4.342*	2.233	1.210	0.072	0.183
Farmland distance	-2.531**	1.022	2.110	0.034	0.146
Slope of the farmland	6.014*	2.133	2.130	0.075	0.334
Extension contact	2.153*	0.430	1.320	0.082	0.112
Farmers' perception	5.114*	3.306	1.220	0.066	0.332
Field days preparation	0.853	0.327	2.140	0.234	0.011
Market distances	2.203	0.571	1.320	0.202	0.100
Off-farm activities	3.642	3.844	1.110	0.614	0.231
Land certification	4.531**	3.655	1.130	0.034	0.436
Land fragmentation	-1.341	2.229	-0.240	0.703	-0.046
Landholding size	5.320**	1.801	2.310	0.026	0.382
Training on LMPs	0.452	1.113	1.210	0.654	0.015
Constant	-21.433	13.512	-2.180	0.213	

Logistic regression	Number of obs	=144
	LR chi2 (12)	= 232.3
	Prob> chi2	=0.00
Log likelihood=-9.05	Pseudo-R^2	=0.89

*Significant at $p<0.1$ and ** $p<0.05$

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Land tenure insecurity is one of the bottlenecks in natural resource management in general and land management practices in particular. One of the major factors related to land degradation and unsustainable land management practices is land tenure insecurity among farmers. Thus, this study presented important information and findings assessing the effect of land certification and landholding size on sustainableland management. Tenure insecurity restricts land rights and reduces farmers' land investments. Majority of the farmersresponded the importance of land certification in providing land tenure security and have felt confident as a proof of land ownership after land certification. Likewise, land tenure security related with landcertification increases farmers' incentive towards land management and farmers engaged in one or more types of land management practices. Further, the result showed that provision of incomparable and not enough compensation created sense of tenure insecurity among the farmers and greatly influences land management practices in study area.

Although most of the farmers were fully confident aboutthe importance of land certification andits contribution to better land management practices, individuals' land sizes significantly influences such confident and determined implementation of appropriateLMPs in study area. Nowadays, due to population pressure, landholding size had been diminishing and there was no extra uncultivated land. As a result, land means the whole thing that farmers necessarily experienced in their life in study area. As indicated from the result, variation in landholding sizes results significant differences in practical implementation of land management practices. Similarly, positive and significant relationship has been found between landholding size and land management practices. Therefore, it can be concluded that smaller size of cultivated land

is one of the major limiting factors of LMPs in study area.Others factors such as demographic and social characteristics of the farmers, institutional factors and physical land characteristics are some of the determinants of farmers' perception, understanding and knowledge towards SLM. Generally, this study confirms complexity of LMPsmaking it difficult to draw clear conclusions about the impact of land certification and land sizes on sustainable land uses.

5.2. Recommendations

The following recommendations were forwarded based on the findings of this study:

a) The government should expand land certification program to all farmers in study area to increase farmers' incentive towards land management.

b) The government should expand land certification to all farmers to increase land tenure security among the farmers and develop cadastral mapping system to update land registration records in study area.

c) The government should give necessary, enough and comparable compensation tothefarmers those lost their land.

d) Awareness creation witheffective, knowledge and skill based extension services should be provided to farmers how to manage the existing land by using improved crop varieties, organic fertilizers and others agricultural intensifications.

e) The rural development strategy of the government should give attention in promoting off-farm income sources so that the existing land is at least maintained and decrease land pressure.

f) Both governmental and non-governmental organizations played considerable role in providing necessary support in the form of material, training and technical to increase farmers' judgment to undertake LMPs for sustainable land use.

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7. APPENDICES

JIMMA UNIVERSITY

COLLEGE OF AGRICULTURE AND VETERINARY MEDICINE SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF NATURAL RESOURCE MANAGEMENT

Dear respondents,

I am conducting a research on Determinants of Sustainable Land Management: focusing on Land Certification and Landholding Size: The case of DunaWoreda, Hadiya Zone, SNNPR, Ethiopia. Your genuine responses to the following questions and actual cooperation are very crucial to attain the real situations regarding my study objectives. Therefore, I kindly ask you to share your available information and practical experiences in your area.

a) <u>Questionnaire Designed for Selected Households</u>

(1) <u>General Household Characteristics</u>

Kebele _____Village/Gote _____Date of interview_____

1. Sex: (1) Male (2) Female
2. Age of the HHs_____
3. Total family members: (1) 1-4 (2) 5-7 (3) more than 7
4. Religion: (1) Muslims (2) Orthodox Christian (3) Protestants (4) Catholic
5. Marital status: (1) Married (2) Single (3) Divorced
6. Education level: (1) Illiterates (2) Read and Write (1-4)

   (3) Elementary School (5-8) (4) High School (9 - 12)

(2)<u>Questionnaires Related to Rural Land Certification Program</u>

7. Is your land registered? (1) Yes (2) No
8. Did you received land certificate? (1) Yes (2) No

9. What level of land certificate do you have? (1) Primary level (2) Secondary level

10. If you say yes for Q8,when did you received your land certificate?_____G.C

11. How the certificate was issued? (1) By the name of husband only (2) By the name of wife only (3) Jointly by the names of husband & wife

12. Do you think certification program increases land tenure security? (1) Yes (2) No

13. Did you makeLMPs as a result of land certification? (1) Yes (2) No

14. Contribution of land certification(Mark with √)

Land certification program	(Yes) %	(No) %
Increases land tenure security		
Reduces bounder conflicts		
Contribute to better land management		
Promotes gender equality		
Used as collateral to get farm inputs		
Provide compensation if the land is taken away for governmental purposes		

15. What types of land management practices you made after certification? (Mark with √)

Land management practices	Before certification		After certification	
	Yes	No	Yes	No
Application of compost & manure				
Tree plantation				
Soil bund construction				
Application of chemical fertilizers				
Crop rotation				
Fallowing practices				

16. Do you think that you will make suchLMPs after certification because of securing of your land right? (1) Yes (2) No

17. Do you have any reasons that you may dissatisfy on current land tenure system which contribute to poor land management? (Mark with √)

Farmers reasons to dissatisfy on current land tenure system	Yes	No
Fear of losing land without enough compensation		
Could not solve land shortage		
Injustice in land distribution		

(3) <u>Questionnaires Related toLand and Landholding Characteristics</u>

18. Do you have your own land? (1) Yes (2) No

19. If you say yes for Q18, how many hectares of land do you have? (Mark with √)

Landholding size(ha)			
0.25-0.75 (1)	0.76-1.26 (2)	1.27-1.77 (3)	more than1.78 (4)

20. How do you see your current land holdings? (1) insufficient (2) sufficient

21. Is the agricultural land is becoming scarce?(1) Yes (2) No

22. If you say yes for Q21, what could be the fundamental reason behind?

(1) Population pressure (2) expansion of forest land (3) land is taken by governmental and NGOs for different developmental purposes

23. How long have been experienced in farming activity? _____ (year)

24. What is the distance of your cultivation field from your homestead?(km)

(1) Between 0.5-1km (2)between 1-1.5km(3) between 1.5-2km (4)more than 2km

25. How do you perceive the distance of cultivation field from your home?

(1) Near (2) medium(3) far (4) very far

26. How do you describe the slope of your land? (1) flat (2) moderate(3)steep

27. How do you describe the degree of soil erosion in your farmland?

(1) Severe (2) moderate (3) minor (4) no erosion risk

28. Do you practice land management structures in your farmland? (1) Yes (2) No

29. If yes for Q28, do you think land size influencessuchstructures? (1)Yes (2)No

30. Have you ever been advised by agricultural extension experts? (1) Yes (2) No

31. If you say yes for Q30, on average how often the extension agent visits you?

(1) weekly (2) monthly (3) quarterly (4) yearly

32. Do you operate fragmented/scattered piece of land?(1) Yes (2) No

33. If you say yes for Q32, how many lands you are operating? _____

34. Have you received agricultural training in the last two year? (1) Yes (2) No

35. If you say yes for Q34, in how many trainingsyou participated in a year? _____

36. Have you participated in any agricultural field days? (1) Yes (2) No

37. If yes, in how many field days you have been participated in a year? _____

38. What types of land management practices your land size influences? (Mark with √)

Land management practices	Yes(1)	No(2)
Application of compost and manure (organic fertilizers)		
Tree plantation		
Soil bund construction		
Application of chemical fertilizers(DAP and UREA)		
Crop rotation		
Fallowing practices		

b) <u>Questionnaires Designed for Key informants</u>

Position_____Date of interview_____Signature_____

1) When the land certification program was started in DunaWoreda? _____G.C.
2) Which levels of land certification did the farmers received? (1) Primary (2) Secondary
3) How many households received land certificates and how many of them did not receive?

   3.1.Received male households _____female households_____total_____

   3.2.Not received male households _____female households_____total_____

4) How do you think land certification program in relation with land tenure security?
5) How do you think land rights are secured as a result of land certification?
6) How land certifications promote farmers' towards sustainableland management?
7) How farmers perceived current land tenure system?
8) Did farmers made observable land improvements due to certificate? (1) Yes (2) No
9) How do you relate land management practices before & after land certification?
10) How do you explain farmers' attitude towards SLM practices after certification?
11) How do you relate land certification with farmers' confidence to get compensation?
12) Do you think farmers owned enough farmland to produce enough food crops?
13) How farmers perceived land tenure security with current landholding size?
14) How do you relate current landholding size with sustainable land management?

c) Questionnaires Designed for Focus Group Discussants

1) How do you find land certification program in securing land tenure?
2) Howdoeslandcertificationincreases sustainable and management?
3) How do you feel about land tenure security before and after land certification?
4) Did you observed any difference in land management practices before and after land certification program?
5) Do you think land tenure security increases farmers' participation on SWC practices?
6) How do you relate landholding size with sustainable land management practices?
7) How farmers' perceived landholding size in relation with land management practices?
8) What you suggest on current tenure system in relation to land management practices?
9) How do you describe farmland distances from the homestead in relation with SLM?
10) How do you describe farmland slope and degree of soil erosion in relation with SLM?