VALUATION OF WOODLAND BENEFIT FROM THE LOCAL HOUSEHOLDS PERSPECTIVES: THE CASE OF LARE DISTRICT IN SOUTHWESTERN ETHIOPIA

MSc Thesis

By

Paul Gatluak Puldeng

December, 2012 GC

Jimma University

VALUATION OF WOODLAND BENEFIT FROM THE LOCAL HOUSEHOLDS PERSPECTIVES: THE CASE OF LARE DISTRICT IN SOUTHWESTERN ETHIOPIA

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By

Paul Gatluak Puldeng

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Jimma University

APPROVAL SHEET

SCHOOL OF GRADUATE STUDIES

As Thesis research advisor, I hereby certify that I have read and valuated this Thesis prepared under my guidance by Paul Gatluak Puldeng in titled "valuation of woodland benefit from the local households' perspectives: the case of Lare District in Southwestern Ethiopia". I recommend that it be submitted as fulfilling the M.Sc thesis requirement.

Debela Hunde Feyssa (PhD, Associate Professor): _____ _____

Major Advisor Signature Date

Wubeshet Chala Erko (MSc): _____ _____

Co-advisor Signature Date

As member of the board of examiners of the MSc Thesis open Defense Examination, we certify that we have read and evaluated the Thesis prepared by Paul Gatluak Puldeng and examined the candidate. We recommended that the Thesis be accepted as fulfilling the Thesis requirement for the degree of Master of Science in Natural Resources Management (Watershed Management).

_____ _____ _____

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_____ _____ _____

Internal Examiner Signature Date

_____ _____ _____

External Examiner Signature Date

DEDICATION

I would like to dedicate this thesis to my wife Nyibol Chuol Wechjock whose consistent her encouragement and support has significantly contributed for successful completion of my graduate work. I also dedicate this work to my lovely daughters Nyagoa Paulgatluak puldeng and Nyawari Paulgatluak puldeng; my son Puldeng Paulgatluak puldeng; my mother Mary Nyayual Joack; my brothers Peter Tharek Puldeng and Titus Tesloach Puldeng who always bear and eager to see my success in work.

STATEMENT OF THE AUTHOR

I Paul Gatluak Puldeng hereby declared that this thesis is my work and all sources of materials used for this thesis have been appropriately acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc degree at the Jimma University College of Agriculture and Veterinary Medicine from the Department of Natural Resources Management (Watershed Management) and is being deposited in the University's Library to be made available to borrowers under rules of the library. I declared that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate. Brief quotations from this thesis are allowable without special permission provided that an accurate acknowledgement of the source is made. Request for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the major advisor or the Dean of the School of Graduate Studies when the intended use of material is for the scholarly interest. In all other instances, however, permission must be obtained from the author.

Name: Paul Gatluak Puldeng Signature ----------

Place: Jimma University College of Agriculture and Veterinary Medicine

Date: December, 2012 GC

BIOGRAPHICAL SCKETCH

The author, Paul Gatluak Puldeng, was born in Gambella National Regional state, Southwestern Ethiopia in Lare Woreda on March 2, 1986. He attended his elementary school (1-4) th grade in Teluth primary school at the same Woreda in 1995 GC, junior secondary school (5-7) th grade at same Woreda in Kuergeng Primary and Junior School from 1998 GC to 2000 GC, 8th grade in 2001 from Dimma Woreda Junior School and (9-10)th grade from Kuergeng Primary and Junior School in (2002-2003) GC. He attended his high school education (11-12)th grade at Gambella senior secondary school from 2004 to 2005 GC. After the completion of his high school education, he joined the Mekelle University and graduated with his Bachelor degree in Natural Resources Economics and management in July 2008 GC. Immediately after his graduation, he joined the bureau of Agriculture and Rural development in Gambella regional state and was assigned to work as a regional environmental economist and lastly transferred to Gambella Agricultural Research Institute and served as a Lare research center manager, and then he was assigned as a Natural Resources research Version Director in Gambella Agricultural Research Institute. In 2010 GC academic year, the author joined the school of graduate studies at Jimma University, college of Agriculture and Veterinary Medicine to pursue his M.Sc degree in Natural Resources Management (Watershed Management).

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LIST OF ABBREVIATIONS

AGHH	Age of Household Head
BV	Bequest value
ECSA	Ethiopian Central Statistic Agency
EDUHH	Education level of Household Head
EFAP	Ethiopian Forest Action Program
EV	Existence value
FOA	Food Agricultural Organization
FR	Fish resources
FSH	Family Size per Household
GHH	Gender of Household Head
GPDC	Gambella Peace and Development Council
$THAK_x$	Total Households' heads of All Kebeles
$THEK_x$	Households' heads of Each Kebele
IPCC	Intergovernmental Panel on Climate Change
MP	Medicinal plants
n	Total numbers of sample size representatives
NCH	Number of Cows per Household
NUV	Non-Use Value
OV	Option value
RP	Revealed Preference
S and W	Soil and water
SCLH	Size of Cultivated Land per Household
SP	Stated Preference
$PHEK_x$	Proportion of Households' heads representative from Each Kebele.
TIH	Total Income per Household

TP	Timber product
UV	Use Value
WEF	Wild edible fruits
WF	Woodfuel
WL	Wildlife

TABLE OF CONTENTS

APPROVAL SHEET ..... **ii**
DEDICATION ..... **iii**
STATEMENT OF THE AUTHOR ..... **iv**
BIOGRAPHICAL SCKETCH ..... **v**
ACKNOWLEDGEMENTS ..... **vi**
LIST OF ABBREVIATIONS ..... **vii**
TABLE OF CONTENTS ..... **ix**
LIST OF TABLES ..... **xi**
LIST OF FIGURES ..... **xii**
LIST OF APPENDIX ..... **xiii**
ABSTRACT ..... **xiv**
1. INTRODUCTION **1**
1.1. Background 1
1.2. Statement of the problem 4
1.3. Objectives 6
2. LITERATURE REVIEW **7**
2.1. Current Condition of Natural woodland 7
2.2. Empirical study of economic valuation of woodland 8
2.3. Potential biases of contingent valuation method 11
2.4. Validation of contingent valuation method 12
3. MATERIALS AND METHODS **14**
3.1. Description of the study area 14
3.2. Economic Values of Gambella Natural Lowland Woodland 16
3.3. Natural resources valuation method background 19
3.4. Contingent valuation method background 20
3.5. Relation between contingent valuation method and willingness to pay 20
3.6. Sources of data 21
3.7. Sampling methods and sample size selection strategies 22
3.8. Data collection 23
3.8.1. Selected component units of woodland's uses value 24

TABLE OF CONTENTS (CONT…)

3.8.2. Selected component units of woodland's none-uses value 24
3.9. Data analysis 26
3.9.1. Description of the econometric model 27
3.9.2. Specification of the Tobit Econometric Model 27
3.10. Relation between iterative bidding game and Tobit Econometric Model 29
3.11. Description and hypothesis of the variables of model 30
3.11.1. Description of the dependent variables of model 31
3.11.1.1. Definition of the uses value of woodland 31
3.11.1.2. Definition of the non-uses value of woodland 32
3.11.2. Description of independent variables and their expected influence on WTP 32
4. RESULTS AND DISCUSSION 35
4.1. Demographic and socioeconomic characteristics of the households 35
4.1.1. Demographic characteristics of the households 35
4.1.2. Socioeconomic characteristics of the households 36
4.2. Natural Lowland Woodland use values contribution to rural households 37
4.2.1. Pearson correlation of woodland uses with explanatory variables 42
4.2.2. Main agents for deforestation acceleration 43
4.3. Maximum willingness to pay of households for management of woodland values 44
4.3.1. Maximum willingness to pay of households to woodland use values 45
4.3.1.1. Attitude of households to woodland use values 51
4.3.2. Maximum willingness to pay of households to woodland non-use values 53
4.3.2.1. Attitude of households to woodland non-use values 54
4.3.3. Economic values of woodland component units 55
4.3.4. The Tobit Model Result 56
4.3.4.1. Factors influencing willingness to pay of households 56
5. CONCLUSION AND RECOMMENDATION 59
5.1. Conclusion 59
5.2. Recommendation 60
REFERENCES 62
APPENDICES 66

LIST OF TABLES

Table 1. Land cover of Gambella region **15**
Table 2. Population of households and proportion of sample size representatives **23**
Table 3. Description of the explanatory variables **34**
Table 4. Demographic characteristics of households **35**
Table 5. Socioeconomic characteristics of the households **36**
Table 6. Timber products (e.g. Log products) consumption by households **38**
Table 7. Wild edible fruits (e.g. Balanites egyptica indica) consumption by households **39**
Table 8. Medicinal plants (e.g. Balanites egyptica indica) consumption by households **40**
Table 9. Hunt meat (e.g. white eared kobs) consumption by households **40**
Table 10. Correlation of woodland uses with variables **42**
Table 11. Agent for deforestation acceleration **43**
Table 12. MaxWTP of households for conservation of wood fuels (e.g. Dry woods) **46**
Table 13. MaxWTP of households for conservation of wildlife (e.g. White eared kobs) **48**
Table 14. MaxWTP of households for conservation of livestock (e.g. Cows) **49**
Table 15. MaxWTP of households for management of existence values (e.g. snakes) **53**
Table 16. Economic values of woodland component units in 2011/2012 GC **55**
Table 17. Tobit Model maximum likelihood **58**

LIST OF FIGURES

Figure 1. Gambella National Regional State Administrative Zones..... 15
Figure 2. Total Economic Values of Forest or Woodland..... 19
Figure 3. Wood fuels (e.g Dry woods) consumption by households..... 37
Figure 4. Water (e.g. Surface water) consumption by households..... 41
Figure 5. Fish resources (e.g. Catfish) extraction by households..... 41
Figure 6. MaxWTP of households for management of timber products (e.g. Log products)..... 45
Figure 7. MaxWTP of households for Mgt of WEF and MP (e.g. Balanites egyptica indica)..... 47
Figure 8. MaxWTP of households for Mgt of land (e.g.cultivated) and water (e.g.surface)..... 49
Figure 9. MaxWTP of households for management of fish resources (e.g. Catfishes)..... 50
Figure 10. MaxWTP of H heads for Mgt of option values (e.g. use values mentioned above) ... 51
Figure 11. MaxWTP of Hs for mgt of bequest values (e.g. use and existence values above)..... 54

LIST OF APPENDIX

Appendix 1. Designed survey questionnaires 67
Appendix 2. White-eared kobs migrate across the Gambella woodland from South Sudan. 75
Appendix 3. Livestock holding per household 75
Appendix 4. Cultivated land holding per household 76
Appendix 5. Remittances per household 76
Appendix 6. Test for multi-collinearity among continuous variables using VIF 77
Appendix 7. Test for association among dummy variables using CC 77

VALUATION OF WOODLAND BENEFITS FROM THE LOCAL HOUSEHOLDS PERSPECTIVES: THE CASE OF LARE DISTRICT IN SOUTHWESTERN ETHIOPIA

ABSTRACT

Woodland provide a wide range of benefits to rural people, ranging from being as a source of new agricultural land, non-timber forest products, timbers and provide a range of on-site ecological services. The world's population today is expanding by 92 million people each year. Rural people pose threats to the forest in general and to some species in particular for the means of generating subsistence and income. It has long been argued that, the forest income in general is relatively more important for the low income households and as a corollary that overuse and degradation will hurt them more. The Gambella lowland woodland has more than 106 woody plant species documented. The major objective was to determine the economic values of Lare district woodland's uses and non-uses value from the local households' heads perspectives. The study was done in Gambella National Regional States of Ethiopia in Southwestern part of the country. Six kebeles were selected purposely from Lare wereda as research target population. In selection of the representative sample size, simple random sampling tecnique was designed and applied. Quantitative data were collected from 200 households' heads of those six kebeles using structured questionnaire. All respondents were farmers and livestock husbandry. Willingness to pay data was collected using bidding game model. Quantitative data were collected and analyzed using both descriptive and econometric model with the help of SPSS version 17 software. Timber product (e.g log product) was seen more significant to local people livelihood support in which about 86% of respondents were observed from the range of 100-301+ numbers of timber per household per year. Moreove; local community in the study area were more interested in conservation of soil and water inwhich about 67% of them pay their maximum WTP at equal or above the bid (30-60) ETB per household per year. For management of fish resources (e.g. Catfish), the sample households' heads who are willing to contribute their maximum WTP below bid were 73.5%. The reason for concentration of many respondents in paying their maximum MaxWTP below starting bid level for management of catfish resource is due to not using it frequently for their daily consumption since it is seasonal use which they are not usually used it. A Tobit model was employed to identify the effect of explanatory variable in WTP of households' heads for management of total woodland resources. For Tobit Model result; total income, and family size were found significant at $p<0.001$ in WTP for management of total woodland. Hence; the result indicates that community in the study area is lacking of a good knowledge about the importance of some uses and non-uses values of woodland. Therefore; government and non-government involvement is needed in provision of training from the different aspect of natural resources management and policies.

Key words: *Lare District, Contribution of woodland uses, Willingness to pay of households.*

1. INTRODUCTION

1.1. Background

Local community often depends directly on non-cultivated natural forest resources. Many of these resources found in forest environment as forest products (Wardle and Kaoneka, 1999). More than 1.6 billion people depend on varies degrees on forests for their livelihood in the world (World Bank, 2004). About 60 million indigenous people are almost entirely dependent on forests. Some 350 million people who live within or adjacent to dense forests depend on them to a high degree for subsistence and income generation. Forests provide environmental services such as clean air and water, prevention of soil erosion, nutrient and carbon cycling, newsprint cardboard, construction materials, edible fruits, renewable energy, oils and fats, various spices, and cork, biodiversity and regulation of global and regional climate-systems. They also provide cultural, spiritual and recreational benefits (Perrings, 2000).

Forest products contribute to the well-being of people especially for low-income earners who live in rural areas and may help to reduce the incidence of poverty (World Bank, 2002). Economists have naturally focused on the market value of specific forest products, although non-market values of forests are now being increasingly appreciated. A significant number of studies on non-market values of forest have been carried out worldwide (International Forestry Commission, 1999).

The importance of forests to the domestic economy varies across the globe. The traditional products, paper, pulp and sawn wood, remain important goods on the world markets, as do many other marketed products directly linked to forest resources for examples natural rubber and wild coffee are important. To the people of Nordic countries, berries and mushrooms serve as by-products provided by forests (Angelsen, 2003; Salo, 1995). For instance, the people of northern Sweden pick up about 25 litres of berries per person per year, which is about three times as much as their fellows' citizens in southern Sweden do (Sunderlin et al. 2005; Eliasson, 1994).

One-quarter of modern medicines originate from plants for examples quinine used for treatment of malaria, vinblastine for control of tumour, and andrographolide used as an antibiotic (Bierer et al., 2010). Non-timber forests products can yield higher returns than any alternative use of the

forest products study from Ecuador (Wunder, 2003; Grimes et al., 1994). The value of potential or realized of medicinal products in forests is often thoughts to be substantial due to success stories such as quinine which is effective against Malaria. Pearce (1999) suggested that, the net benefits of drugs waiting to be discovered in the world's forests are smaller than as we expected, or it is between USD 0.01 – 20 per hectare per year in tropical forests. Simpson, Sedjo and Reid (1996) arrive at similar results. Technological progress currently and in the near future appears to give the synthetic products an advantage. Testing of species for medicinal properties is also proceeding at a slow rate, and hence, the present value becomes lower (Simpson and Craft, 1996). Forests provide a wide range of benefits to rural people, ranging from being as a source of new agricultural land, non-timber forest products (NTFPs), timber and provide a range of on-site ecological services. It has long been argued that, the forest income in general is relatively more important for the poor and as a corollary that overuse and degradation will hurt the poor more than other groups (Byron and Arnold, 1999; Campbell and Luckert, 2002).

Cavendish (2003) distinguishes between three different functions of forest products income in rural households' livelihoods; these are Safety nets: forest products that are used to overcome unexpected income shortfalls or cash needs. Support of current consumption: forest products, those are important to maintain the current level of consumption and prevent the households from falling into deeper famine. A pathway out of poverty: forest products that provide a way to increase household income sustainably either through a stepping out strategy; accumulation of capital to move into other activities or a stepping up strategy; intensification and specialization in existing activities (Dorward et al., 2001; Kabubo Mariara, 2008).

A study done by Co stanza et al. (1997) estimated the total value of the world's ecosystem services. Based on their work, there were 17 ecosystem services identified, ranging from regulation of atmospheric chemical composition to cultural services and the value was estimated for all categories of biomes, including tropical and temperate or boreal forests. Based on this work result, the total yearly value of ecosystem services from forests was estimated to be USD 969 per ha and was suggested that forest ecosystems contribute about 12% of the total value of the world's ecosystem integrity. Case studies in different parts of the world reveal that forests contribution to households' income is considerable. Most of them found that the average share of forest income in total income as cash and kind and it is greater than one fourth. For example, the

detailed survey of environmental resource use in Zimbabwe found that, extraction from forests contributed 35 percent of rural household income (Cavendish, 1999). The study by Godoy et al. (1997) reported that, earnings from forest activities accounted for about 17 to 45 percent of household earnings on average across four Amerindian villages in the Bolivian lowlands and eastern Honduras.

Kassa et al. (2009) stated that, forest products account for about one-third of total households' income of communities in Dendi district of Southwest Ethiopia. A study done by Appiah et al. (2009) in Ghana reported that, forest income provides 38% of the total household income. A research done by Kamanga et al. (2009) in Malawi shows that total forest income contributes 12% to total household income. The strategy for forestry in Scotland National Office for Scotland (2000) suggests that, on an annual basis Scotland's forests might absorb approximately 10% of CO2 emissions attributable to Scotland.

Therefore, this study is as important that it explained the dependency level of Lare rural community to woodland and it also demonstrated the degree of MaxWTP of local households for management woodland resources. Hence, this present study outcome is going to be beneficial in use as guideline for natural resources economist, evaluators and managers in the present and as well as in the future.

1.2. Statement of the problem

The world's population today is expanding by 92 million people each year. Globally was surpassed by six billion in 1999 (Hulscher, 1995). Accordingly, the exploitation of woodland comes with an increase of demand for natural forest goods, land, and the mineral resources that lie underground. This is because, people of the rural areas are significantly exploiting woodland resources mainly because of natural woodland goods are freely available to them and also mentioned that the other main livelihood sources for rural communities are agriculture farming, forest related activities and livestock husbandry.

As a result of these, natural forest or woodland felt under two threats conditions; these are: Forests fall to other land uses: forest was covering two thirds of our earth's surface, but now forests cover only less than one-third of the earth's surface. About 80 acres of forests are cleared each minute in the world to develop farmlands, raise cattle and sheep, and make space for housing, communities' roads, reservoirs, and industries. Forests shrink as population expands: As human population increase, demand for forest products growth as well. The issues which are under question now aday are; are the forests expanding at the same rate as our populations do or are they shrinking? The dilemma today and challenge for the future is how to meet the increases of human needs while protecting environmental quality including woodland standards?

Hulscher (1995) suggested that, the wood fuel problem is as more as the result of deforestation than a cause of deforestation especially in rural areas. However, there is also potential for increased demand to drive unsustainable levels of harvesting with negative consequences on biodiversity, soil fertility and water conservation. This was because; the management of these woodlands is also poor. The rate of tropical forest loss in the world has increased. For example, the annual deforestation rate was about 0.6% in the 1970s but as much as 1.8 – 2.1% in the 1980s (Pearce, 1991). Between 1995 and 2000 about 9,400,000 hectares (ha) of forests were deforested annually across the world (FAO, 2005). The annual rate of forest loss in Africa is about four million hectares (FAO, 2005). Most local people depend on natural resources for their livelihoods and land is their major asset (Platteau, 2006). The impact of human activities on forest conservation and climate change has increased (Searchinger et al. and Malhi et al., 2008; IPCC, 2007).

Deforestation is a major issue in Ethiopia and is one of the main causes of the prevailing land degradation as well as tree cutting is a common occurrence which has been taking place for centuries. The primary causes of Natural forest destruction are agricultural expansion, the increasing demand of construction material, fuel wood and charcoal, hunting, collection of the wild edible fruits and so on. As a result of this forest degradation and it's consequent on land degradations leads to the destruction and erosion of biodiversities of both animals and plants (EFAP, 1993).

The critical issue now a day is the fulfillment of basic need of the people and by pursues new and innovative strategies that allow local community participations in natural resources management. At present, although there are some efforts in planting trees by communities or organizations, there is in general a lack of tendency to plan, mobilize and implement sustainable re-fforestation program across the nation. According to Farm Africa (1999) (cited in Melaku 2003) showed that 90% of the Chilimo forest is disturbed with 35% heavily disturbed and total forest cover was reduced by 50% between 1991 and 2001.

Local communities pose threats to the forest in general and to some species in particular for the means of generating subsistence and additional income. The nature and degree of household dependency on forest resources is largely determined by the socio-economic characteristics of the user households (Adhikari et al., 2004). Accordingly, the rural poor tend to be disproportionately dependent on forest resources in the sense that a higher proportion of their total income comes from forest resources (Sunderlin et al., 2005).

Hence, rural community in this study area is highly dependent on woodland resources for their subsistence and have public right in use of all natural lowland woodland which exist in the area with no permission body in regulation.

Within the same view; community of this area is lacking good knowledge about the importance of non-uses and some of uses value of woodland. As a result of this, it is very defy in sustainable utilization of woodland resources which is looking threat full to regional ecosystem in particular and as well as national ecosystem in general.

1.3. Objectives

The general objective of the study was:

- To determine the economic values of Lare woodland resources

The two specific objectives were:

- ✓ To identify the benefits gained by local households from the woodland uses.
- ✓ To analyze and find out the maximum willingness to pay of local households for management of woodland resources.

2. LITERATURE REVIEW

2.1. Current Condition of Natural woodland

Woodland ecosystems are characterized by irregular rainfall brought by tropical monsoon blowing from south Atlantic and Indian Ocean (Friis, 1992; Demel Teketay, 1999). Lowland forest characterizes by the presence of certain trees species, which are widely distributed in tropical Africa. In Ethiopia, the majority trees species are confining to the lowland area and utmost extends as far as approximately 360E longitude and to an altitude of about 1,400 m (Chaffey, 1979).

Cavendish (2000) reports a 30% reduction in income inequality due to inclusion of forest resources in household surveys in Zimbabwe. Empirical evidence from Uganda and Malawi similarly revealed that forest income significantly contributed to reduced income inequality among rural households (Aryal, 2002; Botha, 2003). In the World Bank meta-study Vedeld et al. (2004), the average increase in the Gini-coefficient when forest income was excluded was found as 0.13 of 0.36 to 0.49. According to Alaska's forests and wildlife (2001), every year more services and other utility of forest products come from local and regional forests. Based on this earlier study, the natural forest or woodland resources fall under six uses. These are:

1) Forests for People: People purposely seek forests for a variety of reasons. They carry on subsistence tradition like watching birds, fishing and hunting, gathering wild fruits, different plants study nature, products, hikes, traps, photograph natures, log homes and picnics.

2) Natural Resuscitation: Every day for bodily survival, use air and water that are stable due to the presence of forests and its products. Breathing oxygen produced by trees and other forest products during photosynthesis processing. An acre of forest plants restores two to three times more oxygen per day than an acre of meadow or tundra plants. Person uses about 360 liters of oxygen daily which is one day's production of one tree.

3) Moisture for Future Rain and Snow: Forests also maintain the global water cycle by returning the rain they use to the atmosphere. In a process called transpiration, a single tree may pump 80 gallons of water vapor into the air on a hot day. Next time you are in a forest, notice how

the humidity level is higher than in an adjacent non-forested area. Forests slow and even stop erosion. Trees and plant roots secure the soil while leafy branches minimize the impact of even the hardest rain or heaviest snow. Have you ever taken shelter from a downpour by going into a forest?

4) Drinking Water: The streams that start in or run through forests are clear and cool and have a more constant flow. The water tables recharged as forests protect watersheds.

5) To ensure Fishing Opportunities: fish use freshwater, stream and lakes for spawning. Their young find the ideal combinations of food and shelter in those waters.

2.2. Empirical study of economic valuation of woodland

Kengen (1997) stated that the valuation of woodland resources values has been a central issue in forestry for quite a long time. Until recently; however, most valuation studies were concentrated on wood products and little attention was given to developing a comprehensive valuation of all goods and services supplied by forests. Now a day there is a large numbers of studies conducted on non-market forest benefits that arise at the level of households. Some evidences are indicated here below.

Kriström (1990) asked a sample of 1100 Swedish households about their WTP for the preservation of 11 pristine old growth woodlands in Sweden. In this study, the WTP was in between 10-20 USD per year per household. Moreover, about ten studies were conducted on management of existence values and reported a considerable variation in values with respect to object in coyote. The result of this earlier study showed that, the lowest reported WTP for coyote forest preservation was US$ 5, while the highest WTP attributed to general wilderness was US$ 61-106. Bruijnzeel (1990) mentioned that, indirect use benefits include mainly those linked to the ecological function and consumption of forest goods but documenting them is not easy. Given the great concern about climate change, the ability of natural forests to carbon dioxide sequestrations is about 20 to 100 times more carbon per unit area than croplands (Cielsa, 1995).

Kramer and Mercer (1997) asked a random sample of U.S. citizens about their valuation of tropical rain forest direct use value management using CVM. On average, respondents reported a WTP of US$ 21-31 per household per year to protect an additional 5% of rain forests. This corresponds to a total WTP of US$ 1.9-2.8 billion. According to Nordhaus and Kokkelenberg (1999), USDA has estimated the total of $9 billion value of forest goods and service in 1993 including production of minerals, timbers and grazing ranges services and was accounts for about 20%, while recreational and wildlife services provided 80%.

Astudy done by Johansson (1989) asked a random sample of 122 Swedes about their once and for all WTP towards three programmes that would save some or all of these species, i.e. preserving 50%, 75% or 100% of the endangered existence species. The average WTPs for these programmes were US$ 93, US$ 129 and US$ 213, respectively. However; these amounts were not of such an order of magnitude that they provided indisputable support for the preservation of all endangered species in Swedish forests. There are a number of studies that shed light on existence values of forests. Another study done by Hagen et al. (1992) found that, the value of preserving an old-growth ecosystem (the value of the spotted owl habitat) could be as high as USD 200 per household. Campbell et al. (1995) used a derived demand approach to estimate woodland values. This study was used a smaller set of products and focused on the producer surplus. The net value of woodland after subtracting the labour costs was estimated to be between US$ 50-85 per household per year in Indonesia.

According to Campbell et al. (1995) study firewood was the most valued good. Cavendish (1996) working in Chivi in Zimbabwe, attempted to integrate miombo woodlands resource use into a broader rural household analysis. For this earlier study the data was taken from 213 household studies across 29 villages in Shindi ward, Chivi Communal areas and collected over a year and each household reported its use of environmental goods and services. In a survey study conducted on forest communities in Orissa in India explained that, about 20 percent of total annual households' income derives from NTFPs and about 36 percent of labor activities are relating to NTFP (Mallick, 2000). At least 150 NTFP are significant in international trade (FAO, 1997). Chopra (1993) estimates that, the total present value of NTFP from a deciduous tropical forest in India vary from a minimum of US$ 219 to a maximum of US$ 317 per hectare annually. Wibe (1994) surveyed about 200 studies in different areas on recreational values or

non-wood forest benefits, most of these studies were based on contingent valuation method. This study presented the values in the range of US$25-US$50 per household per day for recreational visit where the higher value refers to hunting and the lower to other kinds of recreational activities like camping and hiking.

Cavendish (1996) used local trading prices or household's own reported prices for environmental goods and services. However, for the value of browse and graze, Cavendish calculated the livestock asset values. The contribution of woodland resources to cash income was only 8.2% of the total household income of about US$200 per household per year. The top 20% of households derive less than 5% of their cash income of about US$570 per household per year from woodlands whilst the lowest 20% derived nearly 20% of their income from woodlands of about US$50 per household per year. Furthermore; Peters et al. (1989) and Gunatilake (1998) stated that, forest resources are particularly important for poor people in many developing countries because the poor have no capital and few productive assets (Sterner, 2003). Hence, access to commons, or even to degraded open access areas, may constitute a significant, even crucial, contribution to their welfare. According to Cavendish (2000) study from Zimbabwe for example, shows that environmental resources in some rural areas account for more than 40 percent of average total household income and the shoddier the household the greater the share of income from woodland resources.

Generating a large proportion of absolute household income does not necessarily mean that overall extraction of forest resources is high. Indeed, based on empirical evidence from Zimbabwe Cavendish (2000) concluded that, richer households use greater quantities of environmental resources in absolute terms while of inferior quality households are more dependent on the resource. Recreational services of the forest tend to be more valuable to urban wealthy people than to poor people in developing countries, who fight to survive (Kengen, 1997). In a recent study conducted in Alberta Cavendish (2003) stated that, the direct methods of (CVM) had been employing to evaluate the preservation of old-growth forests as caribou habitats. Within this work, a questionnaires survey was administered to 102 households' heads during fieldwork, from October to December. In this research, household was defined as units whose members live, cook, and eat together. In this study, the quantitative data were also collected on household income, expenditure, household characteristics and assets holdings.

Hence, the conventional household income, particular attention was given to different forms of natural forest income accrued through both consumption and cash (Cavendish, 2000). The responses of this CVM questionnaires, gave a median WTP of about 140 Canadian dollars per household per year.

2.3. Potential biases of contingent valuation method

Survey methods used in contingent valuation of non-market priced goods include mail questionnaires (Schneemann, 1997), telephone interviews (Schuman, 1996), and personal interviews (Mitchell and Carson, 1989). Other methods include mall intercepts (Boyle et al., 1994). In most developing countries the literacy level is low, telephones are not readily available for the majority of the population, and address listing of the people is not normally available. Hence, personal interviews tend to be the most reliable mode to collect data with regard to non-market priced goods valuation studies in developing countries. Carson (2000) has shown that CVM can give a reliable result if applied correctly and carefully. However, the method has a number of inherent shortcomings for the respondent to give biased answerers. Six of these potential biases are:

Free ridding: Probably more than any other argument, free riding and strategic bias are the problem that economists have focused upon in criticizing the CVM. The neo-classical theory describes the rational individual as an essentially selfish. In developing this idea, the economists expects such an individual to pretend to have less interest in a collectives activities than he really has (David Pearce and EceO¨ zdemiroglu et al., 2002) so to understate his/her WTP for a public good on assumption that the others could pay for management, he/she enjoyed i.e**.** free riding.

Strategic bias: David Pearce and EceO¨ zdemiroglu et al. (2002), noted that CVM studied depend upon both the respondent's perceived payment obligation and his/her expectation about the provision of benefit from the good. However, if an individual is particularly keen upon a good and calculate that the decision regarding on provision or management depends upon the mean of valuation of sample hen he/she may behave strategically and overstate his/her true WTP, i.e. strategic bidding. To reduce this bias a detail descriptions of each forest value was given to them.

Hypothetical bias: In hypothetical nature of CVM, respondent may not be familiar with the scenario presented to them and their response may not reflect their true WTP (Hanley, 1990). A careful description of the proposed benefit was provided to minimize these biases.

Starting point bias: Arises when the initial value suggested influencing respondent's willingness to pay. Kartman (1997), mentioned three possible sources of bias; these are lack of clear understanding of good or poorly defined value, significant difference between respondent actual WTP and the starting value suggested (if used), and assumption of the respondent that the true value of the good to be around the starting point. The starting bid that was used in this study obtained from the sample pilot survey so that this problem was minimized.

Information bias: If the survey is not well designed, it is easy for the enumerator to ask question that he/she thinks is clear but the respondent may interpret it differently than what was intended. This bias was reduced by carefully designing survey questionnaires; the interviewers were trained and supervised the survey well.

Instrument bias: Occurs if the respondent is hostile to the means by which to payment is likely to be collected. Controversial payment vehicles should be avoided in favor of those most likely to be employed in real life to elicit payment for good in question (Georgiou, et al., 1997). Respondents were asked to choose the payment based on their interest during the pilot survey to solve this problem.

2.4. Validation of contingent valuation method

One approach to assess contingent valuation method critically is to focus on the validity and the reliability of the method. The reliability of measurement has not been considered as problematic in CVM as the validity of measurement. In social research methodology literature, the validity of any measurement has been typically considered from three perspectives, face validity, criterion validity and construct validity (Babbie, 1992; Baily, 1987). These validity concepts have been used also in discussions of the validity of CVM (Mitchell and Carson, 1989; Bishop et al., 1995). Content validity refers to the degree to which a measure covers the range of meanings of the concept and its assessment based up on subjective judgment. According to Mitchell and Carson

(1989) when assessing the content validity of CVM, they stated that it is essential to focus on the structure of the market and on the description of the amenity for example, whether the description of the environmental good is unambiguous or meaningful for respondents and how property right are defined. Comparisons with numerous state-of-the-art books is one alternative to evaluate the content validity of CVM.

In assessment of criterion validity, the measurement scheme is compare with the existening criterion in the area, which is closer to the theoretical construct than the real measure itself. One criterion in contingent valuation is the actual market price (Bishop and Heberlein, 1979). The limitation of this kind of assessment is that it can be applied only if the good is private and marketable such as a hunting permit or if the market price of good can be simulated (Sinden, 1988).

However, in the case of pure public goods simulating market conditions is more complicated and difficult (Navrud, 1992; Brown et al., 1996). The results of several comparisons of actual and hypothetical WTP measurements have been summarized in a meta-analysis. Accordingly the hypothetical WTP in the most common types of CVM studies was found to be about 30% higher than the actual WTP (List and Gallet, 2001).

3. MATERIALS AND METHODS

3.1. Description of the study area

Gambella National Region State is one of the nine regional states of Ethiopia. It is located in the Southwestern part of the Ethiopia bordering southern Sudan, Oromia National Regional State and Southern Nations Nationalities Regional States of Ethiopia. It has an area of 25,800 square kilometers with estimated a total population of 247,000 (Kassahun et al., 2008). The region is divided into three administration zones with eleven woredas which have a total of 220 kebeles as a smallest administrative unit. Gambella is characterized by a variety of elevation; the eastern part has an elevation of 1000-2000 masl; the middle part has an elevation of 500-900 masl and the western part has an elevation of 300-500 masl (Woube, 1999). This trend shows a progressive decline from east to west. In general, the land in the region is characterized as flat plain.

Gambella woodland is characterized by its heavy rainfall during the wet season (May-October) and very little precipitation during the dry season (November-April). The annual rainfall in the Gambella region specifically in Mazanger zone is ranges between 800-1200 mm and it was considered as all year rainfall regime. About 85% of the rain is registered between (May-October) with less rain registered between (November – Aprils) (Woube, 1999). The mean annual maximum temperature of the region is 35 to 38° C with a mean annual minimum temperature of 18 to 20 °C. A according to Kassahun (2008), the average annual temperature of the region is 27.50 °C. As a result of this, Gambella woodland occurs on well-drained sandy soils with altitudinal range of 450 to 800 m. The main economics activities uses as source of livelihoods support in the region are animal husbandry, subsistence farming, traditional fishing and hunting, gathering of wild fruits, medicinal plants, wood fuel and timber products (GPDC, 2006). Gambella National Regional State is home to several key mammal species, such as the White Eared Kob (Appendix 2), Elephant, Buffalo and Roan Antelope as an example. Apart from a large number of water birds, three threatened species the Shoe billed Storks; Black winged Pratincole and Basra Reed Warbles are historically recorded. The general topography is flat, covered by wet grasslands and swamps with grasses growing to three metres height. The

area is of regional importance because the Baro-Akobo Rivers provide half of the flow of the White Nile at Malakal in the Sudan and one sixth of the flow of the main Nile at the Aswan High Dam. The Baro-Akobo Basin covers approximately 76,103km² and comprises of the entire Gambella National Regional State and parts of Oromia National Regional state, Beneshangul Gumuz National Regional state and the Southern Peoples Nations and Nationalities Regional States. The land-use covers of the Baro Akobo river basin in the Gambella Region (Table 1).

Table 1. Land cover of Gambella region

Land Cover	Area (in hectare)	Coverage (in %)
Forests	886,602	26.03
Woodland	1,950,964	57.27
Shrub land /grassland	225,764	6.63
Swampy marshland	249,792	7.33
Cultivated land	93,165	2.74
Total	3,406,287	100.00

Sources: (Sutcliffe and Parks, 2001)

Lare is one of the twelve woredas in the Gambella National Regional State of Ethiopia. Part of the Nuer Zone, Lare is bordered on the south and east by the Agnuak Zone, on the west part separates it by the Baro River from Jikow, and on the north separates it by the Jikow River from the Republic of South Sudan. The town of Lare in Jikawo includes Kuergeng (ECSA, 2007). Follow (Figure 1).

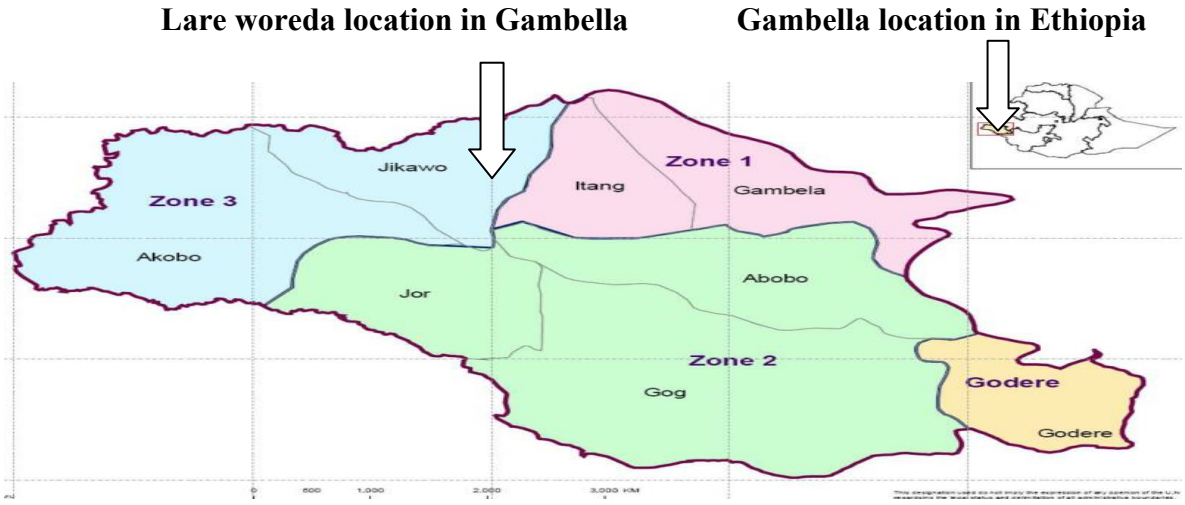


Figure 1. Gambella National Regional State Administrative Zones

The terrain in Lare consists of marshes, grasslands and woodland; elevations range from 300 to 400 meters above sea level. A notable landmark is Gambella National Park, which occupies part of the area south of the Baro. At some point between 2001 and 2007, the eastern kebeles of Jikow were split off to create Lare woreda.

Based on the national census conducted by the ECSA (2007), this woreda has a total population of 31,406, of whom 16,145 are men and 15,261 women; with an area of 685.17 square kilometers, Lare woreda has a population density of 45.84, which is even greater than the Nuer Zone average population which is 23.79 persons per square kilometer. While 6,549 or 20.85% are urban inhabitants, a further 156 or 0.50% are pastoralists. A total of 5,432 households were counted in this woreda, which results in an average of 5.8 persons to a household as family size and 5,217 housing units.

3.2. Economic Values of Gambella Natural Lowland Woodland

Gambella Natural Lowland Woodland is home for different plants and wildlife species which support local people livelihood in many aspects. Chaffey (1979) described Lowland Natural woodland Ecosystems as Lowland Forests, which is comparable to the Moist Semi-deciduous Forest of Ghana and Uganda and the Lowland Seasonal Rainforest of Malawi. Friis (1992) described this vegetation as Dry Peripheral Semi-Deciduous in Guino-Congolian Forest. This is similar with Tesfaye Awas et al. *(*2001) described this ecosystem as Baphia abyssinica Tapura fisheries community in his study on vegetation of Gambella.

Gambella is home to Africa's second-largest mammal migration in Ethiopia, with more than a million endangered antelope and other animals moving through its grasslands. But the government has now leased vast tracts to foreign agribusinesses that are planning huge farms on land designated a national park. As one drove into the woodland, the track ahead was alive with large animals. From the far distance they look like cattle. As drew closer, their numbers grew, and began running in dense column stretching in all directions. They numbered many thousands, with warthogs in among them, darting through the tall wet grass between a series of ponds and heading toward the Baro River, a tributary of the Nile. The antelope were white-eared kob.

Along with the Nile lechwe, another endangered antelope, and the giant shoebill stork, were the main reason for the creation back in 1974 of the Gambella National Park. The 5,000-square-kilometer park occupies much of Gambella, which is a thinly-populated appendix to the far Southwestern corner of Ethiopia (Sutcliffe and Parks, 2001). South Sudan is where most of the white-eared kob came from, traveling across the open woodland bush at the end of the dry season in search of Gambella's open water and wetlands. More than a million of them are estimated to come that way each year, along with a scattering of elephants and giraffes. Hunting was not allowed in the national park but is commonly practiced and seen as of major importance to the subsistence of local communities. Hunt meat is also available at local markets and hence also traded. Bush meat was hunted during all seasons but peaks significantly in the dry season when the White Eared Kob migrates into Ethiopia from the Sudan starting from February to April (Lester Bradford, 2011).

In the presence day there are many trees which give different wild edible fruits in Gambella woodland in which some they are balanites egyptica, tamarindus indica, ziziphus spinachristy, trichilia emetica and celtis Africana, celtis toka and many others trees, bush/shrubs, and grass species which are not mentioned here. These wild edible fruits are giving more benefit to Gambella people in terms of subsistence to local people livelihood. Fishing is a major activity in the rivers, ponds and dams in the area for subsistence, consumption and markets mainly in town. The General Management Plan acknowledges the importance of fishing in terms of subsistence economies, but there is very limited actual information available in 1990.

The Baro-Akobo Basin Master plan states that there are over 70 fish species recorded in the system in Gambella, of which 42 are relevant in terms of consumption. Few examples for them are catfish, tilapia, and Nile perch. Production in 1990 was estimated around 213 tones live weight at the same time as the potential harvested without improvement was estimated at 275 tones. Assuming the consumable fish was 75% of live weight, the quantity of marketable fish is 159,750kg, which amounts to about US$127,800 or ETB 1.6 million assuming a price of US$0.8/kg or ETB10/kg **(**Selkhozpromexport, 1990). The Gambella Region has a potential for crop production, however due to relatively low population densities, there is relatively little cultivated land. The main areas used for agriculture is the eastern part along the riverbanks. Riverbank cultivation is making use of soil moisture caused by the seasonal fluctuation of water

levels. Crops use by local community in the study area are maize, millet, cereals, beans, oil seed, groundnut, tobacco, sweet potato, banana and many others. The total area under cultivation in Gambella is 10,342 ha (2008 to 2009 cropping season) which demonstrates the relatively low dependence of people on crop production. There are some commercial farms, including state farms that are cultivating cotton, maize and coffee on a commercial scale. About 32,000 hectares are cultivated by subsistence farmers and 7,500 hectares by commercial farms **(**CSA, 2009).

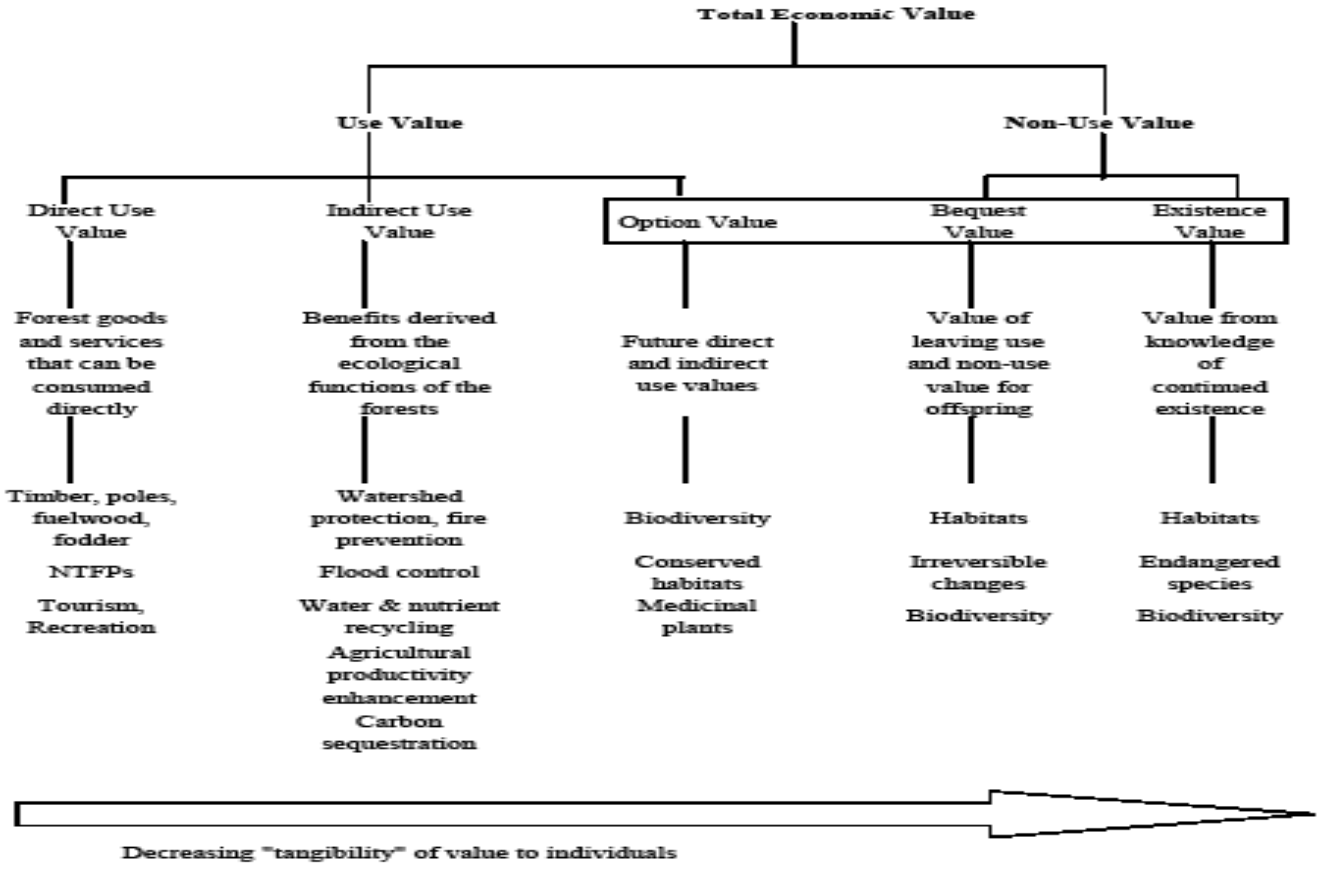
General Management Plan states livestock numbers of cattle, sheep and goats of 349,600, 812,400 and 102,300 respectively on regional level (CSA, 2008). A typical Nuer family keeps 15 to 30 head of cattle and 7 to 8 head of sheep or goats. Public open grasslands within the region are used for grazing by the agro pastoralist Nuer and Agnuak on a seasonal basis. Hence, more information is needed to assess resource use within the region (Selkhozpromexport, 1990). Water availability for household consumption is of major importance to local communities. The study was estimating the value of water provision for domestic consumption in Gambella region. According to that estimates the value of water was estimated between US$25.3 million to US$202.4 million (ETB316 million to 2.5 billion) within scale analysis of 506,100 ha in the region (Koorsgard, 2006). Akobo River provides an important transportation link between Gambella town and Nasir town in the South Sudan. The river is navigable only in the wet season June to September.

The use of medicinal plants is of importance to the majority of rural community residing within due to absence of clinics and long distances to town. Traditionally, plants are not uprooted when picking herbal remedies. Some of medicinal plants which are present now in Gambella are staganotaenia; local community in the study area use its stems or roots for snake bite treatment; calatrophis procera; rural people use its leaf or milk for traditional treatment of wound and many other purposes. A value of medicinal plants in Gambella was estimated as US$3.52/ha/annum **(**Sutcliffe, 2009). According to the recent inventory that was carried out by the Forest Genetic Resources Conservation Project in 2001 Gambella Lowland woodland has more than 106 woody plant species including lianas (Anonymous, 2001).

3.3. Natural resources valuation method background

Methods for valuing non-market priced (e.g. environmental) goods and services can be classified into revealed preference (indirect) and stated preference (direct) methods (Harris, 2006). Stated preference (direct) methods are used to elicit values of non-market priced (e.g. environmental) goods and services directly from respondents by means of survey techniques (Garrod and Willis, 1999; Bateman et al., 2002; Carson et al., 1996, and Mitchell and Carson, 1989). They can be used to estimate total economic value, i.e. use as well as non-use values.

The direct methods mostly applied on valuation of non-market priced goods are contingent valuation and choice experiments (Whittington et al., 1990). Schematic illustration of total economic value is given (Figure 2).



Sources: (David Pearce; Eceo zdemiroglu et al. March 2002)

Figure 2. Total Economic Values of Forest or Woodland

Stated preference technique directly assesses WTP for a particular environmental outcome in a carefully constructed hypothetical or simulated market price. In this present study area, there was no market price set even on direct use values of woodland. According to Agee and Crocker (1994), stated preference technique which is commonly regarded as superior to the others in term of its validity and reliability for valuation of the natural forest resources is contingency valuation method (CVM). Its strength is that, it measure not only use values but also non-use values which has no market price. Hence, in this present thesis iterative bidding game technique was observed the best choice; as a result of this was selected and applied for the estimating of the degree of maximum willingness topay of local community in the study area for management of woodland resources.

3.4. Contingent valuation method background

Contingent valuation surveying was first proposed by Ciriacy Wantrup (1947) and declared that it is only one of the pioneers in contingent valuation. Contingent valuation involves survey techniques such as personal interviews or mail questionnaires to elicit individuals' valuation of the non-market priced good in question (Mitchell and Carson, 1989). Contingent valuation question format includes the iterative bidding game, open-ended, payment-card, dichotomous choice, double-bounded question and multiple-bounded question. The iterative bidding game approach involves querying the respondent at some initial monetary value and keep raising or lowering the value until the respondent declines or accepts to pay (Randall et al., 1974). This approach is well understood and more acceptable than other approaches by people in developing countries (Whittington et al., 1990). This is because the people are use to negotiate over the price of any item they purchase on a market.

3.5. Relation between contingent valuation method and willingness to pay

To estimate people's valuation of non-market goods, economist have long used contingent valuation method (CVM), originally developed in environmental and natural resources economic

(Mitchell and Carson, 1989). The model is also well suited to solicit consumer's WTP for products that is not yet on the market. CVM is now increasingly in developing countries (Alberini and Cooper, 2000). In this method, the researcher creates a hypothetical market price in a non-market and services, invites a group of consumers' subject to co-operate in that market simulation and record the results. Once the household decided signally his/her reservation price, the answers to bid questions are the expression of the true WTP.

The willingness to pay of the households is defined as, the amount that must be taken away from the household total income. In this contact, households' choice could be seen as a decision process. Assuming that each individual knows his/her reservation price for the public goods, he/she compares this value to proposed bid, and then gives yes or no answer. Bergstrom et al. (1989) reported psychological study to supports the argument that the way information are presence to respondents during contingent valuation surveys is likely to have an influence on the responses. The major advantage of this technique over other valuation methods is that, the respondent does not have to be a user of the resource alone in question. This present study was used the iterative bidding game technique for MaxWTP data collection.

3.6. Sources of data

Survey was used both primary and secondary data. The primary qualitative and quantitative data was collected directly from 200 households' heads that were considered as sample size representatives from six kebeles. In the research site, the total households' heads populations were 1438 and are the target population of this research. Furthermore, the head of each household size was stand on behalf of his/her family size as a representative. Secondary data were from books, internet, journals and etc and the sources of data were mentioned. Study sample size was taken using the following formula (David Pearce and Eceo Zdemiroglu et al., 2002).

$$no = \{z^2 * (pq)\} / d^2 \quad \ldots\ldots(1)$$

$$nf = no / \{1 + (no / N)\} \quad \ldots\ldots(2)$$

Where;

no = Estimated sample size

z = Standardized normal deviation (1.96) for 95% degree of confident interval

p = Proportion of the population (0.185) included (18.5%)

q = (1-p) = 0.815

d = Degree of freedom (0.05)

nf = Final sample size (**200 Households' heads**)

N = Total population of the study area (**1438 households' heads**)

Calculated result for estimated and final sample sizes

$no = \{(1.96)^2(0.185 \times 0.815)\} / 0.05$

$= \{(3.8416)\ (0.150775)\} / 0.0025$

$= 0.57921724 / 0.0025$

$=$ **231.686896** estimated sample size;

$nf = (231.686896) / \{1 + (231.686896 / 1438)\}$

$= 231.686896 / 1.1611174520167$

$=$ **199.5** $\approx$ **200** final sample sizes (respondents)

3.7. Sampling methods and sample size selection strategies

In this survey, both non-random and random sampling techniques used are probability sampling technique. Six kebeles were selected purposely from the entire woreda kebeles because of the availability of some limitations in the study area like woodland area occupation, time and budget shortage, lack of road, security problem and e.t.c. For getting the total number of proportion sample size from each kebele, the following formula was used (Table 2).

$$PHEK_x = (THEK_x \div THAK_x) \times (n) \quad \ldots\ldots (3)$$

Where;

$PHEK_x$ = Proportion of Households' heads representative from Each Kebele.

$K_x = K_1, K_2, K_3, K_4, K_5$ & K_6

$THEK_x$ = Total Households' heads of Each Kebele.

$K_x = K_1, K_2, K_3, K_4, K_5$ & K_6

$THAK_x$ = Total Households' heads of All Kebeles i.e. Target population of the study.

$K_x = K_1, K_2, K_3, K_4, K_5$ & K_6

n = Study's sample size i.e. 200 households' heads.

In addition; for selection of the respondents that the designed questionnaires were offered and asked from each kebele, simple random sampling method was applied in which all of the households' heads who were counted up with in the target population were having equal chance of getting representative.

Table 2. Population of households and proportion of sample size representatives

Kebeles	Total households' heads	Proportion of households' heads
Malow	381	53
Teluth	264	37
Koat manchuong	240	33
Ngor	216	30
Koat ngoal	182	25
Riek	155	22
Total	**1438**	**200**

3.8. Data collection

The values of woodland have been divided into use and non-use values (Emerton, 2001; Campbell and Luckert, 2002). The same study divided the use values of woodland into direct, indirect and optional values. In addition to this division, non-uses values of woodland are also of

two types these are existence and bequest. In this study, the benefits of some woodland use values to the rural household (wood fuel, timber products, wild edible fruits, medicinal plants, water consumption, fish resources extraction and Bush meat) of Lare area woodland were tested from the rural households' heads point of view.

Structured questionnaires which were relating to the demographic and socio economic characteristics of the households were given a major concern in the study. Moreover, respondent were deciding their willingness to pay according to their demographic and socio economic characteristics concern. In the specification of the scenario for the CVM questions, the nature of the goods, the condition under which it was made available, and the possible benefits gained because of the presence of management were described and shown to the respondents.

Maximum willingness to pay of rural households' heads for management of each selected components unit of use values, non-use values and total woodland values due to the benefits gained from it was estimated. The selected component unit from each value is mentioned here below.

3.8.1. Selected component units of woodland's uses value

The component units of natural lowland woodland which were used for this specific work were; Direct uses value: timber products (e.g. Log), firewood (e.g. Dry wood), wild edible fruits and medicinal plants (e.g. Balanites egyptica indica), and wildlife (e.g. White eared kob). Indirect uses value: soil and water (e.g. cultivated soil fertility and surface water quality), livestock (e.g. Cows), and fish resources (e.g. Catfish); Option values (Dry wood, Balanites egyptica indica, White eared kob, cultivated soil fertility and surface water quality, Cows and Catfish).

3.8.2. Selected component units of woodland's none-uses value

Existence value (Snake): one of non-use value in which its value was estimated and

Bequest values (Use and existence values mentioned above).

For any given problem, both revealed preference (RP) and stated preference (SP) could be used to measure use values (UV), but the first issue is to consider whether both options are in practice available or not. In some contexts, there was no appropriate proxy market price for use value, from which to estimate their value using revealed preference (RP) technique in the study area; in that case, stated preference (SP) technique was the only option for estimating them. If suitable proxy markets are available, then RP approaches could be used as long as they can fit the need of the analysis. Nevertheless, in any case revealed preference technique can not be used to estimate option and NUV. In this research work, stated preference technique was used for estimating the economic value of use and non-use value since both of them didn't have proxy market price in the study area. Limitation for revealed preference technique use is very high in remote area where there is no proxy market price set to even on major use value of natural goods.

Contingent Valuation Method (CVM) was given a brief account for its usefulness in the context of valuing of natural woodland values, i.e. non-markets and markets goods. Specific strengths and weaknesses of different methods were not given consideration since it is a subject worthy a chapter by its own (Braden and Kolstad, 1992). According to the recent survey of the CVM conducted by Bateman and Willis (1998), stated that contingent valuation method is currently the only most popular technique that allows us to estimate use and non-use values when focusing on the individual's subjective valuation of particular resources uses. Carefully designed questionnaires and trained interviewers were very important that given a priority in the present study.

In this study the method of data collection that was applied for gathering willingness top pay response is iterative bidding game technique. Iterative bidding game technique involves querying the respondent at some initial monetary value and keep raising or lowering the value until the respondent declines or accepts to pay (Randall et al., 1974). This approach is well understood and more acceptable than other approaches by people in developing countries (Whittington et al., 1990). In this thesis work, the iterative bidding technique question formats were used and the survey method was face to face personal interviews. For iterative bidding game technique an anchor bias may exists. These are;

1) Respondents may be influenced by the starting values and succeeding bids used;

2) It also leads to large number of outliers and to 'yea-saying' (giving affirmative but possibly false responses); and

3) Iterative bidding games cannot be used in mail surveys and other self-completed questionnaires.

Qualitative and quantitative data were used in this study from primary and secondry sources. However, the primary data was used CVM (iterative bidding game technique) as a tool of gathering information from 200 households' heads of selected six kebele through structured questionnaires using face-to- face interview. A personal observation from the real condition of the study area was given value. Bidding game technique, with higher or lower follow-up questions was offered to respondents up to the maximum WTP response of each was reached in which the bid set was 30 Ethiopian birr. This bid was set by means of consideration of children registration fee in school which is 20 birr per year, land tax that ranged in average of (30-50) birr per household per year and late comer students' registration charge that is 30 birr per year. Deciding bid was very big challenge or limitation since there was no market price set even for direct use values in the study area.

3.9. Data analysis

For better understanding of demographic and socio economic characteristics of the respondents, categorical variables were analyzed using frequency descriptive statistic. For continuous variables, descriptive statistic was also applied in analysis and the result is presented in tables. For identification of the benefits level of households to each use values of woodland, crosstab descriptive statistic and Pearson correlation coefficient were used in analysis. The result is also presented in tables, bar-charts, pie-charts and graphs. To evaluate the degree of maximum willingness to pay of rural households' heads for management of each woodland use and non-use values, crosstab descriptive statistic was also applied in analysis. To present the results tables, bar-charts, pie-charts and graphs were used. For analyzing MaxWTP response of rural households' heads for management of the total woodland, Tobit Econometric Model (TEM) was

employed for testing of the statistical significant of each explanatory variable at 1%, 5% and 10% significant levels.

3.9.1. Description of the econometric model

A dichotomous regression models have attempted to explain only the probability willingness to pay of local households' heads for management of total woodland resources. There is a broad class of models that have both discrete and continuous parts. One important model in this category is the Tobit. Tobit is an extension of the probit model and it is really one approach to deal with the problem of censored data (Johnston and Dinardo, 1997). Some authors call such models Limited Dependent Variable Models because of the restriction put on the values taken by the regressand (Gujarati, 1995).

3.9.2. Specification of the Tobit Econometric Model

The econometric model applied for analyzing factors affecting the willingness to pay (WTP) of local households' heads for management of total woodland resources is the Tobit model shown below. This model was chosen because it has an advantage over other discrete models (Logistic and Probit) for its identification of censor values; in that, it reveals the probability of maximum willingness to pay of local households' heads. Following Maddala (1992); Johnston and Dinardo (1997), and Green (2000), the Tobit model can be defined as:

$$Yi^* = bYi + Ui \quad i=1, 2 \quad \ldots\ldots (4)$$

$$Yi = Yi^* \text{ if } Yi > 0$$

$$Yi = 0 \text{ if } Yi^* < 0$$

Where,

Yi= the observed dependent variable, in this case the willingness to pay of local households' heads for management of the total woodland resources

Yi*= the latent variable which is not observable

Xi= vector of factors influencing the willingness to pay

bi= vector of unknown parameters

Ui= residuals that are independently and normally distributed with mean zero and a common variance δ2.

Note that the threshold value in the above model is zero. This is not a very restrictive assumption, because the threshold value can be set to zero or assumed to be other value (Green, 2000). The Tobit Model shown above is also called a Censored Regression Model because it is possible to view the problem as one where observations of Yi* at or below zero are censored (Johnston and Dinardo, 1997 and Greene, 2000).

The model parameters are estimated by maximizing the Tobit Likelihood Function of the following form (Maddala, 1997).

$$L = \Pi_{Y}\varphi_{O}\frac{1}{\delta} f\left(\frac{Yi-\beta_i x}{\delta}\right) \Pi_{Y^*\leq O} F\left(-\frac{B_i x_i}{\delta}\right) \quad \ldots\ldots (5)$$

Where f and F are respectively are the density function and cumulative distribution function of Yi*, Πyi*>0 means the product over those i for which yi*>0, and Πyi*≤0 means the product over those i for which yi*≤0.

STATA (Version 11) software was employed to run the Tobit model. It may not be sensible to interpret the coefficients of a Tobit in the same way as one interprets coefficients in an uncensored linear model (Johnston and Dinardo, 1997 and Green, 2000). Hence, one has to compute the derivatives of the estimated Tobit model to predict the effects of changes in the exogenous variables. Maddala (1997) and Johnston and Dinardo, (1997) proposed the following techniques to decompose the effects of explanatory variables WTP. Thus, a change in X (explanatory variables) has two effects. It affects the conditional mean of Yi* in the positive part of the distribution, and it also affects the probability that the observation will fall in that part of the distribution. Similar approach is used in this study.

1. The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\frac{\partial E(Y_i)}{\partial (x)} = F(z)\,\beta_i \quad \ldots\ldots (6)$$

Where, $(\beta_i x_i)$ is denoted by z, following Maddala (1997)
δ

2. The change in the probability of willingness to pay as an independent variable Xi changes is:

$$\frac{\partial F(z)}{\partial xi} = F(z)\,\frac{\beta i}{\partial} \quad \ldots\ldots (7)$$

3. The change in willingness to pay to total woodland with respect to a change in an explanatory variable among respondents is:

$$\frac{\partial E(Y/Y^{*>0})}{\partial x_i} = \beta_i \left[1 - z\,\frac{f(z)}{F(z)} - \left(\frac{f(z)}{(F(z))}\right)^2\right] \quad \ldots\ldots (8)$$

Where, F (z) is the cumulative normal distribution of z, f (z) is the value of the derivative of the normal curve at a given point (i.e., unit normal density), z is the z score for the area under normal curve, b is a vector of Tobit maximum likelihood (ML) estimates and σ is the standard error of the error term.

3.10. Relation between iterative bidding game and Tobit Econometric Model

Empirical data generated from iterative bidding game have been traditionally analyzed using ordinary least squares regression techniques. Proponents of the Tobit Models argue that the Tobit Models addresses the censoring, i.e. large number of zeros typically found in contingent valuation surveys, but linear models often ignore this censoring. The ordinary least squares regression model fails to account for qualitative differences between zero and positive WTP values which may result in a biased estimate of the parameters of interest. This has led to widespread use of Tobit models especially among economists (Greene, 2003). The open-ended question asks respondents how much they would be willing to pay for a specified change in an environmental good (Hammack and Brown, 1974).

The payment-card question format involves listing a number of possible WTP values on a card, and respondents are asked to pick the amount on the card that best represents their WTP (Cameron and Huppert, 1988). The chosen amount is a lower bound for the respondent's WTP, the upper bound being the next highest on the card. The dichotomous choice format is the most frequently used format (Bishop and Heberlein, 1979; Cameron, 1988; Li and Mattsson, 1995). The payment question typically asks the respondent if he or she would pay $X for a specified increase in the quality of a good.

There are only two possible responses to a dichotomous choice question, i.e. "yes," and "no". Since one only knows that the respondent's subjective valuation is lower or higher than a given cost or bid, econometric technique such as logit or probit must be used to estimate the mean and median WTP (Hanemann, 1984; Kristrom, 1990). Most people in developing countries have not used to a take-it-or-leave-it or binary choice kind of purchase, although it is becoming popular in some shops in cities and major towns. Some studies have used double bounded questions that include a second round of bids in which respondents are also asked to indicate if they would pay, a higher bid if 'yes' was the response to the initial bid or a lower if 'no' was the response to the initial bid (Hanemann et al., 1991). Some researchers have also used a multiple boundeded question that is a hybrid of a dichotomous choice and payment card question (Welsh and Poe, 1998; Boman et al., 2008).

In this present study Tobit Econometric Models was the preference model since it addresses the censoring, i.e. large number of zeros typically found in contingent valuation surveys. This model pick was in consideration of Floro and Miles (2003) which explained that, practical data that generated from iterative bidding tecnique have been habitually analyzed using Tobit model.

3.11. Description and hypothesis of the variables of model

Econometric model discussed above is explains many important hypotheses which related to the factors that influence willingness to pay of local households' heads and were identified and explained here below.

3.11.1. Description of the dependent variables of model

The dependent variable of the model was total woodland values (use and non-use values) that the local households' heads were participating payment money for its management due to the benefits provided to them. The variables were having dichotomous nature which takes different categorical values for estimating the maximum willingness to pay of the households' heads.

The Tobit econometric model uses censored values of a dependent variable. As observed in different empirical studies, this variable can be expressed in terms of ratio, actual figure and logarithmic form depending on the purpose of the study. In this study the dependent variable is the willingness to pay of the households' heads for management of total woodland which is expressed in actual values and measured in birr. Tobit model is applied for elicitation of the degree of maximum willingness to pay of the households for woodland management. According to Munasinghe (1995), the variables got a definition like these:

3.11.1.1. Definition of the uses value of woodland

Direct use value: A use value that is determined by the contribution that the environmental or natural resources make to the current consumption and production.

Indirect use value: A value that includes all the benefits derived from functional services that the environment or natural resources or woodland values provided to support current consumption and production.

Optional value: A Value that is determined by the willingness to pay of consumers for un-utilized asset or natural resources; however simply to avoid the risk of not having it available in the future or for preserving their own future benefit.

3.11.1.2. Definition of the non-uses value of woodland

Existence value: Values that arise from the satisfaction of merely knowing that the resources are exist although their values do not intend consumers to use them.

Bequest value: Is a **v**alue that is reflected by the desired to conserve natural forest resources for the benefits of the future generations.

3.11.2. Description of independent variables and their expected influence on WTP

1) Gender of household head

It is dummy variable which takes zero if the household head is male and one if female. Men and women have different options and household tasks in processes of livelihood generation. Likewise, with respect to forest dependency both males and females are depending on woodland but having different focused in collection and use of different woodland's goods for different uses (Lepetu et al., 2009). A research done by Mamo (2000) identified that male headed households are more income secured than female headed households do. In the study area resources owners are male. The better the income household earn, the more likely to be willing to pay for the new scheme.

2) Age of household head

It is continuous variable which is measured in years. Older households' heads are more likely to reject new idea and approach. This variable is expected to have negative sign because older people are some times contradictors with new plan. A study done by Simret (2009), found out that an increase in age of a person some time had negative effect in participation for any new scheme.

3) Education of household head

It is dummy variable which takes zero if the household head is read and write, and one if illiterate. Education knowledge tends to have greater awareness to place higher concern on the importance of woodland resources. A study made by Molla (2005) found that, educated

households had a positive relationship with willingness to pay and tend to increases participation in contribution money for management of natural resources.

4) Family size per household

It is continuous variable which is measured in numbers. Even though explained by many natural resources evaluators that, large family sizes are the more users of woodland resources which supposed to be good contributors for management of woodland, from this specific community more willingness to pay is not expected. The reason behind for this is that, community in this research site is still following extended family living system in which even expose them in to having more family members which need more resources for their livelihood support (Adhikari et al., 2004).

5) Number of livestock per household (e.g cows)

It is continuous variable which is measured in numbers. Households with more livestock have more gain from woodland as their livestock graze woodland grasses and shrubs. They are also having income from livestock sale as well as livestock products (Swallow B.M. and W.M. Woudyalew, 1994). Thus; they would be more willing to contribute money for woodland management.

6) Size of cultivated land per household

It is continuous variable which is measured in hectares. Households who have large cultivated land are beneficial of woodland since woodlad has effect in soil erosion reduction which results in stabilization of soil fertility and having chance for sold out surplus of agriculture products and would contribute more money for woodland management (Swallow B.M. and. W.M., Woudyalew 1994).

7) Total income per household

It is continuous variable which is measured in birr. It is obvious that those households with high income are the more users of woodland resources. Socioeconomic attributes like remittance, Number of cows, agricultural products and woodland uses products were considered as income

sources. Based on income status of households, higher income is answerable for households' participation in willing to pay more money for new sheme. Socio-economic inequalities among the households could play a vital role in different WTP level of household head (Panta et al., 2009). An increase in total income level of household, the more the head participated in paying more money for management of natural resources (Takele, 2008).

Table 3. Description of the explanatory variables

N/s	Name of the variables	Included variable	Types of variable	Hypothesis	Level of measurement
1)	Gender of household head	GHH	Dummy	male (+)	Nominal
2)	Age of household head	AGHH	Continuous	Old age (-)	scale
3)	Education of household head	EDUHH	Dummy	Read and write (+)	Nominal
4)	Family sizes of household	FSH	Continuous	large family size (-)	scale
5)	Numbers of livestock holding per household (e.g cows)	NCHH	Continuous	More cattle (+)	scale
6)	Size of cultivated land per household	SCLH	continuous	Large land (+)	scale
7)	Total income per household	TIH	Continuous	High income (+)	Scale

(+) Plus sign indicate an increase in willingness to pay of local households' heads
(-) Minus sign indicate decrease in willingness to pay of local households' heads

4. RESULTS AND DISCUSSION

4.1. Demographic and socioeconomic characteristics of the households

4.1.1. Demographic characteristics of the households

The demographic characteristic of the local households in the study area was given consideration in this study (Table 4). The result explained that out of 200 respondents interviewed 72.5% were male headed households and only 27% of them were female headed households. The result showed that; majority of the respondents are male headed households in the study area. The data for households' heads ages were collecte and analyzed; in this regard, the study outcome explained that the younger and older of age are 23 and 70 respectively in which its mean is 40.80. The data outcome illustrated that majority of the respondents were allocated in the active age group and are having labor capacity.

Data for educational status of households' heads showed that mainstream of the respondents are illiterate and were about 75.5% whereas only 24.5% of them were read and write. The household sizes composition in the study area has a minimum and maximum family size of 2 and 15 persons per household with an average mean of family size at 8.31 from the total respondents.

Table 4. Demographic characteristics of households

Demographic Variables	n	Minimum	Maximum	Mean	Standard deviation
Gender of household head	200				
Male	145(72.5%)				
Female	55(27.5%)				
Age of household head (in year)	200	23	70	40.80	11.01
Education level of household head	200				
Illiterate	151(75.5%)				
Read and Literate	49(24.5%)				
Family members per H (in number)	200	2	15	8.31	2.57

H= households

n = Total number of sample size (i.e. 200 Households' heads)

4.1.2. Socioeconomic characteristics of the households

Socioeconomic data of the local household in the study area were analyzed (Table 5) and result showed that; all of the respondents were having cows in various numbers (Appendix 3) in which the smaller number and more livestock were 3 and 43 respectively. Hence; the mean livestock holding was 23.80 for all households. For cultivated land, the study outcome explained it that, all of respondents were having private cultivated land at a variant sizes (Appendix 4). Based on that, the smaller cultivated land size is 0.5 ha and the large is 2 ha in which its average mean is 0.70 ha with a standard deviation of 0.35 ha. Total income per household result showed that all of the respondents who were interviewed are having income at a discrepancy level in which the lower and the higher income is 600 and 2500 birr respectively. Thus; its standard deviation is 552.43 for total respondents. From all respondents, only nineteen of them were having cash remittance from their relatives with none of them having cash credit and aid (Appendix 5). The result showed that, majority numbers of respondents haven't remittances.

Table 5. Socioeconomic characteristics of the households

Socioeconomic Variables	n	Minimum	Maximum	Mean	Standard deviation
Livestock holding per H (Cows in number)	200	3	43	23.80	9.50
Size of cultivated land holding per H (in ha)	200	0.50	2	0.70	0.35
Total income per H per year (in birr)	200	600	2500	1275.50	552.43

H= household

n = Total number of sample size (i.e. 200 Households' heads)

4.2. Natural Lowland Woodland use values contribution to rural households

Contribution of woodland (direct and indirect uses) to local community livelihood was estimated and analyzed. Based on that, data for wood fuel (e.g Dry wood) consumption were collected and analyzed. The outcome showed that all of local people are users (Figure 3). The result explained that, about 82.5% of households' heads respondents consumed maximum head loads of wood fuel ranged from (4-9+) head loads per household per month whereas about 17.5% of them were at the range of (1-3) head loads per household per month. Head load is a bundled of woodfuel that a person loaded once a time. This shows the high dependency of local community to wood fuel consumption in this study area.

The result is in agreement with Williams and Shackleton (2002) which stated that over 80% of rural households still uses fuel wood as their primary source of energy. The reason for high consumption was because communities in the study area are all having large family size and livestock which exposed them in uses of wood fuel too much. The second reason was that local community didn't have any option for energy use for their daily activities as well as for their livestock energy consumption unless sun energy. Most reports focus on woodland products use, for example use of firewood (Ham and Theorn, 2001; Liengme, 1983; Banks et al., 1996).

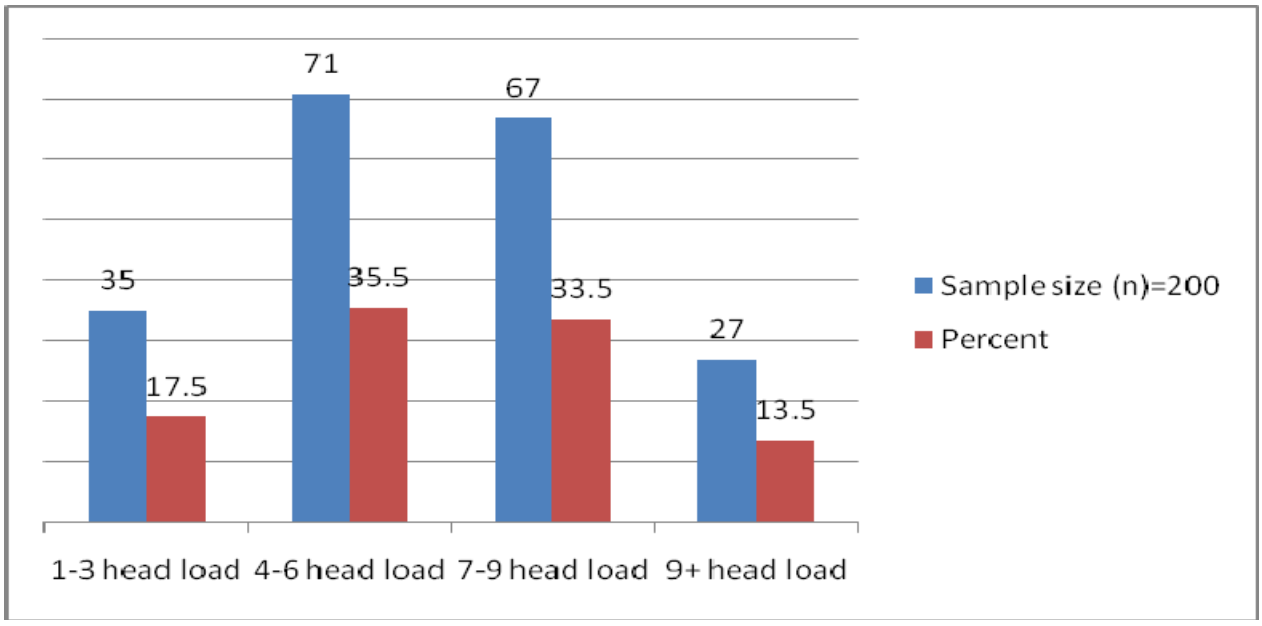


Figure 3. Wood fuels (e.g Dry woods) consumption by households

For timber products (e.g. Log products) consumptions the households' heads responses has shown that, about 86% of them were observed from the range of (100-301+) numbers of timber per household per year. Those who allocated below 100 timbers per year were only 14% of respondents (Table 6). This could not be surprising result because local community in this study area is using timbers for different purpose like for example tugul building, fencing, income generation etc. There are specific localities where the cumulative effects of small scale timbers extraction are considered excessive and the forest or woodland system has been jeopardized (Boudreau et al., 2005). NOS (2000) clarified that, the greatest sequestrations gains are likely to come from woodland growing high quality timbers which would be put to the long live end uses on long rotations, in complex woodland ecosystems with soils of low organic content.

Table 6. Timber products (e.g. Log products) consumption by households

Number of timbers	Sample size (n)=200	Percent
less than 100 timbers	28	14.0
100-200 timbers	77	38.5
201-301 timbers	67	33.5
301+ timbers	28	14.0
Total	200	100.0

Wild edible fruits (e.g. Balanites egyptica indica) data was also collected from rural households' heads and the result showed that 63% of the respondent households were using (0-10 Kg) of wild edible fruits per household per year with only 37% of them at maximum user level (11-16+Kg) (Table 7). As the result of output indicated, it satisfied that local people in the study area are not using wild edible fruits too much. The result for less use of it is due to not acessable year round. Similar study done by Sutcliffe (2009) stated that, none timber forest products (NTFP) i.e. honey, wild edible fruits, gum and e.t.c are of minor importance to local communities livelihood support.

Table 7. Wild edible fruits (e.g. Balanites egyptica indica) consumption by households

Medium Lieeri of WEF	Sample size (n)=200	Percent
< 5 Kg of WEF	66	33.0
5-10 Kg of WEF	60	30.0
11-16 Kg of WEF	50	25.0
16+ Kg of WEF	24	12.0
Total	200	100.0

WEF=wild edible fruits

> **Note**: 1 Medium of Lier = 1 kilogram (Kg). Lier is a local language in Nuer. It is an instrument that local community in the study area is use for measurement of wild edible fruits since kilogram measurement is not always available to them. Lier is of three types, these are: 1) Small lier 2) Medium lier and 3) Large lier. Lieeri is its plural form.

A medicinal plant (e.g. Balanites egyptica) is one of the direct woodland uses in which its degree of contribution to the local households' livelihood was tested. Based on the result, households who consumed (7-10+) bundles of medicinal plant per year are 35% while the majority of them which are about 65% were found using only (0-6) bundle per househol per year (Table 8). Bundle is a method used for measurement of medicinal plant by rural community in this study area; means bunch of roots, stems and leafs of plants that local households use for traditional medication. Based on the analyzed data result it showed that more than half of respondents were not using medicinal plant further; this was the reason that, health center is available to local community and were getting immediate medication from the health center at any time.

Mander, 1998; Dold and Cocks (2002) explained that, forests are the primary sources of medicines which are in use for self-medication for example; over 65% of medicine in the Durban markets is of forest or savanna species and this proportion is similar in the Eastern Cape Province (Cocks et al., 2004). A study by Williams (2004) mentioned that, medicinal plant is slightly higher and closer to 70% in the Faraday market in Johannesburg. Another study by Grace et al. (2002) demonstrated that, approximately one-third of medicinal plant material is barking.

Table 8. Medicinal plants (e.g. Balanites egyptica indica) consumption by households

Bundle of medicine plants	Sample size (n)=200	Percentage
< 3 bundles of medicinal plants	60	30.0
3-6 bundles of medicinal plants	69	34.5
7-10 bundles of medicinal plants	53	26.5
10+ bundles of medicinal plants	18	9.0
Total	200	100.0

Hunt meat (e.g. white eared kob meat) is one of woodland direct use values which give local households sevice for their daily consumptions. Based on analyszed data it shown that, less than half of respondents which are atleast 23% were using (5-7+) Kg of hunt meat (HM) whereas the majority of them which are about 67% were using only (0-4) Kg of HM per household per year (Table 9). The reason for less consumption of hunt meat is due to restriction of them by government and as a result of this, this local people use illegal hunting of wildlife in the area.

Table 9. Hunt meat (e.g. white eared kobs) consumption by households

Kg of hunt meat	Sample size (n)=200	Percent
< 2 Kg of HM	101	50.5
2-4 Kg of HM	53	26.5
5-7 Kg of HM	33	16.5
7+ Kg of HM	13	6.5
Total	200	100.0

HM=hunt meat

A water resource (e.g. Surface water) is one of the indirect uses of woodland value which has a great role in local people livelihood standard. For its importance, data for its consumption were collected from the households' heads point of view; as a result of this, the analyzed data indicated that 57% of respondents were found to consume water from the range of more litre of water per household per month which is about (2881-4321) Litres in which only 43% of them were found at range of (720-2880) litres per household per month (Figure 4).

As the result indicated, there is no much more difference less and more consumption of water. This is because water is vital resources in this study area since it is very lowland area which even need more water for drinking due to hotness of weather condition. Is good to remind audiences that, the water used for bath and livestock consumption were not given consideration in this

study dueto its difficulty to measure and estimate; in this case, only litres of drinking water per household per month was measured.

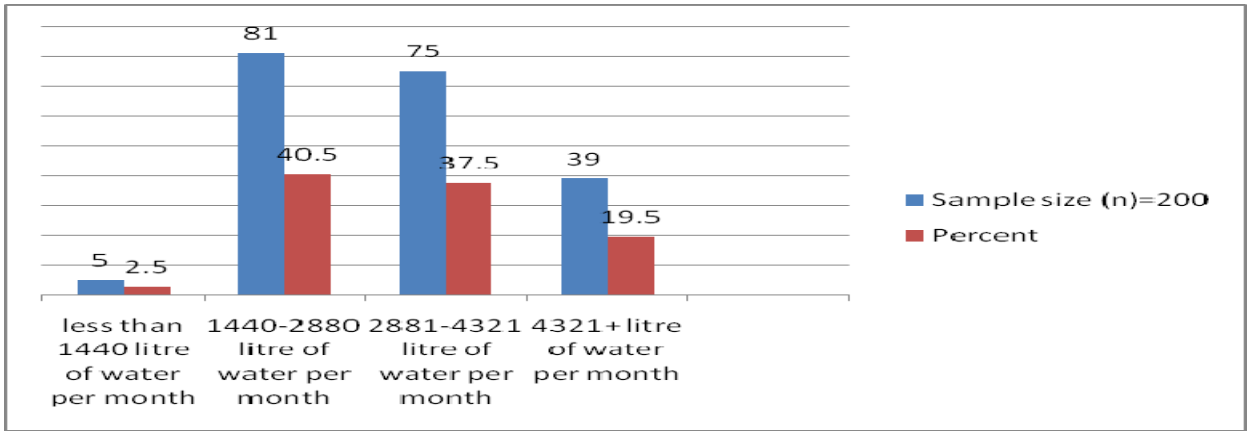


Figure 4. Water (e.g. Surface water) consumption by households

Regarding fish resources (e.g. Catfish) extractions, the households' heads dependency level were estimated and the result indicated that 32% of respondents were allocates to the range of (32-42+) numbers of fish per household per year whereas about 68% of them were seen from the range of (0-31) numbers of fishes per household per year (Figure 5). This result should not be surprising; the core reason is that, fish resources is seasonal use to the local community of this study area since they are using nomadic way of life and having only four months chance for fish resources extraction.

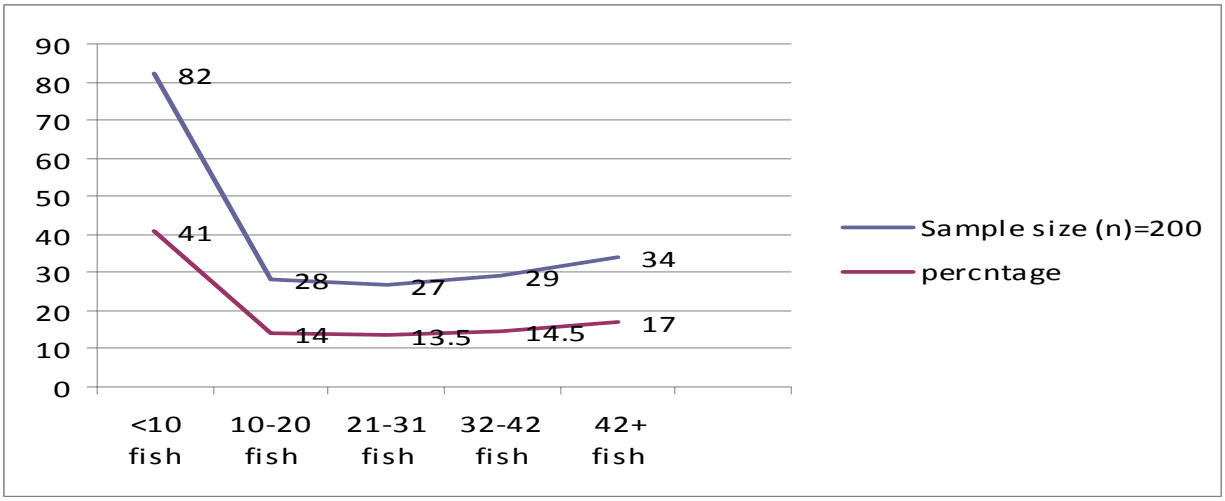


Figure 5. Fish resources (e.g. Catfish) extraction by households

4.2.1. Pearson correlation of woodland uses with explanatory variables

The correlation analysis indicated that, an increase in family member and total income of local households has strong correlation with woodland resources consumption (Table 15). The positive sign of the Pearson correlation coefficients implies the strong relationship among variables.

The study result revealed that, family size and total income of household have positive relationship with consumption of woodfuel (e.g Dry wood), timber Products (e.g. Log products), wild edible fruits and medicinal Plants (e.g. Balanites egyptica) for both, hunt Meat (e.g. white eared kob meat), water Resources (e.g. Surface water) and fish (e.g. Catfish resource). In the same situation, The study outcome showed that, land sizes (e.g Cultivated land) and livestock (e.g Cows) numbers have negative relationship with use values of woodland consumption.

Table 10. Correlation of woodland uses with variables

Explanatory variables		WF	TP	WEF	MP	HM	WR	FR
FSH	Pearson Correlation	0.129	0.102	0.148	0.207	0.194	0.149	0.121
	Sig.	0.068	0.151	0.036	0.003	0.006	0.035	0.087
NCHH	Pearson Correlation	-0.187	-0.129	-0.136	-0.268	-0.372		-0.109
	Sig.	0.008	0.068	0.055	0.000	0.000		0.126
SCLH	Pearson Correlation	-0.297	-0.248	-0.185	- 0.175	-0.176		-0.199
	Sig.	0.000	0.000	0.009	0.014	0.013		0.005
TIH	Pearson Correlation	0.141	0.145	0.144	0.134	-0.016		0.122
	Sig.	0.047	0.041	0.041	0.059	0.825		0.086

FSH=Family Size of Household, NCHH=Numbers of cows holding per Household, SCLH=Size of Cultivated Land per Household, TIH=Total Income per Household, WF=Wood Fuel, TP=Timber Product, WEF= Wild Edible Fruits, MP=Medicinal Plants, HM=Hunt Meat, WR=Water Resources and FR=Fish Resources.

a. Listwise N = 200

4.2.2. Main agents for deforestation acceleration

Rural people in the study area are having public right in uses of woodland uses with no permission body in regulation (Table 11a). They were using their traditional knowledge which is very dare full in sustainable utilization of today scarce resources.

On the same occasion, respondents reported public use of open grazing system on common land permanently in all seasons of the year round for their livestock feed (Table 11b); which is also very harmful to young growing seedlings of trees and grasses species as it is lacking resistance in injury or damage.

Within this learn; local households reports more use of wood fuel and timbers product of public woodland. Traditionally; both deadwood and log timbers products are collected for home and livestock energy consumption and as well as tugul and fence construction (Table 11c). Therefore; these two component units of woodland were have been seen as main agent for deforestation acceleration in the area.

Table 11. Agent for deforestation acceleration

11a.

Permission for woodland resources uses	Sample size	Percent
Public right under knowledge of local community with no permission body	200	100%

11b.

Grazing system	Sample size	Percent
Open grazing on common land permanently in all seasons of the year	200	100%

11c.

Woodland uses consumption	Sample size	Percent
Fuel wood and timber products extraction	200	100%

4.3. Maximum willingness to pay of households for management of woodland values

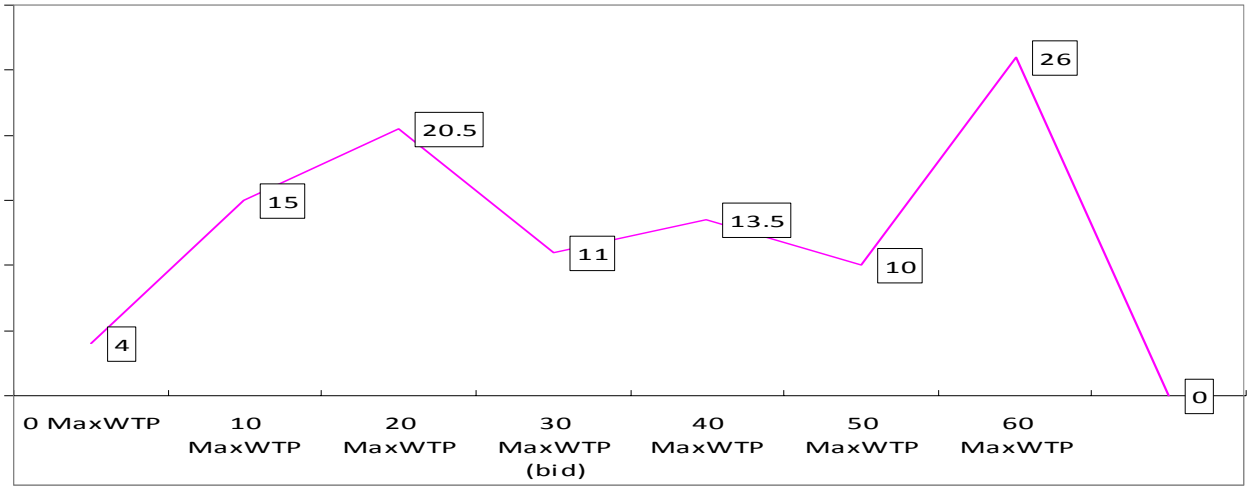
In this study a sample of 200 households' heads were asked about their maximum willingness to pay (MaxWTP) for the management of Lare woodland resources. The research was considering use values like timber product (e.g. log products) management, wood fuel (e.g. dry wood) management, wild edible fruits and medicinal plant (e.g. balanites egyptica) conservation, wildlife (e.g. white eared kob) conservation, soil and water (e.g. cultivated soil and surface water) conservation for sustaining the soil fertility and water quality increase, livestock (e.g. cows) conservation for it's health increases, fish resources (e.g. catfish) conservation that could result in an availability of it in abundance, and option value (e.g. use values mentioned above) management and non-use values i.e. existence value(e.g. snake) consevation for its contribution in eclogical integrity and bequest values (e.g. use and existence values mentioned above) consevation for its significant in support of future generation livelihood and total woodland resources (i.e. use and non-use values) management as it is important in any kind of life aspects.

The reason for estimating maximum willingness to pay of household for management of each woodland unit was the purpose of identifying the thoughts of the local households to each woodland unit. The core issue for estimated maximum willingness to pay of households for management of the total woodland was about to examine the awareness of rural households to the importance of the woodland value. The study indicated the maximum willingness to pay money in an averages order of (0-20) Ethiopian Birr (ETB) below bid, 30 ETB as bit and (40-60+) ETB above the bit were elicited and offered to households' heads.

Thirty birr was set as bid in the midst of consideration of children registration fee in school which is 20 ETB per year, minimum land tax that ranged in between (30-50) ETB per household per year and late comer students' registration charge which is 30 ETB per year. Laying down the appropriate bid was challenged fully since there were no market prices for even direct use values in the study area. This work is similar with Kriström (1990), who asked a sample of 1100 Swedish households about their WTP for the preservation of 11 pristine (old-growth) woodlands in Sweden, and a WTP in the order of 10-20 USD per year per household was reported.

4.3.1. Maximum willingness to pay of households to woodland use values

Willingness to pay (WTP) of households' heads for management of timber products (e.g. Log products) was estimated; within the total sample of 200 household heads, about 61% of them were willing to pay their maximum WTP in equal or above the bid (30-60) Ethiopian Birr (ETB) with only 39% of them pay their maximum WTP less than bid (0-20) ETB (Figure 6). The data output showed that more than half of total sample size pays more above the elicited bid. As a result of this, it is significant that, rural community in the study area were aware of the timber products worth to their daily consumption as they use it for different purpose like tugul construction, fence and income generation.



MaxWTP=maximum willingness to pay

Figure 6. MaxWTP of households for management of timber products (e.g. Log products)

Willingness to pay (WTP) of local households for management of wood fuel (e.g. Dry woods) was also analyzed and the results showed that, those who pay their maximum WTP below bid were 52% whereas about 48% of them pay their maximum WTP in equal or above the bid rage (30-60) ETB (Table 12). Based on analyzed data, more of respondents pay their maximum WTP below the bit for management of wood fuel. Hence; the percentage of those who pay their maximum willingness to pay at zero ETB is smaller than those pay it for timber products which

also indicate the important of wood fuel to local community's livelihood support in the study area as it is only the energy source for them.

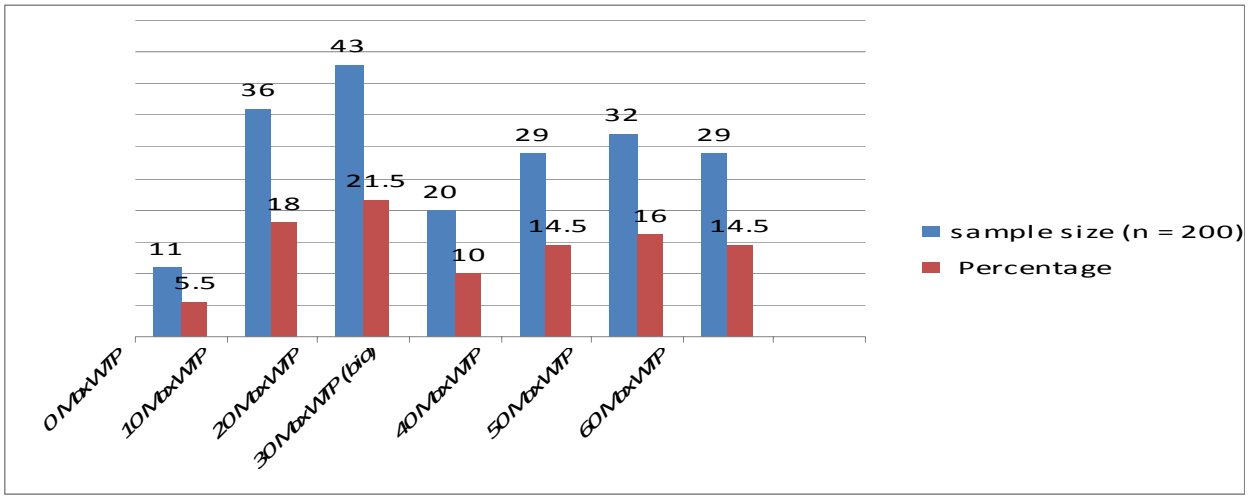
Table 12. MaxWTP of households for conservation of wood fuels (e.g. Dry woods)

WTP amount in birr	Frequency (n = 200)	Percent
0 MaxWTP	2	1.0
10 MaxWTP	52	26.0
20 MaxWTP	50	25.0
30 MaxWTP (bid)	34	7.0
40 MaxWTP	15	7.5
50 MaxWTP	18	9.0
60 MaxWTP	29	14.5
Total	200	100.0

MaxWTP=maximum willingness to pay

Wild edible fruits and medicinal plants i.e. WEF and MP respectively (e.g. Balanites egyptica for both) was also considered in the study and accordingly those respondents who paid maximum WTP at lower bid (0-20) ETB were 45% with a maximum WTP of 55% at equal or greater than bid (30-60) ETB (Figure 7). Therefore; more than half of respondents pay their maximum WTP above elicited bid for management of WEF and MP which indicats more interested in its consrvation.

In view of the fact that the majority of respondents were having large family sizes, livestock products and agriculture output are not enough for their daily consumptions and modern medications. As a result of this, local peoples in the study area are also using wild edible fruits for day to day expenditure support and medicinal plant for traditional diseases treatment. That was the reason why they are more interested in management of them.



MaxWTP=maximum willingness to pay

Figure 7. MaxWTP of households for Mgt of WEF and MP (e.g. Balanites egyptica indica)

Wildlife (e.g. White eared kob) is one of the direct woodland uses which were given consideration in this school work. The result showed that 34% of respondent were contributed their MaxWTP below bid (0-20) ETB per household per year and about 66% of them pay at maximum WTP at equal or over the bid (30-60) ETB (Table 13). In this regard, the majority of household heads were willing to contribute more money for conservation of wildlife which means that, local community in the study area were having information about the goodness of wildlife for its direct contribution to their current consumption specifically; and as well as to the country gross domestic products (GDP) in general, for that case, they are in need of conserved it.

The result is similar with the work of Selman (2003) that examining the wider economics and public benefits of forestry in Britain which looked at several values of wildlife biodiversity and summarized an average household's willingness to pay in between the range of £11 and £53 per household per year to protect or improve the biodiversity of particular woodlands. Another similar study in North America and Europe has used contingent valuation techniques to value wildlife protection programmes and investigates the public WTP for the Wildlife Enhancement Scheme on the Pevensey Levels in the south of England (Willis et al., 1996).

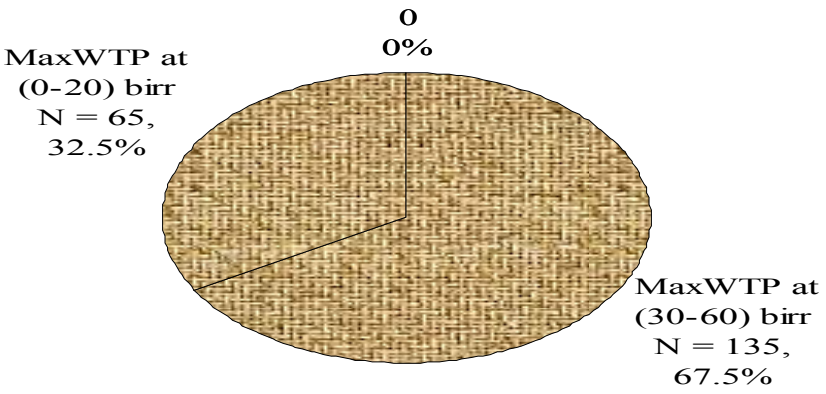
Table 13. MaxWTP of households for conservation of wildlife (e.g. White eared kobs)

WTP amount in birr		Frequency (n = 200)	Percent
	0 MaxWTP	7	3.5
	10 MaxWTP	25	12.5
	20 MaxWTP	36	18.0
	30 MaxWTP (bid)	28	14.0
	40 MaxWTP	28	14.0
	50 MaxWTP	33	16.5
	60 MaxWTP	43	21.5
	Total	200	100.0

MaxWTP=maximum willingness to pay

Land and natural water (e.g. soil fertility and surface water quality) are indirect woodland uses which have a great role in support of rural households' livelihood standard. For conservation of it, maximum willingness to pay (MaxWTP) of local households' heads was analyzed. Accordingly, respondents who responded to pay their maximum WTP under bid are 32.5% in which the majority of them who are about 67.5% were registered from the maximum WTP in upper bid level (Figure 8). The meaning for more contribution of respondents at the maximum WTP above starting point level is because, local community in the study area is farmer which seeks daily consumption from cultivated land and is lacking of even pure daily drinking water. As a result of this, local peoples were more interested in paying more money for soil and water conservation.

The work was similar with Bekele and Drake (2003) who identified determinants of households' adoption of alternative soil and water conservation practices. It is also similar with another study done by Hassan and Nhemachena (2008) that predicted determinants of farm level climate adaptation measures in Africa. Moreover; non-commercial users of water on Flores Island currently pay an average annual fee of $24 for consumption of 190 cubic meters of water (Binnies and Partners, 1994).



MaxWTP=maximum willingness to pay, N= Frequency

Figure 8. MaxWTP of households for Mgt of land (e.g.cultivated) and water (e.g.surface)

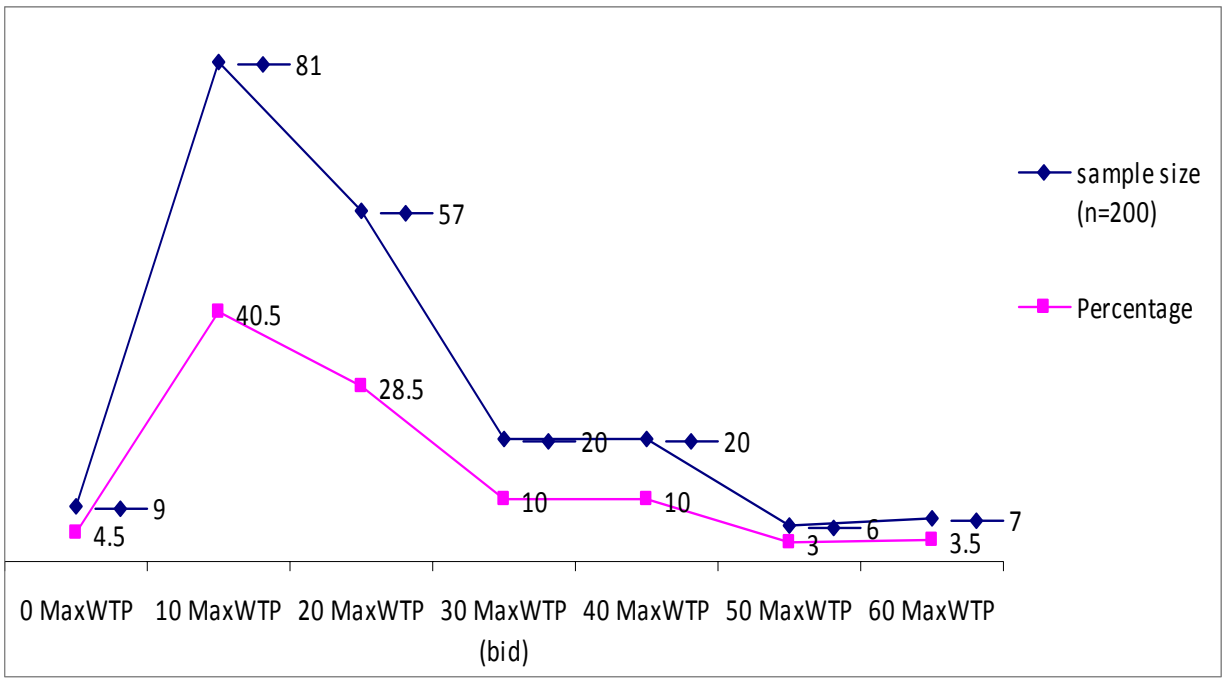
Willingness to pay (WTP) of the households' heads for livestock (e.g. cows) health increase which is woodland indirect uses value was estimated. The result showed that 52% of respondents were contributing their maximum WTP under elicited bid (10-20) ETB per household per year and about 48% of them were willing to pay their maximum WTP at equal and beyond the bid point (30-60) ETB (Table 14). Thus; none of respondents pay maximum WTP at zero ETB for management of cows in the study area. Although many households' heads have been registered below the started bid; there are samples of respondents who pay their MaxWTP at zero ETB which is also an indication of appealing of rural households in management of cows.

Table 14. MaxWTP of households for conservation of livestock (e.g. Cows)

WTP amount in birr		Frequency (n = 200)	Percent
	10 MaxWTP	54	27.0
	20 MaxWTP	50	25.0
	30 MaxWTP (bid)	27	13.5
	40 MaxWTP	27	13.5
	50 MaxWTP	21	10.5
	60 MaxWTP	21	10.5
	Total	200	100.0

MaxWTP=maximum willingness to pay

Fish resource (e.g. catfish resources) is one of the indirect uses of woodland in which the willing to pay of local peoples for its management was investigated. Based on the study outcome, the sample households' heads that were willing to contribute their maximum WTP below the bid were 73.5% in which about only 26.5% of them were registered at maximum WTP at equal or above the bid level (Figure 9). The result indicated that, majority of the respondents were found paying their maximum WTP below the bid point. Hence; the reason for crowded of respondents below the starting bid level for management of it, is owing to not usually use it for their daily consumption since it is seasonal uses resources in which they have chance only for four months in its extraction.

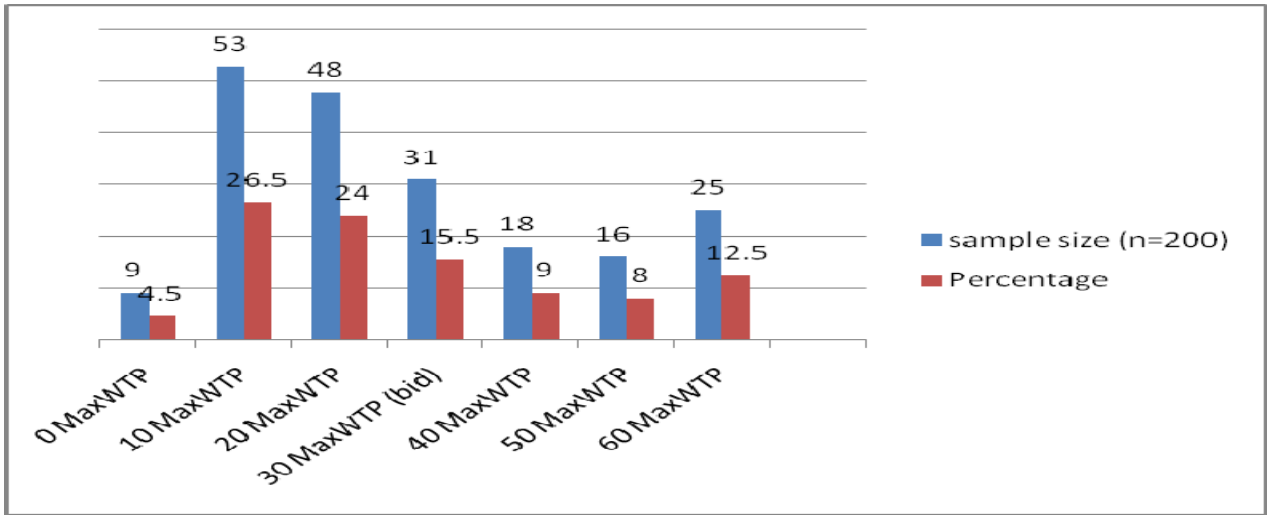


MaxWTP=maximum willingness to pay

Figure 9. MaxWTP of households for management of fish resources (e.g. Catfishes)

Option value (e.g. use values mentioned above) is also woodland use value which was given a value in the study for its importance in support of local people living standard. Households' heads who pay their maximum WTP under bid for management of it were 55% whereas the percentage of those who were contributed money at the maximum WTP level at bid and beyond bid were 45% (Figure 10). Even though many local households' heads did not pay more at

maximum WTP above the bid level for management of option value, still they have a good knowledge about importance of the option value since they are using shifting cultivation system which is one part of option value. In this regard, they leave some part of their cultivated land to nature for some year in which it is going to reclaim nutrient for the future productivity increases. But, the gap is a propos the lack of knowledge of the ecological integrity.



MaxWTP=maximum willingness to pay

Figure 10. MaxWTP of households for Mgt of option values (e.g. use values mentioned above)

4.3.1.1. Attitude of households to woodland use values

Attitude of local households' heads for management of each woodland uses value was investigated and the result showed that, local people were having good attitude toward some use values than the others. Moreover, local community in the study area were more interested for soil and water conservation in which about 67% of them pay their maximum WTP at equal or above the bid (30-60) ETB per household per year. This was the consequence that, 100% of their living standard derived from cultivated land and water resources is a vital resource for them which is in support of their daily consumption and other important activities. The second use value that they were given priority in WTP next to soil and water was wildlife protection; more than half i.e. 66% of respondents pay their maximum WTP at bid and upper the bid for its protection. Even though local community in the present study area was not using hunt meat daily, still they are

awared about the importance of wildlife for its support to present livelihood and tourism attraction in future. Timber product was scored third rank and is one of the important use values for them in which about 60.5% of them pay their maximum WTP at bid and above for its management. Based on the benefit provided to local community, many of them are interested in management of it. This rural community now a day still using timber products for many purposes e.g. construction materials and as a source of incomes for those who do not have other sources of income earns. Wild edible fruits and medicinal plants stood at fourth rank, in which about 55% of households' heads were contributed their maximum willing to pay at elicited bid and beyond (30-60) ETB for its management. This implied that it has role in support of local people daily consumption.

Wood fuel (e.g dry wood) management and livestock (e.g. Cows) health increase data were collected and the output shown that they stand at rank fifth. Therefore; the percentage of those respondents who pay their maximum WTP at bid or above the bid for their management is the same (i.e. 48%) of respondents. Regarding on the maximum WTP of households' heads, the percentage of both of them is almost near to half of the respondents which also indicate the noteworthy of them to rural people. This is dueto that, rural community in the study area does not have any energy option unless woodfuel; and they still depend excessively on livestock products for their daily meal and income generations.

Willingness to pay of household's heads' result for management of option value and fish resources explained that, payment for option value is better than fish resources in which about 45% and 27% of respondents were paying their maximum WTP at equal and above the eliciting point for management of both respectively. Local community in the study area was aware of option value very well since they are using shifting cultivation method and nomadic way of live. Thus; fish is a seasonal resource for them wherein its contribution to their livelihood is very less that could not be compared with any one of uses value of woodland.

Hence; with exception of livestock (e.g. cows) management, there were a section of respondents who were not willing to contribute a value or pay zero ETB for management of woodfuel; soil and water conservation; wildlife conservation; timber products management; fish resources

conservation; option values management; medicinal plants and wild edible fruits management at a percentage level of 1%, 2%, 3.5%, 4%, 4.5%, 4.5%, and 5.5%, for each.

4.3.2. Maximum willingness to pay of households to woodland non-use values

Existence value (e.g. snake) is one of non-uses value of woodland which has also contribution in ecosystem integrity. Consequently; for its management the data output elucidated that around 57% of households' heads were participate in paying their maximum WTP below the bid level (0-20) ETB per household per year and as well as about 43% of them were engaged in the maximum WTP at and above elicited bid (30-60) ETB per household per year (Table 15).

In this situation the majority of respondents pay their maximum amount below the bid which implied that, rural community in the study area are not aware about the momentous of snake value since it is not use value for them. But still households' payment for its management is better than fish resources; this is because, in the study area there are some people who are traditional believers and are having a good view for it.

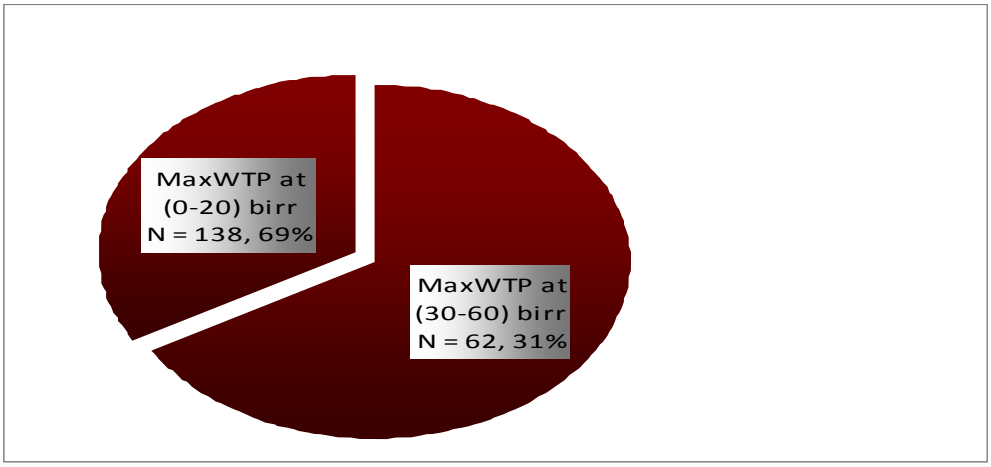
Table 15. MaxWTP of households for management of existence values (e.g. snakes)

WTP amount in birr		Frequency (n = 200)	Percent
	0 MaxWTP	18	9.0
	10 MaxWTP	58	29.0
	20 MaxWTP	38	19.0
	30 MaxWTP (bid)	20	10.0
	40 MaxWTP	20	10.0
	50 MaxWTP	31	15.5
	60 MaxWTP	15	7.5
	Total	200	100.0

MaxWTP=maximum willingness to pay

Bequest value (e.g. use and existence values mentioned above) was another of non-use values which was given worth because of its importance in contribution of the future generation

livelihood support. For this case, the participation of countryside households' heads in payment for its management was estimated. Therefore; the percentage of those respondents who pay their maximum WTP less than bid was bring into being 69%, with the maximum WTP above the bid at 31% (Figure 11). Based on this result, it contented that community in the study area has no good vision for management of bequest value. This alliance with the lack of know how of rural community about the link of generation with the resources.



MaxWTP = maximum willingness to pay, N = Sample size (i.e. 200 households' heads)

Figure 11. MaxWTP of Hs for mgt of bequest values (e.g. use and existence values above)

4.3.2.1. Attitude of households to woodland non-use values

Attitude of rural people for each non-use values was investigated and the result showed that, local households are more interested in management of existence value than bequest value. In this regard about 43% of them is observed from maximum WTP equal and beyond bid level for management of existence value but, only 31% of them pay their maximum WTP above the bid for management of bequest value. According to the data result, respondents are more interested for management of existence value than bequest values. The reason for is because local people in the study area are now the users of some resources which were existence value before and they are aware that there will be time for this none-use value to be uses value for them. From now;

about 9% and 14% of respondents pay zero ETB for management of existence and bequest values correspondingly.

4.3.3. Economic values of woodland component units

Based on the willingness to pay collected data from 200 local households' heads of Lare area which have a total land size of 685.17 square kilometers (Table 16), it showed that the mean willingness to pay of local households' heads for management of woodfuel, soil and water conservation and livestock health increase is greater than the others woodland component units which is about 33 with a unit value of 46,016 Ethiopian birr (ETB) for each. In the same result, the average means of respondents who pay for conservation of timber products, wild edible fruits and medicinal plants, wildlife, fish resources and option values is 32 which have a worth of 46,016 ETB for each. In same situation, an average means willingness to pay of rural households' heads for protection of existence and bequest values is smaller than the rest in which it is 30 and 29 with a unit price of 43,140 and 41,702 ETB respectively.

EV of each woodland unit = Average MaxWTP of n X N

Where;

n = Total sample size i.e. 200 households' heads

N = Total population of households' heads i.e. 1438

Table 16. Economic values of woodland component units in 2011/2012 GC

Woodland units	AV Mean MaxWTP	EV of woodland unit (ETB)
Timber products management (e.g. Log products)	32	46,016 birr
Woodfuel (e.g. Dry wood)	33	47,454 birr
Wild fruits and medicinal plants (e.g. Balanites egyptica)	32	46,016 birr
Wildlife conservation (e.g. White eared kob)	32	46,016 birr
Soil and water conservation (e.g. Soil and water)	33	47,454 birr
Livestock health increase (e.g. Cows)	33	47,454 birr
Fish resources management (e.g. Catfish)	32	46,016 birr
Option values (e.g. Direct uses mentioned)	32	46,016 birr
Existence values (e.g. Snakes)	30	43,140 birr
Bequest values (e.g. uses and existence values mentioned)	29	41,702 birr
TEV of woodland unit (in ETB) per area (in Km^2)		457, 284 ETB per 685.17 Km^2

4.3.4. The Tobit Model Result

Before running the model, therefore; all the hypothesized explanatory variables were checked for the existence of multi-collinearity problem. There are two measures that are often suggested to test the existence of multi-collinearity. These are: Variance Inflation Factor (VIF) for multi-collinearity among the continuous explanatory variables and Contingency Coefficients (CC) for association among dummy variables.

According to Maddala (1992), VIF can be defined as: VIF (Xi) = $1/1\text{-}R^2$ where Ri^2 is the squared multiple correlation coefficient between Xi (one explanatory variable) with the other explanatory variables. A statistical package known as SPSS version 17 was employed to compute the VIF values. Once R^2 values were obtained the VIF values can be computed using the formula. The VIF values displayed in (Appendix 6) have shown that, all the continuous explanatory variables have no high degree multi-collinearity problem among variables since VIF value is less than ten. Similarly; contingency coefficients were computed for dummy variables association (Appendix 7) and the result showed that there is no high degree association problem among variables since CC value is less than one. Based on the above test both the hypothesized continuous and dummy variables were retaining in the model.

4.3.4.1. Factors influencing willingness to pay of households

Estimate of parameters of the variables were expecting to influence willingness to pay of households' heads. There are seven explanatory variables of which two are dummy variables and five of them are continouos variables; and all of them were considered for the analysis. The result of the model data analyzed shows that, three variables were found to be statically significant at 1% and 5% significant level. In cases like this (where the dependent variable is only observed in some range), the Tobit model can be used to analyse the factors affecting the probability and level of WTP (Amemiya, 1985). The application of Tobit analysis is preferred in such cases because it uses both data at the limit as well as those above the limit to estimate regressions (McDonald and Moffit, 1980).

The impact of each explanatory variable on the total woodland management is discussed below (Table 17).

Family size per household (FSH): As expected, family size was negatively influencing the probability willingness to pay of the households' heads for management of total woodland and is significant at 1% significant level. As the member of family size is large, the probability willingness to pay of household head for management of woodland is decreased by -0.08416%. An increase in the family members by one person decreases willingness to pay of household head by a factor of 0.0005961 ETB. This implies that, those households' heads that hold large family sizes are exposed in more consumption which needs more resources for survival. The result is similar with Macmillan and Duff (1998) whose stated that the mean WTP among the general public for native woodland restoration on moorland in Strathspey was £53 per household per year but for a similar project in Glen Affric mean WTP per household (using a different sample) which was about £35 per year.

Number of cows holding per household (NCHH): Having more cows was observed having positive relationship with an increase in WTP of household head for management of woodland resources and is statistically significant at 5% significant level. Hence; having more cows increase the probability willingness to pay of household head for management of woodland by 0.01619%. Therefore; as the number of cows increases by one cow, result in an increase of willilness to pay of head by a factor unit of 0.0001147 ETB. This is the reasons that, having more cows results in sale of it and its products and make respondents chanceful for contrbuting more money for management of total woodland values.

Total income per household (TIH): The regression coefficient of the total income of households per year was found positively influenced the probability of willingness to pay of households and is significant at 1% significant level. And increase in total income of households result in an increase of the probability willingness to pay of heads by a factor of 0.00131%. As the total income of households increase by one birr per year, it results in contribution of more money for management of total woodland value by a factor of 9.26e-06 ETB. This is a motive that, an increase in income makes someone chanceful in participating in any scheme. This is

similar with Eugene E. Ezebilo (2010) the results showed that about 60% of the respondents were willing to conserve the afang plant in Nigeria. The mean willingness to pay of the respondents was 1422.76 Nigerian Naira (NGN), i.e. US$ 9.485 per per household per year and this is corresponded to 7% of their total income from non-timber forest products. The other similar work was; the value estimated through CVM can be added as a subindicator to the proposed indicators for the classification of cedar forests. Therefore, the average WTP per household was estimated at US$42.4 per year was a function of the total income of Lebanese Districts (Sattout, 2004).

Table 17. Tobit Model maximum likelihood

Explanatory variables	Estimated coefficient	Standard error	t-ratio	Change in probability of WTP $\partial F(z)/\partial x_i = F(z)(\beta i/\partial)$	Change among respondents in WTP (∂E) $(^{yI}/_{Y*})>(0/\partial x_I)$
Constant	-1.118568	7.595497	-0.15		
GHH	0.9411644	2.637387	0.36	0.0004138	0.0002986
AGHH	-0.0194612	0.1086654	-0.18	-8.72e-06	-6.17e-06
EDUHH	0.1565958	2.743713	0.06	0.0000699	0.0000497
FSH	-1.87873***	0.4582424	-4.10	-0.0008416	-0.0005961
NCHH	0.3614304**	0.1238303	2.92	0.0001619	0.0001147
SCLH	4.804636	3.349015	1.43	0.0021524	0.0015244
TIH	0.0291854***	0.0021396	13.64	0.0000131	9.26e-06

GHH=Gender of household head, AGHH=Age of household head, EDUHH=Education of household head, FSH=Family size per household, NCHH=Number of cows holding per household, SCLH=Size of cultivated land per household, TIH =Total income per household, ∂ = Sign of derivation.

Log Likelihood function = -75.420285, No of observation = 200, K= 6, F (z) = 0.998603, Sigma (δ) = 16.62234, *** and ** represent level of significance at 1% and 5% respectively.

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

Woodland values have great contribution to the local community livelihood of those who are living around it. Households of the study area gain different benefits from woodland. The result revealed that Lare wereda woodland is very important in that, it contributes significantly to the livelihood of the local communities at various levels for income generation and subsistence.

About 90.5% of respondents in the study area were none remittance households from any sources. The result of the present study revealed that, woodland products like timber products (e.g. log products), wood fuel (e.g. dry wood), wild edible fruits and medicinal plants (e.g. balanites egyptica indica) were woodland uses that are extracted most by local community in the area.

Log products and head load of wood fuels were seen more significant to local people livelihood support in which about 86% and 82.5% of respondents were using it ranging from 100-301+ number of log per household per year and 4-9+ head load per household per month respectively. Concerning utilization of fish resources (e.g. catfish) about more than half of respondents i.e. 68% were seen from the range of 0-31 numbers of fish per household per year. The reason for less use of fish resources is because it is cyclic resources to local community in the study area since they are using nomadic way of living system and are having chance only for four months (February-May) in fish extraction.

The attitute of local households for management of each use values of woodland was investigated based on their maximum willingness to pay responses and the result indicated that local people were having good attitude to some use values than the others. As a result of this local community in the study area were more interested for land (e.g. cultivated land) and water (e.g. surface water) conservation in which about 67% of them were willing to contribute their maximum WTP at 30-60 birr above the bid per household per year. The reason behind for contribution of the majority of respondents above the elicited bid is because all of the

respondents are having private cultivated land and water is a vital resource for their daily consumptions and other activities use.

In the same condition, the study output showed that local households have no good attitude for management of fish resources (e.g. catfish) than any other resources in which only 27% of them contribute their maximum WTP above the bid point. The reason behind is that, fish is seasonal resources to local community in the study area in which its contribution to their livelihood is very less than the rest of woodland uses value.

Similarly, the attitude of rural households for management of each non-use values of woodland was also examined. The result explained that local households are more interested in management of existence value than bequest value inwhich about 43% and 31% of respondents were willing to pay their maximum above bid for management of existence and bequest value respectively. The reason for favoring existence value than bequest value was because, some of respondents were traditional believer who have good knowledge about importance of the existence value.

Tobit econometric model result revealed that an increase in income of households and number of cows have positive effect in participation of households' heads to contribute money for management of total woodland. Hence, income is the solution for any kind of monetary participation in any activity or scheme.

5.2. Recommendation

Maximum willingness to pay result exposed that community in the study area is lacking of good knowledge about the important of some use values of woodland and almost all about non-use values. Hence; more effort is needed to apply in letting local community to let them learn resources especially by provision of necessary training from different aspect of woodland values units.

There is a few Natural Resources Management Projects (NRMP) operated in the area from some specific aspect of resources. For this reason rural people in the study area has no information about the important of some natural resources of the area which is even let them feel not easily acceptable to the researcher idea during explanation for the important of each unit woodland values to the presence and future generations' livelihood.

Thus; only few valuation researches including this thesis was done in the area using specific woodland values units which are not even enough to come up with accessing the benefits of all values of woodland. For that case, more projects are needed to launch to the area.

Therefore, further valuation researches is needed to carry out in the area so that the presence entire resources of the woodland and significant of each units of it in provision of the benefits can be known to rural people and contribute to development plan.

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APPENDICES

Appendix 1. Designed survey questionnaires

Thesis title

Contingency Valuation of Woodland Benefits from Local Households perspective: The Cases of Lare District in the Southwestern Ethiopia

General information on study site and questionnaires

Name of region_____

Name of zone_____

Name of Woreda_____

Name of kebele_____

Name of community_____

Name of enumerator_____

Question number_____

Date of interview_____

Part I Demographics and socio economics characteristics of local household head:

1. **General household head characteristics information: Mark (√) where it required**

1.1 Name of respondent (household head) _____

1.2. Sex of the respondent 0=Male 1= Female

1.3. Age of the respondent _____ (in years).

1.4. Educational status of respondent_____ (in years)

0 = If illiterates 1 = If read and write

1.5. Occupation of respondent 1=Farmer 2= employed in gov't institution 3= employed in non-gov't institution 4=daily laborer 5=Private off-farming activities (e.g. beekeeping, hunter, woodland resources extractor, fisher man, and petty trade 6= House wife 7= student 8=other activities (specify) _____

1.6. Total family size including household head _____ (in numbers)

1.7. Having remittance, credit and aid in (2009/2010)

No	Category	Amount gained in birr in (2009/2010)	Sources **(Code A)**	Types **(Code B)**	Remark
1	Remittance				
2	Credit				
3	Aid				

Code a 1= Relatives 2= Gov't orgs 3= Non Gov't orgs 4= Never 5=other (specify___)

Code b 1= Cash 2= Kind 3= Other (Specify_____)

1.8. Livestock holding in (2010/2011)

1.8.1 Do you have livestock (e.g cows)? 0=Yes 1=No

1.8.2. If your response to Q/n **(2.8.1)** is yes, how many cows you have in (2009/2010) ---------?

1.8.3. Under which grazing system do you use most for your livestock feed?

1= Open grazing on common land permanently in all seasons of the year 2= Moving continuously for grazing search in summer season of the year 3= other (specify_____)

1.9. Cultivated land holding in (2010/2011)

2.9.1. Do you have your own cultivated land of any type? 0=Yes 1=No

3.9.2) If your response to Q/n **(2.9.1)** is yes, then how many hectare of cultivated land you have _____?

1.10. Total income of households (in birr----------) in year 2010/2011

Part II Woodland consumption by rural community

2. Uses consumption

2.1. Uses extracted per household in (2010/2011)

No	Woodland components' units	Units of measurement of woodland resources	Quantity harvested in **(2010/2011)**
1	Fuel wood collected	In head load /month	
2	Timber products harvested	In number/year	
3	Wild edible fruits collected	In lier/year	
4	Medicinal plants extracted	In bundle/year	
5	Hunt /Bush meat consumed	In zuon/year	
6	Water resources consumed	In litres/day	
7	fish resources extracted	In number/ month	

2.2. Under what conditions of permission do you extract woodland uses?

1= under permission of kebele administrators 2= under permission of guards 3= under permission of both 4= public right under knowledge of local community with no permission body 5=other (specify_____)

2.3. What is the main cause of deforestation to your woodland in (2010/2011)?

1= fuel wood and timber products extraction 2= Wild edible fruits and medicinal plants extraction 3= out going hand fire during honey extraction and fire set knowingly for wildlife hunts 4= agricultural expansion and uncontrollable livestock increase 5=natural disaster (flood and unexpected harsh climatic change) 6= others (specify----------)

Part III WTP of local households' head for management of woodland resources due to the benefits that they are gaining from them:

Survey questionnaires prepared for estimating the degree of maximum willingness to pay of the local households' heads for the management of Lare natural woodland resources (some component units of uses and non-uses value) due to the benefit provided using economic valuation method i.e. bidding game technique.

3.1. Woodland uses value

3.1.1. Direct uses value: A uses value that is determined by the contributions that the environmental or natural resources make to the current consumptions and productions.

3.1.1.1. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's direct uses value i.e. **timbers products (e.g. Log products)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.1.2. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's direct uses value i.e. **wood fuel (e.g. Dry wood)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.1.3. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's direct uses value i.e. **medicinal plants and wild edible fruits (e.g. Balanites)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.1.4. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the consevation of your woodland's direct uses value i.e. **wildlife (e.g. White eared kob)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.2. Indirect uses value: A value that includes all the benefits derived from functional services that the environment/ natural resources provide to support the current consumptions and productions.

3.1.2.1. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's indirect uses value i.e. **soil and water (e.g. Soil fertility and surface water quality increase)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.2.2 Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's indirect uses value i.e. **livestock (e.g. Cows health increase)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.2.3. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's indirect uses value i.e. **fish resources (e.g. Catfish)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.1.3. Option values: A Value that is determined by the willingness to pay of consumers for unutilized asset or natural resources; however, simply to avoid the risk of not having it available in the future or for preserving their own future benefit.

3.1.3.1. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's uses value i.e. **option value (uses value mentioned above)** for its contribution in supports to your current livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.2. Woodland non-uses value

3.2.1. Existence value: Values that arise from the satisfaction of merely knowing that, the resources are exist though their values do not intend consumers to use them.

3.2.1.1. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's non-uses value i.e. **Existence value (e.g. Snake)** for its contribution in supports to your environment or ecological integrity and your future generation livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.2.2. Bequest value: Is a value of uses and non-uses of woodland or natural forest's resources that is reflected by the desired to conserves for the benefits of the future generations.

3.2.2.1. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your woodland's non-uses value i.e. **Bequest value (uses and existence values mentioned above)** for its contribution in supports to your future generation livelihood?

If yes then … (_____) Max.WTP

If no then … (_____) Max.WTP

3.3. Total woodland values

3.3.1. Is the total value of all resources of woodland that give services to the local community in the study area.

3.3.1.1. Are you willing to pay 30 birr per your household per year in 2010/2011 as land tax for the management of your total woodland resources i.e. **uses and non-uses value**, for its contribution in supports to your current and future generations' livelihood?

If yes then … (_____) Max.WTP

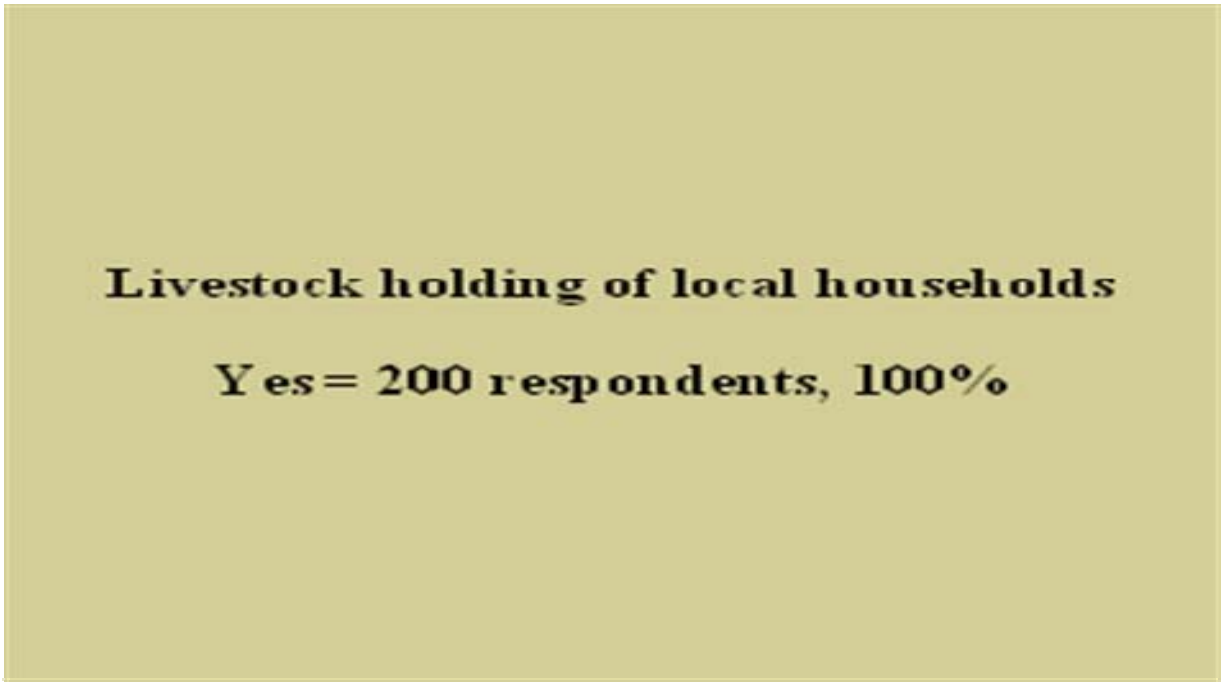
If no then … (_____) Max.WTP

Thank you

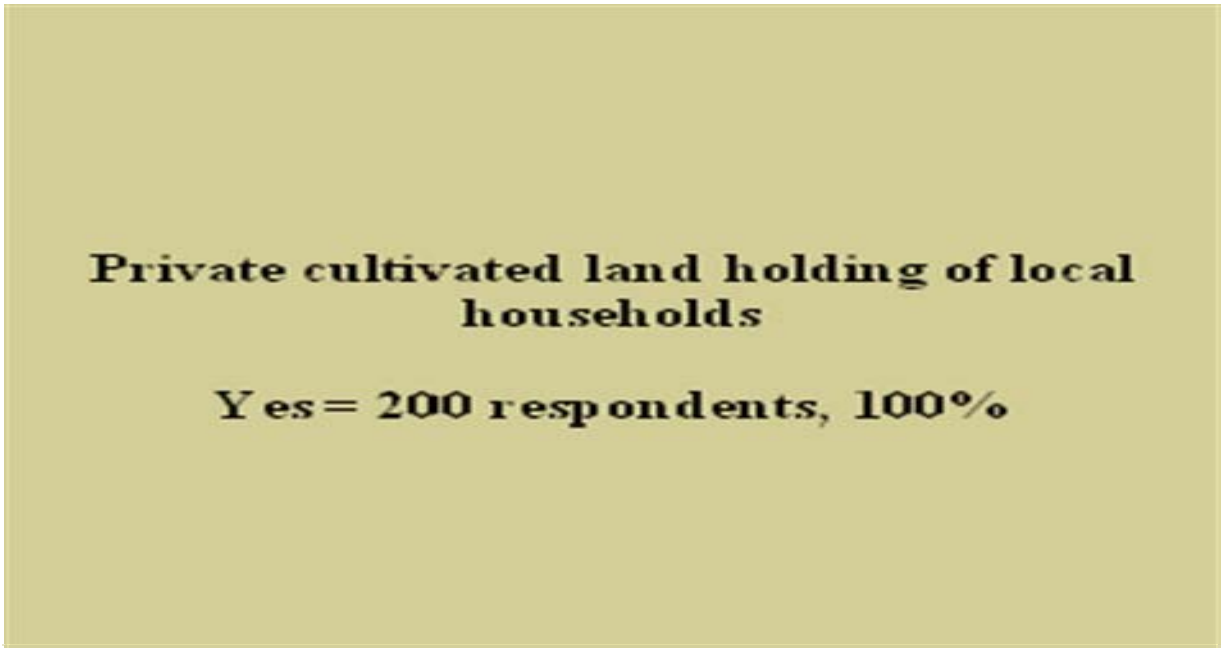
Appendix 2. White-eared kobs migrate across the Gambella woodland from South Sudan.

Source: Lester Bradford, 2011

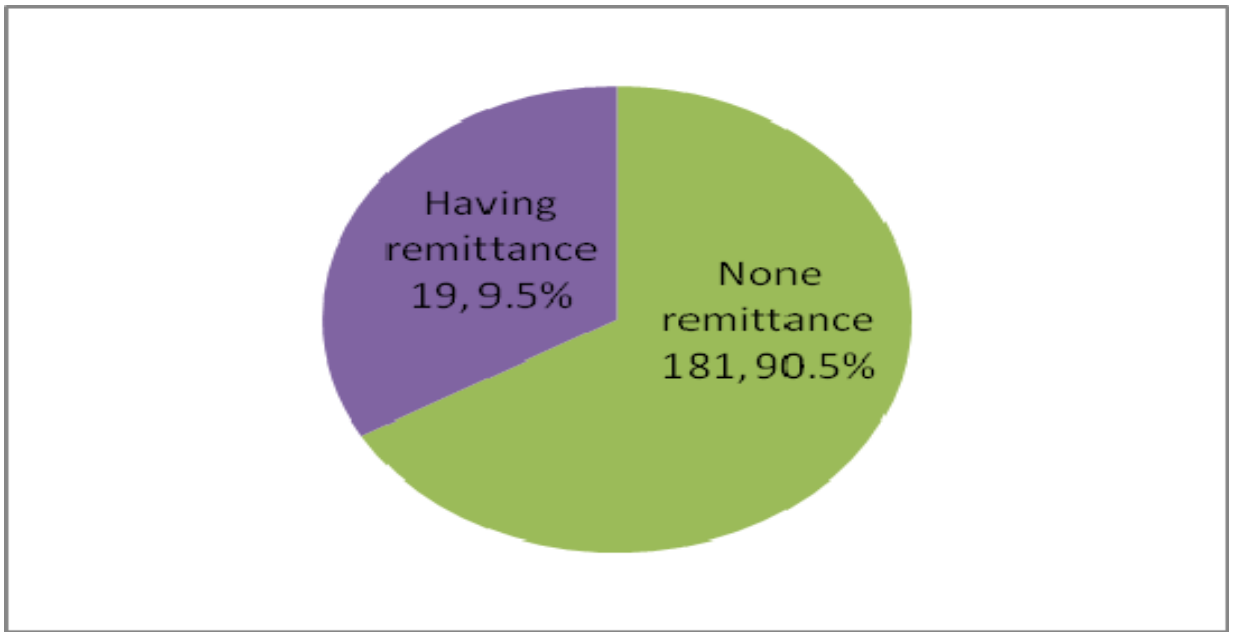
Appendix 3. Livestock holding per households



Appendix 4. Cultivated land holding per household



Appendix 5. Remittances per household



Appendix 6. Test for multi-collinearity among continuous variables using VIF

Continuous independent variables	Collinearity Statistics	
	Tolerance	VIF
Age of household head	0.979	1.021
Household size	0.972	1.029
Livestock holding	0.993	1.007
Cultivated land	0.987	1.013
Total income	0.981	1.020

Note: In all cases, variani inflation factor (VIF) is less than 10; hence, there is no high degree multi-collinearity problem among variables.

Appendix 7. Test for association among dummy variables using CC

Dummy independent variables	GHH	EDUHH
GHH	1	
EDUHH	0.012	1

Note: In this case, contingency coefficient (CC) is less than 1; hence, there is no high degree association problem among variables.