







DETERMINANTS OF AFFORESTATION IN UPPER TANA CATCHMENT AREA OF KENYA: A CASE STUDY OF EMBU AND **KIRINYAGA COUNTIES**

FINAL REPORT BY:

IDOWU TOLULOPE OWOEYE (SDP Student)

MATRIC NUMBER: 143209

DR OLAWALE OLAYIDE

(Sub-Dean/Academic Supervisor)

FAITH MUTHONI AND PAUL NJUGUNA

(On site Supervisors)

JULY 2018

Contents

List of	tables	iv
List of	figures	v
List of	acronyms	vii
Execut	ive Summary	viii
Acknow	wledgements	x
СНАР	TER ONE	1
INTRO	DDUCTION	1
1.0	BACKGROUND TO THE STUDY	1
1.(0.1 Description of the UTaNRMP	3
1.1	PROBLEM STATEMENT	4
1.2	RESEARCH QUESTIONS	6
1.3	OBJECTIVES OF THE STUDY	6
1.3	3.1: Operationalization of Variables	7
1.4	HYPOTHESIS OF THE STUDY	12
1.5	JUSTIFICATION OF THE STUDY	12
1.6	PLAN OF STUDY	15
1.7	DELIMITATION AND LIMITATION OF STUDY	15
СНАР	TER TWO	16
LITER	ATURE REVIEW	16
2.0	THEORETICAL AND CONCEPTUAL FRAMEWORK	16
2.0	0.1 Theoretical Framework	16
2.0	0.2 Conceptual Framework	18
2.1	METHODOLOGICAL FRAMEWORK	20
2.2	EMPIRICAL FRAMEWORK	22
2.2	2.1 Review of Empirical Studies	22
2.3	Review of Upper Tana Natural Resources Management Project (UTaNRMP)	24
2.3	3.1 UtaNRMP Background	24
2.3	3.2 Project Area	25
2.3	3.3 Objective of the Project	25
2.3	3.4 Components of the Project	26
2.3	3.5 Key Institutional Structure	27

2.3.6 B	rief Review of the Baseline Report relating to this Study	28
CHAPTER	3	29
METHODO	DLOGY	29
3.0 ST	ГUDY AREA	29
3.1 N	ATURE AND SOURCES OF DATA	31
3.2 M	IETHOD OF DATA COLLECTION	31
3.3 Al	NALYTICAL METHODS/TECHNIQUES	35
3.3.1	Descriptive Analysis	35
3.3.2	Chi- Square	35
CHAPTER	FOUR	36
RESULTS .	AND DISCUSSION	36
4.1 SC	DCIO-ECONOMIC CHARACTERISTICS AND IMPLICATION	36
4.1.1	Age Distribution of Respondents	36
4.1.2	Gender Distribution of Respondents	36
4.1.3	Distribution of Respondents by Marital Status	37
4.1.4	Distribution of Household Head per River Basin	38
4.1.5	Distribution of Household Members Working per River basin	38
4.1.6	Major Occupation of Household Heads	39
4.1.7	Other Household Socio-Economic Information	39
4.1.8	Engagement in the Sales of Tree or Charcoal	40
4.1 R	ESULTS ON ENERGY USE IN THE HOUSEHOLDS	40
4.2.1	Cooking Appliances used in Households	40
4.2.2	Household Energy Usage	41
4.2.3	Pieces of Firewood Used to Cook Githeri	42
4.2.4	Availability of Energy Saving Jikos in closest Markets to Households	43
4.2.5	Affordability of Energy Saving Jikos	43
4.2.6	Challenges in the Usage of Energy Saving Jikos	44
4.3 R	ESULTS ON AWARENESS OF SUSTAINABLE ENVIRONMENT MANAGEMENT	45
4.3.1	Level of Awareness on Tree Planting Engagement	45
4.3.2	Awareness of Engagement in Natural Resources Management Training	46
4.3.3	Household Members Natural Resources Management Knowledge Acquisition and Usag	;e 48
4.3.4	Ranking of Awareness on Sustainable Environment Management	48
4.4 RESU	JLTS ON THE EFECT OF COMMUNITY INCOMES ON AFFORESTATION	49
		iii

4.4.1	Household Assets Owned	49
4.4.2	Source of Household Income	50
4.4.3	Accessibility to Extension Services and Inputs	50
4.5 RI	ESULTS ON LEVEL OF AFFORESTATION	
4.5.1	Tree Planting Engagement	
4.5.2	Survival Rate of Trees Planted	51
4.5.3	Tree Planting by Household Head Educational Level	52
4.5.4	Tree Planting by Age	53
4.5.5	Tree Planting by Access to Input	53
4.5.6	Tree Cutting Engagement	
4.5.7	Average Number of Trees Harvested Yearly	55
4.5.8	Engagement in CBOS, CFAS, Forest Users Group	55
4.5.9	Involvement of Households in Forest Related Activities	56
4.5.10	Reason for not Engaging in CBOs, CFAs or Forest User Groups	57
4.5.11	Perception on Proper Address of Tree Cutting	57
4.5.12	Effective Measures used by the Community to address the cutting down of Trees	58
4.5.13	Support Required to Reduce Cutting of Trees	
OTHER FIN	IDINGS	59
CHAPTER	FIVE	60
SUMMARY	, CONCLUSION AND RECOMMENDATION	60
5.1 SU	MMARY	60
5.2 CO	DNCLUSION	61
5.3 RI	ECOMMENDATION	63
REFERENC	ES	65
APPENDIC	ES	69

List of Tables

Table 1. 1:	Distribution of household members working per river basin	
Table 1. 2:	Other household socio-economic information	

Table 2. 1:	Cooking appliance used in household	41
Table 2. 2:	Challenges in the usage of energy saving jikos	44

Table 3. 1:	Level of awareness on tree planting engagement	45
Table 3. 2:	Awareness of engagement in natural resources management training	47
Table 3. 3:	Household members natural resources management knowledge acquisition and usage.	48
Table 3. 4:	Awareness on sustainable environment management	48

Table 4. 1:	Household assets owned	49
Table 4. 2:	Source of household income	50
Table 4. 3:	Accessibility to extension services and inputs	50

Table 5. 1: :	Tree planting engagement	.51
Table 5. 2:	Involvement of households in forest related activities	.56
Table 5.3:	Effective measures used by the community to address the cutting down of tree	.58
Table 5. 4:	Support required to reduce cutting of trees	.58

List of Figures

Fig 1. 1:	OPERATIONAL CONCEPT OF DETERMINANTS OF AFFORESTATION	
Fig 2. 1 N	Iap of Kenya showing Upper Tana Catchment Area	30
Fig 3. 1:	MAP SHOWING LOCATION OF RESPONDENTS IN EMBU AND KIRINYAGA	33
Fig 4. 1: Ag	ge distribution of respondents	36
Fig 5. 1:	Gender distribution of respondents	37
Fig 6. 1:	Distribution of respondents by marital status	37
Fig 7. 1:	Distribution of household head per river basin	38
Fig 8. 1:	Major occupation of household heads	39
Fig 9. 1 :	Engagement in the sales of tree or charcoal	40
Fig 10. 1:	Household energy usage	42
Fig 11. 1: F	Pieces of firewood used to cook githeri	42
Fig 12. 1	Availability of energy-saving jikos in closest market	43
Fig 13. 1: A	Affordability of energy-saving jikos	43
Fig 14. 1: S	urvival rates of trees planted	52
Fig 15. 1: 7	Tree planting by household head educational level	52
Fig 16. 1: T	Tree planting by age	53
Fig 17. 1: 7	ree planting by access to Input	54

Fig 18. 1: Household tree cutting engagement	. 54
Fig 19. 1: Average number of trees harvested yearly	. 55
Fig 20. 1: Engagement in CBOs, CFAs, Forest user group	. 56
Fig 21. 1: Reason for not engaging in CBOs/ CFAs/Forest User Group	. 57
Fig 22. 1: Proper address of the cutting of trees	. 58

List of Acronyms	
CESDEV	Centre for Sustainable Development
CBO	Community Based Organization
CIFOR	Center for International Forestry Research
CIG	Common Interest Group
CFAs	Community Forest Associations
FAO	Food and Agriculture Organization
FDA	Focal Development Area
FGD	Focus Group Discussion
GHG	Green House Gases
GoK	Government of Kenya
HHH	Household Head
IFAD	International Fund for Agricultural Development
KES/KSH(s)	Kenya Shillings
KFS	Kenya Forest Service
KFRI	Kenya Forestry Research Institute
KII	Key Informant Interview
NRM	Natural Resource Management
NFP	National Forest Policy
PFMP	Participatory Forest Management Plans
SEM	Sustainable Environment Management
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
STF	Spanish Trust Fund
UTaNRMP	Upper Tana Natural Resources Management Project
WHO	World Health Organization
WRUAs	Water Resources Users Association
UI	University of Ibadan

Executive Summary

Kenya is considered to be a low forest country with a forest cover that is lower than the internationally accepted threshold. Deforestation in the country's water towers is estimated at 50,000 hectares annually, with a consequent yearly loss of over USD 19 million. Surprisingly, Kenya's tree cover, which was 1.7% in 2013 is now at 7.2% (KFS,2016). The partnership between the Global Masters in Development Practice and International Fund for Agricultural Development (IFAD) initiated the IFAD Universities Win-Win Partnership grant which was awarded to carry out a survey on the *Determinants of Afforestation in Upper Tana Catchment Area: A case study of Embu and Kirinyaga Counties* after consulting the supervisors from the Upper Tana Natural Resources Management Project (UTaNRMP) and the Centre for Sustainable Development (CESDEV), University of Ibadan (UI).

The study aimed at determining the factors influencing afforestation in the study area of Embu and Kirinyaga Counties with specific reference to: assessing whether improved efficiency in energy use is related to increased afforestation; examining the level of community awareness on sustainable environmental management (SEM) and assessing whether improved community income is related to increased afforestation using descriptive and inferential statistics such as frequencies, percentages, mean and chi square. The representative sample of 421 households were randomly selected and interviewed with the aid of a well-structured questionnaire. Focused group discussions and key informant interviews were also conducted. Data was analyzed using descriptive and inferential statistics, including chi square.

Majority of the household respondents were male (57%) and less than half were female (43%) more than four- fifths (83.4%) of the respondents were between the ages of 11 and 60 years and are considered to be in their economically active years while only few (3%)were aged 71 years and above. Also, with respect to marital status, a greater percentage of the respondents (85%) were married and only 14.5% were either single, widowed or divorced. Furthermore, majority of the household heads (66%) had completed Secondary and College/University education, 14.5% attended Primary and Vocational training school and only 3% had no formal education, this indicates high literacy level of household heads in the study area. The household size of the respondents was between 1 and 23 with an average of 4 members and only 1.1% with more than 10 household members.

The study reveals the impact of the UTaNRMP on the household in diverse areas as there have been better efficiency in energy use, improved community income, awareness on Sustainable Environmental Management(SEM) and increased afforestation. Majority of the households own farm implements which helps their agricultural productivity and on the average households have 3 Pangas, 2 Jembes and 1 Jembe fork. Also, 78.1% of household have access to inputs such as tree seedlings, herbicides and pesticides and 2 out of 4 household members are financially contributing to the household income giving an average household monthly income of over 20,000Ksh compared to the range of 833-26,667 Kshs per month in 2012 hence better income and improved livelihood which is a positive indicator for afforestation.

58.9% of the land was privately owned with the title deeds and majority of the household owned 1.6 acre of farm which is less than a hectare, this implies that most food crops grown are on a small scale and are mostly consumed by the household members.

The survey revealed that 69.3% of the households in the study area use three-stone Jiko compared to the baseline report of 83%. This indicates 16.5% reduction in the use of inefficient energy appliance. Also, 51% households indicated the choice of firewood as a major source of energy compared to the baseline report of 77.2% which reflects 33.9% positive change thus improved efficiency in energy use in the households. It was discovered that energy saving jikos are available in markets close to each household as 60% of respondents said the jikos are often and always available and only 6% raised the problem of unavailability of energy saving jikos in the market. In the same vein, more than three- fifths (62.7%) of respondents stated that the energy efficient stoves were very and averagely affordable and only 7.8% indicated that they are not affordable for their household. The major challenges faced by households in the use of the efficient stoves include high cost of technology, insufficient income of households, and inadequate awareness of the use of the energy saving stoves.

With respect to community awareness on sustainable environment management and increased afforestation, results revealed that majority of the households in the research area (96.5%) are aware of tree planting, 68.2% have access to extension services and 88.2% are utilizing the NRM information gained during trainings this resulted to a high level of engagement (87.4%) in tree planting which is mostly done twice per year (rainy seasons). The tree cutting rate was at 66.3% which shows that people in the study area engage in planting of trees than felling of trees. Results revealed that about half (46.2%) of those that engaged in tree planting had seedling survival rate between 51-100% and 61.5% of households planted above 20 trees yearly for the past 5 years. The average number of trees harvested yearly is between 1-20 and only 1.4% of the households in the study area harvest over 200 trees yearly for the past 5 years hence sustainability and improved afforestation.

Majority of the respondents (87.6%) believe that the issue of felling of trees is being addressed appropriately and effective law regulations, advocacy/awareness and restrictions on engagement in tree felling have been brilliant addressing measures. 25.2% believe more needs to be done to attain success especially through the measure of advocacy/awareness, effective CFAs and capacity building. 54.1% of the respondents stated the engagement of a household member in the activities of either a Community Based Organization, Community Forest Association or Forest Users Group and 64.6% indicated unawareness of group as the major reason of no account of engagement by household members.

This study further showed that age, level of education, level of awareness on Sustainable Environmental Management (SEM), access to inputs such as tree seedlings, pesticides and herbicides and access to extension service influenced afforestation in the study area.

Overall, the UTaNRMP has contributed significantly to the increased level of afforestation, livelihoods diversification, community-based mutual accountability and learning as well as environmental

sustainability. However, there is the need to put in place a sustainable natural resources management framework for enhancing a sustainable balance in afforestation and livelihoods in Kenya.

Acknowledgements

I give glory and adoration to the Almighty God for carrying out this survey project.

this research.

My profound gratitude goes to my University supervisor and Sub-dean of CESDEV UI, Dr. Olawale Olayide, my two onsite supervisors; the Project Coordinator of the Upper Tana Natural Resources Management Project (UTaNRMP), Mrs. Faith Muthoni and the energetic Land and Environment sub-component supervisor Mr. Paul Njuguna, for giving me the opportunity of drawing from their overflowing fountain of knowledge, their constructive criticisms and corrections have been helpful in

I sincerely appreciate the Global Master's in Development Practice Program and International Fund for Agricultural Development for the award of the IFAD-Universities Win-Win Partnership Grant. A big kudos to the Director, Global Master's in Development Practice, Dr. Lucia Rodriguez and the Director, Centre of Sustainable Development University of Ibadan (CESDEV UI), Prof. Olaranwaju Olaniyan.

My special appreciation goes to other component supervisors of UTaNRMP; Engineer Francis Koome, Mr. Boniface Kikuvi, Mr. Simeon Mumbere and all staff of the Project. Also worthy of recognition is the Community Forest Association (CFA), Water Resources Users Association Member and the Kenya Forest Service of Embu and Kirinyaga Counties. A big thank you to the High Commission of Nigeria in Kenya for their care and concern during my field survey. I really appreciate all the support I got throughout the course of this project.

I owe much gratitude to my parents, Mr. and Mrs. Owoeye for their care, and encouragement. I appreciate my one and only brother and sister Mr. Kehinde Owoeye and Mrs. Taiwo Adebiyi and my fiancé Mr. Babajide Ogunyemi for their moral support and assistance. I love you so much.

To members of Rhema Chapel Oluyole Security Department, and Development Practice Student Association University of Ibadan Chapter I say a big thanks. God bless you abundantly Amen.

I extend my heartfelt appreciation to the families of the Owoeyes, Asiwajus, Oduwoles, Adebiyis, and Ladipos. Thank you all for your encouragement.

I am also grateful to all my classmates (2016/2017) graduating class and my lovely pals Bukola Lawal, Segun Taiwo and Toyib Aremu.

Ajibolanle Aladejubelo, Emmanuel Ademola, Farouk Apata, Dolapo Oyetade, Jesutofunmi Omilani, Azeem Kazeem and Bayonle Amzat thanks for your friendship and moral support. I love you. My appreciation is not complete without mentioning my wonderful team mates, Isaac Oritogun, Kayode Oguntoye and Simbiat Oyiza, we shall continue to soar higher. God bless us all.

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND TO THE STUDY

The sustainability of human beings depends on the proper use of inevitable environmental capital such as soil, water, and vegetation (Keesstra et al., 2016). Forests play an important role in the environment for the provision of necessities of life, and habitat that ensures that benefits are obtained from forest ecosystem goods and services. An estimated 2.4 billion people worldwide benefit from agroforestry systems across one billion hectares and depend on wood energy for cooking and heating.

According to FAO (2018), Forests and trees store carbon, which helps mitigate the impacts of climate change. The total area covered by forests globally is approximately 3866 million ha, almost one-third of the world's land area, of which 95% is natural forest and 5% is planted forest. Tropical forest covers 814 million ha, and 110 million ha is located in Africa, 168 million ha in Asia and the Pacific, and 536 million ha in Latin America. On the contrary, only 25 million ha and 11 million ha of tropical forests are exploited in a sustainable way and conserved with an effective political protection in turn. All the tropical humid forests in Africa suffer from a massive deforestation (Soury, 2007).

Forest are areas of at least 0.5 ha with tree crown cover of more than 10%. They are designated as protected areas which host game parks and forest reserves (FAO 2001b). They make tangible contributions to the national economy by supplying renewable sources of energy in the form of wood fuel and charcoal. According to Aguilai et al., 2012, Afforestation applies to areas that have not been forested for at least 50 years while reforestation applies to land that used to be forested but was turned over to another land use.

Afforestation activities present a specific importance that reduces the negative effects of the torrential rainfall through main components such as the canopy of trees, the vegetation, litter, specific forest soil, loose and powerful high- capacity drainage systems due root development (Miță and Mătreață, 2005).

Currently, there is a global problem because the annual rate of global deforestation is over 13 million hectares, most of which occurs in the developing world. Forest loss in Africa is particularly troubling, two-thirds of the continent's population depends on forest resources for income and food and 90% of Africans use fuel wood and charcoal as sources of energy. Despite, or perhaps because of this dependence on forest resources and non-timber forest products, deforestation in Africa is estimated at about 3.4 million hectares/year (CIFOR, 2005; FAO, 2010). Most forest loss is taking place in countries with relatively large forest area. To date, conversion to small-scale permanent agriculture has been the main contribution to forest loss, but investment in large-scale agriculture could become a major driver of deforestation in the future.

Kenya has approximately 1.42 million hectares of closed canopy forest and it is considered to be a low forest country with a forest cover of 7.2% which is significantly lower than the internationally accepted threshold of 10%. Forests in Kenya can be classified into six broad categories: The High Volcanic Mountains and High Ranges, the Western Plateau, the Dry Northern Mountains, the Southern Hills, the Coastal Forest, and the Riverine Forest. The country's forests are estimated to contribute to 3.6% of Kenya's GDP (NFP, 2014), excluding charcoal and direct subsistence uses. There are currently approximately 165,000 hectares of plantation forestry in Kenya, which are generally poorly managed even though between 2005 and 2010, the Kenya Forestry Research Institute (KEFRI) increased tree seed production by 25% (KSIF, 2016). According to National Forest Policy (2014), Deforestation in Kenya's water towers is estimated at 50,000 hectares annually, with a consequent yearly loss to the economy of over USD 19 million.

The value of Kenya's Forests of being a finite, significant economic resource that should be well managed cannot be overemphasized to achieve Kenya's vision 2030 of effective use of the land to achieve socio-economic and political development and increased forest cover from 7.2% to 10% coverage under a protected area system. Forested catchment supplies 75% of all freshwater for farms, industry and homes while the Upper Tana Catchment Area of Kenya provides water and supplies hydroelectric power to the population.

In 2012, the Upper Tana Natural Resources Management Project an eight-year project started with a rationale based on the link between rural poverty and ecosystem health in a densely populated and environmentally fragile watershed of critical national and global significance. It was noticed that the high prevalence of rural poverty contributes to environmental degradation which in turn reduces sustainable livelihood opportunities; as well as creates negative environmental externalities which includes forest degradation, human-wildlife conflict, encroachment in water sources and reduced availability and quality of water to downstream users. The project thus recognizes a need to arrest the rapid loss of the life-supporting functions of the Tana River ecosystem due to forest degradation, inappropriate agricultural practices, and overgrazing.

The UTaNRMP aligns with IFAD's goal of empowering rural women and men to achieve higher incomes and improved food security and Kenya's Vision 2030 blueprint which aims at creating a "globally competitive and prosperous country with a high quality of life by 2030" thus transforming Kenya into "a newly–industrializing, middle–income country that would provide a high quality of life to all its citizens in a clean and secure environment.

1.0.1 Description of the UTaNRMP

The Upper Tana Natural Resources Management Project is an eight-year project (2012-2020) that is funded by the Government of Kenya, International Fund for Agricultural Development (IFAD), Spanish Trust Fund and the Local Community. The project has the goal of contributing to reduction of rural poverty in the Upper Tana River Catchment among the target population of about 205,000 poor households living in the targeted river basins whose livelihoods revolve around the use of the natural resources in the Upper Tana catchment.

This goal is pursued via two development objectives which reflect the poverty-environment nexus namely: increased sustainable food production and incomes for poor rural households living in the project area; and sustainable management of natural resources for provision of environmental services.

UTaNRMP is being implemented through four (4) components namely: Community Empowerment (US\$ 4.1million / 6% of total project funds); Sustainable Rural livelihoods (US\$ 22.3 million / 32.3% of project funds); Sustainable Water and Natural Resources Management (US\$ 32 million / 46.5% of project funds); and Project Management and Coordination (US\$ 10.5 million / 15.2% of total project funds).

The Sustainable Management of Forest and agricultural ecosystems sub-component addresses the Rehabilitation of Degraded Forest Reserves which include; activities such as capacity building of community groups in participatory forest management, seedling production, enrichment planting of degraded forests, and the rehabilitation of degraded forest areas. Also it relates to the Efficient Use of Fuel Wood such as fuel efficient stoves, biogas generators and charcoal kilns through matching grants, together with training in the manufacture/fabrication and use of such equipment. In addition, it is also concerned about Human-wildlife conflicts and Soil and water conservation on farm lands.

The sub-component's	a targets	are:
---------------------	-----------	------

Activity	Project Target
School Greening Programme	1972 schools to be reached
Forest Rehabilitation	2000 Ha of forest to be rehabilitated
Wildlife Control Fence	60km of fence to be constructed
Matching Grants to Common Fence	400No. CIGs to be funded
Energy savings Jikos	165 Jikos for demonstration
Efficient charcoal Kilns	33 kilns for demonstrations

1.1 PROBLEM STATEMENT

Africa has 14% of the global population and contributes unevenly that proportion to global soil and biomass carbon stocks. By contrast, the continent emits only 3% of global fossil fuel carbon (Williams et al 2007), and 5.3% of the global greenhouse gases from all non-land use sectors (UNFCCC 2005, 2008). The continent's legacy of historic carbon emissions from deforestation before 1990 amounts to merely 10% of the global total (Houghton, R.A, 2003). However, current

land use emissions of carbon and other Greenhouse Gases (GHG) as a contribution to the global total are over-proportionally high and land-use emissions also dominate the continents own GHG emissions as Africa lost more forest area during the period 1990-2005 than any other continent (RURI, 2013).

In Kenya, the major land degradation problems are loss of soil fertility, wind and water erosion of the soils, rangeland degradation, deforestation and desertification. The country among other countries in East Africa has experienced significant losses in forest cover, particularly over the last two decades. The main reasons included agricultural expansion and a rapidly growing population. In addition, poor governance of the forest sector saw the excision by the government, of 67,000 ha of forest land in 2001 (IUCN, 2004) this was the single most important driver which affected gazetted forest areas, most of which were in critical water catchment areas such as, Mau, Mt Elgon and Mt. Kenya (Ochieng, 2009). Vast areas of forests have also been cleared for new settlements and through illegal logging as highlighted by Bussmann (1996). About 12 % of the land areas in the country which was originally covered by closed canopy forests have been reduced to a mere 1.7% of its original size, as a result of population pressure for settlements, infrastructure, demand for wood products and conversion to agriculture (GOK 2010).

Over the past three decades, large areas of forest reserves have been officially "de-gazetted" and in addition, unofficially converted to other uses, mainly agriculture, and the remaining protected indigenous forests have been degraded by decades of logging, both legal and illegal, of valuable timber trees resulting in reduced carbon stocks and degraded biodiversity values (RURI, 2013). Kenya is a place uniquely suited for forest restoration initiatives (Kijani, 2014). The country's forest cover has declined dramatically since independence in 1963; and increasing droughts and recent social upheaval are threatening a potentially prosperous future (UNESCO, 2006). The rapid population growth of 2.6% annually exacerbates environmental and social pressures (FAO, 2010).

Since, the UTaNRMP seeks to tackle environmental and social challenges which include; Catchment degradation arising from the various unsustainable land use practices that include deforestation, charcoal burning in arid and semi- arid areas, Unsustainable grazing practices that hinder natural regeneration potential in forests and rangeland areas either protected or private and Rising demand for wood products especially wood fuel, timber and poles against declining sources. It is imperative to assess the impact of the 6 years old project which targets a positive significant change in areas of environmental degradation and natural resources management. This survey is therefore regarded crucial and timely and seeks to answer the following research questions.

1.2 RESEARCH QUESTIONS

- What is the effect of Improved Efficiency in Energy Use on Afforestation in the study area?
- > What level of Awareness on Sustainable Management in the study area?
- > What is the effect of Improved Community Incomes on Afforestation in the study?
- ➤ What are the major factors influencing Afforestation in the study area?

1.3 OBJECTIVES OF THE STUDY

- Assessing whether Improved Efficiency in Energy Use is related to increased Afforestation in the study area
- Examining the level of Awareness on Sustainable Environment Management in the study area
- Assessing whether Improved Community Incomes is related to increased Afforestation in the study area
- > Identifying the major factors influencing Afforestation in the study area

1.3.1 Operationalization of Variables Operational definition of variables

Research Objectives	Types of Variables	Indicators	Measuring of Indicators	Data Collection Method	Level of Scale	Tools of Analysis	Types of Analysis
1.) Improved Efficiency in Energy Use in the Household -Cooking appliances	Independent	Energy saving cooking appliance	Types of energy saving cooking appliance used	Questionnaire Key Informant Interview, FGD	Ordinal Ratio	Mean Percentage Cross tab	Descriptive Statistics
-Energy sources				Questionnaire			
-Access to energy saving cooking appliance		Sources of cooking Energy Accessibility of energy saving cooking appliance	Types of energy sources used Amount of energy used Availability in nearest market Affordability Distance to the nearest market	Questionnaire Questionnaire			
2.) Increased							

Community	Independent			Questionnaire	Ordinal	Percentage	
Awareness on			Types of	Key Informant	Ratio	Cross tab	Descriptive
sustainable		Awareness of Environmental	environmental	Interview,		Method	Statistics
environment		Management Information	management	FGD			
management			information				
				Ouestionnaire			
-Tree Planting				Key Informant			
Engagement		Engagement/ Use of	No of farmers	Interview,			
- Sustainable forest		Technologies that promote soil	applying soil and				
utilization		and water conservation	water				
-Agricultural		including tree planting	conservation				
Management Practices			including tree				
/technologies on soil			planting				
and water conservation				Questionnaire			
-Sustainable		Level of visit of extension					
Alternative		agents					
• Use of energy							
saving							
devices and			Number of				
techniques		Trainings attended	extension staff				
-Engagement in Forest		Trainings involvement	visits to farm	Documentary			
Related Activities		Application of knowledge		Analysis/			
-Availability of		gained		Questionnaire			
Extension services							
			Categories of				
-Training engagement			Training				

-Application of new			Number of				
knowledge			people trained				
			Number of				
			people applying				
			new knowledge				
3.) Increased Community Incomes	Independent						
- Access to forest			Level of access				
-Access to forest inputs		Forest access	to forest	Questionnaire Key Informant	Ordinal Ratio	Mean Percentage	Descriptive Statistics
-Price of seedlings		Forest inputs access	Level of access	Interview,		Cross tab	Chi -Square
-Sources of seedlings		Amount to be paid for	to forest inputs	ECD			
-Means of		seedlings Accessibility of	Price of	FGD			
transportation		seedlings	seedlings				
-Farm Implements		Seedling source	Availability of				
Ownership		Means of Transportation	seedling in				
-Source of income		Nursery Implements	nearest market,				
from on- farm and off-		Sales of farm produce	Affordability				
farm sources		Business/Entrepreneurship	Distance to the				
		Employment	nearest market,				
			Number of				
			implements				
			owned				
			Income (Ksh)				
			from sale of				
			farm produce				

			(crops, trees,				
			livestock) per				
			year				
			Amount earned				
			(Ksh) per year in				
			household				
4.) Improved	Dependent	Trees planted, harvested, sold			Ordinal	Mean	
Afforestation		and used for personal use per	Number of trees	Questionnaire	Ratio	Percentage	Descriptive
- Area of tree cover		year for the last 5 years	planted, Number			Cross tab	Statistics
		Species plant diversification	of trees				
			harvested,				
		-Species planted	Number of trees				
		-Non- consumptive sources of	sold, Number of				
- Species Available		income	trees used for				
-Forest Product		Community groups	personal use				
		membership					
-Agents of			Number of				
Afforestation			exotic and				
			indigenous				
			species				
			Number of				
			members				
			Improved				
			Livelihood				

1.4 HYPOTHESIS OF THE STUDY

H ₀ :	Improved efficiency in energy use is related to increased afforestation in
	the study area
Alternative Hypothesis:	Improved efficiency in energy use is not related to increased afforestation
	in the study area
H ₀ :	There is improved level of awareness on sustainable environment
	management in the study area
Alternative Hypothesis:	There is no improved level of awareness on sustainable environment
	management in the study area
H ₀ :	Improved Community Incomes is related to increased afforestation in the
	study area
Alternative Hypothesis:	Improved Community Incomes is not related to increased afforestation in
	the study area

1.5 JUSTIFICATION OF THE STUDY

Forests and woodlands contribute significantly to a country's economy. They provide multiple environmental, economic, social and cultural benefits which serves as opportunities for poverty alleviation and economic development. They also play an invaluable role in meeting the cultural and spiritual needs of diverse communities. Forests' provide important benefits which includes acting as carbon sinks, reservoirs of biodiversity and critical habitats for wildlife. In addition, they keep the land productive by conserving soil and water. They also serve as water catchments that recharge rivers and dams which supply water for domestic use and hydro-electric power. Diverse socio-cultural, economic, and environmental factors determine afforestation rates and trends.

According to Asprem 2016, Global annual planting has fallen 50% since 2008. Australia, recently the world's largest chip exporter and a top 3 planter in the 2000s, will see significant contraction of planted areas in the 2010s. South Africa and New Zealand are also experience shrinking plantations. New Chinese plantations are smaller and have higher costs than expected. Government forests in Africa are rapidly depleting, with Tanzania harvesting predicted to collapse in 2018-20. The increasing pressure on

the world's forests and woodlands from the growing human population and many other climatic issues and human-induced deforestation cannot be over emphasized (Guthiga et al 2006). In India, the participatory approach to management of forest resources as a means of providing a sustainable system of management to avoid further deforestation or degradation of forests in forests and communal lands is a serious need (Hill, Ian 1998).

In Kenya, the enactment of the 2005 Forests Act (revised 2016) has admittedly helped to revitalize the sector by giving local communities a stake in the management of state forests. (NEMA 2008). The goal of the Forest policy was to enhance the contribution of the forest sector in the provision of economic, social and environmental goods and services. Community participation in conservation of forestry, which recognized the need of involving communities in forest management as co-workers alongside the government and other stakeholders needs to be promoted (Osumba, 2011).

Although the biological diversity of Kenya remains highly protected there are many unprotected areas and its status is declining fast due to several threats leading to numerous conservation challenges. The major threats to biological diversity in Kenya can be as: the high population pressure, escalating poverty situation, conflicts, poor land use practices, inadequate laws, policies and institutional framework, poor education and inadequate involvement of community participation. Other threats are invasive species, land degradation and pollution occasioned by poor land use practices. A study on the determinants of afforestation in the country will therefore enhance environmental sustainability decision making and add to the growing knowledge on conservation, give detailed analysis on efficient energy use, environment management awareness, community income and influencing factors of improved afforestation, recommend workable policies, serve as a scientific guide, enhance funding of natural resources management projects, give feedback to funding partners, serve as reference in which the change process revealed from study can be adopted and used elsewhere to improve livelihood, conserve the environment and ensure environmental sustainability.

The 2005 Forests Act (revised 2016) provides for community participation in forest management. The best opportunity to engage forest-adjacent communities in forest management in partnership with KFS lies in the formation of Community Forest Associations (CFAs). This provides an avenue for local communities to actively participate in the protection, conservation and management of particular forest areas. In return, they are entitled to a range of user rights such as collecting firewood, timber, herbal

medicine, grass for roof thatching and grazing animals, recreational activities, scientific and educational activities. In Zambia, the Forests Act of 1999 provided legal framework for joint forest management which allowed participation of local communities, traditional institutions, non-governmental organizations and other stakeholders in sustainable forest management and the establishment of joint forest management areas.

More active involvement of local communities is currently hampered by lack of information on potential benefits as well as lack of awareness on the mechanisms for benefit sharing (FRA 2010). Benefit sharing was one of the strongest reasons for acceptance and success of JFM in India as communities tend to have high expectations of immediate benefits that could accrue from their participation (Phiri, 2009). Phiri (2009) also notes that cost-benefit sharing mechanisms should be clearly defined before deciding on the proportion of share of benefits by taking into account various costs and benefits to be incurred. Local community participation is the key strategy to current forestry conservation and management. If wildlife and all the protected areas are to survive, it is imperative that conservation activities and communities are in harmony so that it does not constrain community livelihoods.

1.6 PLAN OF STUDY

This study is divided into five chapters. Chapter one is the introduction of the study. Chapter two presents the review of relevant literature on afforestation. Chapter three describes the methodology of the study with information on the study area, sampling procedure and techniques, source and type of data and analytical tools used in the study. Chapter four presents and discusses the findings of the study, while chapter five gives the summary, conclusion and policy recommendations based on the findings of the study.

1.7 DELIMITATION AND LIMITATION OF STUDY

- ♀ Delimited to Upper Tana Catchment Area
- ♀ Representative sampling was used for the population in the Catchment Area
- Delimited to 4 specific study areas: Energy use, Awareness on Sustainable Environment Management, Community Incomes and Influencing Factors
- ♀ Limitation of Language barrier
- ♀ Limitation of Ununiformed Literacy Level of Respondents
- \heartsuit Time constraint limitation
- ♀ Assumption that all information given are accurate

CHAPTER TWO

LITERATURE REVIEW

2.0 THEORETICAL AND CONCEPTUAL FRAMEWORK

2.0.1 Theoretical Framework

According to Victor and Bakare (2004), many people participate in afforestation activities if they are able or expect to get important livelihood sustaining products from the forests. A number of studies indicate that factors such as socioeconomic benefits, age and education influence people's participation in afforestation projects. But more sustainably, households participate in afforestation activities if they can get important livelihood sustaining products from the forests, such as, fuelwood and fodder (Maskey et al., 2003).

However, Chowdhury (2004) argues that majority of farmers participate in afforestation projects because of anticipated economic benefits, environmental benefits and/or because of social status. He observes that poor socio-economic backgrounds of farmers in terms of occupation and level of income influences the extent of their participation in afforestation projects. He also observed that people's level of education influences their participation in afforestation projects. Age is also one of the factors that have been observed to determine community participation in afforestation activities. While Victor and Bakare (2004) observe that most young farmers participate in afforestation activities because they are able to plant trees and harvest them within their lifetime, Maskey et al. (2003) argue that older people tend to participate more in afforestation activities than younger people because they are retired and have free time to participate in meetings. Maskey et al. (2003) further observe that landholding significantly determines community participation in forestry activities; the hypothesis being that wealthier people are more likely to participate in higher levels of environmental management and the assumption that they have to maintain their influential status and perceive higher benefit with less opportunity cost of participation.

Diverse perspectives from the social and economic sciences have been brought together to study the factors influencing farmers' adoption of rural innovations like tree planting (both in agroforestry and farm forestry systems), and the factors that lead to some forest users practicing better afforestation than

others. Likewise, a diverse range of theoretical and methodological approaches have been used to study these factors (e.g. Amacher et al. 1993, Scherr 1995, Thacher et al. 1997, Salam et al. 2000, Byron 2001, Pattanayak et al. 2003, Mercer 2004, Walters et al. 2005).

The theoretical framework used in this study is drawn from existing studies related to the socioeconomic, perceptional and other possible factors affecting farmers' tree planting and management activity in tropical and sub-tropical countries. Smallholders vary greatly in their socio-economic, perceptional (i.e. attitudes, beliefs) and motivational characteristics, as well as in the land-use related experiences they have. Such variation influences their willingness and ability to engage in certain landuse options and management strategies, including tree planting (e.g. Scherr 1995). Several studies in the tropics and sub-tropics have found that socio-economic, perceptional and motivational factors affect farmers' tree planting (e.g. Thacher et al. 1997, Ravindran and Thomas 2000, Salam et al. 2000, Mahapatra and Mitchell 2001, Simmons et al. 2002, Emtage and Suh 2004), and silvicultural management activity (e.g. Amacher et al. 1993, Summers et al. 2004, Walters et al. 2005). In addition to studies focusing on farmers' socio-economic or motivational characteristics, several other perspectives on farmers' adoption of conservation management strategies are available in the literature.

These perspectives – as listed by Walters et al. (2005) – include information sharing (Lionberger 1960), local knowledge (Redford and Padoch 1992), economic scarcities (Arnold and Dewees 1997, Mercer 2004), geographic location of the plantation (Dewees and Saxena 1997), socio-political structures and institutions, and government policies and incentives. In addition, participation in social organizations – including farmers' groups – is recognized as helping farmers to adopt new farming practices. Other factors found to influence tree planting and management activity includes access to markets (Ravindran and Thomas 2000, Arnold 2001, Scherr 2004) and environmental factors such as site quality (Kumar 2003). While Byron (2001) listed the 'keys' for successful tree planting to be: secure property rights to land and tree crops, a viable production technology, capacity for crop protection, and access to markets.

As shown by these previous studies, it is clear that there are a diverse range of factors influencing farmers' tree planting and management activity. This is because real world settings are complex and vary according to specific locations.

2.0.2 Conceptual Framework

The perception of afforestation as well as the factors that affect and determine the participation and engagement in afforestation activities are explained in Fig. 1. The factor stated in Fig 1 includes; government policies and strategies. Policy and decision made can have both negative and positive impact on Afforestation. For instance, incentives like linking communities with inputs such as seedlings, extension services information, farm mentoring and encouraging cooperative societies, community-based organisations through the giving of incentives could positively affect afforestation. More so, better efficiency in energy use in the household, using improved cooking appliances like Jiko Kisasa, Maendeleo Jiko, Upesi Jiko, Fireless Jiko and other energy saving jikos could increase Afforestation. Increased Green Energy Sources like biofuel, biogas, solar power and better access to the energy saving cooking appliances could lead to high level of afforestation.

Environmental condition is also a major factor that affects afforestation, the effect of diseases and pests on trees and seedlings reduces the survival rate of trees and consequently affects afforestation since low survival rate results to low afforestation. More so, increased community awareness on environmental management will increase the likelihood of engagement in tree planting, nursery management and other forest related activities like bee keeping, mushroom collection and herbal collection. Availability of extension services cannot be over stated as increased training engagement and increased application of new knowledge has its effect on increased tree cover. The level of extension services and research goes a long way in encouraging and making household participate in afforestation activities because extension facilitates the adoption of improved technologies through awareness creation and information dissemination that results in the acquisition of skill, knowledge and training that will help improve efficiency.

Community group awareness and engagement is very important for regular participation, value addition and influence, and decision to be better as people to discuss number of tree seedling they have planted and number that has survived others tend to be encouraged to do better. Improved access to forest, especially farm forest would enhance forest related engagement. Also reduced cost of seedlings, transportation to market to get the seedlings, transportation to farm, improved income all has positive effect on tree cover in a community.

Independent Variables

Improved Efficiency in Energy Use in the Household

- -Improved Cooking Appliances
- -Increased Green Energy Sources
- -Improved Access to Energy Saving Cooking Appliance

Natural Disaster
Climate Change
Survival of tree seedlings
Government Policies
Culture -Soil Types
Land holding per family

Dependent Variables

Increased Afforestation

- Increased Community Awareness
- -Increased Tree Planting Engagement
- Increased Sustainable Forest Utilization
- -Improved Agricultural Management Practices
- -Increased Sustainable Alternative
- •Increased use of energy saving devices and
- techniques -Increased Engagement in Forest Related
- Activities Increased Availability of Extension Services
- -Increased training engagement Increased
- application of new knowledge

Increased Community Incomes

 Increased community groups awareness and engagement - Improved access to forest - Improved access to forest inputs -Reduced distance to tree nursery -Improved means of transportation -Improved agents of afforestation -Reduced time it takes to the forest -Improved means of transportation
 Affordable price of seedlings - Increased access to seedlings – Increased sources of seedlings -Increased Area of Tree Cover
-Increased Species
-Reduced Tree Felling
-Improved use of Green Energy
-Increased knowledge on participatory
management of the forest
-Increased value addition of Forest Product
-Reduced Number of trees harvested

-Reduced Number of trees sold

-Increased Agents of Afforestation

Moderate Variables & Intervening Variables

Fig 1. 1: OPERATIONAL CONCEPT OF DETERMINANTS OF AFFORESTATION

Source: Authors Compilation, (2018)

2.1 METHODOLOGICAL FRAMEWORK

According to Collier *et al.*, (2012) different methods have been used in estimating afforestation and this includes econometrics analysis, economic modelling and opinion survey. Leavey and McCarthy (2002) used econometrics analysis to analyze afforestation rates in relation to a number of financial and economic factors. Macharia (2015) in her study on Factors influencing Community Participation in Forestry Projects used quantitative and quantitative method. The qualitative data analysis was interpreted and inferenced using SPSS and the quantitative data was gotten from structured questionnaire. Descriptive statistics was used determine frequencies, means and results of socio-economic characteristics of respondents, conservation initiatives, income generating activities, forest related activities engagement and the inferential statistics which includes the use of Chi square tested the influence of community awareness in participation of community members, economic factors in community participation and management of the CBO in community participation.

Maraga et al., (2010) used a standardized questionnaire, key informant interview and focus group discussion in collecting data which was analyzed using descriptive statistics in their survey on Factors determining Community Participation in Afforestation Projects in Kenya. Chi- Square (X^2) Test was used to establish the relationship between community participation, socio-cultural, economic and environmental factors. Similarly, in the study on Forest Management by Maurice Ogada (2012) descriptive statistics was used and the sampled households were randomly interspersed in the study area and across management regions. Farley *et al.*, (2015) complied catchment data sets from peer-reviewed journals as well as reports from governmental and research institutes where age, linear, logarithmic and quadratic regressions were compared in their research on effects of afforestation.

The research on Factors Influencing Natural Resources Management by Ng'ang'a and Robinson (2016) adopted a participatory approach where data was constituted using various qualitative research methods. The research methods used included focus group discussions (FGDs), workshops and key informant interviews as well as ad-hoc interviews and documentary research. Management options on Land, Pasture, Forest, Wildlife and feasibility ranks were analyzed using Descriptive Statistics.

Kallio (2013) on the study on Factors Influencing Tree Planting and Management activity used Descriptive statistics, chi square, Mann-Whitney U test and *t*-tests to analyze and study the relationships between farmers' socio-economic characteristics and their tree planting and their silvicultural activity. Also, data were analyzed using Spearman correlations, descriptive statistics, Mann–Whitney U tests and cross tabulations to understand the relationship between plantation quality and the silvicultural practices applied by the farmers.

Descriptive statistics and a logistic regression model was used to analyze household characteristics of respondents and perceptions of local land users regarding the determinants of farmers' tree-growing decisions in the study on Determinants of farmer's tree-planting investment decisions by Gessesse *et al.*, (2016). The outcome variable of local land users' tree-growing decisions was dichotomous, so a binary logistic regression model was used. This statistical model helped in predicting probabilities of tree-growing decisions (the outcome variable) as a function of a set of biophysical and socioeconomic dichotomous or quantitatively measured predictor variables. The chi square was also employed in this study to identify possible associations between the outcome and the set of predictor variables.

Different measures have been used to assess the determinants of afforestation. The study of Oeba *et al.*, 2012 on Modelling Determinants of Tree Planting and Retention on Farm for improvement of Forest cover in Central Kenya used *Descriptive Statistics*. Chi-square statistical test and percentage frequencies were used to explore the association between the likelihood of tree retention and selected determinants. Correlation analysis was performed in order to identify correlated variables before fitting the models. In order to examine the probability and extent at which the farmers were willing to retain trees on farm, multinomial and binary logistic regression models were used.

In sum, various studies have used either the Descriptive statistics, Quadratic Regressions, Logistics Regression Model, Mann-Whitney U test, *t*-tests and Spearman Correlation (Kallio 2013; Macharia 2015; Hamphrey 2016; Gessesse et al., 2016). However, this study used the Descriptive Statistics which was used to find the mean, frequencies and percentage of information given on efficiency of energy use, awareness on Sustainable Environmental Management. Community incomes and major influencing factors of Afforestation at the household level. Also, Chi- square was also used to test for the existence of relationship between household awareness on SEM per River basin.

2.2 EMPIRICAL FRAMEWORK

2.2.1 Review of Empirical Studies

A study in Ethiopia by Gessesse et al., (2016) demonstrated that the adoption of tree-growing decisions by local land users was a function of a wide range of biophysical, institutional, socioeconomic and household-level factors. In this regard, the probability of household size, productive labor force availability, the disparity of schooling age, level of perception of the process of deforestation and the current land tenure system had a critical influence on tree-growing investment decisions in the study watershed. Eventually, the study concluded that the processes of land use conversion and land degradation were serious in the study area, which in turn have had adverse effects on agricultural productivity, local food security and poverty trap nexus. The analysis of the study showed that most of the sample households (62 %) participated in tree-planting activities to manage their own lands. However, 38% of the surveyed farmers did not participate in tree planting. The study exposed that literate farmers were more involved in tree growing than their counterparts.

Similarly, in their investigation of Modelling Determinants of Tree Planting and Retention on Farm for Improvement of Forest Cover in Central Kenya, Onguso *et al.*, (2012) emphasized that education plays a significant role in understanding the need to conserve the environment through various practices. It was explained that during the learning period individuals acquire relevant knowledge, skills, and values appropriate for sustainable farm forestry. This was evident on their study as farmers with secondary school and post-secondary education qualifications planted and retained trees. Knowledge in agroforestry was found to significantly correlate with level of education where college graduates tended to be more

interested in agroforestry than their counterparts with less academic qualifications. Every additional year of education decreased the probability that the household exploited forest/tree products and less conversion of woodlands to arable land. The study also revealed that the acquisition of technical skills improved techniques of the farmers on silvicultural tree management and created awareness on the role of trees on farm and for environmental conservation. The positive correlation between technical skills

and extensions services in the study area implied that majority of the farmers had not obtained knowledge on tree management and access to and use of extension services has a positive impact on silvicultural investment by farmers who had established plantations.

A study by Chowdhury (2004) in Zathila and Betaga villages in Gazipur, Bangladesh, observed that 69% of the respondents participated in social forestry because of anticipated environmental benefits. Thus, community participation and environmental degradation were strongly related (X2_ 0.05 = 0.001). However, unlike the Bangladesh study which indicated that majority (100%) of respondents had planted trees for speculative reasons, only 15% of the respondents in the study of Maraga *et al.*, (2010) on Determinants of Community Participation in Kenya indicated they had planted trees for income generation. Maskey et al. (2003) observed that older people tended to participate more in the community forestry programmes than younger people. This was attributed to the fact that older people were retired and had free time to participate in meetings.

A study in Ondo state, Nigeria, also observed that most farmers within the (35 to 54) years age bracket participated more in the Taungya forestry system than other categories because they were able to plant trees and harvest them within their lifespan (Victor and Bakare,2004). In the study on Forestry carried out by Kallio (2013) the socio-economic characteristics of tree planters and non-tree planters differed significantly in access to off-farm income sources and length of tree planting experience. Tree-planters had the following socio-economic characteristics ownership of larger areas of land and higher value of total assets.

Education and the level of education had a perception effects on desert encroachment and afforestation programme on the study on Community Perception of Afforestation Programme in Toshai, Nigeria. The result of the study also indicated that education is a vital instrument that provides communities positive outlook towards ideas and issues that could contribute to the rural community development. Educated respondents are more inclined to have positive conservation attitude (Meehta and Heinen, 2001). This is consistent with the views of Akinyanju (2000) who also share the believe that in building sustainable communities people should be involved in afforestation program and this require reforms in all social institutions that will help shape value and behavior.

The findings of the study of Titus (2012) on Factors affecting Afforestation programmes in Kitu, County Kenya showed that that majority of the people in Chuluni division had received formal education up to

primary level, and that most household had over 5 members. The afforestation programmes were affected by high population densities and human settlements, and wood fuel was the common form of energy in the area. The study concluded that there was a relationship between afforestation programmes and human settlements. Deforestation in the study area involved cutting down trees for construction, charcoal burning and firewood. The study concluded that Legal actions should be taken against those who cut down trees indiscriminately.

2.3 Review of Upper Tana Natural Resources Management Project (UTaNRMP)

2.3.1 UtaNRMP Background

Upper Tana Natural Resources Management Project (UTaNRMP) is an eight- year project (2012-2020) funded by Government of Kenya (GOK), International Fund for Agricultural Development (IFAD), Spanish Trust Fund (STF) and the local community. The goal of the project is to "contribute to reduction of rural poverty in the Upper Tana river catchment". This goal is pursued via two development objectives which reflect the poverty-environment nexus namely:

- (i) Increased sustainable food production and incomes for poor rural households living in the project area; and
- (ii) Sustainable management of natural resources for provision of environmental services.

The objectives are in line with:

Kenya's Vision 2030: The Kenya's long term development blueprint which aims at creating a *"globally competitive and prosperous country with a high quality of life by 2030"* and *"providing a high quality of life to all its citizens in a clean and secure environment"*.

Sustainable Development Goals: The project is directly addressing the following SDGs:

Goal No. 2 End Hunger, achieve food security, improved nutrition and promote sustainable agriculture;

Goal No. 5 Achieve gender equality and empower all women and girls;

Goal No. 6 Ensure access to water and sanitation for all;

Goal No. 7 Ensure access to affordable, reliable, sustainable and modern energy for all;

Goal No. 13 Take urgent action to combat climate change and its impacts;

Goals No. 15 sustainably manage forests, combat desertification, halt and reverse land degradation halt biodiversity loss.

The 2011-2025 IFAD Strategic Objectives: of ensuring that poor rural women, men, and rural youth have better and sustainable access to natural resources, climate change adaptation and mitigation measures, improved agricultural technologies and services, and opportunities for rural enterprise development and off-farm employment, as well as empowerment of the rural poor through access to markets effective participation in policy and programming processes.

IFAD Kenya Country Strategic Opportunities Programme (COSOP) 2013- 2018: strategic objectives of improving gender responsiveness, climate-resilient and sustainable community based natural resource management, improving intensification of access of vulnerable rural women, men and youth to productivity enhancing assets, technologies and services and enhancing value addition and marketing.

Agricultural Sector Development Strategy (ASDS) 2010-2020: The strategic thrust of the document include: increasing productivity, commercialization and competitiveness of agricultural commodities and enterprises and developing and managing key factors of production.

2.3.2 Project Area

The project area is Upper Tana catchment which covers an area of 17,420 km², is home to 5.2 million people and includes 24 river basins and the tributaries of the four rivers that drain into the Tana River as shown in Table 1.1. The area covers six (6) counties (Embu, Tharaka Nithi, Meru, Nyeri, Murang'a and Kirinyaga). The project is also covering areas in the Mt. Kenya and Aberdares water towers covering the national parks and surrounding forest reserves.

2.3.3 Objective of the Project

The project aims at poverty reduction targeting about 205,000 households (1,025,000 people) whose livelihoods revolve around the use of the natural resources of Upper Tana catchment. These include smallholder crop and livestock farmers, agro-pastoralists, fishermen, rural traders, and community groups involved in natural resources management (NRM) and income generating activities. Special focus is on women and youth as well as other vulnerable groups within the above categories. The project also provides indirect benefits to the non-target groups in the Upper Tana catchment through services and enterprises linked to the project activities, as well as to populations outside the catchment who rely on water and hydro-electricity from the river system.
The overall goal of the UTaNRMP is to contribute to poverty reduction and address the felt needs of the beneficiaries which supports Kenya's Vision 2030; Sustainable Development Goals (2015-2030); The 2011-25 International Fund for Agricultural Development (IFAD) Strategic Objectives and Kenya's Agricultural Sector Development Strategy (ASDS) 2010-2020. The Project utilizes various approaches which includes: Participatory Rural Appraisal (PRA); Participatory Forest Management (PFM) and Community Forest Association Development and Financing cycle (CDFC); Water Development cycle (WDC); Ecosystem Approach; School Greening Programme; Farmer Field Schools (FFS) and other impactful engagements.

UTaNRMP River Basins

MKEPP Basins (4)	River	Ena (Itimbogo, Thura, Rwanjoga, Gangara) Kapingazi/Rupingazi (Kiye, Thambana,Nyanjara, Itabua, Kathita) Kathita (Ngaciuma, Kinyaritha, Kuuru,Riiji) Kithinu/Mutonga (Naka, Nithi, Maara south, Maara north, Thuci)
High Priority Basins UTaNRMP (1	River for 2)	Maragua, Murubara, Nairobi, Ragati, Rujiweru, Rupingazi, Saba Saba, Thangatha, Thanantu, Thiba, Thika/Sasumua, Thingithu
12 Other Basins	River	Amboni/Muringato, Iraru, Kayahwe, Lower Chania, Mara, Mariara, Mathioya, Nyamindi, Ruguti, Rwamuthambi, Sagana and Ura.

2.3.4 Components of the Project

<u>Community Empowerment Component:</u> This component is designed to empower communities to sustainably manage natural resources. It aims at engaging communities to build their capacity to develop plans aimed at improving NRM while also improving their livelihoods, food security and nutrition. The component therefore supports capacity building at community level through mobilization and awareness raising, establishing and strengthening key community structures and institutions, and development and implementation of community action plans. The outputs of this component include:

- (i) Communities with increased awareness of sustainable NRM;
- (ii) Key community organizations with increased capacity to manage natural resources sustainably; and
- (iii) Community action plans for livelihood improvement and sustainable NRM.

<u>Sustainable Rural Livelihoods Component</u>: This component aims to improve the incomes and living standards of the target group using interventions that are beneficial to the management of the natural resource base. This component has two sub-components that include:

- (i) Adaptive research and demonstrations led by Kenya Agriculture and Livestock Research Organization (KALRO); and
- (ii) Adoption of Income Generating activities (IGAs) through Common Interest Groups (CIGs).

The outputs from this component include:

- (i) Agricultural packages adapted to various agro-ecological and socio-economic contexts; and
- (ii) CIGs successfully adopt or improve farm and/or non-farm income generating activities (IGAs).

<u>Sustainable Water and Natural Resource Management Component:</u> This component is designed to improve the sustainable utilization of water and other natural resources, mainly using community groups including the Water Resources Users Associations (WRUAs) and the Community Forest Associations (CFAs). The component has two sub-components namely: (a) sustainable management of water resources, and (b) sustainable management of forest and agricultural ecosystems. The outputs under this component include:

- (i) Water resources of the upper Tana catchment sustainably managed; and
- (ii) Sustainably managed forest and agricultural ecosystems.

Project Management and Coordination Component: This component is designed to ensure that the project is effectively and efficiently managed. The objective of the component is to enhance management in implementation and coordination of project activities so as to ensure the project is implemented to achieve its objectives. This component has two sub-components namely: (a) project management, and (b) Knowledge Management and Learning (KM&L). The expected outputs for the component are:

- i) Fully functional Governance, Management, Monitoring and reporting systems, and
- Knowledge about Natural Resources Management effectively managed and disseminated to stakeholders.

2.3.5 Key Institutional Structure

The key institutional structures that ensure smooth running of the project starting at the policy level up to the implementation level include: Project Steering Committee (PSC); Project Coordinating

Team (PCT); County Project Coordinating Committee (CPCC) and County Project Facilitating Team (CPFT). Sub-County Implementing Teams (SCITs) were established at sub-county levels to support community based institutions such as WRUAs, CFAs, FDACs and CIGs.

2.3.6 Brief Review of the Baseline Report relating to this Study

According to the baseline study, the average income across the river basins ranged from Kshs. 10,000 to Kshs. 320,000 per year (Kshs. 833-Kshs. 26,667 per month) and the average household size across the river basins was 6 people. Sale of agricultural products was listed by about 80% of households as the main source of income, followed by casual labour (40%). On the average less than half the respondents (43%) had title deeds. Firewood was the main source of cooking energy for 85% of the people. On asset ownership and access; mobile phone, radio, television sets and water tanks were the most common assets. Ownership of mobile phones was 51.4% and access to the TV was 35.2%. Very few persons had attended any environmental training courses, with only 12% of household members interviewed indicating they had attended such courses. The survey indicates that 83% of households use the three stone jiko, while 13% used improved cook stoves. Only 10% used green energy sources, mainly solar and Tree planting was undertaken by about 88% of households in the river basins, with no significant difference among the river basins.

CHAPTER 3

METHODOLOGY

3.0 STUDY AREA

The Tana River basin is the largest and most important basin in Kenya. Its catchment covers approximately 17% of Kenya's land mass, and the flow of the Tana River basin constitutes 27% of the total mean discharge measured along rivers in the country's major drainage basins. The basin has both the largest existing generated hydro-power and the greatest remaining hydro-power potential and presently accounts for approximately 61% of the total power supply in the country.

The catchment provides water for about half the country's population, and most of the country's hydroelectric power. The area includes the Mount Kenya and Aberdares National parks and surrounding forest reserves. The area is under heavy and growing population pressure with an average of about 250 inhabitants per km². Due to the importance of the catchment area to national economic growth and development, the Government of Kenya (GoK) and IFAD financed the Mount Kenya East Pilot Project (MKEPP) from 2004-2012, which linked sustainable use of natural resources, especially water and forests, with enhancement of rural livelihoods. At the request of the Government, IFAD and the Government of Kenya designed a new project UTaNRMP after the evaluation of MKEPP indicated successful implementation.

The project area is the Upper Tana catchment which consists of 25% of Kenya's gazetted forests. The project area covers an area of 17,420 km2 and includes 24 river basins and the tributaries of four river basins under the former Mt. Kenya East pilot Project (MKEPP) that drain into the Tana River. The River basins crisscross three ecological zones summarized as Tea, Coffee, and Cotton production areas. The catchment area covers the six counties of Murang'a, Nyeri, Kirinyaga, Embu, Tharaka-Nithi and Meru and is home to 5.2 million people. Its temperature is estimated at an average of between 9°C - 28°C and it receives substantial rainfall with average annual precipitation of 1206mm. The wettest season is experienced between March and July while the hottest comes between January and mid- March. The land is largely arable and is well watered by a number of rivers and streams. Agriculture is the main driver of the economy in this catchment with over 70% of the residents being small scale farmers.



Fig 2.1 Map of Kenya showing Upper Tana Catchment Area

3.1 NATURE AND SOURCES OF DATA

Primary and secondary data were used for this survey. The secondary data were collected from journals reports, newsletters, UTaNRMP base-line surveys, interview reports, published research works, internet and books. The primary data was collected through key informant interviews, focus group discussions, individual household respondent interviews, questionnaires and observations and a mixed-method evaluation design, quantitative and qualitative data collection methods was adopted.

Questionnaires were administered through enumerators after the objectives of the survey had been properly explained and they were properly trained on how the questions should be answered. Testing of survey instruments was carried out in the survey areas after which the responses were reviewed and necessary correction were made to the instruments. In the interests of comparability, some baseline questions relevant to the present were kept, although additional ones were added.

Meetings with household respondents and other stakeholders in the study area were facilitated by personnel of the UTaNRMP. The focus group discussions and interviews with members of the Water Resource Users Associations and Community Forest Associations were well guided and structured.

3.2 METHOD OF DATA COLLECTION

Stratified random sampling was employed to select the households to be interviewed. The target population of the project area (Embu and Kirinyaga) was stratified along the river basins in the area constituting the first stratum. Each river basin (first tier stratum) was then divided into three sub-strata representing the upper, middle and lower sections of the river basin (second tier stratum). Since population along the river basin is not equally distributed, and taking into consideration that the upper and lower zones of the river basins were normally less densely populated than the middle zones of the river basin, the sample of each river was then divided in the ratio of 1:2:1 for the upper, middle and lower sections respectively (UTaNRMP Impact Assessment Report, 2017).

The sample size per river basin was then determined proportionately depending on the number of FDAs per river basin. This decision was based on the level of activities by the UTaNRMP in the River basins, cost limitation and time limitation of study.

Embu and Kirinyaga counties was used for this research. The River basins in these counties are as follows:

	S/No.	County	River Basins	Length (Km)	Size	Total No. of FDAs	Proportionate Sample size	Adjusted Sample size	Total
	1.	EMBU 516,212	Rupingazi	78	354	4	44	60	135
	2.		Thuci		152	5	55	75	
S	1.	KIRINYAGA 537,054 357 sq km	Nyamindi	78	453	10	110	110	286
	2.		Thiba	78	715	15	165	176	
			TOTAL			36	374	421	421

1. Embu: Rupingazi, Kabingazi, Mutonga/Thuci, Thura, Rwanjoga, Gangara, Itimbogo, Itabua/Rupingazi.

2. Kirinyaga: Kirwara, Kiwe, Rwamuthabmi, Thiba, Nyamindi, Mugaka

River basins used for the study include:

3.2.1 Sampling Technique

Conchran's sample size formula (Conchran, 1977) was used to calculate the sample.

Using the formula:

$$n= \frac{Z^2 P (1-P)}{d^2}$$

Where:n= the sample size

Z= Z statistics for level of confidence

P= expected prevalence or proportion

d= precision

$$n = (1.96)^2 (0.05) (0.05)$$
$$0.5^2$$

n= 384

For non- response 10% of n will be add to n = (38+384) = 422

Adjusted Sample Size =421



Fig 3. 1: MAP SHOWING LOCATION OF RESPONDENTS IN EMBU AND KIRINYAGA

The following data collection tools were used during the survey:

Individual Household Structured Questionnaire: These was used to collect quantitative data. Data was collected on socio-economic characteristics such as age, education status, occupation and marital status and data on afforestation variables such as, access to inputs, price of seedlings, sources of seedlings, means of transportation, farm implements ownership was also collected via the individual household questionnaire.

Focused Group Discussion

The Focused Group Discussions (FGDs) was conducted with project beneficiaries across the river basins in the project area. The FGDs was made up of 5–15 members of the:

- 1. Community Forest Associations (CFAs)
- 2. Water Resource Users Association (WRUAs)

FGD:1 NUMBER of CFA PER COUNTY

- i. New Njukuri CFA in Embu West
- ii. Kangaita CFA in Kirinyaga Central

FGD: 1 NUMBER OF WRUA PER COUNTY

- i. Upper Rupingazi WRUA in Embu West, and North
- ii. Upper Thiba WRUA in Kirinyaga

* Key Informant Interview

The selection of the key informants was based on purposive sampling and their relevance to the survey objectives. The respondents included:

- 1. The Desk Officer for Upper Tana NRM Project at KFS Office in Embu County
- 2. Deputy Ecosystem Conservator (KFS) Embu West
- 3. Sub- County Forest Officer- Kirinyaga Central

- 4. Ecosystem Conservator (KFS) Kirinyaga
- 5. Deputy Head Teacher- St. Ursula Girls Boarding Primary School, Embu
- 6. Teacher at Gikuyari Secondary School, Embu
- 7. Head Teacher at Githwi Secondary School, Kirinyaga

3.3 ANALYTICAL METHODS/TECHNIQUES

Data Collected was analyzed using Descriptive Statistics, and Chi Square.

3.3.1 Descriptive Analysis

Descriptive tools include: tables, simple frequency distribution and measures of central tendency such as mean and percentage. The mean is the average of the data collected. It would be obtained by adding up all the values of a particular data variable, and dividing by the number of data items. Frequencies refer to statistical method by which the variables would be tallied according to the class they fall into, while the percentage refers to the rate or ratio per hundred of each variable.

3.3.2 Chi-Square

The Chi-square was used to test for the existence of a relationship between two variables. This was used with nominal and ordinal variables such as awareness level of sustainable environment management and River basin of Respondent. SPSS 20 was used to carry out data analysis and the number in the "Asyp. Sig." column for "Pearson Chi-Square row" was checked and recorded. Cases where the value was less than .0, the statistics was said to be significant and the relationship between such variables is regarded as not due to chance.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents and discusses the results of the data analysis. The socio-economic characteristics examined include variables such as age, gender, marital status, educational attainment etc. of the household respondents in the study area. The efficiency in energy use, awareness of sustainable environment management information as well as major factors influencing afforestation were discussed.

4.1 SOCIO-ECONOMIC CHARACTERISTICS AND IMPLICATION

4.1.1 Age Distribution of Respondents

The result in Figure 4.1 revealed that more than four- fifths (83.4%) of the respondents were between the ages of 11 and 60 years and are considered to be in their economically active years while only few (3%)were aged 71 years and above. The average age of the respondents stood at 49.1 ± 12.2 years which implies that the household members are ageing. This could eventually affect their engagement in afforestation activities negatively.

Fig 4. 1: Age distribution of respondents



AGE DISTRIBUTION OF RESPONDENTS

4.1.2 Gender Distribution of Respondents

Figure 5.1 shows that over half of the household respondents (57.7%) were males. Based on this result, it can be deduced that out of 10 people engaged in forest related activities in the study area, 7 will be men.

Source: Field Survey, 2018

Fig 5. 1: Gender distribution of respondents

GENDER DISTRIBUTION OF RESPONDENTS



Source: Field Survey, 2018

4.1.3 Distribution of Respondents by Marital Status

With respect to marital status, a greater percentage of the respondents were married (85.5 %), while only about 7.4 % were either single, separated or divorced as shown in Figure 6.1. In other words, married household constituted the majority in the study area.

Fig 6.1: Distribution of respondents by marital status



DISTRIBUTION OF RESPONDENTS BY MARITAL STATUS

Source: Field Survey, 2018

4.1.4 Distribution of Household Head per River Basin

Majority of households, 89% in Thuci and 85% in Nyamindi as well as Thiba have a man as the head of the household while 17% of the household in Rupingazi are female headed.

Fig 7. 1:Distribution of household head per river basin



DISTRIBUTION oF HOUSEHOLD HEAD PER RIVER BASIN

Source: Field Survey, 2018

4.1.5 Distribution of Household Members Working per River basin

Table 1.1 reveals that out of 5 household members in Thiba River basin 3 are not financially contributing to the family thus more cases of inability to afford energy saving jikos, inputs such as tree seedlings, herbicides and pesticides etc.

Table 1. 1: DISTRIBUTION OF HOUSEHOLD MEMBERS WORKING PER RIVER BASIN

RIVER BASIN	AVERAGE NO OF	RANGE	AVERAGE NO OF	RANGE
	HOUSEHOLD		HOUSEHOLD	
	MEMBERS		MEMBERS NOT	
	WORKING		WORKING	
Nyamindi	2		2	
Rupingazi	3		2	
Thiba	2	1-11	3	0-17
Thuci	3		3	

Source: Field Survey, 2018

4.1.6 Major Occupation of Household Heads

Figure 8.1 reveals that the major occupation of household heads in all the River basins is farming. However, Rupingazi has the highest (87%) of household heads engaged in farming and 9% of household heads in Thiba are employed in either government parastatals or private companies.

Fig 8. 1: Major occupation of household heads



MAJOR OCCUPATION OF HOUSEHOLD HEADS

4.1.7 Other Household Socio-Economic Information

Table1. 2 shows that the average household income in the study area is 20899Ksh monthly thus improved livelihood as the baseline report revealed 26667Ksh as the highest household income in 2012. Also, members are able to afford 3 meals per day even though they own a small portion of land. This survey reveals that most farmers in the survey area are small scale farmers. More so, the larger the size of farm a farmer uses, the higher the production levels are likely to be, and the higher the probability of afforestation.

Table 1. 2: OTHER HOUSEHOLD SOCIO-ECONOMIC INFORMATION

	AVERAGE	RANGE
Household income	20899Ksh	
Meals per Day	3	1->3
Land Area Owned	1.65	0.125 – 22

Source: Field Survey, 2018

Source: Field Survey, 2018

4.1.8 Engagement in the Sales of Tree or Charcoal

Figure 9.1 reveals that only 15% of households in Embu and Kirinyaga Counties are engaged in Charcoal sales thus low level of charcoal use by households in the counties. This indicates reduced cutting of trees for charcoal production in the study area which has a positive effect on afforestation.

Fig 9.1: Engagement in the sales of tree or charcoal

ENGAGEMENT IN THE SALES OF TREE OR CHARCOAL



Source: Field Survey, 2018

4.1 RESULTS ON ENERGY USE IN THE HOUSEHOLDS

4.2.1 Cooking Appliances used in Households

Table 2.1 reveals an average of 69.3% households use three-stone Jiko compared to the Baseline report of 83%. This indicates 16.5% reduction in the use of inefficient energy appliance thus a positive effect on afforestation. In line with this, 20% of households in Thuci use Maendeleo Jiko and 27.7% of households in Thiba use Gas cooker. This should be more encouraged and improved on for improved afforestation. However, 76.6% and 51.6% of households in Rupingazi still use Three-stone Jiko and Normal Charcoal Jiko respectively despite their benefit from energy efficient stoves. This result reveals that there is high prevalence of environmental pollution in Rupingazi which is negative to afforestation.

					Table 2.
Cooking Appliance	Nyamindi(%)	Rupingazi (%)	Thiba(%)	Thuci(%)	1:
THREE-STONE JIKO	68.6	76.6	55.9	76	
NORMAL CHARCOAL JIKO	32.4	51.6	38	46.7	A DDI IA
MAENDELEO JIKO	8.8	10	15.2	20	NCF
UPESI JIKO	2.9	0	8.2	1.3	USED IN
JIKO KISASA/KUNI MBILI	18.6	6.7	14.7	5.3	HOUSEH
KENYA CERAMIC JIKO	2.9	1.7	2.7	0	OLD
ROCKET JIKO	2	3.3	11.4	1.3	0LD
UNCLADDED LINER	0	0	0.5	4	
KEROSENE STOVE	14.7	6.7	10.3	16	
LPG COOKER/MEKO	8.8	8.3	18	18.7	
FIRELESS JIKO	1	3.3	2.2	8	
PARAFFIN STOVE	10.8	18.3	11.4	14.6	So
GAS COOKER	14.7	20	27.7	12	urce
ELECTRICITY COOKER	1	0	2.1	2.7	urce.
					Field

Table 2

Survey, 2018

4.2.2 Household Energy Usage

Figure 10.1 reveals that 21% of households in Embu and Kirinyaga counties use energy sources other than Firewood and Charcoal. This indicates an improvement in choice of energy sources as 51% household indicated the choice of firewood as a major source of energy in Embu and Kirinyaga compared to the baseline of 77.2% reflecting 33.9% positive change. This implies improved efficient use of energy thus positive effect on afforestation.





Source: Field Survey, 2018

4.2.3 Pieces of Firewood Used to Cook Githeri

Since over half of the house hold (69.2%) still use Three-Stone Jiko, the result in figure 11.1 reveals high use of firewood in cooking Githeri. Since reduce use of firewood reduces tree felling and vice versa 56.1% household use of 1-10 pieces of firewood would cause low efficiency in energy use thus a negative effect on afforestation.





Source: Field Survey, 2018

4.2.4 Availability of Energy Saving Jikos in closest Markets to Households

Figure 12.1 reveals that over half (52%) of the household members have access to energy saving jikos in the market closest to their houses and only 6% have no access to energy saving jikos. This is positive on Afforestation as increased access to energy efficient stoves could lead to improve afforestation.





Source: Field Survey, 2018

4.2.5 Affordability of Energy Saving Jikos

Figure 13.1 reveals that 62.7% of the respondent can averagely and easily afford the energy saving jikos. This implies improved livelihood of respondent thus a positive indicator on increased afforestation as preference of material use changes with time once there is financial capability which could affect afforestation positively





Source: Field Survey, 2018

4.2.6 Challenges in the Usage of Energy Saving Jikos

Table 2.2 reveals that 42% of households in Rupingazi, 38% of households in Nyamindi and Thiba have lack of funds as a major problem in the usage of energy saving jikos even though a minimum of two people are working in a household of 4 in the River basin. 40% of households in Thuci have how level of information on the importance and use of energy saving jikos thus reduced awareness leads to reduced afforestation.

Challenges in the usage of Energy Saving Jikos	Nyamindi	Rupingazi	Thiba	Thuci
Access to Technology	17%	15%	28%	15%
Lack of Awareness	23%	33%	30%	40%
Inflexible Attitude to New Tech	14%	12%	13%	17%
Lack of Funds	38%	42%	38%	32%
High Cost of Technology	27%	11%	46%	14%
No Technical Know-how	8%	10%	10%	16%
No Tangible Reason	2%	8%	2%	1%

Table 2. 2: CHALLENGES IN THE USAGE OF ENERGY SAVING JIKOS

Source: Field Survey, 2018

4.3 RESULTS ON AWARENESS OF SUSTAINABLE ENVIRONMENT MANAGEMENT

4.3.1 Level of Awareness on Tree Planting Engagement

Asymp. Sig. (2-sided)

Chi-Square Tests

df

Value

Table 3.1 reveals a significant relationship was established between the Level of awareness of Tree Planting Engagement and the River basin the respondent was situated in, $X^2 = 21.00$ and p = 0.01. General level of awareness is gathered to be highest in Nyamindi and seconded by Rupingazi. In the same vein, it was observed that compared to the population size, Thiba had the highest number of respondents unaware of the Tree Planting engagement followed by Rupingazi.

Pearson Chi-Square	20.992 ^a	9	.013						
Likelihood Ratio	21.535	9	.010						
N of Valid Cases	421								
AWARENESS ON	TREE PLA	NTING EN	GAGEMENT			Name of Rive	r Basin		Total
					Nyamindi	Rupingazi	Thiba	Thuci	
Awareness of Tree	e Very	Aware	Count		43	38	94	27	202
Planting			Expected	d Count	48.9	28.8	88.3	36.0	202.0
Engagement			% within	n Name of	42.2%	63.3%	51.1%	36.0%	48.0%
			River Ba	asin					
	Awar	e	Count		53	17	80	44	194
			Expected	d Count	47.0	27.6	84.8	34.6	194.0
			% within	n Name of	52.0%	28.3%	43.5%	58.7%	46.1%
			River Ba	asin					
	Awar	e but not	Count		4	1	2	3	10
	intere	sted	Expected	d Count	2.4	1.4	4.4	1.8	10.0

Table 3. 1:LEVEL OF AWARENESS ON TREEPLANTING ENGAGEMENT

Symmetric Measures 3				3.9%	1.7%	1.1%	4.0%	2.4%	
		Value	Approx. Sig	g.	5.770	1.770	1.170	1.070	2.170
Nominal by Nominal	Phi	.223	.013		2	4	8	1	15
	Cramer's V	.129	.013		3.6	2.1	6.6	2.7	15.0
N of Valid Cases		421			2.0%	6.7%	4.3%	1.3%	3.6%
Total		Count			102	60	184	75	421
		Expected Cor	unt		102.0	60.0	184.0	75.0	421.0
		% within Nat River Basin	ne of	1	00.0%	100.0%	100.0%	100.0%	100.0%

Awareness of Engagement in Natural Resources Management Training								
Name of River Basin Total								Sourc
			Nyami ndi	Ruping azi	Thiba	Thuci		e:
Awareness of	Very Aware	Count	24	25	62	20	131	Field
Engagement in		Expected Count	31.7	18.7	57.3	23.3	131.0	Surve
Natural Resources		% within Name of	23.5%	41.7%	33.7%	26.7%	31.1%	у,
Mgi. Iraining		River Basin						2018
	Aware	Count	35	18	85	34	172	
		Expected Count	41.7	24.5	75.2	30.6	172.0	
		% within Name of	34.3%	30.0%	46.2%	45.3%	40.9%	
		River Basin						
	Aware but not	Count	17	2	7	7	33	
	interested	Expected Count	8.0	4.7	14.4	5.9	33.0	

4.3.2 Awareness of Engagement in Natural Resources Management Training

	-	% within Name of River Basin	16.7%	3.3%	3.8%	9.3%	7.8%	Table
	Not Aware	Count	26	15	30	14	85	3.2
		Expected Count	20.6	12.1	37.1	15.1	85.0	
		% within Name of	25.5%	25.0%	16.3%	18.7%	20.2%	reveal
		River Basin						с <u>о</u>
Total		Count	102	60	184	75	421	5 a
		Expected Count	102.0	60.0	184.0	75.0	421.0	signifi
		% within Name of	100.0%	100.0%	100.0	100.0	100.0	0
		River Basin			%	%	%	cant

relationship was established between the Level of awareness of Engagement in Natural Resources Management Training and the River basin the respondent was situated in, $X^2 = 27.00$ and p = 0.01. Level of awareness on engagement in NRM is gathered to be highest in Thiba and seconded by Thuci. In the same vein, it was observed that Nyamandi had the highest number of respondents unaware of that they should engage in Natural Resources Management Project followed by Rupingazi.

Table 3. 2:AWARENESS OF ENGAGEMENT IN NATURAL RESOURCESMANAGEMENT TRAINING

Symmetric Measures							
		Value	Approx.				
Sig.							
Nominal by	Phi	.261	.001				
Nominal	Cramer's V	.151	.001				
N of Valid Cases		421					

Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)				
Pearson Chi-	28.654 ^a	9	.001				
Square							
Likelihood Ratio	27.572	9	.001				
N of Valid	421						
Cases							

Source: Field Survey, 2018

4.3.3 Household Members Natural Resources Management Knowledge Acquisition and Usage

Table 3.3 explains most household members trained use the training utilized for better life and

productivity. This is a positive indication as increased use of knowledge gained leads to increased afforestation.

Table 3. 3:HOUSEHOLD MEMBERS NATURAL RESOURCES MANAGEMENTKNOWLEDGE ACQUISITION AND USAGE

HH Members Natural Resources Management Knowledge Acquisition and Usage	Average Number	Range	STD
HH Members Trained	1.7	1-8Persons	0.964
HH Members Utilizing Knowledge gained	1.5	0-6Persons	0.842

Source: Field Survey, 2018

4.3.4 Ranking of Awareness on Sustainable Environment Management

Table 3.4 reveals 96.5% of the households in the study area are aware of Tree Planting Engagement. This reflects a high level of engagement in tree planting in the study as increased awareness on tree planting should lead to engagement in the act of planting. 77% of households indicated lower level of awareness regarding Legal Harvesting of Forest Product compared to the other environment management choices.

This can be attributed to the fact that some household members believe there should be easy access to the forest for harvesting of product since they belong to the community. In all, over three quarter of households in the study area are aware of Sustainable Environment Management which is a higher tendency of improved afforestation.

Table 3. 4: AWARENESS ON SUSTAINABLE ENVIRONMENT MANAGEMENT

SEM	Frequency	Percentage	Position
Tree Planting Engagement	406	96.4%	1 ST
Reduce Bush Fire	352	83.6%	12 th
Livestock Keeping	397	94.3%	2 nd
Legal Harvesting of Forest Product	324	77%	17 th
Reduced Use of Charcoal	378	89.8%	5 th
Use of Energy Saving Jikos	372	88.4%	6 th
Engagement in NRM Training	335	79.8%	14 th
Application of Knowledge from Training	363	86.3%	8 th
Engagement in Forest Related Activities	333	79.1%	15 th

Reduce Tree Felling	379	90%	4 th
Environment Management Advocacy	313	84.4%	10 th
Participation in Conservation Activities	363	86.3%	8 th
Flexibility of Traditional Preference	331	78.6%	16 th
Reduce Timber Sales/Domestic Use	364	86.5%	7 th
Reduce Fuel Wood Sales/Domestic Use	380	90.3%	3 rd
No Stealing of Wildlife/Poaching	353	83.9%	11 th
Adherence to Forest Restriction	350	83.1%	13 th
Use of Irrigation System	358	85.1%	9 th

Source: Field Survey, 2018

4.4 RESULTS ON THE EFECT OF COMMUNITY INCOMES ON AFFORESTATION

4.4.1 Household Assets Owned

The table 4.1 explains that majority of the households had phone (Handset mobile) thus better communication with community group members and also extension agents. Mostly all households have a Panga, Jembe, Jembe Fork this implies genuine engagement in farming as it is anticipated that the higher the number of farm implements, the higher the output, the higher the income and hence level of afforestation.

Table 4. 1:HOUSEHOLD ASSETS OWNED

Household Asset Owned	Average Number	Min-Max	Std.
TV	0.8	0-4	0.57
Phone (Handset mobile)	2.3	0-12	1.7
Car	0.1	0-2	0.35
Fridge	0.1	0-2	0.32
Gas Cooker	0.6	0-6	0.69
Computer	0.1	0-3	0.4
Bicycle	0.5	0-3	0.63
Iron	0.5	0-3	0.59
Motor Cycle	0.26	0-2	0.46
Farm Implements Owned			
Panga	3	0-14	1.83
Jembe	1.6	0-22	1.97
Jembe Fork	1.2	0-22	1.47
Sickle	0.3	0-5	0.86
Secateurs	0.4	0-6	0.77
Milking Can	0.6	0-4	0.78
Fishing Gear	0.03	0-4	0.3
Knapsack Sprayer	0.6	0-4	0.62

Source: Field Survey, 2018

4.4.2 Source of Household Income

Table 4.2 reveals that most of the household income is gotten from sales of horticultural produce and seconded by sales of food crops. Sales of Wood/Tree/ Charcoal gives the least income and average income of household is revealed to be over 20,0000KSh. This implies increased income and thus improved afforestation.

Table 4. 2: SOURCE OF HOUSEHOLD INCOME

Household Income	Average Monthly Income	Std.
Livestock Sales	4,411Ksh	13507
Livestock Product Sales	3,4229Ksh	7600
Business/Entrepreneurship	2,169Ksh	6970
Horticultural Produce Sales	4,719Ksh	23736
Food Crop Sales	4,509Ksh	14820
Seed Sales	1,661Ksh	14239
Wood/Tree/Charcoal Sales	3,75Ksh	2799

Source: Field Survey, 2018

4.4.3 Accessibility to Extension Services and Inputs

Table 4.3 reveals that 68.7% had access to extension service and 78.1% had access to inputs. This implies that majority of the respondents are able to access extension services and inputs thus improved productivity and a positive effect on afforestation.

Table 4. 3: ACCESSIBILITY TO EXTENSION SERVICES AND INPUTS

Accessibility	Frequency	Percentage
Extension Service	287	68.2%
Inputs (Seedlings, Pesticides, Herbicides etc.)	329	78.1%

Source: Field Survey, 2018

4.5 **RESULTS ON LEVEL OF AFFORESTATION**

4.5.1 Tree Planting Engagement

Table 5.1 explains that majority of households that planted trees in Nyamindi planted 1-20 trees and Thiba households had the highest percentage of 1-20 trees planted. In the same vein, households in Rupingazi planted mainly 1-20 trees but with highest planting (13%) of 201&above and highest level of no engagement in tree planting (13.4%) compared to other River basins. 17.4% of households that planted trees in Thuci planted over 100 trees. This result implies improved tree cover in the survey area.

Table 5. 1:TREE PLANTING ENGAGEMENT

Tree Planting Engagement in each River Basin	Nyamindi	Rupingazi	Thiba	Thuci
1-20	28.4%	33.3%	<mark>37%</mark>	33.3%
21-50	21.6%	23.4%	21%	<mark>25.3%</mark>
51-100	<mark>22.4%</mark>	11.6%	16.3%	12%
101-200	9.8%	5%	6.5%	<mark>10.7%</mark>
201&above	6.7%	<mark>13.3%</mark>	5.8%	6.7%
Total Percentage of engagement in Tree Planting per River Basin	<mark>88.9%</mark>	86.6%	86.6%	88%
Total Percentage of <mark>no</mark> Engagement in Tree Planting per River Basin	11.1%	13.4%	13.4%	12%
Total Number of Respondents in River basin Source: Field Survey, 2018	102	60	184	75

4.5.2 Survival Rate of Trees Planted

Fig 14.1 reveals that about half of the trees planted had over 50% survival rate thus improved afforestation.

Fig 14. 1: Survival rates of trees planted



Source: Field Survey, 2018

4.5.3 Tree Planting by Household Head Educational Level

Figure 15.1 reveals that the higher the level of education of household head the higher the engagement in tree planting as households with household heads that have College/ University education engaged in tree planting more than household heads that had lower level of education. This implies education has a positive effect on afforestation this can be as a result of better understanding of multiplier effects of tree planting.





Source: Field Survey, 2018

4.5.4 Tree Planting by Age

Figure 16.1 shows that over half of the households' respondents (56.3%) that participated in tree planting were between the ages 11 and 50. 41.1% were between the ages 51-70 and only 2.7% were between 71-10. This implies that households reduce their tree planting activity once they turn 50 years which can affect the level of afforestation negatively since the mean age of the respondents is 49.1.





Source: Field Survey, 2018

4.5.5 Tree Planting by Access to Input

The figure 17.1 indicates that 81.5% of households that had access to input such as seeds, seedlings, herbicides and pesticides engaged in tree planting. This result could be an indication that access to input has a positive influence on any form of level of afforestation.





Source: Field Survey, 2018

4.5.6 Tree Cutting Engagement

Figure 18.1 reveals that less that half (33.7%) of the respondents are not engaged in tree cutting engagement.



Fig 18. 1: Household tree cutting engagement

Source: Field Survey, 2018

4.5.7 Average Number of Trees Harvested Yearly

Figure 19.1 reveals that majority of the trees harvested (71%) are between 1 and 20. Lower harvesting of trees indicates higher probability of improved afforestation.

Fig 19. 1: Average number of trees harvested yearly



Source: Field Survey, 2018

4.5.8 Engagement in CBOS, CFAS, Forest Users Group

Figure 20.1 shows that over half (54.1%) of households in the project area had household members engaged in either Community Based Organization, Community Forest Association or Forest Users Group which is a good action for capacity building and improved Afforestation.



Fig 20. 1: Engagement in CBOs, CFAs, Forest user group

Source: Field Survey, 2018

4.5.9 Involvement of Households in Forest Related Activities

Table 5.2 reveals that households involved in forest related activities in Nyamindi mainly engaged in Beekeeping. Also, about half of households in Rupingazi (45%) are not involved in forest related activities. Thiba households collected more herbs from the forest and Thuci households were more involved in Grazing and Fuel Wood collection than other Forest related activities.

Table 5. 2:INVOLVEMENT OF HOUSEHOLDS IN FOREST RELATED ACTIVITIESSource: Field Survey, 2018

nette iteusen for net Enguging in Obos, er is er i erest ester ereups	4.5.10	Reason	for not	Engaging	in	CBOs,	CFAs or	Forest	User	Groups
---	--------	--------	---------	----------	----	-------	----------------	--------	------	--------

Involvement of Households in Forest Related Activities	Nyamindi	Rupingazi	Thiba	Thuci
Beekeeping	27.4%	20%	19%	16%
Timber/Logging	7.8%	1.6%	6%	4%
Mushroom Collection	3.9%	0%	1.6%	0%
Charcoal	2.9%	0%	7.6%	6.7%
Grazing	16.7%	18.3%	13.5%	24%
Fuel Wood Collection	32.4%	30%	26%	38.7%
Herbal Collection	5.8%	5%	20.1%	9.3%
Not involved in Forest Related Activities	29.4%	45%	35.3%	33.3%

Figure 21.1 reveals unawareness of existing groups as the major reason of no engagement in CBOs CFAs or Forest User Group.

Fig 21. 1: Reason for not engaging in CBOs/ CFAs/Forest User Group



Source: Field Survey, 2018

4.5.11 Perception on Proper Address of Tree Cutting

Figure 22.1 reveals that majority of the respondents (87.6%) believe that the cutting of trees is addressed appropriately by the community.

Fig 22. 1: Proper address of the cutting of trees

60				
	87.6			
0	Yes		No	

Source: Field Survey, 2018

4.5.12 Effective Measures used by the Community to address the cutting down of Trees

Table 5.3 shows that majority of the Respondents believe that Effective Law Regulation, Advocacy/

Awareness and Restriction have aided the reduction in cutting of trees.

Table 5.3:EFFECTIVE MEASURES USED BY THE COMMUNITY TO ADDRESS THECUTTING DOWN OF TREE

Effective Measures used by the Community to address the	Percentage
cutting down of Trees	
Effective Law Regulation	43.4
Advocacy/ Awareness	30.4
Restrictions	16
Capacity Building	7.3
Monitoring Engagement	3

Source: Field Survey, 2018

4.5.13 Support Required to Reduce Cutting of Trees

Table 5.4 reveals that advocacy/awareness, effective CFAs, training and capacity building are the major

support needed to ensure further reduction of the cutting of trees.

Table 5. 4: SUPPORT REQUIRED TO REDUCE CUTTING OF TREES

Support required to reduce cutting of trees	Percent
Advocacy/Awareness	46.1
Effective CFAs	24.3
Training/ Capacity Building	23.5
Access to Extension Agent	3.5
Access to Seedlings	2.6

Source: Field Survey, 2018

OTHER FINDINGS





- ✓ Upper Thiba WRUA Kinrinyaga's enagement in planting of 15,000 tree seedlings with 90% survival rate
- ✓ New Njuikiri CFA have planted over 30,000 tree seedlings from January-May 2018 V Households in training on
- Engagement on Soil and water conservation
- ✓ Upper Rupingazi WRUA training of 21 members and training and awareness to over 15000 community members













St. Ursula Boarding Primary School & St Ann Kiriari have benefitted from one Biodigester each

Njuriu Boys School have also benefitted from Biogas

Upper Rupingazi





CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

In ensuring the address of catchment degradation and the environmental challenges faced in the Upper Tana Catchment Area due to its socio-economic importance to the country, Kenya. This study assessed the Determinants of Afforestation in Upper Tana Catchment Area (Case study of Embu and Kirinyaga Counties) and the contributions of the Upper Tana Natural Resources Management Project (UTaNRMP) to livelihoods and environmental sustainability.

Quantitative and qualitative research methods were adopted for the study. The representative sample of 421 households were randomly selected and interviewed with the aid of a well-structured questionnaire. Focused group discussions and key informant interviews were also conducted. Data was analyzed using descriptive and inferential statistics, including chi square.

Results revealed that afforestation in the catchment area has improved and there is increased awareness and engagements in sustaining the environment. Forest cover in most of the forests areas initially degraded have been rehabilitated and there has been enhanced species regeneration for instance the New Njukiri CFA in Embu West, Kirimari Ward, has planted 150,000 tree seedlings, 75% exotic and 25% indigenous tree species in 2 years (2015-2017) with an average survival rate of 75% while the Kangaita Community Forest Users Association has rehabilitated 55 hectares of the Kangaita Forest in Kirinyaga County. The Upper Tana NRM Project has led to improvement in the level of mutual accountability, conservation awareness and learning. Communities have embraced new sources of income like ecotourism, beekeeping and Plantation Establishment and Livelihood Scheme (PELIS) which has helped in increasing forest cover as well as improving food security.

St. Ursula Boarding Primary School, St. Anne Kiriari Secondary School and Ngubiu Boys have received bio digesters and biogas respectively and the Chairman of Upper Rupingazi Water Resources Users Association (WRUA) admitted the community has been given over 600 energy efficient stoves that saves time and do not emit smoke. The study revealed improved income as the average household monthly income was over 20,000Ksh compared to the range of 833-26,667 Kshs per month in 2012. Similarly, the average household meal per day is 3 meals and 81.7% of the households indicated no hunger in the last 1 month. Results also revealed that social and economic factors significantly influenced livelihoods diversification and afforestation in the catchment area.

Overall, the UTaNRMP has contributed significantly to livelihoods diversification, increased level of afforestation, enhanced community-based mutually accountability and learning as well as ensured environmental sustainability. However, there is the need to put in place a sustainable natural resources management framework for enhancing a sustainable balance in afforestation and livelihoods in Kenya.

5.2 CONCLUSION

The major goal of this study is to determine factors influencing afforestation in the study area. The result findings have shown better living standards; majority of the households can afford 3 meals a day. Also households have been able to acquire assets such as phones and farm implements as 2 out of 4 household members are productive and financially contribute to the family thus improved livelihood.

Also, improved efficiency in energy use has positive effect on Afforestation in the study area as results reveals 16.5% reduction in the use of inefficient energy appliance, 21% use of energy sources other than firewood and charcoal, 88.4% awareness on the use of Energy saving Jikos, about 88% engagement in tree planting, over 33% no involvement in tree cutting activity and only 8.2% engagement in harvesting of above 50 trees yearly.

Furthermore, it is deduced from the study that households are very much aware of information on sustainable environment management. There is over 80% awareness on engagement in tree planting, reduced bush fire, livestock keeping, reduced use of charcoal, application of environment management training gained, environment management advocacy, participating in conservation activities, no stealing of wild life/poaching, adherence to forest restrictions, reduced fuel wood collection, use of irrigation systems, reduced timber sales and domestic use.

Improved community incomes have positively affected afforestation in the study area as households indicated that their main sources of income are from farming, off farm and employment which helped in the provision of meeting household needs as at when due. Over 4000 Ksh is gotten monthly from the sales of horticultural produce, livestock and food crops as households have basic farm implements which has influenced low level of charcoal use and buying of trees among household members as their farming engagement has encouraged the planting of trees on farms and has led to the low level of engagement in businesses that will negatively affect afforestation as only 15% of households in the study area are engaged in charcoal or tree sales thus improved afforestation.

The major influencing factors of afforestation in the study area includes; Level of Education of household heads (the higher the educational level of household heads the higher their engagement in tree planting and vice-versa), Age (56.3% of respondents that indicated households tree planting engagement are between ages 11 and 50), Access to Input (81.5% of households that engaged in afforestation had
access to tree seedlings). Also, engagement in forest management community groups like the Community Forest Associations, Proper address of felling of trees through majorly effective law regulation, advocacy and awareness positively influenced afforestation.

In all, there is efficiency in energy use, high level of awareness on sustainable environment management practices, livelihood improvement and increased afforestation in the catchment area.

Overall, the UTaNRMP has contributed significantly to livelihoods diversification, increased level of afforestation, enhanced community-based mutual accountability and learning as well as ensured environmental sustainability.

However, there is still need for household members to be aware of the importance and how to use energy saving jikos so as to improve afforestation, reduce tree felling, manage time effectively, reduce work load and other health related challenges. In the same vein, technical support is needed to increase survival rate of tree seedlings and manage pest infestation on seedlings as well as trees. More so, there is crucial need for more households to be better involved in positive and productive forest related activities like bee-keeping, mushroom collection and eco-tourism that would help improve livelihood and there should be improved address of tree felling especially through effective law regulations, advocacy and awareness.

Therefore:

The null hypothesis that improved efficiency in energy use is related to increased afforestation in the study area is accepted and the alternative hypothesis that improved efficiency in energy use is not related to increased afforestation in the study area is rejected

The null hypothesis that there is improved level of awareness on sustainable environment management in the study area is accepted and the alternative hypothesis that there is no improved level of awareness on sustainable environment management in the study area is rejected The null hypothesis that improved community incomes is related to increased afforestation in the study area is accepted and the alternative hypothesis that improved community incomes is not related to increased afforestation in the study area is rejected

5.3 **RECOMMENDATION**

This study has examined the effect of efficiency in energy use on afforestation, level of awareness on Sustainable Environment Management, it assessed the effect of community incomes on afforestation and determined the major factors influencing Afforestation in the study area. Based on findings of this study the study recommends that:

- Households should be introduced to awareness creation programmes on the importance of energy saving jikos that would increase and encourage their interest in using the energy efficient stoves as well as green energy sources. Sensitization projects should be done in institutions, social groups, public and private organizations etc. Household members between the ages of 11 and 30 should be a major target and the media should be effectively used during and after each awareness program especially the social media to increase awareness level and improve the use of energy efficient appliances
- Seedlings should be more accessible for the planting of indigenous species alongside exotic species of trees and more household members between the ages of 11-30 should be encouraged to engage in tree planting
- Institutional support should be more efficient, effective and timely and monitoring and follow up process should be carried out on regular basis. Also more energy jiko stoves should be available in the markets closest to households especially in Thiba and Thuci River basins
- The different community groups in all the river basins especially Rupingazi and Thuci should be encouraged to engage in more capacity building programs. Grants should be more available for small and large-scale forest related activities especially bee keeping, mushroom and its marketing and extension agents should monitor beneficiaries of such grants to ensure beneficiaries do not divert funds to buy other personal needs so as to improve livelihood of households and ensure improved afforestation

- Household tree felling engagement should be further addressed mainly through Effective Law Regulation, Effective Community Forest Associations, Advocacy and Awareness, Training and Capacity Building
- Community groups should facilitate household in accessing funds for increased stream of income and improved livelihood
- There should be better engagement of household members in Community based organizations, Community Forest Associations or Forest User Groups especially through effective awareness of the presence of the groups in the community, organization of NRM oriented entrepreneurship programs in the various communities, better orderliness and management and improved group transparency

REFERENCES

African Institute of Development Policy (2012) Population, Climate Change and Sustainable Development in

Kenya

Agevi Humphrey, Mwendwa Kaleb Adamba, Koros Hillary, Mulinya Carolyne, Kawawa Rashid Calvince1, Kimutai Donald Kipruto4, WabusyaMoses, Khanyufu Mercy, Jawuoro Stanely (2016) PELIS Forestry Programme as a Strategy for Increasing Forest Cover and Improving Community Livelihoods: Caseof Malava Forest, Western KenyaAmerican Journal of Agriculture and Forestry 2016; 4(5): 128-135 http://www.sciencepublishinggroup.com/j/aja

Amacher, G.S., Hyde, W.F. & Rafiq, M. (1993) Local adoption of new forestry technologies: An example from Pakistan's northwest frontier province. *World Development* 21(3):445–453.

Amr, H., & Richiedei, S. (2000) Sahel NGO population network case study. Washington, DC: Policy Project USAID.

Bai, Z. G. & Dent, D. L. (2006) Global assessment of land degradation and improvement: pilot study in Kenya. Report 2006/01 Wageningen: ISRIC—World Soil Information.

Bai, Z. G., Dent, D.L., Olsson, L., & Schaepman, M. E. (2008) Global assessment of land degradation and improvement 1: Identification by remote sensing. Report 2008/01

Bai, Z., & Dent, D. (2008) Land degradation and improvement in Argentina Identification by remote sensing (p. 149). Wageningen, The Netherlands: International Soil Reference Information Center—World Soil Information.

Berhan Gessesse, Woldeamlak Bewket, and Achim Bräuning (2015) Determinants of farmers' tree-planting investment decisions as a degraded landscape management strategy in the central highlands of Ethiopia. Department of Geography and Environmental Studies, Kotebe University College, Addis Ababa, Ethiopia

Beth Wanjira Macharia (2002) Factors Influencing Community Participation In Forestry Conservation Projects: A Case Of Kithoka-Twajai Forest Community Based Organization, Meru County Kenya.

Bussmann R. (1996). Destruction and management of Mount Kenya's forests. Ambio 25:315-317.

Byron, N. (2001) Keys to smallholder forestry. Forests, Trees and Livelihoods 11(4):279-294

Chowdhury (2004) Community Participation in Social Forestry Zathila and Betaga Villages, Gazipur, Bangladesh COFORD, Dublin.

Collier, P., Dorgan, J., and Bell P. (2002) Factors Influencing Farmer Participation in Forestry. Dewees, P.A. (eds). (1997). Farms, trees and farmers: responses to agricultural intensification. Earthscan, London. 141–169 pp.

Emtage, N.F. & Suh, J. (2004) Socio-economic factors affecting smallholder tree plantingand management intentions in Leyte province, Philippines. *Small-scale ForestEconomics, Management and Policy* 3(2): 257–271.

FAO (2010) Global Forest Resources Assessment 2010. FAO Forestry Paper 163 and FAO 2010 Global Forest Resources Assessment 2010 Country Report Kenya.

FAO (United Nations Food and Agriculture Organization) Land degradation estimates in Kenya: Chapter 4. Rome, Italy.

GOK (2013) National Land Reclamation Policy (Final Draft) Ministry of Water and Irrigation. Republic of Kenya

Government of Kenya (GoK) (2007) Kenya vision 2030: A globally competitive and prosperous Kenya. Nairobi:

Government of Kenya (GoK). (2009). Sessional Paper No. 3 of 2009 on the National Land Policy August 2009.

Government of Kenya (GoK). (2010). Agricultural Sector Development Strategy 2010–2020.

Government of Kenya (GoK). (2013). National Environment Policy Final Draft, February 2013.

Greene, H. W. (2003). Econometric Analysis: Pearson Education, Inc., Upper Saddle River, New Jersey, USA.

Human society and the environment. Bodenkultur-Wien and Munchen-, 57(1/4), 197.

Irene N. Nganga and Lance W. Robinson (2016) Factors Influencing Natural Resource Management In Pastoral Systems: Case Of Tana River County, Kenya

Infodev Consultants Limited (2017) Impact Assessment Survey Upper Tana Natural Resources Management Project (UtaNRMP)

IUCN: Community involvement in Forest Management in Eastern Kenya

James N. Maraga1, Jacob K. Kibwage and Boniface O. Oindo (2010) Factors Determining Community Participation In Afforestation Projects In River Nyando Basin, Kenya. African Journal of Environmental Science and Technology 4(12), pp. 853-859 DOI: 10.5897/AJEST10.212.

Kathleen A. Farley W, Esteban G. Jobba´ Gyw Z And Robert B. Jackson*W Kenya Strategic Investment Framework for Sustainable Land Management 2017 – 2027. Ministry of Environment and Natural Resources.

Kamfor Company Limited (2014) Upper Tana Natural Resources Management Project (UtaNRMP) Baseline Survey Report

Kumar, A., Sinha, A.K. & Singh, D. (2003). Studies of Eucalyptus plantations under the farm forestry and agroforestry systems of U.P. in Northern India. *Forests, Trees, and Livelihoods* 13: 313-330.

Lal, R., Lorenz, K., Hüttl, R. F., Schneider, B. U., & von Braun, J. (Eds.). (2013) Ecosystem services and carbon sequestration in the biosphere. New York: Springer Science.

Lal, R., Safriel, U. & Boer, B. (2012). Zero net land degradation: A new sustainable development goal for Rio+ 2: A report prepared for the Secretariat of the United Nations Convention to combat Desertification

Maarit Helena KALLIO (2013) Factors influencing farmers' tree planting and management activity in four case studies in Indonesia

Mahapatra, A.K. & Mitchell, C.P. (2001) Classifying tree planters and non planters in a subsistence farming system using a discriminant analytical approach. *Agroforestry Systems* 52 (1): 41-52. management in pastoral systems: Case of Tana River County, Kenya

Mbow, C., Brandt, M., Ouedraogo, I., de Leeuw, J. & Marshall, M. (2015) What four decades of earth observation tell us about land degradation in the Sahel? Remote Sensing7, 4048–4067 (ISSN 2072-4292).

MITA, Pompiliu, and Simona MATREAȚA. (2005) "The role of afforested areas upon the surface runoff variation "Analele Universitații Spiru Haret Seria Geografie nr. 6, 2003

Muia, V. K., & Ndunda, E. (2013) Evaluating the impact of direct anthropogenic activities on land degradation in arid and semi-arid regions in Kenya. Nairobi, Kenya: Kenyatta University.Google

Mundia, C. N., & Aniya, M. (2006) Dynamics of land use/cover changes and Degradation

National Forest Policy (2014). Republic of Kenya

NEMA (2010). State of the Environment Report 2010. National Environment Management Authority (NEMA), Nairobi.

Ochieng, R. M. (2009). A review of degradation status of the Mau Forest and possible remedial measures GRIN: Publish and Find Knowledge.

Pattanayak, S. K., Mercer, D. E., Sills, E., & Yang, J. C. (2003) Taking stock of agroforestry adoption studies, *Agroforestry Systems* 57(3): 137-150.

Ravindran, D.S. & Thomas, T.H. (2000) Trees on farms, stores of wealth and rural livelihoods Insights and evidence from Karnataka, India. *International Forestry Review* 2(3):182–190

Ruri Consultants (2013) Analysis of drivers and underlying causes of forest cover change in the various forest types of Kenya.

Salam, M.A., Noguchi, T. and Koike, M. (2000) Understanding why farmers plant trees in thehomestead agroforestry in Bangladesh. *Agroforestry Systems* 50(1): 77–93.

Scherr, S.J. (1995) Economic factors in farmer adoption: patterns observed in Western Kenya. *World Development* 23: 787–804.

Scherr, S.J. (1997) Meeting household needs: Farmer tree-growing strategies in western Kenya. In: Arnold, J.E.M.,

Sumit Chakravarty, S. K. Ghosh, C. P. Suresh (2012) Deforestation, Causes, Effect and Control Strategies

Thacher, T., Lee, D.R., & Schelhas, J.W. (1997) Farmer participation in reforestation incentive programs in Costa Rica. Working paper 97-11. Department of Agricultural, Resource and Managerial Economics; Cornell University, Ithaca, New York.

UNCCD. (2013). Background Document, The Economics of Desertification, Land Degradation and Drought: Methodologies and Analysis for Decision-Making. In 2nd Scientific Conference on Economic Assessment of

Desertification, Sustainable Land Management and Resilience of Arid, Semi-Arid and Dry Sub-Humid Areas. April 9–12, 2013—Bonn, Germany.

UNEP. (2002). African Environment Outlook: GEO-4, United Nations Environment Programme Nairobi.

UNEP. (2009). Kenya: Atlas of our changing Environment. Nairobi: United Nations Environment Programme

UNESCO Courier (2006) Fighting Desertification in Kenya

Vincent Onguso Oeba, Samuel C. J. Otor, James B. Kung'u, and M. N.Muchiri1 (2012) Modelling Determinants of Tree Planting and Retention on Farm for Improvement of Forest Cover in Central Kenya

Walters, B.B., Sabogal, C., Snook, L.K. & de Almeda, E. (2005) Constraints and opportunities for better silvicultural practice in tropical forestry: An interdisciplinary approach. *Forest Ecology and Management* 209(1-2): 3–18.

Waswa, B. S. (2012) Assessment of Land Degradation Patterns in Western Kenya: Implications for Restoration and Rehabilitation. ZEF. University of Bonn, Germany.

Wattenbach, H., Bishop-Sambrook, C., & Dixon, J. (2005) Improving information flows to the rural community. Agricultural Management, Marketing and Finance Occasional Paper (FAO)

APPENDICES

Activity Description	Time	lines (V	Weeks)				
	1	2	1	1	2	1	8

1.) Resumption, Introduction and Orientation Onsite:21 st March-23 rd March	
2.) Review of Literature, Formulation of Questionnaire, Pretest of Questionnaire, Coding and Analysis to check consistency: 26 th March-6 th April	
3.) Full Survey of Embu county (Questionnaire, FGD, Key Informant: 9 th April -13 th April	
4.) Full Survey of Kirinyaga county (Questionnaire, FGD, Key Informant): 16 th April - 27 th April	
5.) Data Coding and Analysis: 30 th April - 4 th May	
6.) Presentation of Preliminary Report and Trip back to Nigeria: 7 th May- 11 th May	Ŷ
Timeline for all Activities	

PHOTO GALLARY



Collage 1: Pictures showing the Student interacting with some of the Survey Respondents



Collage 2: Pictures showing student and her other team members with (i) the UTaNRMP staff during the visit of Dr.Olawale Olayide (ii) Primary and Secondary school students during SDGs Awareness in Embu County, Kenya (iii) the UTaNRMP and the Nigeria High Commission in Kenya while presenting the Swahili and English translation of the SDGs.

IFAD-MDP FIELD PRACTICUM

Upper Tana Natural Resources Management Project, Kenya (Environment Sub-Component)

RESEARCH TOPIC: Determinants of Afforestation in Upper Tana Catchement Area: A case study of Embu and Kirinyaga County

This questionnaire is designed to facilitate my research on the earlier stated research topic. Therefore, it would be appreciated if you provide responses to the questions with utmost sincerity as your answers will be kept confidential. Please tick (X) where necessary and provide suggestions where required. ThanksName of respondent: Date: S/No.: County of Residence: Name of Sub-County: Name of River Basin: River Basin: Upper (Tea) [] Middle (Coffee) [] Lower (Cotton) [] Name of FDA/CFA/WRUA/CIG: Position held Name of Enumerator: GPS Coordinates: Longitude: Latitude: Altitude: SECTION A: SOCIO ECONOMIC CHARACTERISTICS OF HOUSEHOLDS 2. Age of Respondent? (Years) **1. Gender of Respondent** Male [] Female [] 3. How long have you lived in this area? (Years) 4a. Are your household members aware of any community group? Yes [] No [] 4b. Which group are they engaged in? FDA [] CFA [] WRUA [] CIG [] Other [] specify ______ 5. Do you belong to a social group? [] Yes, please specify [] No, give reason _____ 6. Who is the head of your household? Man [] Woman [] Male Youth [] Female Youth [] 7a. Household Size.....? 7b. Number of household members working? 7c. Number of household members not working?

8. What is the highest level of education?

9. Highest Education Level	None	Primary	Secondary	College/ University	Vocational Training
Household Head					
Household Spouse					
Children					

10a. Main occupation of household head? Farming [] Off-Farm [] Employment [] Other (Please specify):

10b. Main occupation of spouse of household head? Farming [] Off-Farm [] Employment [] Other (Please specify):

11. Other occupation of household? Farming [] Off-Farm [] Employment [] Other (Please specify):

12. What is the total land area owned by household? (Acres)

Crop Farming	[]: Crops sold	l:	
Livestock	[]: Sale of ar	imals/animal products:	
Sale of seeds	[]: Types of s	eeds	
Sale of Trees/Cha	arcoal []: Tree Spe	cies: Indigenous [] Exotic []]
Business	[]: Type of B	usiness:	•••••
Employment:	Temporary []	Permanent []	Remittance []
Others []:			

16. Household Income and Expenditure in the past one (1) month:

.....

	IE		EXPENDITURE			
S/No.	Particulars	Amount (KShs)	S/No.	Particulars	Amount (KShs)	
a.	Livestock sales		a.	Transport (boda boda, matatu)		
b.	Livestock products (eggs, milk, meat honey)		b.	Buying food		
С	Business/ Entrepreneurship		с	Buying of Fuel Wood		
D	Unearned income(interest, dividend, royalties, capital gains)		d	Building houses		
е	Sale of horticultural produce		е	Communication (airtime)		
F	Sale of food crop		f	Belongings(Tv, Shoes, Clothing)		
g	Sale of seeds		g	Leisure (bar, sports, movies)		
Н	Petty trade (hawking)		h	Investment in business (non- agriculture)		
1	Leasing out agricultural equipment		i	Water bill		
J	Formal employment		j	Electricity bill		
К	Sales of wood/tree/charcoal		k	Medical expenses		
L	Land lease		1	School Fees/College		
М	Casual employment		m	Insurance		
Ν	Land sale		n	Merry go round		
0	Other income (please specify)		0	Other expenditure (specify)		

17. Assets owned (number owned = 1, year it was bought = 2 note: insert numbers and dates)

Farm mach.	1	2	House hold	1	2	HH.	1	2	Agric.	1	2	Agric. tools	1	2
									Tools					
Tractor			Tv			Computer			Panga			Knapsacks		
Oxen plough			Phone			Bicycle			Jembe			Watering can		
Spray pump			Car			radio			Jembe fork			Wheelbarrow		

Irrigation pump		Fridge		Motorcycle		Sickle	Milking can	
Other		Gas cooker		others		Secateurs	Fishing gear	
		Motor Bikes				Rake	others	

18. Structures on farm (type: Permanent = 1, Semi permanent = 2, temporary =3)

S/No	Structures	Numbers	type
a.	Residential house		
b.	Granary (grain store)		
с.	Equipment store		
d.	Toilet Facility		
e.	Other		

19a. Have your family members eaten one meal per day in the last one year?	Yes []	No[]	
19b. If yes Q 19a above, how long was it? Within a month []2-3 months []	Above 3 mont	ths []	
20. How many meals do you normally take per day? 1 meal [] 2 meals [] meals []	3 meals []	above	three
21. What is the composition of your meals (tick as much as possible)? Maize []	Rice []	Wheat pr	oducts [
] Meat/Fish [] Legumes [] Fruits [] Vegetables []			
22. Does the household head own a bank account? Yes [] No []			
23. If Yes in Q22 above, how often is the account used? Always [] Often [] Son	netimes [] Neve	er[]	
24. What is the marital Status of Household head? Single [] Married [] Divor	ced [] Wido	w[] ۱	Nidower
[]			

SECTION C: INFORMATION ON INCREASED COMMUNITY AWARENESS ON SUSTAINABLE ENVIRONMENT MANAGEMENT

1.) Please indicate if your household is aware that the following practices is essential by writing 1,2,3 or 4 in

appropriate boxes.(Very Aware =1, Aware =2 Aware but not interested =3 Not aware=4)

Practices	Awareness	Practices	Awareness
	rating		rating
Tree Planting Engagement		Environment Management	
		Advocacy	
Reduced Bush Fire		Participation in Conservation	
		Activities	
Proper Livestock Keeping		Flexibility of Traditional	
		Preference	
Legal Harvesting of Forest Product		Reduced Timber Sales/	
		Domestic Use	
Engaging in Natural Resources Mgt.		Reduced Fuel wood Sales/	
Training		Domestic Use	
Reduced Charcoal Production		No Stealing of Wildlife/	
		Poaching	
Use of Energy saving jikos, devices		Adherence to Forest	
and techniques		Restrictions	
Application of Knowledge gotten from		Use of Irrigation Systems	
Trainings			
Engagement in Forest Related		Others specify)	
Activities			

Reduced Tree Felling		
Reduced Charcoal Use		
Forest Land Ownership		

2.) Which forest related activities are you involved in? Beekeeping { } Timber/Logging{ } Mushroom collection { } Charcoal{ } Grazing{ } Fuel wood collection{ } Herbal Collection{ } Not involved in Forest Related Activities{ } Other (Please specify)

3a.) Do you have access to extension service? Yes { } No { } 3b.) If Yes in Q3a, how often do you have access to extension service? Weekly [] Monthly [] Yearly [] Other (Please specify)

4a.) Have your household members gotten any training on environment or natural resources management? □Yes □No

4b.) If Yes in Q4a above, which training did they undertake? (Please tick, but where more than one, put numbers)

Forest Management Nurseries Establishment and Management Energy Saving Devices and Techniques Proposal Writing Record Keeping Community Artisan Training Other (Please specify)

5a.) If Yes in Q4a above, how many of your household members were trained? -----? (Number)

6.) If No in Q 4a above, why have your household members gotten no training on environment or natural resources management?

Lack of interest { } Lack of access to training { } Involvement in other preferred trainings { } No tangible reason seen to undertake training { } Other (Please specify)

SECTION D: INFO	SECTION D: INFORMATION ON INCREASED COMMUNITY INCOMES							
1a	Do you have adequate access to the forest?	□Yes □No						
1b	What is the distance from your house to the tree nursery?	(Km)						
2	Do you have access to inputs such as seedlings, herbicides or pesticides?	□Yes □No						
3a	What is the average prices per species of seedlings?	(KSh)						
3b	How easy is it for households to access tree seedlings	Very [] Averagely [] Fairly [] Never[]						
3c	What is the source of tree seedlings for planting?	Market[] Forest [] Friends [] Forest Group Nursery[] Private Nursery[] Own farm[] Other (specify)						
4a	What is the means of transportation to the forest?	Trekking Car Bicycle Lorry						

		Other (specify)
4b	How many minutes will it take to get to the forest	0-20min [] 21-40 [] 41-60 (Mins)
	from your house through the means mentioned in Q4a above?	61-80mins[] 81mins&above []
5	What is the state of the road to your forest	Motorable { } Not Motorable { }
	location?	Path way{ } Other (Please specify)
SECT	TON E: INFORMATION ON IMPROVED AFFOREST	ATION
Name of For	est in River Basin:	
1a	Do you undertake tree planting on farm /forest area?	□Yes □No
1b	If yes in Q 1a above, how many tree seedlings do you plant	on 1-20 [] 21-50[] 51-100[]
	farm /forest per year for the past 5 years?	101-200[] 201&above[]
1		Other (Please specify)
Ic	If yes, in Q Ia above, how often do you undertake tree plant per year?	Twice/Seasonally[]
1d	If yes in Q1a above, what is the survival rate of the tree seed	lings 1-10 [] 11-20[] 21-30[]
	planted? (in percentage %)	31-40 [] 41-50 [] 51-60[]
		91-100[]
2	Which is the most available species of trees to the household	!? Exotic[] Indigenous[]
3	Which is the most preferred species of trees to the household	Exotic[] Indigenous[]
4a	Do you undertake tree felling on farm/forest area?	□Yes □No
4b	If Yes in Q4a, what is the average number of trees harvested	1-20 [] 21-50[] 51-100[]
	yearly for the past 5years?	101-200[] 201&above[]
40	If Ves in Ω/a , what is the average number of trees sold year	$v_{\rm for} = \frac{1}{20} \begin{bmatrix} 1 & 21 \\ 50 \end{bmatrix} = 51 \begin{bmatrix} 100 \\ 1 \end{bmatrix}$
40	the past 5 years?	101-200[] 201&above[]
		Other (Please specify)
5	What is the average number of trees for personal use yearly	for 1-20 [] 21-50[] 51-100[]
	the past 5 years?	101-200[]201&above[]
6		Other (Please specify)
6a	Do you have any agreement or written contract with any buy tree?	rer of YES { } NO { }
6b	If Yes, in 6a above how often do you supply them?	Weekly[] Monthly[] Yearly[
		J Other (Please specify)
7a	Do the cutting down of trees affect you?	
7b	If Yes, in Q 7a above, how does it affect you?	Land Slides[] Floods[] Soil
		Erosion[] Low Harvest[]
		Unpredictable Rainfall[]
		Destruction of Homes[]
		Conter (Please specify)
8a	Is the issue of cutting of trees being addressed by the	\square Yes \square No
	community?	

86	If Yes, in Q8a above, how are they being addressed?	Effective Law Regulation[] Advocacy/ Awareness[] Restrictions [] Capacity Building, Monitoring Engagement[] Access to seedlings[] Other (Please
8c	If Yes in Q8a above, are they being addressed successfully?	Yes No
8d	If No, in Q 8c above, what support is required?	Advocacy/ Awareness[] Effective CFAs [] Training/Capacity Building[] Access to Extension Agent[] Access to seedlings[] Other (Please specify)
9a	Are your household members engaged in any Community Based Organization/ Community Forest Association/ Forest User Groups etc ?	□Yes □No
9b	If No, in Q 9a above, why are they not engaged in any of the groups?	Unaware of Group[] Ineffective Group[] Un- organized Group[] Lack of Order and Management [] No plan [] Corrupt Group[] Lack of interest[] Other (Please specify)

KEY INFORMANT INTERVIEWS: FORESTERS, WRUA, ECOSYSTEM CONSERVATORS & OTHER KFS STAFF

COUNTY:

SUB-COUNTY:

FOREST STATION/ WRUA STATION:

RESPONDENT:

PHONE NUMBER OF CONTACT PERSON:

NAME OF CONTACT PERSON:

POSITION OF THE CONTACT PERSON:

i)	How	can	you	describe	your	relationship	with	the	UTaNRMP	Project	so	far?
			•••••			••••••	• • • • • • • • • • • • • •				•••••	••••
		•••••		•••••						•••••	• • • • • • • • •	••••
		•••••	•••••	•••••		•••••		•••••	••••••	•••••	•••••	••••
ii)	What a of For	are son est and	ne of th Ecosys	e UTaNRM	IP proje gement?	ct activities that Give list of the	it you h e project	ave be t activi	en involved in ties, outputs, o	terms of c utcomes a	oordir	ation
					•••••				-			••••
				•••••								••••
		•••••		•••••				•••••		•••••	•••••	••••
		•••••	• • • • • • • • • •	•••••		•••••		•••••	••••••	•••••	•••••	••••
;;;)	Ном п	nany C	 ΕΛς ard		noratin	a in the County	Sub Co	untu?				
III <i>)</i>	110w II			currentity	perating	g in the County.	Sub-CC	Junty !				
					· · · · · · · · · · · · · ·		· · · · · · · · · · · · · ·					••••
												••••
:)	Cin ee			f the LITeN		f	1		al Circa list			
IV)	Since	the mce	eption c	or the UTan	KMP, I	ave you formed	i any ne	W CFP	s? Give list			
				•••••	• • • • • • • • • • •	••••••	• • • • • • • • • • •		••••••	•••••	• • • • • • • • •	••••
												•
v)	How n	nany C	FAs ha	ve been fun	ded by t	hrough the UT	aNRMP	Projec	t?			
				•••••							• • • • • • • •	••••
		•••••	•••••	•••••	• • • • • • • • • • • •			•••••		•••••	• • • • • • • • •	••••
		•••••	•••••	•••••	• • • • • • • • • • • •	•••••		••••	••••••	•••••	• • • • • • • • •	••••
vi)	Descri PFMP	be the s?	role of	KFS in es	tablishi	ng the CFAs a	nd to w	hat ex	end have you	helped the	em de	velop
		•••••		•••••						•••••	• • • • • • • • •	••••
		•••••	•••••	•••••				•••••			•••••	••••
												••••

vii)	To what extent can you say the PFMPs implementation have succeeded?
viii)	Has the implementation of the project led to environmental awareness among residents in the project area?
ix)	To what extent has the activities of the CFAs within the project framework helped in, improving efficient energy utilization, Tree Planting Engagement, Sustainable forest utilization, Forest Governance, Forest Law Enforcement, Agricultural Management Practices /technologies on soil and water conservation, Use of energy saving devices and techniques, Engagement in Forest Related Activities, Availability of Extension services , Training engagement and application of knowledge?
x)	What can you observe in the livelihood of community since the UTANRMP started?
xi)	Rehabilitation of forest – give average, survival rate in percentages and monitoring mechanism that has been put in place for tree nurseries development and seedling restocking?
··· ···	
 xii)	What are some of the environmental challenges still facing the County/sub-county and how can they be addressed within the framework of the UTANRMP project?
xiii)	Has the project given your office any institutional support? If Yes give details

FGD: CFA members, WRUA members

Farm Forestry programme What is the Number of beneficiaries per year in the County for the last 4 years when UTANRMP started the on-farm tree planting? \triangleright How many tree seedlings does each farmer plant? preferred species What are the tree and why? \geq What criteria did you use to pick participating farmers? \geq Did you undertake any capacity building support for the participating farmers? Give details of training, beneficiaries and overall impact of the training \triangleright Estimate the average survival rate of tree seedlings? \triangleright In percentages what is the adoption rate of the tree planting activity in your area? What monitoring mechanism place programme? are the put in for the What challenges has the programme faced so far and what mitigation measures have you put in place?

FGD	Guiding Questions	Responses from FGD participants
1)	Contact Details (CFAs):	
	Name of contact person:	
	Position of the contact person:	
	Phone Number of contact person:	
2)	Association Details (CFAs/ WRUA):	
,		
2a)	Name of the CFA/ WRUA:	
2h)	Name of the River Basin (WRUA) or	
20)	Forest Station (CFA):	
	Torest Station (CTTY).	
2c	Location of the CEA/WRUA (county sub $-$	
20)	county ward):	
	county, ward).	
2d)	Membership details-Number of members-	
24)	Men Women Young Men Young	
	Women PLWD).	
2e)	Brief history of the CFA /WRUA when	
20)	started why started.	
	started, why started.	
2f)	Is your group registered?	
/		
	Do you have a group constitution and by-	
	laws?	
2g)	Does your association have an approved	
67	Sub-catchment Management Plan (WRUA)	
	or Participatory Forest Management Plan	
	(CFA)	
2h)	Does your group have an Executive	
,	Committee?	
	What are the roles of this committee?	
	What is the composition of this committee	
	(Men, Women, Young Men, Young	
	Women, and PLWD)?	
	Do you have other sub-committees?	

	What are their roles?	
2i)	What are the core activities of the	
2j)	How are women, youth and PLWD involved in your group's activities?	
3)	Improved Efficiency in Energy Use (CFAs	/WRUAs)
3a	What energy conservation technologies	
	have you been introduced to the	
	Association?	
3b	Which ones have you adopted?	
3c	What has been the impact of adoption of	
	these technologies?	
4)	Increased Community Awareness On Sus	tainable Environment Management (CFAs/WRUA)
4a	How would you rate your CFA's /WRUAs	
	ability to undertake your activities?	
	(Development and implementation of	
	action plans-PFMPs//SCMPs)	
4h	training have you been involved in?	
40	How many members were trained?	
	What measures have been taken to ensure	
4c	application/adoption of	
4d	knowledge/technologies gained in the	
	training programs?	
	How many members are involved in	
	activities related to improved knowledge	
4e	/technologies? Adopters Trained/Untrained	
	What are the measures taken to increase	
	community awareness in sustaining the	
	Iorest? What is your take on urban and industrial	
	supply of forest products?	
4f	How have you been able to strengthen	
	governance and ensure orderliness in the	
	Association?	
4g		
5)	Increased Community Incomes	
5a	Have you benefitted from matching grants	
	from the Project?	
5b	What were your major activities and their	

	outcomes and the impact of these grants?
	How has it affected the lives of your
5c	members and the larger community?
6)	Improved Afforestation (CEAs/WDUA)
0)	Improved Anorestation (CFAS/WKUA)
6a	What are the reasons for increased tree
	cover in your area?
6b	To what extent have you planted trees in
	your group? (Please specify area in
	hectares and the density per ha and number
	of seedlings)
60	What have you observed regarding tree
00	herwasting salas and use in the past 5
	harvesting, sales and use in the past 5
	years?
6d	What are the things that would still be
	existing if there was no CFAs/WRUA?
6e	List the 5 major challenges that your
	Association face as far as tree planting is
	concerned. What are the coping
	mechanisms and/or recommendation?