COMMUNITIES' CONSIDERATION UNDERLYING VALUATION OF AGRICULTURAL LAND: A CASE STUDY OF LUSHOTO DISTRICT, TANZANIA

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN LAND USE PLANNING AND MANAGEMENT OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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ABSTRACT

A study was conducted in Lushoto, District, Tanzania to identify farmers' perceived agricultural land value determinants to establish determinants for agricultural land valuation across different land use types. Remote sensing and GIS techniques were used to identify dominant agricultural land uses for screening the agricultural land value determinants across the land uses. Household survey, key informant interview, and focus group discussions were used to explore farmers' criteria. Content analysis was used to transform verbal information into numerical data to examine the agricultural land value determinants. Relative Importance Index was used to determine the relative agricultural land value with respect to land uses, agricultural land value determinants, and land types. Binary logistic regression was used to establish relationships between farmers' perceived agricultural land value and determinants. Dominant identified agricultural land uses were: agroforestry (41% – 60%), crop cultivation (13% – 43%), woodlots (2% – 8%) on the hills and sloping lands, vegetable cultivation (8% – 12%) in the valley bottoms and, open spaces and settlements (1% – 9%) on the lower slopes. Land under vegetable cultivation was highly valued with Relative Importance Index (RII = 0.76), followed by agroforestry (RII = 0.64), woodlot (RII = 0.6), crop cultivation (RII = 0.59), and Open spaces and settlements (RII = 0.38). Valley bottoms were the most valued lands (RII of 0.853) when compared to other lands. Farmers' identified physical and social-cultural determinants for valuation of agricultural land were: topography, soil fertility, nearness to water, nearness to road, aesthetic, heritage, and management practice(s). Farmers' perceived determinants that were significantly higher ($p < 0.05$) across the land uses were nearness to water, nearness to road, soil fertility, aesthetic, heritage, and management practices. Agricultural land valuation involving farmers is a new paradigm shift in the land valuation process, hence further studies are recommended in diverse agro-ecosystems landscapes.

DECLARATION

I, WERENFRID MICHAEL do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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LIST OF ABBREVIATIONS AND SYMBOLS

ADRPTD	Arizona Department of Revenue Property Tax Division
CA	Content Analysis
DAICO	District Agriculture Irrigation and Cooperative Officer
df	degrees of freedom
FAO	Food and Agriculture Organization of the United Nations
FGD	Focussed Group Discussion
GIS	Geographic Information System
iAGRI	Innovative Agricultural Research Initiative
IVSC	International Valuation Standards Council
LSD	Least Significant Difference
LUP	Land Use Planning
MNR	Magamba Nature Reserve
NGO	Non Governmental Organization
p	Probability
PRA	Participatory Rural Appraisal
RII	Relative importance index
SEKOMU	Sebastian Kolowa Memorial University
SHEIRUDE	Sharing Environmental Information to stimulate creativity for Rural Development
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TEGoVA	The European Group of Valuers' Associations
URT	United Republic of Tanzania

USAID	United States Agency for International Development
USD	United States Dollar
VEO	Village Executive Officer
WUMs	West Usambara Mountains

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Land is an unexpanded resource primarily for production, mineral storage and provision of space for settlements, industries, and other social activities. The land that is under crop and livestock production is termed as agricultural land. Agricultural land is found more in rural areas where most of the population depends on it for different agricultural uses to sustain their livelihood. Due to population increase there has always been a demand for more land, and one of the impacts is conversion of arable land which is suitable for agriculture to other uses perceived to be of more economic potential. This shift however contributes to food insecurity (Plantinga *et al.*, 2002). According to Cotula *et al.* (2009), there is more pressure on highly valued arable land which is suitable for investment, and most of it is occupied by local people.

In recent years, there has been large scale land acquisitions, which sometimes suppress local people and upgrade to land grabbing taking place at a very high rate in African countries including Tanzania, and other developing countries outside Africa (Cotula *et al.*, 2009; Deininger *et al.*, 2011; German *et al*., 2011; Oakland Institute, 2011; Oxfam, 2012).

Also, increased urbanization or expansion of urban areas, industries, and commerce on one hand have put pressure on valuable agricultural land (Barnard *et al.*, 1997; URT, 1997b; Njungbwen and Njungbwen, 2011; Nishihara, 2012; Mishra and Moss, 2013). All these challenges may have negative effects such as displacement of small scale farmers while leaving them with limited benefits (Deininger, 2011; FAO, 2013).

Some of the negative benefits include unfair compensation during expropriation leading to conflicts as an indication of competition for arable land (URT, 1997b). With regard to highlighted challenges it is important to recognise that agricultural land has value (URT, 2007). This is not only for fair compensation, but also for easier identification of policies that prevent socially undesirable land use changes especially from agricultural land to other uses (Nishihara, 2012).

Valuation of agricultural land or farmland has been taking place for different purposes (FAO, 2009; IVSC, 2011). Studies conducted in developed countries including the United States of America (USA), European countries, and South Africa indicate that three approaches based on market value have been used in valuation of agricultural land (Haugen and Aakre, 2002; ADRPTD, 2012; Wessels and Willemse, 2013). These approaches include the income analysis, sales comparison and cost of replacement. In Tanzania the basis for assessment of the value of any land is the market value which is computed using either sales comparison, income analysis and or cost of replacement approaches or methods (URT, 2001). All these approaches are comprised of criteria that are used during land valuation process.

Under the income analysis approach the productivity and benefits generated by the agricultural land are the major criteria. In rural areas income is mainly obtained from land productivity (FAO, 2003). Agricultural land productivity and earnings are determined by physical properties including soils types, fertility and depth (FAO, 2003). Despite the good land qualities, earnings are low in rural areas in developing countries like Tanzania due to limited farm inputs. According to Wessels and Willemse (2013) valuation of land based primarily on the production value and commercial return is creating problems in rural areas. The situation is different for developed countries where inputs to agriculture

are not a problem. For example Nickerson *et al.* (2012) noted that farmland values in USA were supported by farm earnings in 2009 and 2010.

Size, location near to (urban areas or town centres), land features, and assets on the land are the criteria under sales comparison approach which are used to compare the subject land and comparables (German *et al.*, 2000). Important conditions with this approach are having current, adequate and arms-length transactions (FAO, 2009; IVSC, 2011; TEGoVA, 2012). According to Wyatt (1997) and Awasthi (2014) these conditions are difficult to attain in rural land markets since there is no active market and sometimes people are understating the value to have a reduced tax. Moreover people are selling land unwillingly to solve family problems and this gives buyer power to dominate the price decision.

Cost of replacement approach is only applicable when there is high improvements on the land (IVSC, 2011; TEGoVA, 2012). This is not the case for most of the rural lands in Tanzania which makes it difficult for the approach to be applicable. According to Sulle and Nelson (2009), the market value conditions are rarely met in rural areas. This makes the value computed by the use of the approaches, and their criteria doubtful. In addition Awasthi (2014) commended that, the traditional land valuation methods are not capturing the non use value; as a result the partial value is computed leading to undervaluation. The author asserted further that, under an imperfect market where there is no levelled playing field and market is tilted in favour of the buyer, the market fails to capture owner's perception value of agricultural land determined by owners' criteria. This creates a huge gap in agricultural land value as perceived by landowners who mostly are farmers and value of the land as recognized by the government (Awasthi, 2014). According to FAO (2009), lack of balance of power between the acquiring agency and the land owners can

lead to unfair compensation. One of the ways to achieve balance is when owners' (farmers') determinants are also identified and integrated in valuation process. Therefore more criteria/determinants are to be explored from farmers in order to enrich the valuation procedures.

According to Awasthi (2014) agricultural land assumes different values for different owners, so investigation of landowner's perception on the value of farmland and identifying factors which influence perception on value of farmland would provide useful insights to policy planners while fixing the appropriate value of land. Therefore the use of only the criteria under the adapted methods during agricultural land valuation is not relevant when considering the situation in rural areas of Tanzania. This is because, communities' criteria which are vital and may be integrated or used together with the market based methods for improving agricultural land valuation have not been explored in detail (Wessels and Willemse, 2013). Proper valuation of agricultural land ensures reduced conflicts, but this is hampered by inadequate criteria since a good link of information between land appraisers and communities is lacking. Therefore this study was intended to establish communities' determinants for valuation of agricultural land.

1.2 Justification

Valuation is plainly an important component of agricultural land market safety and security as a property (TEGoVA, 2012). Several studies have tried to investigate determinants of agricultural land value. Awasthi (2014) studied social economic determinants which influence the landowner's perception value of agricultural land in India but not the attributes used by farmers. Kleynhans and Opperman (2005) did an empirical study to determine buyer's ratings of possible motivations for buying land in Stellenbosch district, South Africa but did not study the seller's (farmers as owners of

land) important determinants used to assign a value to an agricultural land. Abelairas-Etxebarria and Astorkiza (2012) asserted that buyers of land are willing to pay high for variables leading to potential uses like residential development but did not study what farmers (sellers) are willing to receive based on their attributes. These studies indicate little has been done particularly in Tanzania on investigating important determinants used by farmers (who are sellers) as owners of land to assign value to agricultural land of which this study intends to fulfil.

Igbinosa (2011) asserted that sellers and buyers as part of a rural community knows the characteristics or features of agricultural land that influence its value. This landowners' knowledge about the value of their lands with regard to their attributes if captured in the valuation criteria can improve the valuation process of agricultural land (Wessels and Willemse, 2013). Establishment of criteria to consider in valuation of agricultural land as per buyers' and sellers' perceptions is important for achieving sense of balance during valuation.

According to Goodwin *et al*. (2003), Kleynhans and Opperman (2005), Nickerson *et al*. (2012), Nilsson and Johansson (2013), Wessels and Willemse (2013) and Awasthi (2014) criteria for agricultural land valuation have a base from both physical and social-cultural landscapes attributes. Thus by integrating the physical and social-cultural landscapes would contribute important knowledge towards valuation process of agricultural land whereby perception of how farmers characterize and attach value to their land is vital.

Information obtained from this study would contribute towards formulation of informed policies for protection and preservation of agricultural land, proper estimation of land rents and taxes, and fair compensation. With informed policies communities living in

rural areas would have a feeling of equity for the estimated value of agricultural land. This is envisaged to reduce conflicts among communities themselves, between communities and both domestic and foreign investors, and communities and government.

1.3 Objectives

1.3.1 Overall objective

The overall objective of the study was to establish farmers' determinants for valuation of agricultural land

1.3.2 Specific objectives

i. To determine agricultural land use types with respect to agricultural land value in the study area
ii. To determine common farmers' determinants for valuation of agricultural land
iii. To establish a relationship between the identified farmers'determinants for valuation of agricultural land and agricultural land value

1.4 Research questions

i) Which agricultural land use types are related to valued agricultural land?
ii) Which criteria farmers are using to assign value to agricultural land?
iii) What are the important criteria for valuation of agricultural land under specific agricultural land use type?

1.5 Conceptual Framework

The conceptual framework (Fig. 1) underlying the study is centred on a number of factors including available land, agricultural land, agricultural land uses practised by the farmers, farmers' criteria for valuation of agricultural land, land laws and policies. Integrating

these factors lead to agricultural land value obtained by involving farmers, policies and land laws. Hence the land is used for sustainable peace and justice among different land stakeholders.

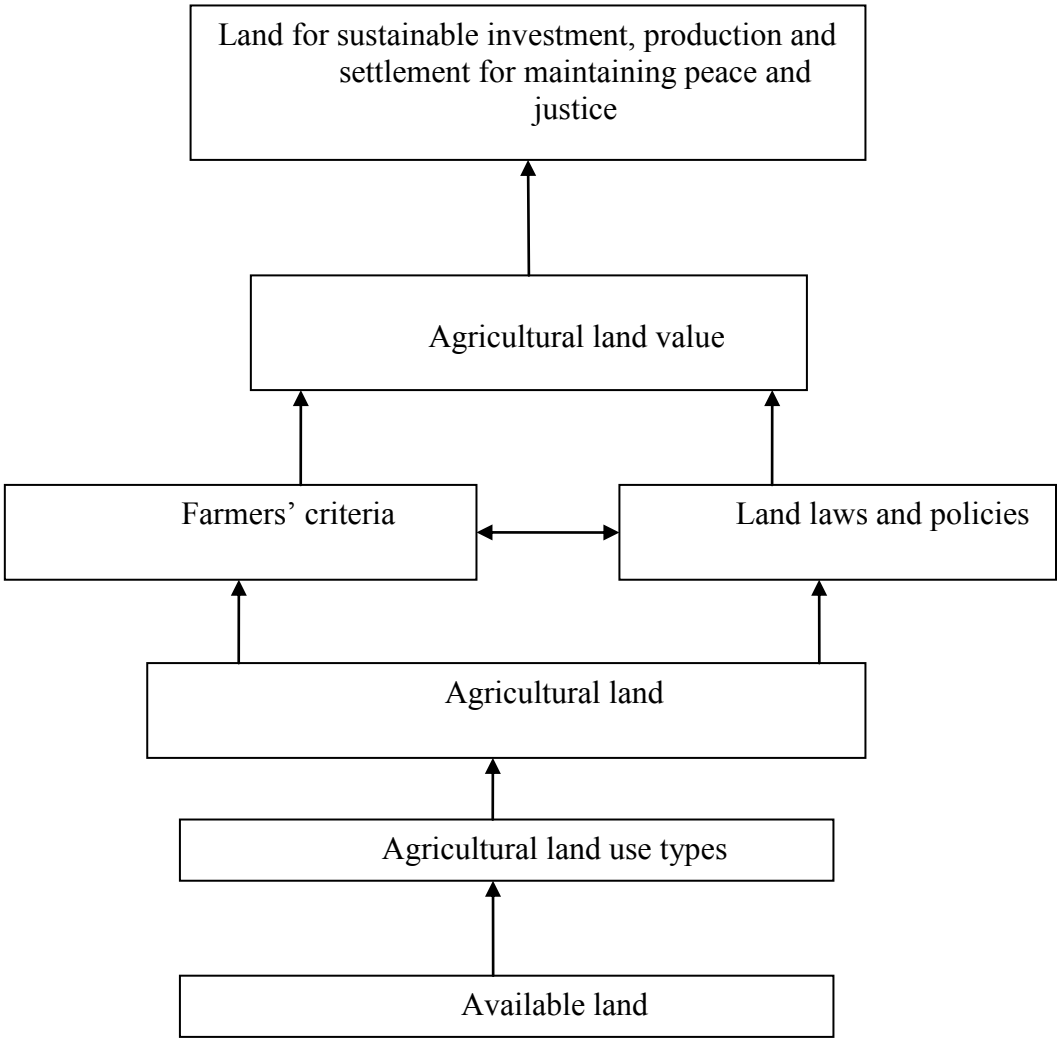

Figure 1: Conceptual framework underlying the study

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Basic Concepts on Land, Agricultural Land and Valuation

Land is a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface including those of the near-surface climate the soil and terrain forms, the surface hydrology, the near-surface sedimentary layers and associated groundwater reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity (FAO, 1995).

In Tanzania context "land includes the surface of the earth and the earth below the surface and all substances other than minerals or petroleum forming part of or below the surface, things naturally growing on the land, buildings and other structures permanently affixed to or under land and land covered by water" (URT, 1999a, 1999b).

Land has different uses, and according to FAO and UNEP (1999) " land use is characterized by the arrangements, activities and inputs by people to produce, change or maintain a certain land cover type". In Tanzania land is under different uses like settlement, forest and woodland, National parks, grazing land and cultivation (URT, 1997b). Some of the benefits associated with forest and woodland covers are timber, poles, firewood, charcoal, climate amelioration and water catchment protection. According to (URT, 1997b) land has value, and in Tanzania is mainly used in agriculture where most of the population are smallholder farmers.

Agricultural land means "land including arable land, land under permanent crops and land under permanent meadows and pastures". In general any land for crop cultivation

and or for livestock grazing is considered as agricultural land. (OECD, 1997; FAO, 2014). Agricultural land and farmland are used synonymously (Sklenicka *et al.*, 2013).

In Tanzanian context land for agricultural use is stated clearly to be separate from land used for livestock and pastoralist (URT, 2007). Agricultural land is the land used for agricultural use like cropping and pasture, and it does not include pastoral or grazing lands (URT, 1997a). Agroforestry is a practice of integrating trees on farms as a natural resource management system (ICRAF, 2007). Although agroforestry contributes to different sectors (including forest, fisheries, environment and agriculture) is not clearly elaborated in the sectoral policies and legislations. This should be considered during review of different sectoral legal documents such as Forest Policy of 1998 (Msuya and Kideghesho, 2012). Grazing land means "a developed or undeveloped land used for grazing by a pastoralist (person whose household livelihood depends on livestock and includes nomads, transhumant and semi-transhumant) (URT, 2010). In this study the Tanzanian context was considered since in the study area pastoralists were not found indicating an absence of pastoral lands.

Sound utilization of agricultural land can contribute towards the solution of social issues like unemployment and migration of the youth from rural areas to the urban as argued by Havranek *et al*. (2007). In order to manage and protect this agricultural land or farmland as an asset or property, its safety, market, and security for sustainable use and management, valuation is vital (Lavee and Baniad, 2013; TEGoVA, 2012).

Valuation is the process of carefully estimating the worth of any property including agricultural land with regard to its characteristics based on experience and knowledge based judgment (Yomralioglu and Nisanci, 2004). There are several basis of assessment

of any land (including agricultural land) value as indicated by TEGoVA (2012) but in Tanzania the market value is the basis of assessment (URT, 2001). The market value is assumed to be reached between a willing buyer and a willing seller acting knowledgeably, prudently and without compulsion in an arm's length transaction after proper marketing (URT, 1997b; IVSC, 2011; TEGoVA, 2012). According to Awasthi (2014) under perfect market conditions, market value of agricultural land indirectly reflects perceptional value as perceived by the buyers and sellers. The market value may be assessed by sales comparison, income capitalization and or cost approaches (Engindeniz, 2003; Kleynhans and Opperman 2005; TEGoVA, 2012).

Awasthi (2014) asserts that, the traditional land valuation methods rely on either capturing income generation potential of farmland or use market price for obtaining farmland value, and not capturing the non use value, as a result the methods capture the partial value leading to undervaluation. The author stated further that, since agricultural land assumes different values for different owners, a land valuation model that is capable to measure landowner perceptional value of farmland and identify factors which influence perceptional value of farmland would provide useful insights to policy planners while fixing the appropriate price of land.

Perception refers to how different groups in a society view an issue, for example how communities value agricultural or their rural land in their perspective. Perceptions are driven by interests which if not considered in decision making might lead to emergence of conflicts between individuals and groups of different interests (Woodcock, 2002). For example Awasthi (2014) found the value of farmland as perceived by landowners to be 44% higher than the one recognized by the government. In Tanzania safeguarding interests of citizens over their land is part of Tanzanian land policy statement (URT,

1997a). The policy states that "land will be allocated to investors according to their ability to develop it and that interests of citizens over their land shall be safeguarded".

2.2 Purpose for Valuation of Agricultural Land

Valuation of property particularly agricultural land has been taking place for several purposes including determination of agricultural prices, renting costs and premium, planning of investment according to production capacity, taxing, wealth assessment, mortgage, and fair compensation (Burger, 1998; URT, 1999a; URT, 1999b; Brown, 2008).

According to IVSC (2011) the purpose of valuation always determine the basis of value. In Tanzania the basis of value is the market value only for compensation purpose, but for other purposes is not stated clearly what should be the basis of value. For example under market-based valuation, buyers' or sellers' specific criteria that are not available to market participants are not considered (IVSC, 2011). Therefore the value of land reached without including farmers specific determinants is giving partial value of agricultural land (Awasthi, 2014). This is leading to not only unfair compensation but also impairing the other purposes like mortgage and prioritizing investment areas.

2.3 Determinants of Agricultural Land Value

According to Nilsson and Johansson (2013) agricultural land values are determined by income generated from both agricultural and potential non agricultural uses. Productivity, payments to support farmers from government or Non-governmental organizations, variables describing the market, macroeconomic factors (such as expected returns from agricultural uses, alternative investment opportunities and interest rates), soil quality, irrigation status, crop intensity, recreation features and urban pressure indicators are the

key determinants of agricultural land values and prices (Barnard *et al*., 1997; Goodwin *et al*., 2003; Feichtinger and Salhofer, 2011; Nickerson *et al*., 2012; Nilsson and Johansson, 2013). Proximity to major population centres like capital cities, municipal centres, and district centres was also highlighted by Kleynhans and Opperman (2005) as among the determinants of land prices. Some of the determinants are a combination of several determinants i.e. for example Barnard *et al*. (1997), conceptualize productivity to be an interaction of precipitation, temperature and soil.

Also Henning *et al.* (1996) found that increased cost of production and relatively high interest rates is also attributed to decrease in agricultural land values . Non market factors like scenic beauty or aesthetic attractiveness and cultural heritage also have been considered important determinants of the value of agricultural land (Kleynhans and Opperman, 2005; Wessels and Willemse, 2013).

Sklenicka *et al.* (2013) used general linear modeling to identify the driving factors affecting farmland prices across the Czech Republic. In this study parcel accessibility, natural soil fertility, settlement proximity, municipality population and travel time to the capital were found to be significant ($P < 0.05$) predictors of farmland prices. Also Plantinga and Miller (2001) in their study to quantify the effect of future development on the current value of agricultural land found a highly non-linear relationship between land value and explanatory variables which were agricultural rents, distance to metropolitan areas, population change in metropolitan areas, interest rates, and conversion costs. Abelairas-Etxebarria and Astorkiza (2012) using pricing hedonic model, found that buyers of land were willing to pay high for land potential to residential development and high land prices were not linked to agricultural uses. This means that high agricultural land values are likely to be associated with non agricultural uses. The authors asserted

further that, purchasers were not willing to pay too much for a decrease in distance from a village center or municipality center as there was no noticeable difference in services provided or every land parcel was perceived to be near to centre. In this study several distance variables were used i.e. distance from village, capital city, speed motor way, and village centre.

Afrane and Adjei-Poku (2013) on their study carried out in urban area observed that low valued lands were more prone to land use changes compared to high valued lands. The same trend was reported for agricultural land by Plantinga *et al.* (2002), Abelairas-Etxebarria and Astorkiza (2012) and Nishihara (2012) who asserted that agricultural lands were being converted to other uses in rural areas because they were assigned little value partly due to inadequate and well research determinants for valuation of agricultural lands in rural areas.

2.4 Methods used in Valuation of Agricultural Land

There are three main approaches based on market value used during valuation of land in general including agricultural land namely income analysis, sales comparison and cost analysis (TEGoVA, 2012; Appraisal Institute, 2013). These methods are also used in Tanzania to estimate the value of any land being for agriculture or residential for compensation purpose (URT, 2001).

2.4.1 Income Analysis

Income analysis is a method of carefully estimating the value of a property based upon its income producing capabilities and capitalizes the income to present value, with consideration given to current investment requirements (Appraisal Institute, 2013). With this method the value is reached by upgrading the future cash flows that can be generated

by an asset like agricultural land to a present value. Problems arise in forecasting future information and capitalization rate determination (Aragonés-Beltrán *et al.*, 2008).

2.4.2 Sales comparison method

According to the definition by Appraisal Institute (2013), Sales comparison method "is a process of deriving a value indication for the subject property by comparing similar properties that have been sold recently in the market with the subject property, identifying appropriate units of comparison, and making necessary adjustments to the sale prices of the comparable properties based on relevant, market-derived elements of comparison". Wyatt (1997) and Aragonés-Beltrán *et al.* (2008) argue that, with this approach adequate recent records of transactions are required, but it is always difficult to collect and find relevant information on comparable assets and quantify their explanatory properties or variables. Also according to Aragonés-Beltrán *et al.* (2008), this method does not perform well with qualitative explanatory variables.

2.4.3 Cost approach

The third method is the cost approach which is a process comparing the cost of the subject improvements to the cost to develop similar improvements as evidenced by the cost of construction of substitute properties with the same utility as the subject property (Appraisal Institute, 2013). This approach is used when there is no existence of similar market prices and direct income generation or there is a need to adjust subject property prices (TEGoVA, 2012). Based on the shortcomings of the three traditional methods of asset valuation, Aragonés-Beltrán *et al.* (2008) argue that they are not suitable for current valuation since more criteria are to be incorporated in the value of an asset like agricultural land. It is highlighted in this study that new approaches like Diakoulaki's, Goal Programming, the Analytic Hierarchy Process (AHP), and Analytic Network

Process (ANP) which use multi-criteria have been developed and used by researchers for valuation of several assets and recommended them for other assets including agricultural land. Some of the determinants or attributes which were used in these approaches and relevant for agricultural land valuation are proximity to common facilities, proximity to motorways or roads, plot size and shape, physical and geological characteristics, and topographic characteristics. Also some studies like Sklenicka *et al.* (2013), Awasthi (2014) and Kleynhans and Opperman (2005) have been conducted to spot important criteria to be considered during agricultural land valuation. Some of these criteria which can also be captured from farmers are topography, soil fertility, existence and bequest values, and closeness from village, thus this study intends to explore more determinants from community or farmers.

2.5 Stakeholders /community involvement in the process of agricultural land valuation

Different stakeholders (such as citizens and government) on land need reliable information about land values (Henning *et al.*, 1996). Igbinosa (2011) recognizes that sellers and buyers as part of a rural community knows the characteristics or features of agricultural land that influence its value. Establishment of information on buyers and sellers perceptions on the criteria to consider in valuation of land is important in order to have a balance or equal consideration during valuation. The policies and legislations related to land matters in Tanzania (National Land Policy of 1998, Land and Village land Acts of 1999, Land use planning Act of 2007) don't provide a platform for communities to share their opinion on agricultural land value determinants.

Kleynhans and Opperman (2005) did an empirical study using 10 point scale to determine buyers' ratings of possible determinants of high valued land or motivations before buying

land in Stellenbosch district, South Africa. In this study, Factor analysis provided a hierarchy of determinants or motivations. Terroir was the dominant site factor and the most important determinant or motivation, followed by location relative to Cape Town, the aesthetic beauty of the property, accessibility of the property, potential for new/more vineyards, Meso-climate and the status of the "address". According to the authors "Terroir is an existing (often still unknown) relationship/interaction between the natural environmental factors; climate, topography and soil which have the potential (also often unknown) to induce a specific character into an agricultural product". These natural environmental factors are determinants of agricultural land value. This indicates that involvement of stakeholders in sharing information particularly on the determinants for valuation of agricultural land is vital.

Awasthi (2014) identified and grouped factors that have significant effect on agricultural land value into two groups which are agricultural land characteristics (such as land productivity and location of the land) and socio-economic factors including age, education, and dependency on income from agriculture. Using regression model the author found that age of the landowner had negative impact on the farmland perceived value while education, dependency on income from agriculture and had positive impact. This demonstrates that socio-economic factors which are judged by the knowledge and experience of the communities are important if incorporated/captured in the criteria for land valuation. Based on the literature criteria used by traditional methods to value agricultural land are not sufficient leading to computation of partial value, hence there is a need for additional research on the criteria for valuation of agricultural land as perceived by communities knowledge and experience in rural areas. Thus this study intends to explore from community (farmers) their perceived criteria to assign value to agricultural lands so that can be integrated in the valuation process.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Description of the Study Area

3.1.1 Location

The study area is located in the Western Usambara Mountains in Lushoto District, Tanga region, Tanzania. The study area is geographically located between Universal Transverse Mercator (UTM) coordinates 420270 m E to 423600 m E and 9476450 m N to 9483530 m N, zone 37 M covering the hamlets of Kibohelo, Fyoifyoi, Ndabwa and Makanya (Fig. 2). The altitude of the study area (Kibohelo, Fyoifyoi, Ndabwa and Makanya) ranges from 1620 m above sea level (amsl) in the valley bottoms to 2020 m amsl on the hill summits of the dissected plateau ridges.

3.1.2 Climate

The Western Usambara Mountains experiences bi-modal rainfall pattern with long rains occurring during March to May (*masika*) and short rains during November to December (*vuli*). The annual precipitation varies considerably according to locations from 600 mm in the lowlands to 1200 mm in the highlands per annum (Hieronimo *et al.*, 2014). The average annual temperatures vary with altitude from about 27°C to 17°C at 800 and 1,800 m asl, respectively (URT, 2008; Shelukindo, 2000; Hubeau, 2010). The study area is covered by two distinct agro-ecological zones namely cold humid and cold dry zone (Kyaruzi, 2012).

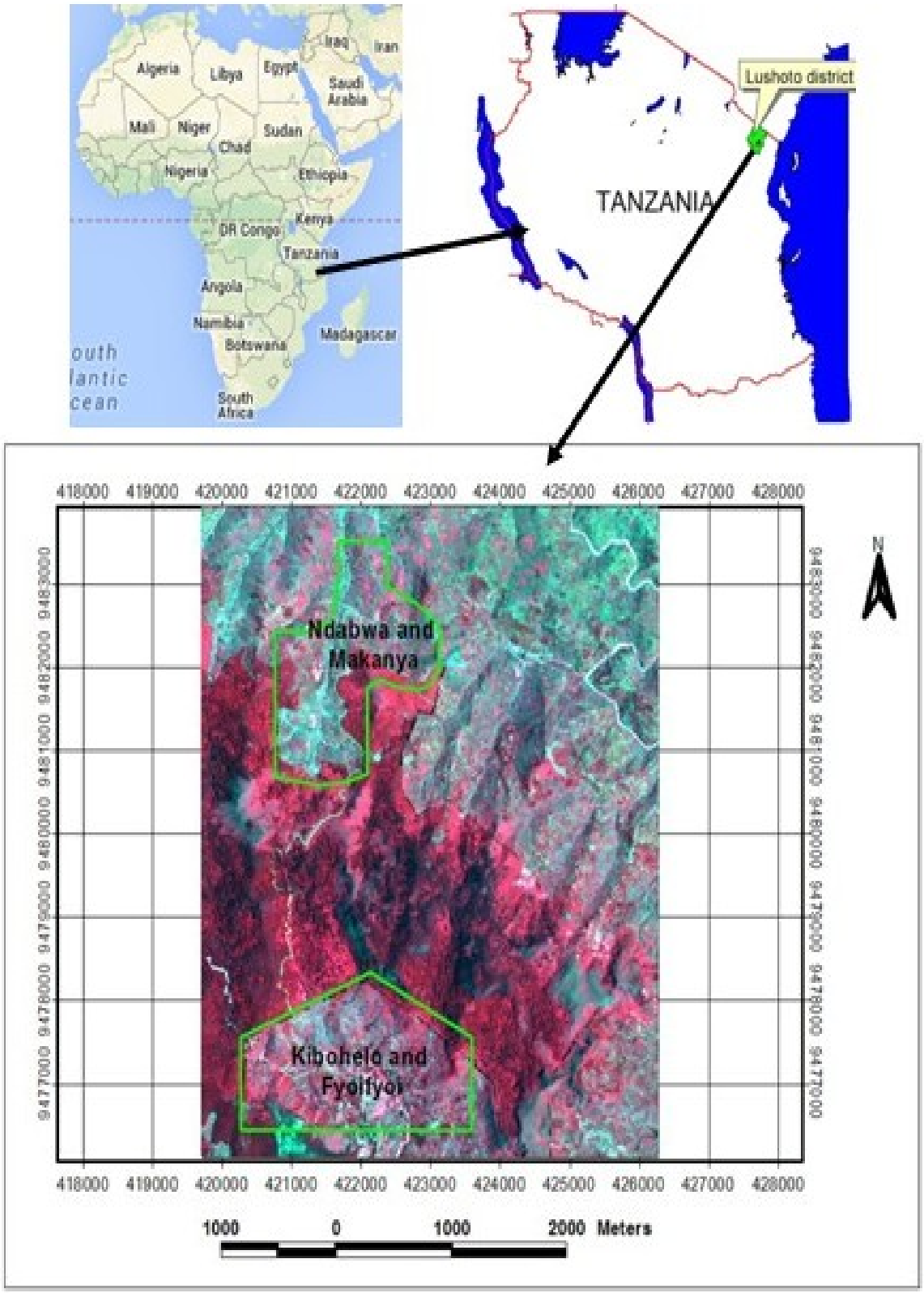

Figure 2: Map showing geographical location of Kibohelo, Fyoifyoi, Ndabwa, and Makanya hamlets in Lushoto District, Tanzania

3.1.3 Vegetation and land use

Natural forest surrounding the study area has different types of natural vegetations. The most common vegetation species in the natural forest include *Ocotea usambarensis* and *Podocarpus usambarensis* while the plantation forests are dominated by cedar *(Juniperus procera),* cypress *(Cupressus* Lusstanica) and pine (*Pinus petula* and *Pinus radiata*) (Masunga, 2009; Hubeau, 2010). The natural forest is playing an important role in conserving the water sources which are very important in relishing the livelihood of the people in the area.

The study area is characterized by mixed farming system. Smallholder farming is the main economic activity for majority of the households in Lushoto District (Neerinckx, 2006) and cattle rearing. About 90% of the population in the district depends on smallholder farming. The valley bottom lands are used for vegetable production mainly for cash income. Sloping lands and summit lands are used for settlement surrounded by patches of grasses which are used for grazing, woodlots and agro-forest. The sloping lands and summit lands are used for planting fruit trees such as plums, avocado, strawberries, pears, apples and peaches, and growing annual and perennial crops such as maize, Irish potatoes, beans, banana, sugar cane and cassava. The predominant vegetable crops are cabbages, carrots, tomatoes, onions and cauliflower.

3.1.4 Demography

Lushoto District has a total population of 492 411 inhabitants of whom 46.75% and 53.25% are men and women respectively; and the average household size is 4.7 (URT, 2013). The district has an average annual population growth rate for the period of 2002 to 2012 of 1.76% and a population density of 120 inhabitants per km^2. The wards Lushoto (comprising the hamlets of Kibohelo and Fyoifyoi) and Lukozi (comprising the hamlets

of Ndabwa and Makanya) where the study was done have a total population of 28 190 of which 47% are men and 53% are women for Lushoto ward, and 11 998 of which 47.2% are men and 52.8% are women for Lukozi ward (URT, 2013). The inhabitants belong to two major tribes or ethnic groups: the Wasambaa who constitute the largest group mostly found in Makanya and Ndabwa hamlets, followed by the Wambugu who are mostly found in Kibohelo and Fyoifyoi hamlets and the minor immigrants from diverse origins in other regions like Wapare and Wachaga (Lyamchai *et al*., 2011).

3.2 Materials and Tools

The following materials and tools for data collection were collected and prepared before going to the field.

i. Base map and data collection tools (i.e. Questionnaires, Checklist for key informants and Focus group discussions): the base map was updated during field work to obtain the land use types while Questionnaire, checklist were used to collect information from farmers during field work.

ii. Topographic maps scale 1:50 000 from Ministry of Lands, Housing and Human Settlements Development, Tanzania: (Mlalo sheet No. 109/2 and Lushoto sheet No. 109/4), and acquisition of satellite image. Topographic maps and satellite image were digitized to obtain contour lines and land use types of the study area respectively.

iii. Hand held Global Position System (GPS) receiver i.e. Garmin GPS receiver, and digital camera; GPS was used to locate land plots and geo-reference the land use types while the camera was used to take pictures on the study area.

iv. Sound recorder tool which was used to record the dialogues during FGDs and interview.

3.3 Research Design and Sampling Procedure

Cross sectional design which allows data to be collected once at a single point in time was used in this study to collect data from a selected sample of respondents using survey techniques such as household interview using questionnaire, focused group discussions (FGDs), participant observation and key informants interview. The sample size postulated by Bernard (2000) who contended that the minimum sample should be at least 30 respondents regardless of the population size was adopted. Table 3 shows the distribution of population, households and sample sizes in the respective hamlets. The purposive sampling procedure was applied to select the district, wards, villages and hamlets.

The study was carried out into four hamlets with two distinct agro-ecological zones namely cold humid zone (Kibohelo and Fyoifyoi hamlets) and Cold dry zone (Ndabwa and Makanya hamlets), (Kyaruzi, 2012). The sampling frame was households, and each household had to nominate a representative (adults from 18 to 80 years, and mostly nominee were a father or mother) in all hamlets. Households were randomly selected and a sample size of 120 households obtained. Ninety four of them, who were ready, willing and available, were interviewed using questionnaires to obtain primary data. During data collection both men and women were given equal chance to participate or share their experience and knowledge on behalf of the household without the influence of the other.

According to Beaman and Dillon (2010), a household is a domestic unit consisting of related or unrelated members who live and eat together in the same dwelling space, and acknowledge the authority of a man or woman who is the head of household . In this study, the household was considered an appropriate basic sampling unit as it is perceived that it is from this unit interests and perceptions of respondents can be taped and measured.

3.4 Methods for Data Collection

A combination of data collection methods also known as triangulation method were used to avoid investigator biasness as argued by Oppermann (2000). Both primary and secondary data were collected, whereby secondary data were collected through documentary reviews of both published and unpublished documents and used to supplement and enhance the primary data.

3.4.1 Generation of land use map

Manual interpretation of SPOT image and on screen digitization was carried out in ArcView 3.2a to produce a base map of the study area. Field observation and georeferencing of the mapped land use types using GPS receiver, and use of other reference materials such as Google images and topographic maps as groundtruthing techniques were used to update the base map into final land use map. Topographic map was used to generate slope and elevation map for identification of different landform types in the study area.

Participant observation facilitated collection of information on land use types of the study area. The method involved observation of the present land uses, landscape elements and taking some photographs of the agricultural land uses, observing local people's activities on their lands, networks and processes in the field to supplement information collected through other methods. The mapped land use types were subsequently used as a reference by farmers to identify specific criteria for the specific land uses. Later the criteria were related to agricultural land value by using Regression model to obtain important criteria for agricultural land valuation across the land use types.

3.4.2 Household survey

Household survey using Questionnaire (Appendix 2) was done to elicit information on household socio-economic data, their perception about agricultural land characteristics, agricultural land value determinants, and the relative importance of each determinant in valuing agricultural land. The questions were formulated in English and thereafter translated into *Kiswahili* to facilitate easy communication during data collection. The questionnaire was pre tested before being applied in the study area to check its reliability and validity (Mettrick, 1993), and corrected where necessary. The relative importance according to farmers perception, of each identified criterion for the valuation of agricultural land was determined by individual (respondent) farmer on a 5 point Likert Scale.

Respondents were required to assess the criteria with regard to their own piece of land or rented land or land managed on behalf of land owner in order to ensure that at least the farmer has knowledge on that agricultural land to which the criteria are subjected. Each criterion was subjected to each land use type found to be exercised by the individual household. Land value Relative Importance Index (RII) was used to rank the value of agricultural land with respect to each criterion across the different land use type. Details of data collected in the field, sources of data and analyses executed are given in Appendix 1.

3.4.3 Focus group discussion, key informant interview and observation

Focused group discussions (FGDs) were carried out with identified key people guided by a checklist of questions (Appendix 3) to collect qualitative data about the important criteria for valuation of agricultural land based on landscape elements or features. The FGDs targeted people with fair understanding including village elders and youth of both

sexes, and farmers or owners of agricultural lands. Eight (8) FGDs were conducted in the study area; each group comprising at least 6 people, where by aged people were separated from youth, and men were separated from women to reduce the inferiority complex. Sound recorder was used to record the discussions for later retrieval of key information which could not be noted down on a paper during discussion.

Key informant interview was used to supplement the information obtained through FDGs i.e. Perception of key informant on agricultural land valuation (Possible land use types and their relative importance to the value of agricultural land, the important criteria or factors used to value the agricultural land). A key informant is a person or audience who is knowledgeable, informed, accessible and willing to talk about the issue/s concerning the study (Mbwambo, 2000). In this respect, a checklist (Appendix 3) was used to guide the discussion with key informants who in this study included: village elders; village leaders, hamlet leaders, and extension officers. Informal discussions were also conducted with relevant parties like the Ward Executive Officers (WEOs) and Village Executive Officers (VEOs).

3.5 Data Analysis

Both qualitative (content analysis and Ranking) and quantitative (Logistic regression model) methods of data analysis were employed during data analysis in order to address the study objectives. By using content analysis (Weber, 1990) qualitative data from questionnaires, observation, the information collected through verbal discussions with the key informants and FGDs was transformed into numerical data and used to identify major agricultural land use types, different land units, and generate key farmers reported land based attributes for valuing agricultural land. Relative Importance Index (RII) which was used by Oloke *et al.* (2013) to determine important factors affecting residential property

values was also used in this study to rank the relative importance of agricultural land value with respect to land under different land use types and attributes of the farmers' identified determinants as shown in Equation 1 (Memon *et al.,* 2012). The weighting of agricultural land value with respect to determinants' attributes was done on a 1 – 5 weighting levels; 1= very lowly valued, 2 = lowly valued, 3 moderately valued, 4 = highly valued and 5 = very highly valued.

$$RII = \left(\sum_{i=0}^{n} Pi * Ui\right)/Nn \quad \text{..... (1)}$$

Whereby;

RII = Agricultural land value Relative Importance Index

P = Weighting level of agricultural land value

U = frequency of respondents on i^{th} weighting level

N = Sample size

n = Highest weighting on the scale

i = levels of a weighting scale

The data collected through structured questionnaire were organized through sorting and filtering, and coded to facilitate data entry into Excel before analysis by Statistical Package for Social Sciences (SPSS 16.0).

Binary logistic regression model was used to evaluate farmers reported landscape based determinants/attributes **(independent variables)** which are related to agricultural land value **(dependent variable).** To test whether the regression coefficients are statistically significantly from zero, the Wald statistic that asymptotically in large samples follows a Chi-Squared distribution was used. The Wald statistic is distributed as Chi-square with degrees of freedom (df) equal to the number of constrained parameters (r). To assess the goodness of fit of the regression model to the data, the model chi-square at 5% probability

level, the Hosmer and Lemeshow and classification table were used. The higher the percentage of classification the better the variables are explained in the model.

The dependent variable (Y) was conceived as a composite determined by a number of independent (predictor) variables as tabulated in Appendix 4. The independent (predictor) variables were scored on a 5 point Likert scale (1 – 5; 1= very lowly valued, 2 = lowly valued, 3 moderately valued, 4 = highly valued and 5 = very highly valued). The response (agricultural land value) was represented by an index obtained by computing the mean score for each household to obtain agricultural land value index. The cut off point for agricultural land value index was subjectively selected to be 3.5 implying that means below 3.5 were considered lowly valued and equal or above 3.5 were considered highly valued. This was then transformed into a dichotomous response variable as follows; $< 3.5 = 0$ and $\geq 3.5 = 1$. The independent variables included in the analysis were nearness to water, nearness to road, soil fertility, topography, aesthetic, heritage, and management practice(s).

The Binary logistic regression that was used to represent the linear combination of the variables (dependent and independent) is shown in Equation 2.

$$Yi = \beta_0 + \beta_{i1}X_{i1} + \beta_{i2}X_{i2} + \beta_{ig}X_{ih}... + ei \quad (2)$$

Whereby;

Yi = the i^{th} dependent variable (agricultural land value) score of the linear combination of independent variables underlying valuation of agricultural land in the study area, which stands for non-standardized logistic regression equation.

X_1 to X_h = independent variables which include:

X_1 = Nearness to water,

X_2 = Nearness to road,

X_3 = Soil fertility,

X_4 = Topography,

X_5 = Aesthetic,

X_6 = Heritage and

X_7 = Management practices

β_0 = Constant term of the model, e = is the error term

$ß_{i1} \ldots ß_{ih}$ = Independent variable coefficients showing the marginal effect of unit change (negative or positive) in the independent variables on the dependent variable.

i = 1, 2, 3 and 4. Indicating the four land use types

N (total number of respondents) = Sample size i.e. 94 for this study

h = Total number of independent variables (h = 7)

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Agricultural Land Value in Relation to Agricultural Land Use Type

4.1.1 Spatial distribution of land use and cover types in the study area

Spatial distribution of agricultural land use and cover types are presented in Fig. 3 and Fig. 4. The percentage coverage of each land use type is given in Table 1. Five major agricultural land use types were identified in the study area: vegetable cultivation which was mainly found in the valley bottoms; crop cultivation (annual and perennial crops), agroforestry, and woodlots which were mainly found on the sloping lands and lands on hill summits; and open space (with grassland) mainly found around homesteads and on a common community land areas for recreation and grazing. The fact that vegetables are subset of annual crops still in this study “vegetable cultivation” was separated from “other annual and perennial crops cultivation” since vegetable farming was observed as a unique and dominant land use type in the study area mainly for cash income.

Farmers’ settlements were found scattered within the agroforestry, crops cultivation, woodlot cultivation, and open space land use types. Also there were other land uses like social services centres including schools and hospitals.

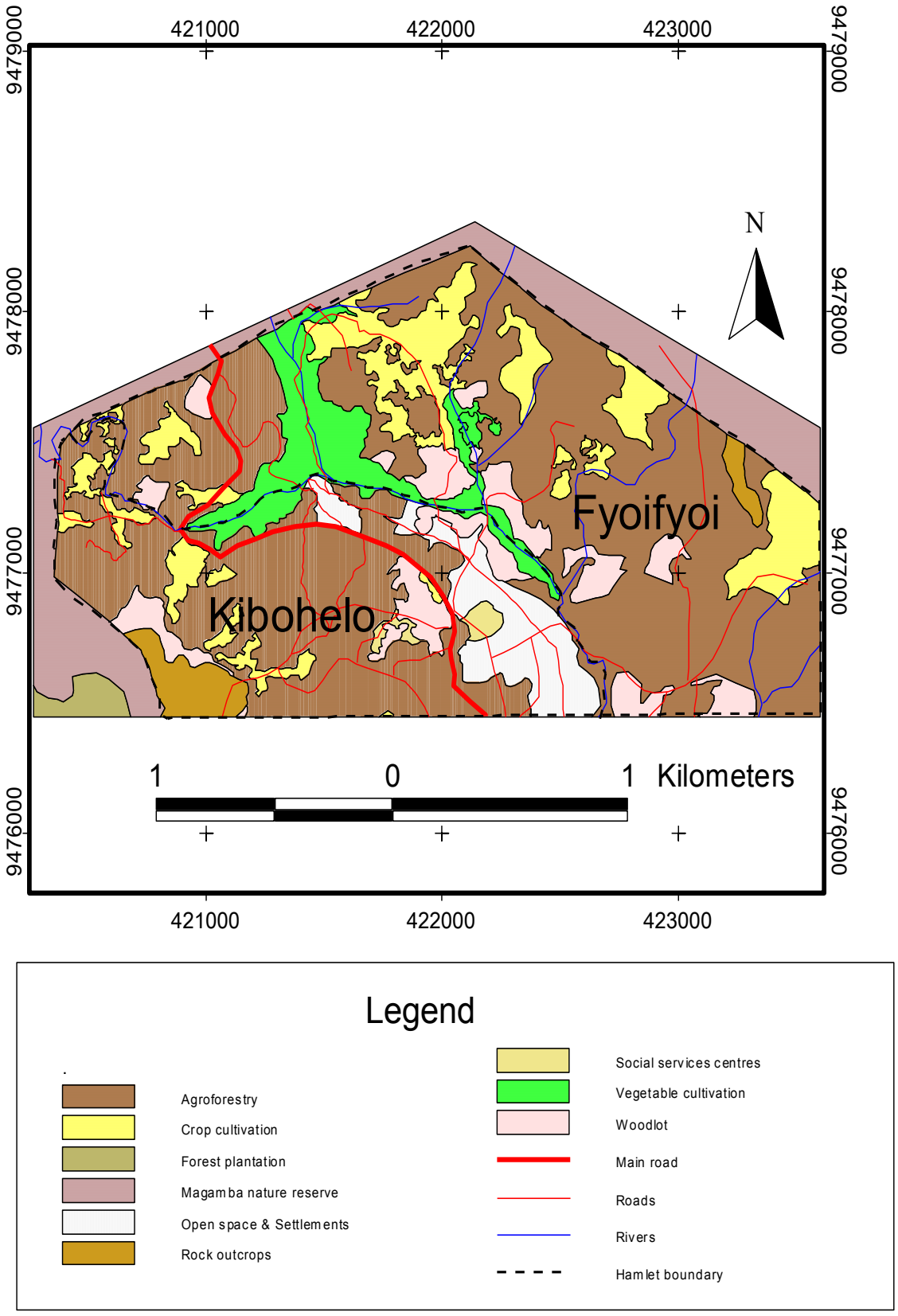

Figure 3: Spatial distribution of land use and cover types in Kibohelo and Fyofyoi hamlets in Lushoto District, Tanzania

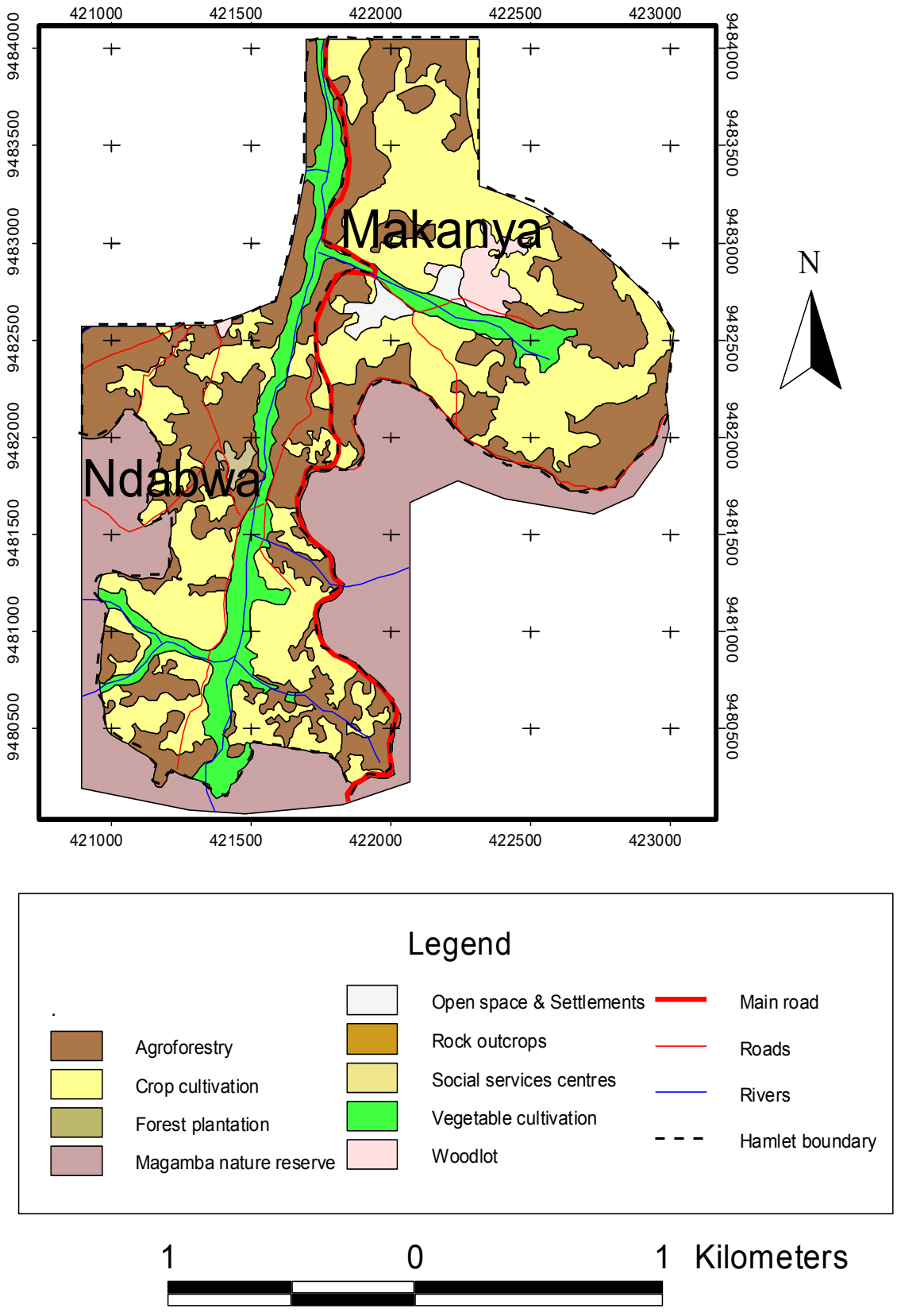

Figure 4: Spatial distribution of land use and cover types in Ndabwa and Makanya hamlets in Lushoto District, Tanzania

Table 1: Land use and cover types proportion in Ndabwa, Makanya,Kibohelo and Fyoifyoi hamlets in Lushoto District, Tanzania

	Area (%) coverage	
Land use and cover types	Ndabwa and Makanya	Kibohelo and Fyofyoi
Agroforestry	40.88	60.23
Crop cultivation	43.94	13.43
Vegetable cultivation	11.56	7.63
Woodlot cultivation	1.90	8.44
Forest plantation	0.00	1.05
Social services centres	0.40	0.66
Open space and Settlements	1.27	8.56
Total	100	100

4.1.2 Major agricultural land use types on different land categories

4.1.2.1 Vegetable cultivation

In Plate 1, a section of land for vegetable cultivation in the study area is presented. This agricultural land use type is mostly dominant in the valley bottoms where the slope is between 0% and 15% (Average slope is 8%). In some places, vegetable cultivation is also practiced on bench terraces constructed to attain nearly level land on the lower slopes of the sloping lands adjacent to valley bottoms. Vegetable cultivation is mainly for cash income and is the main income generating activity in the study area. The main types of vegetables grown were: cabbages, capsicum, eggplant, spinach, carrots, tomatoes, onions, and cauliflower.

Plate 1: Vegetable cultivation in Ndabwa hamlet in Lushoto District, Tanzania

4.1.2.2 Agroforestry

Agroforestry land use type (a combination of timber trees and crops) is given in Plate 2. This land use type was dominant in the sloping and summit lands with slopes ranging from 15% to 82% where land is prone to soil erosion. The agroforestry land in the study area was mainly of three combinations: (i) timber trees and crops (both perennial and annual crops) comprised of Silky oak (*grevillea robusta*), eucalyptus (*Eucalyptus globulus*), pines (*Pinus sp.*), maize, Irish potatoes and banana; (ii) fruit trees and crops (both perennial and annual crops) comprised of apples, plums, pears, avocado, *santa rose,* maize, beans, Irish potatoes, and sugarcane and; (iii) crops (both perennial and annual crops), timber and fruit trees comprised of Silky oak (*grevillea robusta*), eucalyptus (*Eucalyptus globulus*), pines *(Pinus sp.)*, cypress (*Cupressus lusitanica*).

Plate 2: Agroforestry formed with timber trees, annual and perennial crops in Ndabwa hamlet in Lushoto District, Tanzania

4.1.2.3 Crop cultivation

Crop cultivation (both annual and perennial crops excluding vegetables) category is given in Plate 3. The annual crops apart from vegetables cultivated in the study area included maize, beans and Irish potato while the perennial crops were banana, sugarcane and cassava. These crops were mainly for food consumption though the Irish potato and sugarcane were also for cash income. These crops were cultivated on sloping lands and in few occasions in the valley bottoms. However, farmers considered crop cultivation in the valley bottoms as underutilization of valley bottoms when compared to vegetables.

Plate 3: Annual and perennial crops cultivation on the sloping land with contours in Makanya hamlet in Lushoto District, Tanzania

4.1.2.4 Woodlots

Woodlot cultivation in the study area is presented in Plate 4. Woodlots are fields which are planted with tree species only and were found on sloping lands and hill summits. Normally annual crops can be planted within young trees before the trees have attained growth stage that has shading effect on the crops. The tree species forming the woodlots were mainly Silky oak (*Grevillea robusta*), pines (*Pinus sp.*), black wattle (*Acacia mearnsii*) and eucalyptus (*Eucalyptus globules*). Woodlots are planted for cash income though it takes longer time (between 10 to 15 years) to harvest. Other benefits obtained from woodlots include firewood which is mostly harvested by women during pruning of the trees.

Plate 4: Woodlot of Silky oak (*Grevillea robusta*) in Makanya hamlet in Lushoto District, Tanzania

4.1.2.5 Open space and settlements

Open spaces and settlements was a land use type dominant around homesteads in the study area (Plate 5). Open spaces extended few meters (up to 20m) from the house and was mainly used for grazing livestock and also as a resting/recreation place for a family. Farmers in the study area were keeping a mixture of few numbers of animals (one to four) including cattle, goats, and sheep. Animals were also fed with supplemental pastures like Guatemala (*Tripsacum andersonii*) and elephant (*Pennisetum purpureum*) grass commonly planted around and across crop fields (either on contours or without following contours) for erosion control. Animals were also grazed on common community land areas which were used for recreation, and for village meetings.

Plate 5: Open space and settlements in Makanya hamlet in Lushoto District, Tanzania

4.1.3 Relative value of agricultural land with respect to agricultural land use types in the study area

Relative value of agricultural land with respect to different agricultural land use types identified in the study area is presented in Table 2.

Table 2: Farmers' response on the value of agricultural land with respect to major agricultural land use types in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Land use type	Farmers' response on agricultural land value (%)					RII
Crop cultivation	20.6	14.7	17.6	35.3	11.8	0.59
Agroforestry	17.6	11.8	35.3	23.5	11.8	0.60
Woodlot	20.6	20.6	32.4	14.7	11.8	0.64
Vegetable cultivation	44.1	32.4	2.9	8.8	11.8	0.76
Open spaces and settlements	2.9	14.7	5.9	23.5	52.9	0.38

Key: RII – Land value Relative importance index; weighting levels: 1 = very lowly valued, 2 = lowly valued, 3 = moderately valued, 4 = highly valued, 5 = very highly valued

Note: Vegetable cultivation in the valley bottoms is an important and unique farming system in the study area for cash income and hence in the context of this study it was considered separately from other crop cultivation

Land under vegetable cultivation was ranked the highest with Land value Relative Importance Index (RII) of 0.76 (Table 2). This is due to the fact that vegetable cultivation is dominant on productive lands and is mainly for income generation. This is in line with the study conducted by Uematsu *et al.* (2013) who found vegetables and fruits as high value crops correlating positively with highly valued farmlands. In this case, farmers consider highly valued crops as determinant of the land value under this land use category.

Land under woodlot was ranked the second (RII = 0.64) (Table 2). This may be due to the fact that woodlot is also for income generation despite the fact that it takes longer time (between 10 to 15 years) to harvest. The value of the land under woodlot was perceived higher compared to the value of the land under Agroforestry. This is in line with Duguma and Hager (2011) who reported that land under small scale woodlots (SSW) was more profitable when compared to land with boundary tree and shrub planting (BTP), and homestead tree and shrub growing (HTG) . Also the author argued that land under SSW has more reserved capital compared to land under cereal farming (CF). In the study area SSW seems to be financially less attractive when compared to vegetable cultivation. In this case farmers consider profitability of the crop as determinant of the value for agricultural land under this land use category.

Land with agroforestry was ranked in the third position (RII = 0.60) (Table 2). This is based on the perception that growth of crops under trees is ineffective due to effect of shading from trees, and low tree density when compared to woodlots. Farmers perceived less income generation from this land use type despite the benefits obtained by having a variety of agricultural products associated with agroforestry farming system. Thus lands under this use are less valued when compared to lands under woodlot.

Land under crop cultivation (annual and perennial crops excluding vegetables) was ranked fourth (RII = 0.59) (Table 2). This may be due to its dependency on seasonal rains as it is mostly done on the sloping lands. Tenge *et al*. (2005) observed that fields planted with maize and beans in the study area were significantly affected by low soil fertility hence low crop productivity. The low soil fertility was caused by soil erosion. Similar observations were reported by Duguma and Hager (2011) who found that land under cereal farming (CF) was less valued compared to SSW, HTG and BTP. Under this land use types farmers perceived land productivity as a determinant of the agricultural land value.

Land under open space and settlements which is mainly used for both recreation and grazing was ranked the fifth (RII = 0.38) (Table 2). This type of agricultural land was least valued when compared to other lands. This may be attributed to low productivity and income generated from this land use type. According to URT (2007), distribution of agricultural land potentials and their relative values are among the important issues to be considered in the regional and district land use framework plans.

4.2 Farmers Determinants for Valuation of Agricultural Land

The farmers' identified determinants for valuation of agricultural land were based on physical and socio-cultural landscape characteristics. A total of seven determinants divided into physical and social cultural determinants were identified namely: physical determinants (topography, nearness to water, nearness to road, soil fertility) and social cultural determinants (aesthetic, heritage, and management practices). These determinants obtained through household survey were used in the Logistic Regression Model as independent variables.

4.2.1 Physical determinants

Topography

Topography of the study area is given in Fig. 5 and Fig. 6. Relative importance of the land topography with respect to agricultural land value according to farmers' perception is presented in Table 3 and 4 respectively. Generally, farmers classified the study area into three categories of land topography; valley bottom lands, sloping lands, and lands on hill-land summits. Fig. 5 and Fig. 6 show that, valley bottom lands are found on elongated, flat land portion intercalated through bordering hills with slopes ranging from 0 to15% and elevation ranging from 1620 to 1660 m and 1740m to 1820 m (Fig. 5 and Fig. 6 respectively). Sloping land is between the footslopes and shoulder of the hill, and the slope gradient ranges from 15 to 82%. Hill summit lands are identified on the crests of the hills (Fig. 5 and Fig 6). Topography influences the way farmers interact with their lands for crop production and provision of services to sustain their livelihood. This is in line with Oduwaye (2009) and TEGoVA (2012) who asserted that topography affects the value of land since it can give such a land greater or lesser area that can be worked easily.

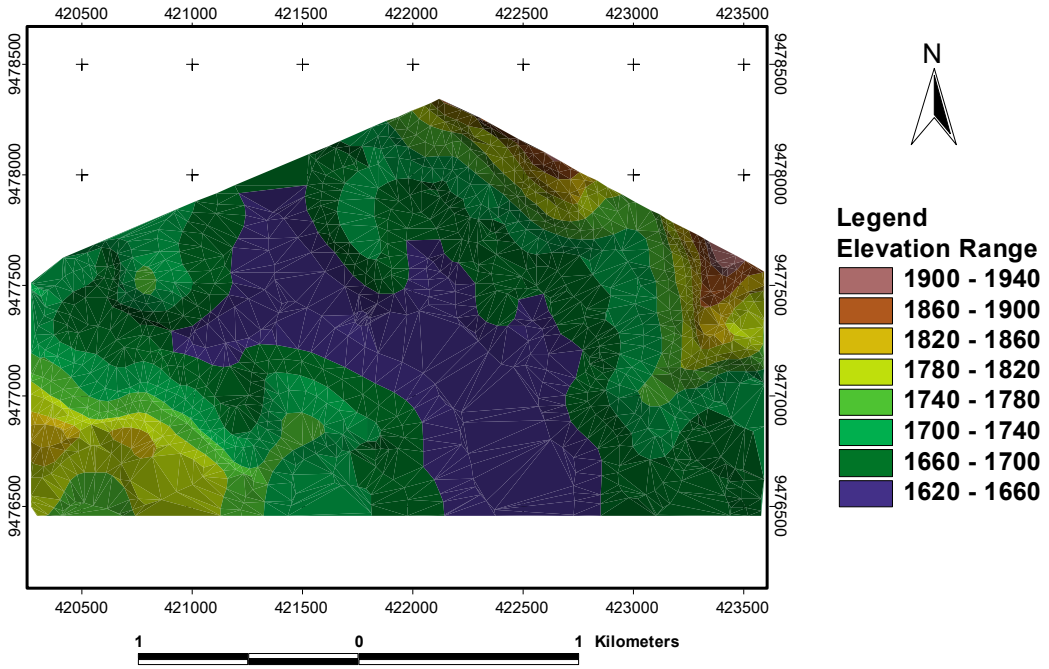

Figure 5: Digital elevation model of Kibohelo and Fyofyoi hamlets in Lushoto

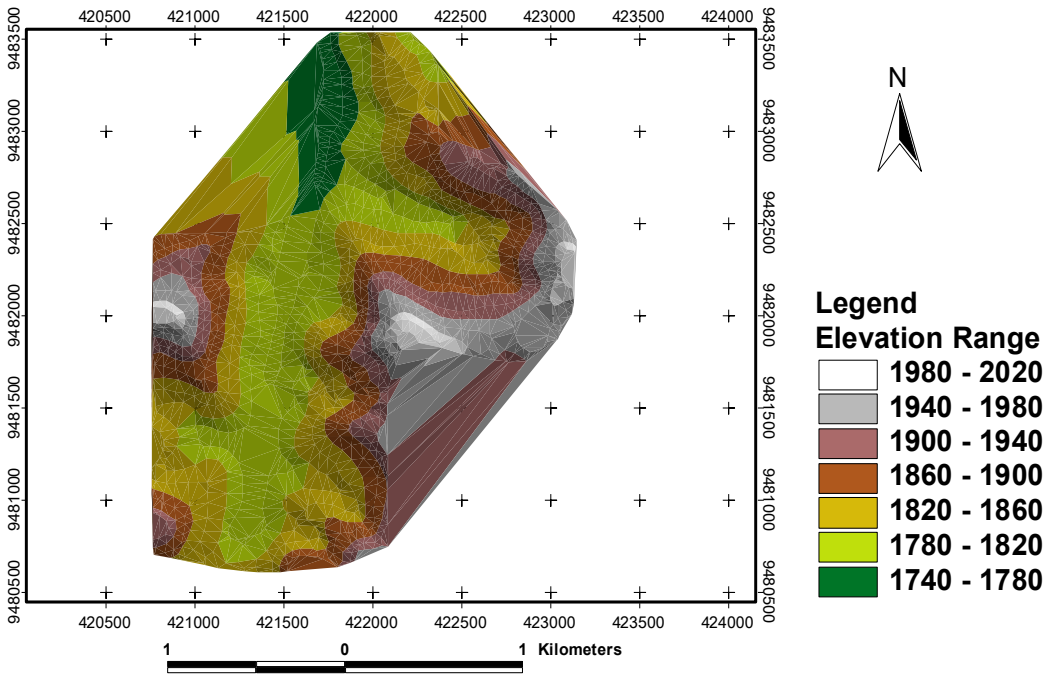

Figure 6: Digital elevation model of Ndabwa and Makanya hamlets in Lushoto District, Tanzania

Table 3: Farmers' response on the value of agricultural land under diverse topographic units in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Land topography	Farmers' response on agricultural land value (%)					RII
Valley bottom lands	62.7	4.4	20.1	5.3	7.4	0.853
Sloping lands	26.4	6.0	51.8	7.0	8.8	0.745
Hill summit lands	2.9	0.0	11.5	18.2	67.4	0.402

Key: RII – Land value Relative importance index; weighting levels: 1 = very low valued, 2 = low valued, 3 = moderately valued, 4= highly valued, very highly valued

Table 4: Farmers' response on agricultural land value with respect to land slopes in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Parcel slope (%)	Farmers' response on agricultural land value (%)					RII
$S < 10$	13	19	10	1	4	0.358
$10 \leq S \leq 20$	3	9	19	9	2	0.255
$S > 20$	0	4	2	2	3	0.056

RII – Land value Relative importance index; weighting levels: 1= very low valued, 2= low valued, 3= moderately valued, 4= highly valued, 5= very highly valued
Note: Slopes were obtained using GIS techniques by locating farmers' parcels using GPS

Valley bottom lands were the mostly valued lands (RII of 0.853) when compared to the sloping (RII = 0.255) and hill summit lands (0.056). High rank of the valley bottom lands is attributed to land qualities which include soil fertility, water availability, low magnitude of soil erosion, land productivity, and cash income earned. The results are consistent with observations made by de Graaff *et al.* (2008) who asserted that in Peru farmers prefer valley bottom lands because of good land qualities associated with relatively high productivity. The value of the sloping lands was ranked second when compared to valley bottom lands and lands on hill summits (Table 3). The lands on this category were used for settlements, perennial and annual crops cultivation, and growing of fruit and timber trees. Sloping lands are prone to soil erosion the magnitude of which

depends on the level of steepness and the soil depth. According to study conducted by de Graaff *et al.* (2008) in Bolivia, SWC measures on steeper slopes require relatively higher investment costs in terms of labour which reduce the value of the agricultural land.

The value of the lands on the hill summits were ranked the least valued due to the associated investment costs on these land types, difficult to reach, and poor land qualities including low soil fertility when compared to the other land types on the landscape. According to Ndakidemi and Semoka (2006) most of the ridge summits in West Usambara Mountains (WUMs) are comprised of shallow or rocky to moderately deep soils, with weak structure and profile development, and moderate to poor moisture storing properties.

Table 4 shows that, lands with slopes less than 10 percent were highly valued (RII = 0.358) followed by those between 10 and 20 (RII = 0.255) and those above 20 percent (RII = 0.056) in that order. This indicates that as the slope of agricultural land increases the value of such land decreases according to farmers' response. According to FAO (2003) slope is among the factors which increases the operational costs of farming and management of soil erosion control costs. Farmers might have considered this in ranking the three categories of slope revealing their awareness on the impact of slope to agricultural land value. According to Knapen *et al*. (2006) and Naudé *et al.* (2012) slope is among the topographical variables, and topography has to be considered by valuers during agricultural land valuation (Oduwaye, 2009; TEGoVA, 2012; Naudé *et al.*, 2012).

Soil fertility

Farmers' response on the value of agricultural land under different soil fertility levels is presented in Table 5. Farmers were aware that soil fertility is an important determinant of

land value attributed to soil nutrients and organic matter. In the study area farmers have a general knowledge about soil fertility levels in their farms judged with experience. This is consistent with Sklenicka *et al.* (2013) who reported soil fertility as a strong determinant of farmland value in Czech Republic. Mishra and Moss (2013) have also used soils parameters (i.e. salinity, bulk density, permeability, drainage, and soil depth) in modelling farmland values in United States. With moderate soil fertility most of the farmers (29%) assigned their land from average to high value. It is apparent from this study that lands with high to very high soil fertility levels (RII of 0.113 and 0.769 respectively) corresponds to high land value (Table 5). This is consistence with Tsoodle *et al.* (2006) who narrated that high soil fertility levels leads to high land productivity which in general increases the farmland value. Thus the higher the soil fertility the higher the land value and vice versa.

Table 5: Farmers' response on the value of agricultural land with respect to soil fertility in Lushoto District, Tanzania

Agricultural land value (Weighting scale)	5	4	3	2	1	
Soil fertility levels	Farmers' response on agricultural land value (%)					RII
Very low	0	0	1	0	0	0.003
Low	1	1	2	1	1	0.003
Moderate	2	13	16	4	3	0.172
High	5	10	8	2	2	1.113
Very high	3	12	8	0	0	0.769

Key: RII – Land value Relative importance index; weighting levels: 1 = very low valued, 2 = low valued, 3 = moderately valued, 4 = highly valued, 5 = very highly valued

Nearness to water sources

Distribution of rivers in the study area is presented in Fig. 7 and Fig. 8. Farmers' response on the relative importance of distance from water source with respect to agricultural land value is presented on Table 6. Thus according to farmers, sources of water like rivers, swamps and streams which provide water for irrigated agriculture and domestic use is an

important determinant for valuing agricultural land. Buck *et al.* (2014) used availability of water (nearness of water to land parcel) as well to determine the farmland value in United States. From Table 6, land parcels which were less than 100m from the river were highly valued (RII = 0.391), followed by those between 100 to 200m (RII = 0.085), and above 200m (0.068) in that order. This indicates that farmers perceived the value of land to increase towards the river and vice versa. This is consistence with Flores-benítez *et al.* (2013) who found that agricultural land values were reduced due to lack of water. The value of land can be affected by different uses of water on private or public land (Bark *et al.*, 2011).

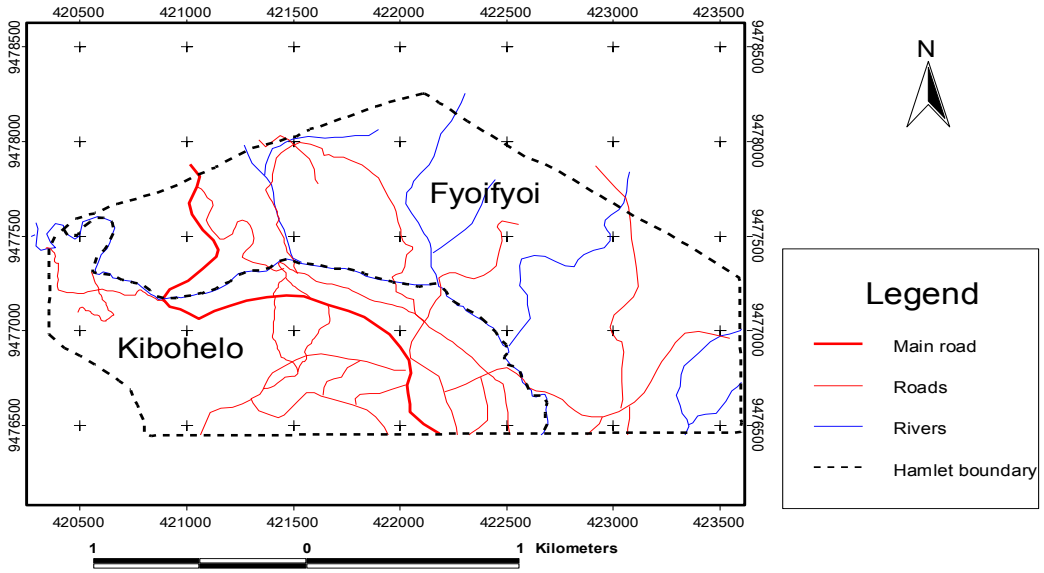

Figure 7: Spatial distribution of roads and rives in Kibohelo and Fyoifyoi hamlets in Lushoto District, Tanzania

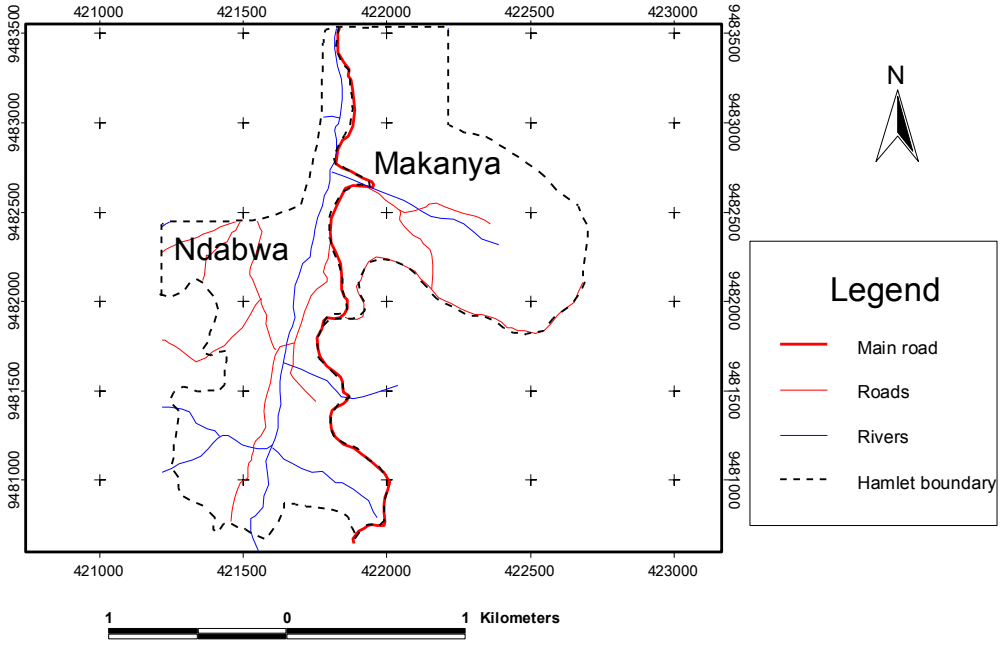

Figure 8: Spatial distribution of roads and rives in Ndabwa and Makanya hamlets in Lushoto District, Tanzania

Table 6: Farmers' response on the value of agricultural land with respect to distance from a river in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Distance from a river (m)	Farmers' response on agricultural land value (%)					RII
< 100	32	3	2	2	11	0.391
100 – 200	3	1	2	1	18	0.085
> 200	1	1	1	2	21	0.068

Key: RII – Land value Relative importance index; weighting levels: 1= very low valued, 2= low valued, 3= moderately valued, 4= highly valued, 5= very highly valued
Note: The distances were obtained using GIS techniques by locating farmers' land parcels using GPS

Nearness to road

Distribution of road networks in the study area is also presented in Fig. 7 and Fig. 8. Farmers' response on the relative importance of nearness to the road with respect to agricultural land value is presented in Table 7. The results clearly indicate that the value of the land increases towards the road and vice versa. Road networks as means of transportation were also identified by farmers as one of the major determinants for

valuing agricultural land. This is due to its importance in delivering agricultural produce from farms to the markets. Sklenicka *et al.* (2013) asserted that accessibility to a farm parcel is an important determinant of agricultural land value.

Table 7: Farmers' response on the value of agricultural land with respect to distance from a road in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Distance from a road (m)	Farmers' response on agricultural land value (%)					RII
< 100	25	7	3	2	4	0.339
100 – 200	12	7	3	5	5	0.224
> 200	3	5	4	4	11	0.133

Key: RII – Land value Relative importance index; weighting levels: 1= very low valued, 2= low valued, 3= moderately valued, 4= highly valued, 5= very highly valued
Note: The distances were obtained using GIS techniques by locating farmers' land parcels using GPS

4.2.2 Social-cultural determinants

Aesthetic

Farmers' perception on the agricultural land value with respect to aesthetic attributes is presented in Table 8. Farmers perceived the landscape of the study area to be attractive and beauty, and stressed that aesthetic has contribution to land value. Aesthetic was listed and used to determine social and ecological value of different land uses in Ethiopia (Duguma and Hager, 2011). Aesthetic was also identified and used by Mathews and Rex (2011) in their study to develop farmland valuation model. According to farmers, aesthetic is attributed to the land parcel characteristics such as topography, the nature of surroundings such as Magamba Nature Reserve (MNR), and land use types (valley bottom lands, agroforestry, woodlots, and the communal grounds). According to farmers trees from agrofoerstry and woodlots contribute to the aesthetic because they are planted in space on agricultural lands. MNR is natural (not planned), comprised of not only trees

but also shrubs, and surrounding agricultural lands thus making it an aesthetic attribute; it contains various species of trees forming a different canopy and visual attraction from that of farm trees (agroforestry and woodlots). Also land shape was also considered as an individual aesthetic character, due the fact that some agricultural lands are not having (plants (trees) but bare land have aesthetic from its topographic appearance.

Table 8: Farmers' response on the value of agricultural land with respect to aesthetic attributes in Lushoto District, Tanzania

Agricultural land value (Weighing levels)	5	4	3	2	1	
Aesthetic attributes	Farmers' response on agricultural land value (%)					RII
Magamba Nature Reserve (MNR)	25	10	33	8	24	0.646
Farm trees	17	5	15	43	21	0.568
Land shape	48	14	23	4	10	0.823
Communal ground	4	7	17	36	37	0.464

Key: RII – Land value Relative importance index; weighing: 1= very low valued, 2= low valued, 3 = moderately valued, 4= highly valued, 5 = very highly valued

From Table 8 it is clear land shape provides more aesthetic value leading to increased agricultural land value (RII = 0.8230), followed by attraction from MNR (RII = 0.646), trees (RII = 0.568) and the least is the communal ground (RII = 0.464). Land shape comprised of valleys and mountains was mostly valued probably due to its attractiveness for good view from mountains and valley bottoms. Reed and Kleynhans (2009) argued that the presence of rivers or streams, mountains, and beautiful views were aesthetic reasons for lifestyle buyers in Western Cape Province, South Africa. This is consistence with farmers' perception concerning land shape (valley bottoms, mountains and slopes). MNR was ranked second because farmers were attracted with ecological benefits obtained from it. This is in line with Lisec and Drobne (2009) who explained that natural protected areas provide values and benefits to the surrounding community. Although communal ground was least valued (RII = 0.464) still farmers considered it attractive for

recreation and it is reported that foreigners have been visiting the ground for recreation. Reed and Kleynhans (2009) and Banzhaf (2010) asserted that open spaces in rural lands are attractive hence provides aesthetic views.

Heritage

Farmers' response on the value of agricultural land with respect to heritage attributes is presented in Table 9. Under the social-cultural landscape farmers mentioned inheritance as a very important criterion in valuing their agricultural land. According to Banzhaf (2010) inheritance is a non-use value and it was also identified by Duguma and Hager (2011) as one of the social determinants of ecological values for different land uses in Ethiopia. Farmers stressed that the number of generations that have occupied a land parcel/land area will significantly influence the land value. For example in the study area a land inherited with seven generations was perceived of high value by the family members and regarded as a prestige to the family.

Table 9: Farmers' response on the value of inherited agricultural land with respect to presence of settlements in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Inheritance	Farmers' response on agricultural land value (%)					RII
Inherited land (with settlement)	20	8	3	4	10	0.316
Inherited land (without settlement)	18	3	1	3	31	0.278

Key: RII – Land value Relative importance index; weighing levels: 1= very low valued, 2= low valued, 3 = moderately valued, 4= highly valued, 5= very highly valued

Table 9 shows that among inherited land parcels with settlement, most of the farmers perceived those lands to have relatively high value. It also shows that among inherited land parcels without settlement, most of the farmers perceived such lands to have

relatively low value. This indicates that the value depends much on how long a farmer or generation has been living on the inherited land and not how long a person or generation has possessed the land. The belief is that, most of inherited lands with settlements have ancestors and relatives' tombs, so by their values and customs these lands are highly valued.

Management practice

Some of the management practices in the study area are presented in Plate 6. Farmers' response on the agricultural land value under different management practices is presented in Table 10. Farmers stressed management practice(s) as a determinant of agricultural land value. The management practices which were reported by farmers in the study area included grass strips (*miraba)*, contours, drainage channels, mulching, organic manure application, fallowing, and bench terraces sometimes reinforced with elephant grasses or Guatemala.

According to de Graaff *et al.* (2008) farmers' efforts or labour investment in land management is a determinant for value addition to agricultural land. Apart from labour investment, also farmers in determining the value of agricultural land may base on the functionality and impact of a management practice(s) to crop production.

Plate 6: Management practices in Kibohelo and Fyoifyoi hamlets in Lushoto District, Tanzania

Table 10: Farmers response on the relative value of agricultural land under different management practices in Lushoto District, Tanzania

Agricultural land value (weighting levels)	5	4	3	2	1	
Management practice	Farmers' response on agricultural land value (%)					RII
Terraces	19	47	19	16	0	0.668
Grass strips (*Miraba*)	18	19	27	33	5	0.598
Organic manure	8	13	41	35	3	0.563
Terraces and Organic manure	77	13	3	7	0	0.880
Grass strips (*Miraba*) and Organic manure	69	19	10	1	0	0.842
Drainage channels	0	0	3	11	86	0.193
Fallowing	0	3	10	7	80	0.256

Key: RII – Land value Relative importance index; weighting levels: 1 = very lowly valued, 2 = lowly valued 3 = moderately valued, 4 = highly valued, 5 = very highly valued

Table 10 shows that farmers perceived land with a combination of terraces and organic manure management practices to be the most valued (RII = 0.880), followed by land with *Miraba* and organic manure (RII = 0.842), land with terraces (RII = 0.668), land with *miraba* (RII = 0.598), land with organic manure (RII = 0.563), land under fallowing (RII = 0.256), and land with drainage (RII = 0.193) in that order (Table 10). Wickama *et al*. (2014) found that, lands with terraces had high organic content, high crop yield and reduced soil erosion compared to the ones with grass strips (*miraba*) and or no management practice(s). Based on Wickama *et al*. (2014) findings it was expected land with terraces to be valued more when compared to the ones with *Miraba* and organic manure but farmers perception in this study is inconsistence with this.

4.3 Important Farmers' Perceived Criteria for Valuation of Agricultural Landunder Different Farming Systems/Land Use Types

4.3.1 Relationship between farmers' perceived criteria for valuation of agricultural land and agricultural land value under vegetable cultivation

Table 11 presents the relationship between farmers' perceived agricultural land value and determinants for agricultural land value under vegetable cultivation. The results show that nearness to road, aesthetic and heritage had significant influence on the value of agricultural land under vegetable cultivation ($p < 0.05$). The results indicate that, one unit increase out of five levels of importance is associated with odds of having a high land value by multiplicative factor of 9.837, 4.073 and 16.997 for nearness to road, aesthetic and heritage respectively (Table 11).

Table 11: Important determinants for valuation of agricultural land under vegetable cultivation

	Variables in the equation					
Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Nearness to water	1.134	.885	1.642	1	.200	3.108
Nearness to road	2.286	.800	8.157	1	.004*	9.837
Soil fertility	1.509	.783	3.709	1	.054	4.521
Topography	.871	.625	1.944	1	.163	2.389
Aesthetic	1.404	.679	4.280	1	.039*	4.073
Heritage	2.833	1.317	4.629	1	.031*	16.997
Management practices	.453	.618	.536	1	.464	1.573
Constant	-22.868	7.254	9.939	1	.002	.000

Key: B = variable coefficient, S.E. = Standard error, Wald = Wald chi-square test statistic, df = degrees of freedom, sig. = Level of significance, Exp(B) = odds ratio , * = significant at $p < 0.05$.

The significance of nearness to road implies that transportation of agricultural produce is easier for a parcel of agricultural land that is near to a road and, the vice versa is true. Accessibility to the parcel of agricultural land through transportation network such as road network have impact on transportation costs and this determines the value of land (Banzhaf, 2010; Sklenicka *et al.*, 2013).

Cultivated landscapes often have aesthetic qualities (de Groot, 2006). Since vegetable cultivation in the valley bottom lands is associated with high valued lands attributed to good land qualities and high productivity, this might have influenced its attractiveness. Kleynhans and Opperman (2005) found aesthetic to be an important motivation factor for buyers of agricultural land and it has also featured as important criteria for farmers as owners. Topography, trees, and surrounding environment contributes to aesthetic or attractiveness of a land parcel (Reed and Kleynhans, 2009; Kok *et al*., 2014). According to Swanwick (2009) aesthetic appreciation and cultural heritage are among the services and benefits provided by every landscape.

4.3.2 Relationship between farmers' perceived criteria for valuation of agricultural land and agricultural land value under agroforestry

Relationship between farmers perceived agricultural land value and determinants of agricultural land value under agroforestry is presented in Table 12. The results show that nearness to water, nearness to road, soil fertility, heritage, and management practices had significant influence on the value of agricultural land used for agroforestry ($p < 0.05$). The results indicate that, one unit increase out of five levels of importance is associated with odds of having a high land value by multiplicative factors of 6.350, 2.956, 4.282, 3.804, and 4.696 for nearness to water, nearness to road, soil fertility, heritage, and management practices respectively (Table 12).

Table 12: Important determinants for valuation of agricultural land under agroforestry

	Variables in the equation					
Variable	B	S.E.	Wald	Df	Sig.	Exp(B)
Nearness to water	1.848	.665	7.718	1	.005*	6.350
Nearness to road	1.084	.527	4.237	1	.040*	2.956
Soil fertility	1.455	.658	4.884	1	.027*	4.282
Topography	.732	.580	1.596	1	.206	2.080
Aesthetic	.692	.565	1.501	1	.221	1.997
Heritage	1.336	.554	5.817	1	.016*	3.804
Management practices	1.547	.600	6.640	1	.010*	4.696
Constant	-19.599	5.242	13.980	1	.000	.000

Key: B = variable coefficient, S.E. = Standard error, Wald = Wald chi-square test statistic, df = degrees of freedom, sig. = level of significance, Exp(B) = odds ratio , * = significant at $p < 0.05$.

It could be argued that being near to the water source simplifies access to water for both domestic use and irrigation. MacDonald *et al.* (2010) argue that agricultural land value is affected directly by the use of water. This implies that a land parcel under agroforestry located near to water sources is of higher value compared to the ones far from the water sources, and may be as the distance from the water source increases the effect of water to the value becomes insignificant.

Nearness to road was significant and this may be due to the fact that, the closer the parcels of land to roads the more movements are simplified to several places like town centres hence more related to the high value of the land. According to Banzhaf (2010) and Sklenicka *et al.* (2013) accessibility to an agricultural land through transportation network have impact on travel costs and this determines the value of such land.

Soil fertility determines the quality of agricultural land and when the soils are good the quality is high leading to high land value (Buck *et al.,* 2014). Banzhaf (2010) also contended that the quality of agricultural land is always used to estimate the land's value. Thus the significance of the soil fertility might be associated with aforementioned arguments in this paragraph.

In the study area 86 percent of farmers with agroforestry were born in the study area and inherited the land. According to Lisec and Drobne (2009) cultural heritage brings benefits to society. Therefore this might have influenced the significance of heritage. Agroforestry are located on areas with slopes (i.e. marginal to very steep slopes) making them prone to soil erosion resulting to soil fertility loss. To combat this farmers invest and practice different management practices with different functionality. Cost of investing in management practices as asserted by Tenge *et al.* (2005) and de Graaff *et al.* (2008) or their functionality as asserted by Klimina, (2013) are contributing to the agricultural land value.

4.3.3 Relationship between farmers' perceived criteria for valuation of agricultural land and agricultural land value under crop cultivation

Table 13 shows the determinants for valuation of agricultural land under crop cultivation (annual and perennial crops excluding vegetables) in the study area. The results show that

nearness to water, nearness to road, soil fertility and condition had significant influence on the value of agricultural land in the study area ($p < 0.05$). The results indicate that for one unit increase out of five levels of importance is associated with odds of having a high land value by multiplicative factors of 13.383, 11.132, and 6.162, for nearness to water, nearness to road, and heritage respectively (Table 13).

Table 13: Important determinants for valuation of agricultural land under crop cultivation

	Variables in the equation					
Variable	B	S.E.	Wald	Df	Sig.	Exp(B)
Nearness to water	2.594	1.027	6.386	1	.012*	13.383
Nearness to road	2.410	1.052	5.252	1	.022*	11.132
Soil fertility	1.916	.981	3.813	1	.051	6.792
Topography	1.436	.913	2.475	1	.116	4.203
Aesthetic	1.704	.950	3.221	1	.073	5.498
Heritage	1.818	.822	4.890	1	.027*	6.162
Management practices	1.412	.757	3.475	1	.062	4.104
Constant	-29.654	9.323	10.118	1	.001	.000

Key: B = variable coefficient, S.E. = Standard error, Wald = Wald chi-square test statistic, df = degrees of freedom, sig. = Level of significance, Exp(B) = odds ratio , * = significant at $p < 0.05$.

Being near to the water source simplifies access to water for both domestic use and irrigation. This is consistent with Flores-benítez *et al.* (2013) and Buck *et al.* (2014) who contended that availability of water for irrigation is an important determinant for agricultural land valuation. It is also true to argue that the shorter the distance of a parcel of agricultural land from a river or water source the easier the accessibility to irrigation water.

Road network is very important for public transportation and even transportation of crops like Irish potatoes. Selection of nearness to road is consistence with Naudé *et al*. (2012) who argued that roads in an important factor for land valuation. According to Sklenicka

et al. (2013) agricultural lands which have no transportation network hinder or demoralize agricultural uses hence lowly valued. Also the quality of a near road to a parcel of land affects the land value (Tsoodle *et al*., 2006).

Heritage appeared also significant as an important determinant of agricultural land value for land under annual and perennial crops cultivation. This is consistence with Mathews and Rex (2011) who found that cultural heritage was rated high by community as a contributor of farmland value in North Carolina. The authors stressed further that heritage is among the significant contributors to the economy and quality of life. Also according to Lisec and Drobne (2009) cultural heritage has a special place for each society.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this study attempts were made to identify agricultural land use types, farmers' criteria for agricultural land valuation across agricultural land use types, and finally to establish farmers perceived criteria for valuation of agricultural land in the study area. Based on the findings from this study the following conclusions are pertinent:

i. The study has identified major agricultural lands across various agricultural land uses and ranked by the community according to the relative importance of the land value. Valley bottom lands for vegetable cultivation; sloping lands and hill summit lands for annual and perennial cropping, agroforestry, woodlots, homesteads, and community land areas. The community land areas are for grassland, recreation and grazing.

ii. The study has demonstrated that farmers (community) were able to identify both physical and social-cultural determinants for valuation of agricultural land including topography, soil fertility, nearness to water, nearness to road, aesthetic attributes, land heritage, and management practices. Farmers were also able to describe and rank the elements or attributes of each determinant with respect to agricultural land value.

iii. Farmers or community as owners of land have showed that different agricultural land uses, topographic units, and elements (attributes) of different determinants impact agricultural land values differently in the study area.

iv. Relationship between farmers' or community's perceived agricultural land value and determinants of the agricultural land value demonstrated that nearness to water, nearness to road, soil fertility, aesthetic, heritage, and management

practices are important land determinants for valuation of agricultural land across land use types. Therefore determinants of agricultural land value for one parcel of agricultural land are not necessarily the same for another parcel of agricultural land since such lands have different characteristics or features. In general farmers/community have portrayed their capacity and ability in identifying and describing the determinants of agricultural land value, hence it is important that they are considered in the valuation process.

5.2 Recommendations

The following recommendations are made in the light of gaps revealed from the findings of this study so as to provide further insights into criteria for valuation of agricultural land based on farmers'/community's perceptions.

i. Establishment of criteria to consider in valuation of agricultural land as per buyers' and sellers' perceptions is important for achieving sense of balance during valuation. Therefore, in this study it is strongly recommended to explore and establish knowledge the sellers and buyers have on the characteristics or features of agricultural land that could influence its value. Such knowledge if captured in the valuation criteria can improve the valuation process of agricultural land.

ii. Criteria for agricultural land valuation have a base from both physical and social-cultural landscapes. It is therefore recommended to integrate both physical and social-cultural determinants in the valuation process of agricultural land whereby farmers' perception are taken into consideration in the land laws and policies.

iii. Agricultural land valuation with strong involvement of farmers or community is a new paradigm shift in the process of valuing agricultural land. Hence further studies are recommended to take into consideration diverse agro-ecosystems and social-cultural setting with multiple cropping landscapes.

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APPENDICES

Appendix 1: Summary of data collection techniques used for study objectives

Output/objectives	Type of data collected	Source of data/ information	Data collection and analysis method(s)	
			Data acquisition	Data analysis
1. To identify agricultural land use types found in the study area in relation to its value	- Different land use types - weighing of land value in relation to each land use type	- Observation and Satellite image - Interviews with different stakeholders (farmers)	- Remote sensing - Garmin GPS	- ArcView GIS 3.2a - Excel
2. To identify criteria used by farmers to value agricultural land in the study area	- Landscape elements characterization - Different criteria as given out and described by a farmers	- Discussions with different stakeholders (communities or farmers) - Information from key informants	- Interview with key informants - Focused group discussion with stakeholders - Questionnaire	- Content analysis - Excel
3. To establish criteria for valuation of agricultural land in the study area	- Ranking of physical, & Socio-economic factors Weighting of agricultural land value	- Interviews with different stakeholders (h/holds and key informants)	- Focused group discussion. - Questionnaire survey.	- Logistic regression model using SPSS

Appendix 2: Household questionnaire survey form

[1]. Household Identification

Division …… Ward……

Village …… Hamlet ……

Household Identification No……GPS coordinates……

[2]. Household data

You are requested to provide information on the following questions. All information will be treated confidentially.

[1]. Name of respondent: ……..

[2]. Age…… (Years)

[3]. Sex of respondent: Male☐ Female☐

[4]. Marital status: Married☐ Single☐ Divorced☐ Widowed☐ Others (specify)……

[5]. Origin: Are you native of this area? Yes☐ No☐

[6]. Residence duration if not native…… (Years)

[7]. Education level: None☐ Primary☐ Secondary☐ College☐ Others (Specify)……..

[8]. Social position……..……...

[3]. Household information on agricultural land

Include all land owned by you even though these are considered separate units; cropland, pasturelands, woodland, and wasteland etc.

[9]. How many acres do you own? . . . . . **None ☐**

(If ‘‘**None**” mark **X** and skip to question [10])

a. How much this owned land would it sell for? . . . . . **Tshs.** (Give your best estimate of market value. Do not give assessed value.)

b. Have you purchased any of this land? **Yes ☐ No ☐**

If “**Yes**” give **Year:** . . . . . **Size (acres):** . . . . . **Price:** . . . . . .

c. Do you rent any of this land to others? **Yes ☐ No ☐**

If “**Yes**” how much do you receive as a rent? . . . . . **None☐**

[10]. How many acres do you rent from others (include acres worked on shares; also include land you use without paying any rent)? . . . . . **None☐**

(If "**None**" mark **X** and skip to question [11])

a. How much would this rented land sell for? . . . . . **Tshs**

(Give your best estimate of market value. Do not give assessed value.)

b. How much do you pay your landlord cash as rent? . . . . . **None☐**

[11]. How many acres do you operate for others as a hired person? . . . . . **None☐** How much would this managed land sell for? . . . . . **Tshs**

(Give your best estimate of market value. Do not give assessed value.)

[4]. Agricultural land use values and the factors influencing the values/cash rents

[12]. What is the agricultural land value for an agricultural land use type? Make the best estimates you can for your area. Complete only the sections applicable to your area.

[13]. What are the major factors influencing agricultural land (farm land) values and cash rents in your area? (write each factor against the letter)

A		F	
B		G	
C		H	
D		I	
E		J	

[14]. Indicate your assessment of the factors mentioned in 13 above, on their influence of agricultural land value by writing the appropriate number as a rank below the factor.

The ranking scale is a 5 point level whereby 1= very low valued, 2 = low valued, 3 moderately valued, 4 = highly valued and 5 = very highly valued.

Agricultural land use type			**Average land value**			**Average rent value**					
Agro-forest			**. . . . . Tshs**			**. . . . . Tshs**					
Location of the land unit (hamlet)											
GPS coordinates (write coordinates in the cell below)	Geomorphic Unit (Tick in the appropriate empty cells below)										
	Valley (a)		Slope (b)			Ridge (c)					
Factors influencing the value	A	B	C	D	E	F	G	H	I	J	K
Ranking (Rank by using the numbers 1, 2, 3, 4 & 5)											

Agricultural land use type			**Average land value**			**Average rent value**					
Vegetable cultivation			**. . . . . ..Tshs**			**. . . . . Tshs**					
Location of the land unit (hamlet)											
GPS coordinates (write coordinates in the cell below)	Geomorphic Unit (Tick in the appropriate empty cells below)										
	Valley (a)		Slope (b)			Ridge (c)					
Factors influencing the value	A	B	C	D	E	F	G	H	I	J	K
Ranking (Rank by using the numbers 1, 2, 3, 4 & 5)											

Agricultural land use type			**Average land value**			**Average rent value**					
Other annual and perennial crops			**. . . . . .Tshs**			**. . . . . Tshs**					
Location of the land unit (hamlet)											
GPS coordinates (write coordinates in the cell below)	Geomorphic Unit (Tick in the appropriate empty cells below)										
	Valley (a)		Slope (b)			Ridge (c)					
Factors influencing the value	A	B	C	D	E	F	G	H	I	J	K
Ranking (Rank by using the numbers 1, 2, 3, 4 & 5)											

Agricultural land use type			**Average land value**			**Average rent value**					
			. . . . . Tshs			**. . . . . Tshs**					
Location of the land unit (hamlet)											
GPS coordinates (write coordinates in the cell below)	Geomorphic Unit (Tick in the appropriate empty cells below)										
	Valley (a)		Slope (b)			Ridge (c)					
Factors influencing the value	A	B	C	D	E	F	G	H	I	J	K
Ranking (Rank by using the numbers 1, 2, 3, 4 & 5)											

[15]. Please provide any other general comments you have about agricultural land values, rents and factors influencing them in your area .....……

Appendix 3: Checklist for Key Informants/Focused group discussion

Key informants

A. Village leaders/Village elite groups/Villagers

B. Representatives of NGOs/CBOs and Religious group

Issues to be discussed and collected

General information

a. Date……Place of interview…….

b. Name…….....….Sex……

c. Position……

1. What are the agricultural land use types on your area?

   i) . . . . . Value . . . . . Tshs

   ii) . . . . . Value . . . . . Tshs

   iii) . . . . . Value . . . . . Tshs

   iv) . . . . . Value . . . . . Tshs

   v) . . . . . Value . . . . . Tshs

   vi) . . . . . Value . . . . . Tshs

2. Which agricultural land use type is of higher social-cultural value compared to the others? Rank them in order of potentiality eg. ii, iii, i, ... meaning (ii) is of more value followed by (iii) then (i).

3. What are the factors affecting the value of agricultural land use types mentioned in Question 1? Arrange the factors in order from the most to the least influencing factor

For i (a) . . . . . (b) . . . . . .(c) . . . . . . (d). . . . . (e) . . . . . .

For ii. (a) . . . . . (b) . . . . . (c) . . . . . (d). . . . . (e) . . . . . .

For iii. (a) . . . . . (b) . . . . . (c) . . . . . (d). . . . . (e) . . . . . .

For iv. (a) . . . . . (b). . . . . (c) . . . . . (d). . . . . (e) . . . . . .

Appendix 4: Farmers ranking of criteria for valuation of agricultural land

Respondent ID	Land use type	A	B	C	D	F	G	H	I	Y	Cut off value 3.5
1	V	5	4	5	5	3	3	1	4	3.75	1
2	V	4	4	3	4	1	4	1	5	3.25	0
2	AGH	5	5	4	2	1	4	1	5	3.38	0
3	V	5	5	5	3	1	3	1	5	3.50	1
3	AGH	1	3	3	1	1	4	2	5	2.50	0
4	V	5	4	3	2	1	3	1	4	2.88	0
4	AG	1	4	2	3	2	4	1	2	2.38	0
5	V	5	5	4	5	1	3	1	5	3.63	1
5	CH	2	3	3	2	2	2	5	5	3.00	0
6	V	5	4	4	3	1	3	1	5	3.25	0
6	C	1	4	3	3	2	1	2	5	2.63	0
7	V	3	4	1	4	1	3	1	2	2.38	0
7	AGH	1	3	3	3	1	3	4	4	2.75	0
8	V	5	4	3	4	1	1	1	3	2.75	0
8	AGH	1	5	1	4	1	4	5	3	3.00	0
9	V	5	5	5	5	1	5	1	5	4.00	1
9	AG	3	3	4	4	3	3	1	4	3.13	0
10	V	5	4	4	4	2	3	2	4	3.50	1
10	AG	1	4	4	3	1	4	4	5	3.25	0
11	V	4	2	2	1	3	3	1	2	2.25	0
11	AGH	1	1	1	1	1	2	5	5	2.13	0
12	V	4	4	3	2	1	2	1	2	2.38	0
12	CH	2	2	3	1	1	2	1	3	1.88	0
13	AGH	5	3	3	5	5	3	3	4	3.88	1
14	V	5	5	4	1	1	3	1	5	3.13	0
14	AGH	1	2	1	2	1	2	4	4	2.13	0
15	V	5	4	5	3	1	4	1	1	3.00	0
15	AGH	5	4	4	1	1	4	1	5	3.13	0
16	V	5	2	4	4	1	1	1	2	2.50	0
16	AGH	1	4	4	3	1	2	4	5	3.00	0
17	V	5	4	4	4	1	2	1	3	3.00	0
17	AG	1	1	2	1	2	2	4	3	2.00	0
17	CH	1	1	1	2	4	1	2	3	1.88	0
18	V	5	5	4	4	3	2	1	5	3.63	1
18	AGH	1	4	5	5	5	4	5	5	4.25	1

Appendix 4: continued

Respondent ID	Land use type	A	B	C	D	F	G	H	I	Y	Cut off value 3.5
19	AGH	1	4	4	4	1	2	4	5	3.13	0
19	C	3	4	5	3	5	4	1	5	3.75	1
20	V	5	5	4	4	4	4	1	5	4.00	1
20	AGH	1	4	5	1	3	5	4	5	3.50	1
21	V	5	5	4	5	4	4	1	3	3.88	1
21	AG	1	5	3	2	5	4	3	4	3.38	0
22	V	5	1	3	1	5	3	1	1	2.50	0
22	AG	5	3	3	1	5	3	2	1	2.88	0
23	V	5	1	1	5	4	4	1	5	3.25	0
23	AGH	1	1	5	2	4	3	2	2	2.50	0
23	C	1	1	3	2	3	4	5	2	2.63	0
24	V	5	1	5	4	2	4	1	5	3.38	0
24	AGH	1	1	4	5	5	4	5	4	3.63	1
25	V	5	2	5	3	5	5	1	2	3.50	1
25	AGH	1	3	2	1	5	3	1	3	2.38	0
26	V	5	4	5	4	1	3	1	4	3.38	0
26	AH	1	3	2	5	3	3	3	5	3.13	0
27	V	5	1	5	4	5	2	1	4	3.38	0
27	AGH	1	1	3	3	5	4	5	2	3.00	0
28	V	5	5	5	5	5	5	1	5	4.50	1
28	AG	1	2	4	2	5	4	1	5	3.00	0
28	CH	5	5	2	1	4	5	1	5	3.50	1
29	V	5	3	4	4	5	2	1	5	3.63	1
29	AGH	4	4	3	1	5	3	5	3	3.50	1
30	V	5	5	3	5	2	4	1	5	3.75	1
31	AGH	5	5	3	5	3	4	1	1	3.38	0
32	V	5	5	4	3	4	3	5	3	4.00	1
32	AGH	1	4	4	3	5	4	2	4	3.38	0
32	C	5	5	2	2	4	2	5	1	3.25	0
33	V	5	5	3	5	4	3	4	3	4.00	1
33	AGH	1	4	3	3	2	4	5	4	3.25	0
34	V	5	2	4	5	1	5	1	1	3.00	0
34	AG	5	2	5	5	4	4	5	5	4.38	1
35	V	4	3	4	4	5	4	1	1	3.25	0
35	AG	1	5	4	4	4	2	5	2	3.38	0

Appendix 4: continued

Respondent ID	Land use type	A	B	C	D	F	G	H	I	Y	Cut off value 3.5
36	AGH	2	5	3	3	3	2	4	3	3.13	0
37	AGH	3	5	3	4	4	2	4	5	3.75	1
38	V	5	5	5	3	4	3	1	3	3.63	1
38	CH	3	2	3	4	4	5	2	5	3.50	1
39	V	5	3	4	3	5	3	1	4	3.50	1
39	AGH	1	2	3	5	1	2	5	5	3.00	0
39	C	1	3	4	2	2	4	1	4	2.63	0
40	V	4	2	3	2	1	4	1	4	2.63	0
40	C	2	3	4	2	1	3	5	4	3.00	0
41	V	5	2	3	4	3	2	1	3	2.88	0
41	AGH	2	1	3	3	5	1	4	5	3.00	0
41	CH	3	5	5	5	3	3	1	3	3.50	1
42	V	5	2	4	5	4	2	1	4	3.38	0
42	AGH	5	2	4	3	3	5	3	5	3.75	1
43	AGH	3	1	3	2	4	5	1	3	2.75	0
43	C	1	5	3	4	5	5	1	2	3.25	0
44	V	5	5	4	4	4	4	1	3	3.75	1
45	V	5	5	4	3	4	4	5	3	4.13	1
45	AGH	1	5	4	3	4	4	5	3	3.63	1
46	V	5	5	4	4	4	5	5	4	4.50	1
46	CH	5	5	4	2	4	4	5	3	4.00	1
47	V	5	5	4	4	4	5	5	4	4.50	1
47	AGH	1	4	3	5	4	4	5	4	3.75	1
48	AGH	1	5	4	4	4	4	5	3	3.75	1
48	C	1	4	3	4	4	3	1	2	2.75	0
49	V	5	5	4	3	4	5	5	3	4.25	1
49	CH	5	1	4	3	4	4	5	2	3.50	1
50	AGH	1	5	4	5	4	5	3	5	4.00	1
50	C	5	1	4	3	4	4	1	5	3.38	0
51	AGH	1	1	4	4	4	3	4	2	2.88	0
52	V	3	5	3	3	4	4	1	4	3.38	0
52	AGH	1	5	3	3	4	3	4	4	3.38	0
52	C	1	1	4	3	3	3	5	2	2.75	0
53	AGH	1	2	4	3	4	3	1	2	2.50	0
53	C	1	1	3	3	4	3	5	2	2.75	0

Appendix 3: continued

Respondent ID	Land use type	A	B	C	D	F	G	H	I	Y	Cut off value 3.5
54	V	5	4	3	3	4	5	1	3	3.50	1
54	AGH	1	4	3	4	4	3	5	2	3.25	0
54	C	1	4	3	4	4	3	5	2	3.25	0
55	AGH	1	5	3	3	4	3	5	4	3.50	1
55	C	1	4	4	3	3	3	5	2	3.13	0
56	AG	1	2	3	3	3	3	5	2	2.75	0
56	C	1	4	3	3	4	3	1	2	2.63	0
57	V	5	5	4	4	4	5	5	3	4.38	1
57	AGH	1	5	4	3	4	5	2	4	3.50	1
57	C	1	1	4	3	4	4	1	3	2.63	0
58	C	1	5	4	4	4	4	5	2	3.63	1
59	V	5	5	4	4	4	4	1	3	3.75	1
59	C	5	5	4	3	4	3	5	4	4.13	1
60	V	5	5	5	4	4	4	5	2	4.25	1
60	CH	1	1	4	4	4	3	5	2	3.00	0
61	CH	1	1	4	4	4	4	1	2	2.63	0
62	V	5	4	4	3	3	4	5	3	3.88	1
62	AGH	1	2	3	4	5	4	5	2	3.25	0
62	C	1	1	3	3	4	3	5	2	2.75	0
63	CH	1	1	3	4	4	3	5	2	2.88	0
64	V	5	5	3	5	4	5	1	3	3.88	1
64	AGH	1	1	3	4	4	3	4	5	3.13	0
64	C	1	4	3	4	4	3	1	2	2.75	0
65	V	5	2	5	3	4	5	5	5	4.25	1
65	CH	1	1	2	5	3	4	5	4	3.13	0
66	C	1	2	1	2	4	4	1	2	2.13	0
67	V	5	4	4	5	5	4	4	5	4.50	1
67	CH	1	5	1	2	5	4	5	3	3.25	0
68	V	5	5	4	5	4	5	5	3	4.50	1
68	CH	1	5	3	3	4	5	2	3	3.25	0
69	AG	1	1	5	4	4	3	1	2	2.63	0
69	CH	1	5	1	1	5	4	5	2	3.00	0

Appendix 3: continued

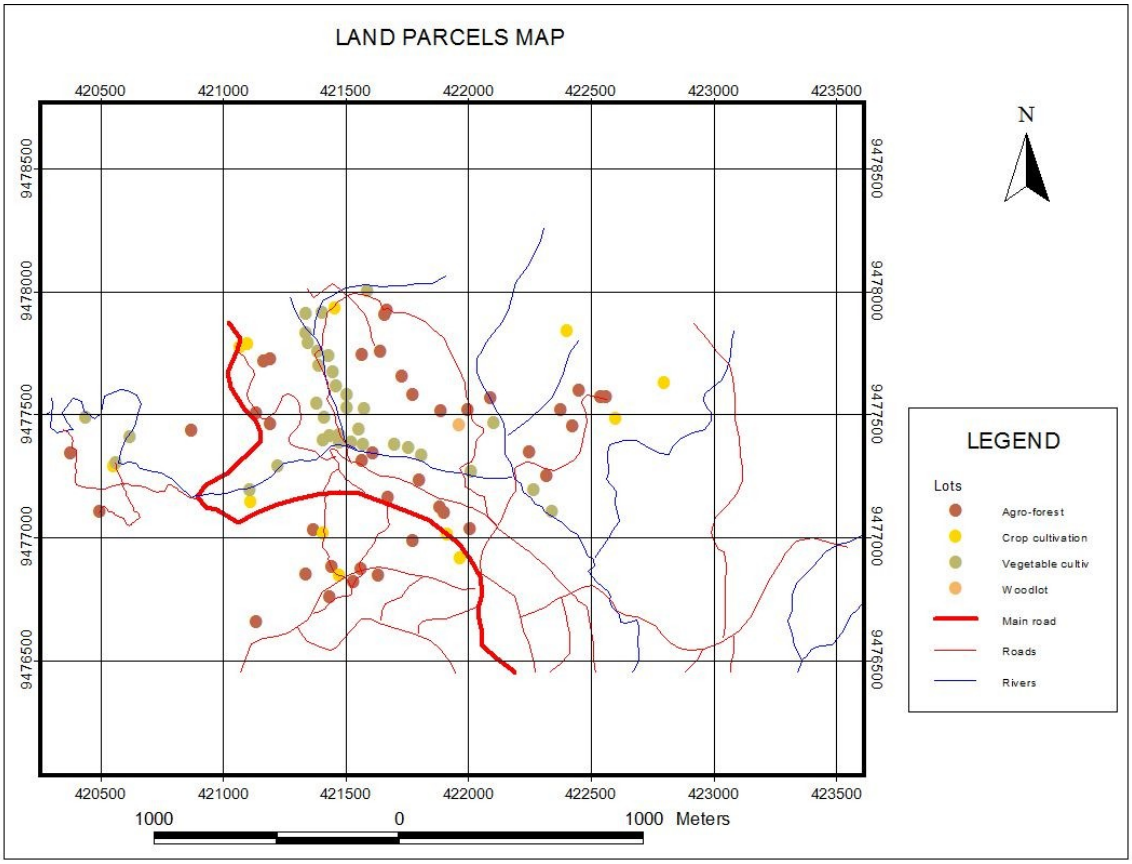
Respondent ID	Land use type	A	B	C	D	F	G	H	I	Y	Cut off value 3.5
70	V	5	3	4	5	1	5	1	3	3.38	0
70	AG	1	3	3	2	1	4	2	3	2.38	0
70	CH	4	3	3	4	1	4	1	5	3.13	0
71	V	1	4	3	3	3	5	1	5	3.13	0
71	AG	1	1	5	4	5	4	1	5	3.25	0
71	CH	1	5	3	4	4	5	5	5	4.00	1
72	V	5	5	4	3	4	5	1	3	3.75	1
72	CH	1	5	3	3	4	5	1	4	3.25	0
72	C	1	1	3	3	3	5	1	5	2.75	0
73	V	5	5	4	5	5	5	1	2	4.00	1
73	AGH	1	5	4	4	3	4	1	2	3.00	0
74	AGH	1	5	3	1	3	3	1	5	2.75	0
74	C	1	3	3	5	1	4	1	3	2.63	0
75	V	4	1	4	3	4	5	1	4	3.25	0
75	C	1	3	2	3	3	3	1	4	2.50	0
76	CH	1	1	2	3	4	1	1	5	2.25	0
77	V	5	5	4	4	5	5	4	3	4.38	1
77	AGH	1	5	3	4	2	3	1	5	3.00	0
78	CH	1	5	3	5	4	5	5	4	4.00	1
79	V	5	5	4	3	4	5	5	4	4.38	1
79	AG	1	5	4	4	4	5	5	4	4.00	1
79	CH	1	5	3	5	4	5	5	2	3.75	1
80	AH	1	1	2	2	3	4	4	5	2.75	0
81	AH	1	5	4	2	3	4	5	2	3.25	0
82	CH	1	5	5	4	5	5	5	3	4.13	1
82	C	1	5	5	4	5	5	1	2	3.50	1
83	V	5	2	3	3	4	3	1	5	3.25	0
83	CH	1	5	3	3	5	4	5	5	3.88	1
84	V	5	5	3	4	4	5	5	4	4.38	1
84	AG	1	5	4	4	4	5	5	2	3.75	1
84	CH	2	5	4	3	3	4	5	5	3.88	1
85	AGH	1	5	3	5	3	4	1	3	3.13	0
86	V	5	5	4	2	4	5	1	3	3.63	1
86	AG	1	1	4	1	4	3	1	2	2.13	0

Appendix 3: continued

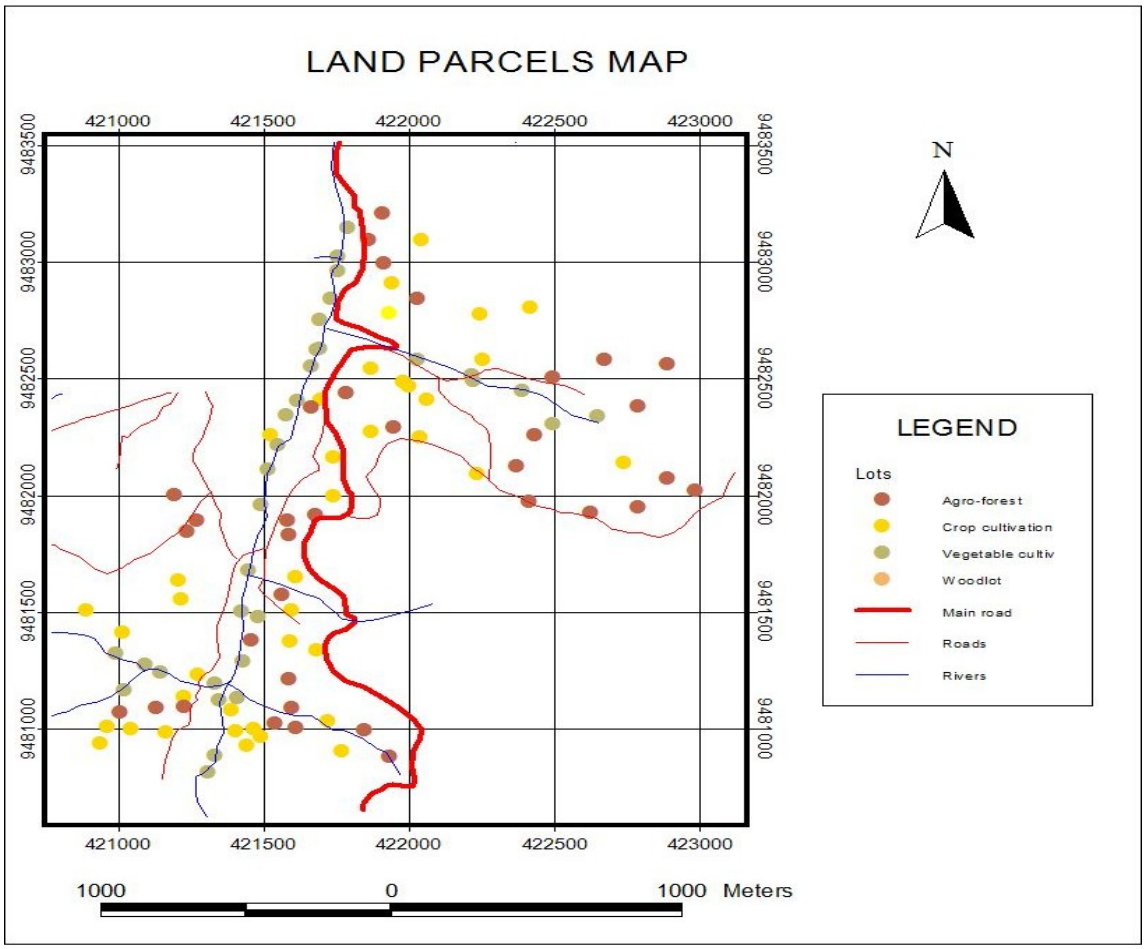
Respondent ID	Land use type	A	B	C	D	F	G	H	I	Y	Cut off value 3.5
87	V	5	5	3	4	3	5	4	3	4.00	1
87	AG	1	5	4	2	3	4	2	3	3.00	0
87	CH	1	1	3	4	3	2	1	2	2.13	0
88	V	5	5	4	4	4	5	5	4	4.50	1
88	CH	1	5	3	4	3	4	5	2	3.38	0
89	AGH	1	1	3	4	4	4	5	4	3.25	0
89	C	1	1	2	3	2	3	1	2	1.88	0
90	AGH	1	5	3	3	3	3	4	5	3.38	0
91	AGH	1	1	4	3	4	4	5	5	3.38	0
92	AGH	1	5	3	3	4	3	5	4	3.50	1
93	C	2	5	3	4	4	4	1	3	3.25	0
94	C	1	1	4	4	4	3	5	2	3.00	0

Whereby; AG – Agro-forest, AGH – Agro-forest and home place, C – Crop cultivation, CH – Crop cultivation and home place, V – Vegetable cultivation, A – Nearness to water source, B – Nearness to road, C – Soil fertility, D – Topography, F – Climate condition, G – Aesthetic, H – Heritage, and I – Management practices, Y – dependent value index

Appendix 5: Spatial distribution of interviewed land parcels (Kibohelo and Fyofyoi)



Appendix 6: Spatial distribution of interviewed land parcels (Ndabwa and Makanya)



Appendix 7: Household sampling

S/No	Hamlets	Number of households	Sample size	Number of interviewed
1	Kibohelo	106	30	26
2	Fyoifyoi	112	30	21
3	Ndabwa	84	30	18
4	Makanya	97	30	29
Total		399	120	94