

**THE CONTRIBUTION OF PALM CRAFT MATERIALS TO HOUSEHOLD
INCOME IN WESTERN LOWLAND ZONE. MWANGA DISTRICT, TANZANIA**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT FOR THE
REQUIREMENTS OF THE DEGREE OF MASTER OF SCIENCE IN
MANAGEMENT OF NATURAL RESOURCES FOR SUSTAINABLE
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ABSTRACT

This study was designed to determine the contribution of palm craft materials to household income in Western lowland zone of Mwanga district. Data was collected by social economic survey and field inventory. The social economic survey involved interviewing sampled respondents in households, sellers and customers of palm craft materials and products in the market place and discussion with focus groups. Information gathered was type of species, quantity harvested, type of products produced, uses and marketing of palm craft materials and produced products. Field inventory was also conducted to get the estimates of the available palm craft materials in Kileo forest reserve and in general land. Data from social economic survey were analysed by using Statistical Package for Social Sciences (SPSS) computer programme. Field inventory data were analysed using Microsoft Excel computer programme. The study has revealed that palm craft materials have significant contribution ($P < 0.01$) to household income compared to other economic sources in the four villages of Kileo ward. Palm craft materials contributed 56 % of total household income while crops, business and livestock contribute 21 %, 15 % and 8 percent respectively. Market of palm craft products was not good. It was also observed that the amount of palm craft material harvested was lower than what both Kileo forest reserve and in general land could supply. It was recommended that; product development and marketing should be conducted in order to utilize the full potential of the forest reserve and general land, villagers in Kileo ward should be helped to organize themselves into economic groups dealing with plant craft materials, Forest Division should introduce quarter harvesting system of wild date palm in Kileo forest reserve and that Kileo forest

reserve and the general land with doum palm should be managed in a sustainable manner through Participatory Forest Management.

DECLARATION

I, ELINIPA MNZAVA SEKIETE, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my original work, and has never been submitted, nor concurrently being submitted for a degree award in other university.

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Date

The above declaration is confirmed

Prof K.F.S. Hamza
(Supervisor)

Date

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successful. Special thanks go to my Pastor Mr. Mathew Sasali of Falkland Worshiping Centre who was responsible for my spiritual health during my stay at SUA.

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DEDICATION

This work is dedicated to my husband, sons and daughter whose fountain of aspiration and love contributed to my success.

TABLE OF CONTENTS

ABSTRACT.....	iii
DECLARATION.....	v
Prof K.F.S. Hamza	Date...v
COPYRIGHT.....	vi
ACKNOWLEDGEMENTS.....	vii
DEDICATION.....	ix
TABLE OF CONTENTS.....	x
LIST OF TABLES.....	xvi
LIST OF FIGURES.....	xviii
LIST OF PLATES.....	xix
LIST OF APPENDICES.....	xxv
LIST OF ABBREVIATION AND SYMBOLS.....	xxxix
CHAPTER ONE.....	1
1.0 INTRODUCTION.....	1
1.1 Background Information.....	1
1.1.1 Non-Timber Forest Products in Tanzania.....	1
1.1.2 Forestry in Mwanga District.....	2
1.2 Problem Statement and Justification.....	3
1.2.1 Problem Statement.....	3
1.2.2 Justification.....	4
1.3 Objective of the Study.....	4
1.3.1 Overall Objective.....	4

1.3.2 Specific Objectives.....	4
1.4 Hypotheses of the Study.....	5
1.5 Research Questions.....	5
CHAPTER TWO.....	6
2.0 LITERATURE REVIEW.....	6
2.1 Definition	6
2.2 Types, Uses and Contribution of NTFPs to Household Economy	6
2.2.1 Foods 6	
2.2.2 Medicinal and Bioactive Products.....	9
2.2.3. Natural Colorants and Dyestuffs	10
2.3 Plant Craft Materials.....	11
2.3.1 Fibres 11	
2.3.2 Grasses and Leaves.....	12
2.3.3 Important Plants for Craft Materials.....	13
Uses of wild date palm.....	15
Propagation.....	16
2.4 Importance of Non Timber Forest Products (NTFPs).....	18
2.5 Problems of Utilizing NTFPs.....	19
2.6 Commercialization of NTFPs.....	20
CHAPTER THREE.....	22
3.0 MATERIAL AND METHODS.....	22
3.1 Study Area.....	22
3.1.1 Geographical Location.....	22
3.1.2 Communication.....	23

3.1.3 Topography.....	23
3.1.4 Geology	23
3.1.5 Climate	24
3.1.6 Vegetation.....	25
3.2 Data Collection Methods.....	25
3.2.1 Research Design.....	25
3.2.2 Social Economic Survey.....	27
3.2.2.1 Sampling Procedure and Sample size.....	27
3.2.2.2 Participatory Rural Appraisal	28
3.2.3 Field Inventory Survey.....	31
3.2.4 Secondary Data.....	32
3.3 Data Analysis.....	32
33	
CHAPTER FOUR.....	34
4.0 RESULTS AND DISCUSSION.....	34
4.1 Social Economical Survey.....	34
4.1.1 Number of Respondents in each study area.....	34
4.1.2 Ethnic Groups.....	34
4.1.3 Marital Status of Respondents.....	35
4.1.4 Education level of Respondents.....	36
4.1.5 Household Size.....	37
4.1.6 Distribution of Respondents by Age.....	38
4.1.7 Distribution of Respondents by Gender	39
4.2 Land Ownership and Farm size.....	40

4.3 Sources of Household Income	42
4.3.1 Crop production	42
4.3.2 Livestock Production	43
4.3.3 Business	44
4.3.4 Palm Craft Materials.....	45
4.3.4.1 Palm Species used as Craft Material	45
Plate 1a: Wild date palm (<i>Phoenix reclinata</i>) found in Kileo forest.....	46
Plate 1b: Doum palm (<i>Hyphane compressa</i>) found in general land in Kileo ward	47
4.3.4.2 Distance Covered to the Harvesting Area.....	47
Plate 2: Doum palm around a household	48
4.3.4.3 Trend of Availability of Palm Craft Material.....	48
4.3.4.4 Amount of Palm Leaves Harvested from Kileo Forest Reserve and General Land	49
4.3.4.5 Value of Palm Craft Material Harvested from Kileo Forest Reserve and General Land.....	50
4.3.4.6 Types, Amount and Value of Weaved Products from Palm Craft Materials.....	51
Plate 3a: Types of weaved product (large baskets, hard and soft mats, and brooms) from palm craft materials	52
Plate 3b: Types of weaved product (medium baskets, handbags and winnowing trays) from palm craft materials	52
4.3.4.7 Marketing of Palm Craft Materials.....	55
4.3.4.8 Role of Gender in Harvesting and Weaving of Palm Craft Materials ..	57
4.4 Field Inventory Survey.....	59

4.4.1 Stocking of Palm Trees in Kileo Forest Reserve.....	59
4.4.1.1 Regenerantes.....	59
4.4.1.2 Stems	59
4.4.2 Harvestable Palm Craft Material from Kileo Forest Reserve and in General Land	59
4.4.2.1 Harvestable Palm Craft Material from Kileo Forest Reserve.....	60
4.4.2.2 Harvestable Palm Craft Material from Kileo General Land.....	60
4.5. Contribution of Palm Craft Materials to Household Income in Kileo Ward	61
4.6 Potential of Kileo Forest Reserve and the General Land in Enhancing Household Income.....	62
CHAPTER FIVE.....	65
5.0 CONCLUSION AND RECOMMENDATIONS.....	65
5.1 Conclusion.....	65
5.2 Recommendations	66
Further studies on domestication and commercialize the useful palm specie should be carried.....	66
REFERENCES.....	67
APPENDICES.....	79
Appendix 1: Information on crop production economic activity.....	79
Appendix1a: Percentage of respondent who own land.....	79
Appendix 1b: Percentage area under crop cultivation (ha)	79
Appendix 2: Utilization of plant craft materials in the household.....	79
Appendix 2a: Distance covered to where wild date palm leaves are harvested.....	79
Appendix 2b: Distance covered to where doum palm leaves are collected.....	80

Appendix 2c: Trend for utilization of plant craft materials.....	80
Appendix 2d: Weaved products from plant craft materials.....	81
Appendix 2e Market status of raw palm craft material.....	82
Appendix 3: Questionnaire for household's survey.....	83
PART 1. General information.....	83
B. Livestock production.....	85
C. Business.....	86
D. Other economic activities.....	86
D. Uses of craft materials.....	90
Appendix 4: Questionnaire for palm craft materials market survey.....	92
Appendix 5: Check list for District forest officer	95
Appendix 6: Check list for Ward/village officers	97

LIST OF TABLES

Table 1: Number of respondents and corresponding percent from each selected village	34
Table 2: Marital status of respondents	36
Table 3: Education level of respondents.....	37
Table 4: Household size in studied village	38
Table 5: Distribution of respondents by age.....	39
Table 6: Average number of adult males and females in a household	40
Table 7: Average income from crop production per month per household.....	43
Table 8: Annual household income from livestock	44
Table 9: Household income from business	45
Table 10: Area where palm craft materials were collected.....	46
Table 11: Types, average quantity and value of palm leaves harvested per household in different villages in Kileo ward.....	50
Table 12: Amount and value of weaved products produced in the study villages	54
Table 13: Prices of weaved products from palm craft materials.....	57
Table 14: Contribution from raw palm leaves in the household by gender	58
Table 15: Contribution of weaved palm products in the household by gender	58
Table 16: Amount of wild date and doum palm which could be harvested in Kileo Forest per year.....	59
Table 17: Amount of harvestable doum palm in general land surrounding the four villages in Kileo ward	60

Table 18: Contribution of various income sources to the annual household income in the study area.....	62
Table 19: Percentage of palm craft material harvested in Kileo forest reserve and the general land	62

LIST OF FIGURES

Figure 1: Location of the study area in Mwanga district, Kilimanjaro region.....	26
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LIST OF PLATES

ABSTRACT.....	iii
DECLARATION.....	v
Prof K.F.S. Hamza	Date...v
COPYRIGHT.....	vi
ACKNOWLEDGEMENTS.....	vii
DEDICATION.....	ix
TABLE OF CONTENTS.....	x
LIST OF TABLES.....	xvi
LIST OF FIGURES.....	xviii
LIST OF PLATES.....	xix
LIST OF APPENDICES.....	xxv
LIST OF ABBREVIATION AND SYMBOLS.....	xxx
CHAPTER ONE.....	1
1.0 INTRODUCTION.....	1
1.1 Background Information.....	1
1.1.1 Non-Timber Forest Products in Tanzania.....	1
1.1.2 Forestry in Mwanga District.....	2
1.2 Problem Statement and Justification.....	3
1.2.1 Problem Statement.....	3
1.2.2 Justification.....	4
1.3 Objective of the Study.....	4
1.3.1 Overall Objective.....	4
1.3.2 Specific Objectives.....	4

1.4 Hypotheses of the Study.....	5
1.5 Research Questions.....	5
CHAPTER TWO.....	6
2.0 LITERATURE REVIEW.....	6
2.1 Definition	6
2.2 Types, Uses and Contribution of NTFPs to Household Economy	6
2.2.1 Foods 6	
2.2.2 Medicinal and Bioactive Products.....	9
2.2.3. Natural Colorants and Dyestuffs	10
2.3 Plant Craft Materials.....	11
2.3.1 Fibres 11	
2.3.2 Grasses and Leaves.....	12
2.3.3 Important Plants for Craft Materials.....	13
Uses of wild date palm.....	15
Propagation.....	16
2.4 Importance of Non Timber Forest Products (NTFPs).....	18
2.5 Problems of Utilizing NTFPs.....	19
2.6 Commercialization of NTFPs.....	20
CHAPTER THREE.....	22
3.0 MATERIAL AND METHODS.....	22
3.1 Study Area.....	22
3.1.1 Geographical Location.....	22
3.1.2 Communication.....	23
3.1.3 Topography.....	23

3.1.4 Geology	23
3.1.5 Climate	24
3.1.6 Vegetation.....	25
3.2 Data Collection Methods.....	25
3.2.1 Research Design.....	25
3.2.2 Social Economic Survey.....	27
3.2.2.1 Sampling Procedure and Sample size.....	27
3.2.2.2 Participatory Rural Appraisal	28
3.2.3 Field Inventory Survey.....	31
3.2.4 Secondary Data.....	32
3.3 Data Analysis.....	32
33	
CHAPTER FOUR.....	34
4.0 RESULTS AND DISCUSSION.....	34
4.1 Social Economical Survey.....	34
4.1.1 Number of Respondents in each study area.....	34
4.1.2 Ethnic Groups.....	34
4.1.3 Marital Status of Respondents.....	35
4.1.4 Education level of Respondents.....	36
4.1.5 Household Size.....	37
4.1.6 Distribution of Respondents by Age.....	38
4.1.7 Distribution of Respondents by Gender	39
4.2 Land Ownership and Farm size.....	40
4.3 Sources of Household Income	42

4.3.1 Crop production	42
4.3.2 Livestock Production	43
4.3.3 Business	44
4.3.4 Palm Craft Materials.....	45
4.3.4.1 Palm Species used as Craft Material	45
Plate 1a: Wild date palm (<i>Phoenix reclinata</i>) found in Kileo forest.....	46
Plate 1b: Doum palm (<i>Hyphane compressa</i>) found in general land in Kileo ward	47
4.3.4.2 Distance Covered to the Harvesting Area.....	47
Plate 2: Doum palm around a household	48
4.3.4.3 Trend of Availability of Palm Craft Material.....	48
4.3.4.4 Amount of Palm Leaves Harvested from Kileo Forest Reserve and General Land	49
4.3.4.5 Value of Palm Craft Material Harvested from Kileo Forest Reserve and General Land.....	50
4.3.4.6 Types, Amount and Value of Weaved Products from Palm Craft Materials.....	51
Plate 3a: Types of weaved product (large baskets, hard and soft mats, and brooms) from palm craft materials	52
Plate 3b: Types of weaved product (medium baskets, handbags and winnowing trays) from palm craft materials	52
4.3.4.7 Marketing of Palm Craft Materials.....	55
4.3.4.8 Role of Gender in Harvesting and Weaving of Palm Craft Materials ..	57
4.4 Field Inventory Survey.....	59
4.4.1 Stocking of Palm Trees in Kileo Forest Reserve.....	59

4.4.1.1 Regenerantes.....	59
4.4.1.2 Stems	59
4.4.2 Harvestable Palm Craft Material from Kileo Forest Reserve and in General Land	59
4.4.2.1 Harvestable Palm Craft Material from Kileo Forest Reserve.....	60
4.4.2.2 Harvestable Palm Craft Material from Kileo General Land.....	60
4.5. Contribution of Palm Craft Materials to Household Income in Kileo Ward	61
4.6 Potential of Kileo Forest Reserve and the General Land in Enhancing Household Income.....	62
CHAPTER FIVE.....	65
5.0 CONCLUSION AND RECOMMENDATIONS.....	65
5.1 Conclusion.....	65
5.2 Recommendations	66
Further studies on domestication and commercialize the useful palm specie should be carried.....	66
REFERENCES.....	67
APPENDICES.....	79
Appendix 1: Information on crop production economic activity.....	79
Appendix1a: Percentage of respondent who own land.....	79
Appendix 1b: Percentage area under crop cultivation (ha)	79
Appendix 2: Utilization of plant craft materials in the household.....	79
Appendix 2a: Distance covered to where wild date palm leaves are harvested.....	79
Appendix 2b: Distance covered to where doum palm leaves are collected.....	80
Appendix 2c: Trend for utilization of plant craft materials.....	80

Appendix 2d: Weaved products from plant craft materials.....	81
Appendix 2e Market status of raw palm craft material.....	82
Appendix 3: Questionnaire for household's survey.....	83
PART 1. General information.....	83
B. Livestock production.....	85
C. Business.....	86
D. Other economic activities.....	86
D. Uses of craft materials.....	90
Appendix 4: Questionnaire for palm craft materials market survey.....	92
Appendix 5: Check list for District forest officer	95
Appendix 6: Check list for Ward/village officers	97

LIST OF APPENDICES

ABSTRACT.....	iii
DECLARATION.....	v
Prof K.F.S. Hamza	Date...v
COPYRIGHT.....	vi
ACKNOWLEDGEMENTS.....	vii
DEDICATION.....	ix
TABLE OF CONTENTS.....	x
LIST OF TABLES.....	xvi
LIST OF FIGURES.....	xviii
LIST OF PLATES.....	xix
LIST OF APPENDICES.....	xxv
LIST OF ABBREVIATION AND SYMBOLS.....	xxx
CHAPTER ONE.....	1
1.0 INTRODUCTION.....	1
1.1 Background Information.....	1
1.1.1 Non-Timber Forest Products in Tanzania.....	1
1.1.2 Forestry in Mwanga District.....	2
1.2 Problem Statement and Justification.....	3
1.2.1 Problem Statement.....	3
1.2.2 Justification.....	4
1.3 Objective of the Study.....	4
1.3.1 Overall Objective.....	4
1.3.2 Specific Objectives.....	4

1.4 Hypotheses of the Study.....	5
1.5 Research Questions.....	5
CHAPTER TWO.....	6
2.0 LITERATURE REVIEW.....	6
2.1 Definition	6
2.2 Types, Uses and Contribution of NTFPs to Household Economy	6
2.2.1 Foods 6	
2.2.2 Medicinal and Bioactive Products.....	9
2.2.3. Natural Colorants and Dyestuffs	10
2.3 Plant Craft Materials.....	11
2.3.1 Fibres 11	
2.3.2 Grasses and Leaves.....	12
2.3.3 Important Plants for Craft Materials.....	13
Uses of wild date palm.....	15
Propagation.....	16
2.4 Importance of Non Timber Forest Products (NTFPs).....	18
2.5 Problems of Utilizing NTFPs.....	19
2.6 Commercialization of NTFPs.....	20
CHAPTER THREE.....	22
3.0 MATERIAL AND METHODS.....	22
3.1 Study Area.....	22
3.1.1 Geographical Location.....	22
3.1.2 Communication.....	23
3.1.3 Topography.....	23

3.1.4 Geology	23
3.1.5 Climate	24
3.1.6 Vegetation.....	25
3.2 Data Collection Methods.....	25
3.2.1 Research Design.....	25
3.2.2 Social Economic Survey.....	27
3.2.2.1 Sampling Procedure and Sample size.....	27
3.2.2.2 Participatory Rural Appraisal	28
3.2.3 Field Inventory Survey.....	31
3.2.4 Secondary Data.....	32
3.3 Data Analysis.....	32
33	
CHAPTER FOUR.....	34
4.0 RESULTS AND DISCUSSION.....	34
4.1 Social Economical Survey.....	34
4.1.1 Number of Respondents in each study area.....	34
4.1.2 Ethnic Groups.....	34
4.1.3 Marital Status of Respondents.....	35
4.1.4 Education level of Respondents.....	36
4.1.5 Household Size.....	37
4.1.6 Distribution of Respondents by Age.....	38
4.1.7 Distribution of Respondents by Gender	39
4.2 Land Ownership and Farm size.....	40
4.3 Sources of Household Income	42

4.3.1 Crop production	42
4.3.2 Livestock Production	43
4.3.3 Business	44
4.3.4 Palm Craft Materials.....	45
4.3.4.1 Palm Species used as Craft Material	45
Plate 1a: Wild date palm (<i>Phoenix reclinata</i>) found in Kileo forest.....	46
Plate 1b: Doum palm (<i>Hyphane compressa</i>) found in general land in Kileo ward	47
4.3.4.2 Distance Covered to the Harvesting Area.....	47
Plate 2: Doum palm around a household	48
4.3.4.3 Trend of Availability of Palm Craft Material.....	48
4.3.4.4 Amount of Palm Leaves Harvested from Kileo Forest Reserve and General Land	49
4.3.4.5 Value of Palm Craft Material Harvested from Kileo Forest Reserve and General Land.....	50
4.3.4.6 Types, Amount and Value of Weaved Products from Palm Craft Materials.....	51
Plate 3a: Types of weaved product (large baskets, hard and soft mats, and brooms) from palm craft materials	52
Plate 3b: Types of weaved product (medium baskets, handbags and winnowing trays) from palm craft materials	52
4.3.4.7 Marketing of Palm Craft Materials.....	55
4.3.4.8 Role of Gender in Harvesting and Weaving of Palm Craft Materials ..	57
4.4 Field Inventory Survey.....	59
4.4.1 Stocking of Palm Trees in Kileo Forest Reserve.....	59

4.4.1.1 Regenerantes.....	59
4.4.1.2 Stems	59
4.4.2 Harvestable Palm Craft Material from Kileo Forest Reserve and in General Land	59
4.4.2.1 Harvestable Palm Craft Material from Kileo Forest Reserve.....	60
4.4.2.2 Harvestable Palm Craft Material from Kileo General Land.....	60
4.5. Contribution of Palm Craft Materials to Household Income in Kileo Ward	61
4.6 Potential of Kileo Forest Reserve and the General Land in Enhancing Household Income.....	62
CHAPTER FIVE.....	65
5.0 CONCLUSION AND RECOMMENDATIONS.....	65
5.1 Conclusion.....	65
5.2 Recommendations	66
Further studies on domestication and commercialize the useful palm specie should be carried.....	66
REFERENCES.....	67
APPENDICES.....	79
Appendix 1: Information on crop production economic activity.....	79
Appendix1a: Percentage of respondent who own land.....	79
Appendix 1b: Percentage area under crop cultivation (ha)	79
Appendix 2: Utilization of plant craft materials in the household.....	79
Appendix 2a: Distance covered to where wild date palm leaves are harvested.....	79
Appendix 2b: Distance covered to where doum palm leaves are collected.....	80
Appendix 2c: Trend for utilization of plant craft materials.....	80

Appendix 2d: Weaved products from plant craft materials.....	81
Appendix 2e Market status of raw palm craft material.....	82
Appendix 3: Questionnaire for household's survey.....	83
PART 1. General information.....	83
B. Livestock production.....	85
C. Business.....	86
D. Other economic activities.....	86
D. Uses of craft materials.....	90
Appendix 4: Questionnaire for palm craft materials market survey.....	92
Appendix 5: Check list for District forest officer	95
Appendix 6: Check list for Ward/village officers	97

LIST OF ABBREVIATION AND SYMBOLS

%	-	Percentage
a. s. l.	-	above sea level
CBFM	-	Community Based Forest Management
DNRO	-	District Natural Resources Officer
FAO	-	Food and Agriculture Organisation of the United Nations
FITI	-	Forest Industries Training Institute
ha	-	hectare
H/H	-	Household
ICRF	-	International Centre for Research in Agroforestry
JFM	-	Joint Forest Management
Kg	-	Kilogram
Km ²	-	Kilometer squared
LAFR	-	Local Authority Forest Reserve
m	-	Meter
MLNRT	-	Ministry of Land Natural Resources and Tourism
MNRT	-	Ministry of Natural Resources and Tourism
NFBP	-	National Forest and Beekeeping Programmes
NFP	-	National Forest Programme
NGOs	-	Non-Governmental Organisation
NSGRP	-	National Strategy for Growth and Reduction of Poverty
NTFPs	-	Non- Timber Forest Products
NRT	-	United republic of Tanzania.

NWFPs	-	Non Wood Forest Products
°C	-	Degree centigrade
PFM	-	Participatory Forest Management
PP	-	Pages
PRA	-	Participatory Rural Appraisal
Rm	-	Running metre
SUA	-	Sokoine University of Agriculture
Spp	-	Species
Sq. km	-	Square kilometer
Tsh	-	Tanzania shilling
URT	-	United Republic of Tanzania
US\$	-	United States of America Dollar

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

1.1.1 Non-Timber Forest Products in Tanzania

Tanzania is endowed with a lot of natural resources including timber and Non-Timber Forest Products (NTFPs). Important NTFPs in Tanzania include fuel wood, poles, craft materials, medicinal plants, honey, mushrooms, fruits, vegetables, wild animals and birds. These products could enhance the economic development of the country if utilized well. However, the full potential of NTFPs, is yet to be realized in the country. In order to improve the utilization of NTFPs a number of policies were formulated or the existing ones reviewed. On NTFPs, the Tanzania Forest policy (MNRT 1998) section 13 states that: Investments in non- wood forest products industry, product developments and marketing will be encouraged in order to utilise the full potential as well as to domesticate and commercialise the products with high demand. Palm craft materials belong to the NTFPs earmarked to improve the economy. Palm craft material when utilized properly has a high potential to contribute to the household income in the communities where they are available. The current utilization of NTFPs in Tanzania is very low. Among the reasons for the low utilization of NTFPs and thus its low contribution to the development of the country is poverty. According to URT (2005) the prevalence of income poverty in Tanzania is still high. Results of the Household Budget Survey of 2000/01 showed that the proportion of the population below the national food poverty line is 18.7 percent and that below the national basic needs poverty line is 35.7 percent. There is also a big disparity between urban and rural poverty for both food and basic needs poverty. Poverty remains

overwhelmingly in rural areas where 87 percent of the poor population live, and is highest among households who depend on agriculture. On its effort to combat poverty, the government of Tanzania formulated the National Strategy for Growth and Reduction of poverty (2005). It was pointed out in the document that efforts will be stepped up to reduce the proportion of the rural population below the basic needs poverty line from 38.6 percent to 24 percent by 2010. Among the operational goal for this target is an increased contribution from wildlife, forestry, and fisheries, to the income of rural communities.

1.1.2 Forestry in Mwanga District

The forest resources of the North Pare Mountains are of outstanding importance for the people living in Mwanga District (Wardell, 1991). They have a great catchment^s value i.e. collecting, storing and releasing water as well as providing timber and NTFPs, which are important for the peoples' survival. Further, forests in general play the role of regulating climate as well as conserving soil. Furthermore, the forests are the habitat for various endemic indigenous hardwood timber species such as *Newtonia buchananii*, *Zanthoxylum spp*, *Ficalhoa laurifolia*, *Olea africana*, *Cordia africana* and *Brachylaena huillense* (Wardell, 1991).

According to Semgalawe (1996) Mwanga District natural forests occupy a total area of 327 km² or 12 % of the district area. Out of this, 207 km² are traditional forests "mpungis" and 120 km² are government owned forest reserves. In the last two decades deforestation and over-exploitation of these natural resources has become a serious problem in the district.

Kileo Forest Reserve which is one of the traditional forests in western lowland zone of Mwanga district has been identified as a unique biological resource with valuable tree species (Burren, 2002). These species which are found in the wet area includes *Brachystegia spp*, *Albizia spp*, *Combretum,spp* and *Syzygium spp*. In addition to these indigenous species there are also planted species such as *Milicia exelsa*, *Cedrella odorata* and *Cordia abyssinica*. In addition to timber, this forest reserve provides also NTFPs. Among the most important NTFPs collected from Kileo LAFR were palm craft materials “Ukindu” (*Phoenix reclinata*) and “Mikoche” (*Phoenix dactylifera*), which are used for making baskets and mats. Craft materials from palm species are getting more important and seem to have a potential of increasing household income.

1.2 Problem Statement and Justification

1.2.1 Problem Statement

The Western lowland of Mwanga district where the study was carried out is situated on the leeward side of the North Pare mountains (Kan, 1977). Rainfall is erratic and unreliable resulting into frequent crop failure. Due to this problem residents are forced to look for other economic activities such as animal keeping. However, due to poor rain fall, which result into lack of grass/fodder and drinking water for animals, animal keeping becomes also difficult forcing the people in Kileo - Mwanga to increasingly turning to off- farm employment. Gunatilake (1993) reported that it has been estimated that already more than a third of rural household income is derived from non-farm activities. In Kileo, handcraft is one of the alternative means of income generation and already some people use palm craft materials from the forest and from general land for basketry and mats production. Mbuya *et al.* (1994) reported that plant craft materials play a considerable role in

contribution to the household income to the rural community in Tanzania. It is thus expected that palm craft material play a role in enhancing livelihood for the people in the lowland zone of Mwanga District. However, the level of their contribution to household income for the people in lowland zone of Mwanga district is not known and thus not included in the district development plans.

1.2.2 Justification

This study intends to assess the contribution of palm craft materials from western lowland zone of Mwanga district to the household income. Results from this will form a basis for recommendation on efficient and sustainable utilization of palm craft materials. The results will also help development officers to assist villagers to organize themselves into production and or marketing groups. This will in turn increase the marketing of palm craft materials so as to raise incomes of the local households thus alleviating poverty.

1.3 Objective of the Study

1.3.1 Overall Objective

Overall objective of this study is to determine the contribution of palm craft materials to household income in Western lowland zone of Mwanga district.

1.3.2 Specific Objectives

Specific objectives of study are as follows:

1. To identify current uses, and marketing of palm craft material
2. To determine the utilization level of palm craft material in the study area.
3. To determine the contribution of palm craft material to household income.

4. To conduct inventory of palm craft materials in Kileo Forest Reserve and in the general land.

1.4 Hypotheses of the Study

H₀: Palm craft materials have no significant contribution to household income of the rural people in Western lowland zone of Mwanga district, Tanzania.

H₁: Palm craft materials have significant contribution to the rural people in Western lowland zone of Mwanga district, Tanzania.

1.5 Research Questions

1. What types of palm craft materials are available in the study area?
2. What are the uses of palm craft materials in the western lowland zone of Mwanga district?
3. What socio- economic factors influences the use of palm craft materials?
4. What quantities of palm craft materials are harvested per year in a household?
5. What are the gender roles with regard to palm craft material production?
6. What is the market status of palm craft materials?
7. What is the contribution of palm craft material to household income?
8. How much palm craft materials are available both in Kileo Forest Reserve and in the general land?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Definition

Non- Timber Forest Product (NTFPs) refers to the forest products other than timber obtained from leaves, barks, roots, branches and other parts of the tree as well as edible animal and plant food products. Wickens (1991) defined NTFPs as all biological materials other than round wood and derived sawn wood, woodchips, wood based panel and pulp that may be extracted from the natural ecosystems, managed plantations and be utilized within the household, be marketed or have social cultural or religious significance. When the specific term “non-timber forest product” was first proposed in 1989, it referred to “all biological materials other than timber, which are extracted from forests for human use” (Belcher, 2003). Non-Timber Forest Products are also known as non-wood forest products, non-wood goods and services, other forest products, secondary forest products and as special forest products.

2.2 Types, Uses and Contribution of NTFPs to Household Economy

Tropical forests are full of NTFPs that people use every day for their needs such as food, medicines, craft materials and building, fodder, resins, dyes and flavorings.

2.2.1 Foods

The food security of millions of rural dwellers all over the world depends to large extent on the survival of nature and the ability of man to manage natural resources sustainably for the production of his basic needs (Hamza, 1997). Forest plays a direct and indirect role in

food production and food security. Edible plant products gathered from forests including leaves, flowers, fruits, roots, seeds, nuts, tubers, bulbs, sap and mushrooms.

According to Kabuye (1997) wild fruits play an important role in peoples diet and contribute to the economy of the rural community. Fruits and berries collected in the forest are an important source of minerals and vitamins. Fruits of *Adansonia digitata*, *Dispyros usambarensis*, *Bauhinia thoningii* and *Vitex payos* are excellent source of vitamin C. Compared to domesticated fruits it was found that wild fruits have higher vitamin and mineral contents. In Tanzania, wild fruits are found in various forests. Msuya *et al.* (2004) reported that Uluguru North and Ruvu North Forest Reserves are important sources of indigenous edible fruits and that these fruits play a vital role in the nutrition of people bordering the two forest reserves.

Hamza (1997) explains that nuts provide valuable sources of energy, protein, oils, minerals and vitamins suitable for human consumption. Some nuts have their food reserves in the form of starch instead of protein. Nuts include chestnuts *Castanea* spp, acorns *Quercus* spp, water chestnuts *Trapa* spp, bambara groundnuts *Vigna subterranean* and lotus seeds *Nelumbo* spp. Nuts have the additional value in that most of their fats are highly unsaturated and are consequently beneficial in that they do not raise blood cholesterol.

Edible mushrooms have a lot of potential as food and income generator. According to Hamza (1997) mushrooms feature quite significantly in the diet of many ethnic groups. They are added to sauces and relishes for flavouring. Often they are consumed as meat

substitutes. In Tanzania, the tradition of collecting edible mushrooms is still alive in the countryside the knowledge which is passed on to new generation (Marja *et al.*, 2003).

According to Hamza (1997) leaves and flowers of certain tree species are used as vegetables. They are used either fresh or dried. Young leaves of *Adansonia digitata* for instance are picked and eaten as salad or when cooked. Other species whose leaves are eaten as vegetable include *Chlorophora exelsa*, *Pterocarpus* spp, *Vitex doniana*, *Albizia syzgia*, *Bidens pilosa*, *Cassia obtusifolia* and *Myrianthus arboreus* spp. Mattila *et. al.* (1997) explain that wild leaf vegetables are an important part of traditional diet in many part of Africa. The chief value of these wild leaf vegetables is to increase food palatability, supplying trace quality of protein in the diet.

Roots tubers and bulbs provide carbohydrates and some minerals. They are draught and famine foods not only because they can survive under reduced precipitation, but also because they can be an important source of water. According to Hamza (1997) about 10 % of the wild species in Swaziland were identified as edible bulbs and roots where bulbs of *Aloe saponaria* were the most frequently used. Sene (2000) pointed that the tropical forests and woodlands contain a host of plants that produce edible roots and tubers.

Sap is frequently tapped for beverages, and is often high in sugar and minerals. The sap may either be drunk fresh or left to ferment, becoming wine. According to Hamza (1997) certain palm species are used for wine, these include *Borassus flabellifer* in northern Brazil and *Raphia hookeri* and *Elaeis guineensis* in West Africa. Palm wine is a particular important cultural beverage in West Africa, and is served at cultural and ceremonial occasions throughout the region.

Wild animals are another important forest food (Hamza, 1997). For communities living in the vicinity of forests, natural woodlands and fallow areas, wild animals play a significant role in local diets. In some cases they provide a single largest source of animal protein. Animal food products include: bush meat, fish, honey, insects and snails.

2.2.2 Medicinal and Bioactive Products

For many thousand of years, all over the world, people relied on plants and to a lesser extent on animals for their medicines (Hamza, 1997). The majority of the population in many developing countries still rely on traditional medicine either totally or partially for Medicare. Many households lack cash for, or access to manufacture drugs. In many case hospitals are a secondary resort in illness and invariability in all instances the sick consult traditional medicine practitioner when clinical treatments tends to fail.

According to Kokwako (1993) medicinal plants play a key role in world health. Herbal medicines bridge the gap between the availability of and demand for medicines in developing countries. Plant remedies account for about 90 % of all remedies used for treatment in the world. Some of these medicinal plant species for example *Azadirachta indica* (neem) can treat a number of ailments. In East Africa for example neem is used to treat teeth problems, skin disorders, stomach problems, fever, infections and other disorders. Hence, the name “*muarobaini*” which denotes that the plant can cure forty different diseases. Animals whose body parts are used in traditional medicine include the scrub, the hares (*Lepus saxatilis* and *L. capensis*), the porcupin (*Hystrix africaeaustralis*) the polecate (*Ictonyx striatus*) and the pangolin (*Manis termminkii*).

Medicinal plants also support economic growth through activities related to growing, harvesting, processing and marketing of products. Export of medicinal plants e.g. *Cinchona spp* from which quinine is extracted and *Jateorhiza palmata* generates employment and serves as a source for foreign exchange. Maximillian, *et al.* (2000) reported that a single healer earned on average a net annual income of T.sh 2.3 million (US\$ 2 591 at Tsh 888 exchange rate) from medicinal plants.

Leaves of a number of plant species have stimulatory characteristics (Hamza, 1997). These include plant species such as *Catha edulis* (miraa), *Euphobia serendipida* and *Rhoicissus revoilii*. The fresh leaves and tender young shoots of these trees are chewed to achieve a state of increased alertness and enhanced concentration. Various animal and bird parts are believed to have curative properties. Many forest plants have toxic properties. Some have lethal substances in their different components. The most important use of plant toxins by rural population is the use of certain plant poisons to give arrows more lethal power. Some plant poison e.g. poison from *Sesbania sesban* are used to stun fish so that they can easily be caught. Leaves of a number of plant species have stimulatory characteristics. The fresh leaves and tender young shoots of some trees are chewed to achieve a state of increased alertness and enhanced concentration (Hamza, 1997).

2.2.3. Natural Colorants and Dyestuffs

Natural dye is a chemical compound of natural origin, which is soluble in the medium used to impart colour to a textile and other non-food products (Green, 1995). Natural colorants and dyestuffs are an important group of Non Timber Forest products. They can be of plant or insect origin these products have various end uses. Natural colorants are

employed to impart colour to food products, textiles and other non-food products. In the past a very large number of forest trees and large shrubs were employed for dyeing purpose at the local community level. Today however, usage in developing countries of these natural forest dyestuffs has been reduced substantially owing to competition from synthetics but it has not by any means disappeared.

According to Green (1995) natural dyes produce various shades such as black, yellow, green, blue and purple. Red colour from North African henna plant and orange- brown from the Indian tree, are primarily used to colour fabric materials used to make baskets and walking sticks. Henna plant is also used to colour women's toes, nails, lips, hands and feet. Dyes of various shades can be extracted from a number of indigenous trees in Tanzania. The common tree species that are good sources of dye include *Adansonia digitata*, *Bridelia* spp. *Milicia exelsa*, *Euclea divinaru*, *Pterocarpus angolensis* and *Syzygium cordatum*.

2.3 Plant Craft Materials

Plant craft materials can be defined as all plants species used for weaving products such as mats, baskets, house decorations and rope making. Plant craft materials include fibres from stems, leaves and grasses.

2.3.1 Fibres

Indigenous trees are an important source of fibres (Hamza 1997). Fibres fall into three categories including soft, hard and surface fibres. Soft fibres are obtained from the bast or stem of plants, hard fibres are obtained from the leaf and surface fibre are those which are

borne on the surface of stems, leaves and seeds. Considering their general use, they are classified as textile fibres, brush fibres, weaving fibres, filling fibres, natural fabrics and paper making fibres.

According to Hamza (1997) fibres are important for making items for household use, musical instruments, agricultural product containers such as baskets, bags and granaries, fishing and hunting equipments. They are also used for making cloth items and to produce pulp for paper and rayon manufacture. Fibres from plants species may have multiple uses. Fibre from *Adansonia digitata* can be used for making horse girths and tethers, baskets, strings for musical instruments and brooms. Fibres from *Sesbania aculeate* are best for cordage and first grade fibre pulp for paper and rayon manufacture. Fibres from *Cannabis sativa* are chiefly used for cordage, sacking and sail cloth making. Baskets and bags made from *Oxytenanthera abyssinica* are used for transporting vegetables and fruits. Fibres from violet tree *Securidaca longependunculata* are used to make string and rope for fishing nets and lines, birds and animal snares, thread to sew bark cloth and bead string for necklaces. Fibres from roots are also used for sewing items such as nets, socks, mats, bags and sacks. These are harvested from *Acacia nilotica*, *A. tortilis*, *Adansonia digitata*, *Tamarindus indica*, *Cordia africana*, *Brachystegia spiciformis* and *Lannea schweinfurthii* (Hamza, 1997).

2.3.2 Grasses and Leaves

Grasses from the wild are used for many purposes (Hamza, 1997). For house construction and thatching the following species are important: *Cymbopogon* spp. *Hyperhania* spp. *Sporobolus* spp, *Cyperus* spp, *Typhas* spp, *Phragmites* spp; *Impurata cylindrica*,

Saccharum munja, *Saccharum spontaneum* and *Heteropogon contortus*. For making hats and mat split culms of *Phragmites* spp. and *Arundo* spp are used. *Thysanolaena maxima* is used for making paper, sweeping brooms and fodder. For making ropes *Eulaliopsis binata*, *Desmostrachya bipinnata* and *Saccharum munja* is also used for furniture manufacturing. Palm leaves such as date palm are used widely in construction of houses, granaries and for making fences around compounds. The leaves being flat, strong and fibrous are platted and woven to make baskets, beer strainers, straw hats, mats and chair seats.

2.3.3 Important Plants for Craft Materials.

- **Rattan**

Rattan is the most valuable palm for fibre in South East Asia (Sastry, 2001). It is the second most important forest product (after timber) in this region. They are extremely versatile with a wide range of traditional and local uses. They are used for cords, ropes, hawsers; they are made into baskets and other containers, mats and furniture. Many people depend on sale of rattan and rattan handcrafts or other products to supplement their farm income all year around. Rattan occurs in many varieties and qualities. For furniture making those that are supple and of good colour are best. According to Sastry (2001) Rattans are important commodities in Indonesia, Malaysia, Philippines, Sri Lanka and Thailand. Actually all rattans used in trade are collected from the wild. In East Africa, there is a number of promising species of rattan for coastal and highland rainforests. In these regions rattan are used for furniture making, walking sticks and basketry (Hamza, 1997).

- **Palm**

Wild date palm (*Phoenix reclinata*)

This attractive palm with its characteristic slender, leaning stems is a feature of riverine bush and forest. It is almost always associated with water, either on riverbanks or in swamps (Alice, 2004). *Phoenix reclinata* can reach up to 12 m but is most often between 3 and 6 m. It may be either single or multi-stemmed, sometimes forming a dense, bushy clump. The leaves are arching, bright green fronds and form crowns at the top of the stems. The old fronds remain on the tree and become 'perricoats' as they hang straight down beneath the crown. The flowers appear during August, September and October. Male and female plants are separate. The inflorescences form attractive yellow sprays. Male flowers produce masses of pollen, which is released in clouds. The orange-brown fruits are borne during February, March and April. They are oval in shape and smaller than the commercial date Palm usually grows from the coast to 3000 m (Coates and Palgave, 2002).

According to Alice (2004) this palm could be used as a specimen tree in a large garden with sweeping lawns. It may also form part of a dense wildlife garden planting. When fruiting, it will attract birds and other animals if they are in the vicinity. When young it could be used as a container plant. The wild date tolerates light frost and waterlogged conditions. In colder areas the young plants will need protection from frost for the first few seasons. For propagation by seed, mature fruit should be selected and all the pulp removed. Sow in a mix of river sand and compost. The seeds can either be pressed gently into the medium or covered lightly. Do not allow the medium to dry out. Germination should begin after about a month. Transplanting can be carried out when the first leaf is 50 mm long. Young plants grow quite slowly and will need slow release fertilizer in the

growth medium. For vegetative propagation, suckers from an adult plant can also be removed and planted. Wild date is best planted in full sun but does grow in light shade. The growth rate is variable, depending on a good water supply, which will also probably affect the ultimate size and shape of the palm (Joffe, 2001).

Uses of wild date palm

The leaves are used to make mats, baskets and hats. Brooms for sweeping around rural dwellings are made from the dried inflorescences. The midrib of the frond is used to construct fish enclosures (kraals). Palm wine is made from the sap. People sometimes eat the heart of the crown. Children enjoy the gum produced by the roots. Xhosa boys when undergoing their initiation rites wear special skirts made from the leaves. The fruits are edible and apparently taste quite similar to the commercial date. The spines apparently have traditional medicinal use. Other uses include fuel wood, dye, ornamental, and riverbank protection (Alice, 2004). According to Kahn (1991) Amazonian native palms provide many useful products. All parts of the plants are used: leaves (thatching, basketry, building materials, fibres), trunk (building material, starch), fruits (edible fruit, oil, charcoal), and roots (medicines).

In North Africa, the leaves have been commonly used for making huts (Morton, 1987). Mature leaves are made into mats, screens, baskets, crates and fans. The processed leaflets, combined with ground up peanut shells and corncobs, are used for making insulating board. The leaf petioles have been found to be a good source of cellulose pulp. Dried, they are used as walking sticks, brooms, fishing floats, and fuel. The midribs are made into baskets. The leaf sheaths have been prized for their scent. Fiber from the old

leaf sheaths is used for various purposes including packsaddles, rope, coarse cloth and large hats. It has been tested as material for filtering drainage pipes in Iraq, as a substitute for imported filters.

Propagation

According to Morton (1987) date palms grow readily from seeds if the seeds and seedlings are kept constantly wet. But seedlings are variable and take 6 to 10 years to fruit. Furthermore, 50 % of the seedlings may turn out to be males. The best and common means of propagation is by transplanting the suckers, or offshoots when they are 3 to 5 years old and weigh 18-34 kg. They are usually separated from the parent palm as needed, but in southern Algeria suckers are often put on sale standing in tubs of water. Some offshoots are maintained in nurseries until roots are formed, though most are sets directly in the field after a seasoning period of 10 to 15 days just lying on the ground, in order to lose 12 to 15 % of their moisture. In parts of Egypt subject to annual flooding, very large offshoots up to 226 kg are planted to avoid water damage. The potential of tissue culture for multiplication of date palms is being explored in Iraq, Saudi Arabia and in California.

Doum palm, (*Phoenix dactylifera*)

According to Ruffo *et al.* (2002) doum palms are common in dry areas along river courses and at the coast, 0 – 1 400 m often forming pure stands on deep sand or alluvial soils. It requires a high water table and hot climate for good growth. They are distributed in lowland arid Africa from Egypt through Ethiopia, Sudan, Somalia and Kenya southwards to Kilimanjaro, Morogoro and Mtwara Regions in Tanzania. Ripe fruits are collected from the ground or picked from the tree and eaten raw. The pulp is sweet with a pleasant odor

and much liked by children and herdsman. The kernels are also eaten after breaking the nut. The juice from young fruits is sucked like coconut milk. A good palm wine is produced from sap obtained by tapping the tip of the main stem and the pulp of the fruit is eaten as a remedy for intestinal worms (Ruffo *et al.*, 2002). Other uses include use of leaves as fibre for weaving mats, baskets, hats, fans and for thatching houses. The wood is used for firewood and building poles.

Fan palm (*Hyphane petersiana*)

Fan palm is usually solitary and unbranched, but occasionally several stems may grow together, the narrow dark trunks sometimes leaning or curved, 15-20 m (Ruffo *et al.*, 2002). The stem base is raised on a mass of fibrous roots and the trunk usually has a swelling 1-2 m below the crown. They are found along watercourses in tropical conditions in East Africa inland on alkaline soils with a high water table, elsewhere by the coast. Trees may be numerous on alluvial flats, sandy plains and in many types of woodland. Fan palms are distributed in northern, central, eastern and southern Tanzania from Lakes Manyara and Eyas southwards, throughout the Zambezi region, to Northern Gauteng, Angola, and Namibia through the Congo basin to West Africa. Ripe fruit pulp is eaten raw. Kernels are edible and young fruits produce sweet juice. Palm wine produced from sap is used as medicine for intestinal worms and stomachache. Leaves are used as fibres for making mats, hats, baskets, fans, and for thatching houses (Mbuya *et al.*, 1994).

Massive palm (*Raphia farinifera*)

Mbuya *et al.*, (1994) reported that Massive palm grows in cluster in Swamp forest, reaching 25 m but usually much less. The trunk reaches 60 cm or more across and to 10 m

high, covered with large leaf bases, old rotting ones, plant debris and epiphytes. They are widespread in gallery forests, freshwater swamp forest, along riverbanks and in the western shoreline forests of lake Victoria from zero to 2 500 m a.s.l. Raphias are distributed in Tanga region and other costal areas of Tanzania, Southern highlands as well as on Zanzibar and Pemba Islands. They are also found in Uganda, Kenya, Southern tropical Africa and on Madagascar. According to Mbuya *et al.*, (1994) fruits are crushed in motor, water added, boiled and left to cool. The floating oils is then skimmed off and used in cooking. The outer layer of the young leaflets is easily removed and makes excellent fibre for string, ropes, baskets and mats. The strong midrib is used locally for rafters, chairs and ladders.

2.4 Importance of Non Timber Forest Products (NTFPs)

While there has been a growing concern about forest conservation and biodiversity issues in general since the 1980s, management of NTFPs as viable alternative to timber-based forestry has began to attract attention (Mallik, 2000). More important the realization has already emerged to shift focus on NTFPs whose extraction could meet the objective of revenue generation for the forestry sector without affecting forest conservation measures.

Tewari (1994) reported that forestry experts and policy makers all over the world perceive NTFPs for its economic importance. NTFPs play a crucial role in the daily life and welfare of the people. In recent years, NTFPs have attracted considerable global interest (Conserve Africa Foundation, 2004). This is due to the increasing recognition that NTFPs can provide important community needs for improved rural livelihood. NTFPs contribute to household food security and nutrition, help to generate additional employment and

income, offer opportunities for processing enterprises, contribute to foreign exchange earnings, and support biodiversity conservation and other environmental objectives. Trees and forests contribute in many ways in combating malnutrition and improving diets in local communities and rural households. Not only do they directly provide food and medicines, but also they indirectly improve agricultural production, thereby improving access to food. Trees and forests contribute to improving the well being of local populations by providing a wealth of food, flavourings, medicines and beverages. In fact, it can be said that nearly every tree, shrub or grass species is used in one way or another. Beyond this, they represent a source of income for a large number of people, especially forest communities, who are the main traders of NTFPs.

Further, despite the problematic features of NTFPs, the prominent role of women in their harvest however make them ideal for smothering the flow of food, fodder, fuel and other products for the direct consumption or use of numerical large number of forest dependent communities and also for supplementing their household income. In 1988 forest- based activities in Tanzania employed 730 000 man-years, 25 000 man years working in NTFPs activities (MLNRT, 1989).

2.5 Problems of Utilizing NTFPs

NTFPs have been used throughout tropical Africa for centuries (Leakey *et. al.*, 1994). They are heterogeneous and often dispersed. They vary considerably in their concentration and some are available only during particular seasons. Their problems are varied and complex because the same product can be produced from different raw materials or the same NTFP material can be produced from different products. Therefore their

management needs a mix of different skills, technology and knowledge base (FAO, 1999). Other peculiarities with NTFPs are; these products acquire a value only when an individual collect and brings them to the collection center for sale, their use and access often take place within the context of multiple and overlapping rights, these are links to particular communities and culture and make the information gathering as well as exchange difficult. As a result, the bulk of NTFPs available in the forests is left uncollected and unutilized.

2.6 Commercialization of NTFPs

NTFPs are sold in local and regional markets, and few have found international market (Falconer, 1990). For example, while the pulp of the bush mango (*Irvingia gabonensis*) is eaten fresh, its extracted kernels and those of the related species *I. wombolu*, are traded regionally throughout the year. From Cameroon, this trade extends to Nigeria, Equatorial Guinea and Gabon (Ndoye, 1995). The trade of kola nuts extends from humid zone countries of West Africa up into the dry zone where there is a big demand by the Muslim community. Chewing sticks likewise are traded northwards in West Africa, with a street value put on the trade from Kumasi market in Ghana of about US \$ 9 million per year (Falconer, 1990). In Cameroon, the bark of *Prunus africana* (pygeum) is exported to Europe where pharmaceutical products estimated valued at US \$150 million per year are produced for worldwide trade and treatment of prostate gland disorders (Cunningham & Mbenkum, 1993). In southern Africa, some indigenous fruits are marketed locally as wines and jams, with a liqueur Amarula from *Sclerocarya birrea* fruits (Amarula) now on the international market. In Amazonia, products from the peach palm (*Bactris gasipaes*)

are also being exported. The palm heart trade has been estimated at around US\$ 50 million per annum (Clement and Villachica, 1994), with the fruits also having a similar value.

These few examples indicate that NTFPs have a place in the economies of tropical countries. Those being traded internationally usually involve some processing, either before or after exportation. Currently, most of these products are being collected in the wild, and of the above examples only peach palm is being grown purposefully for export markets (Leahey *et.al.*, 1994).

CHAPTER THREE

3.0 MATERIAL AND METHODS

3.1 Study Area

The study was conducted in four villages surrounding Kileo forest reserve in Kileo ward, Mwanga district. The forest reserve is located in the Western lowlands zone of Mwanga district, one of the six districts of Kilimanjaro Region. Kileo forest reserve is a legally constituted Local Authority Forest Reserve under Mwanga District Council. The DNRO is responsible for its day-to-day management.

The reserve is bordered in the East by Kivulini village, Southern Kenya - Tanzania border and Kwaivonoka/Nanyori river, in the North by Moshi district demarcated by Moshi-Taveta railway line, in the West by Ghona (Himo) river, in the South by Kifaru/Ruvu or Pangani river, at the foot of the Pare mountains and in the South-West by Kileo village (Mwanga District Council, 2000).

3.1.1 Geographical Location

Mwanga district covers an area of 2 641 sq. km and lies between latitude 3°46' to 3°47' South and longitude 37°35' to 37°50' East. It is bordered by Simanjiro district in the West, Kenya and lake Jipe in the Northeast, Same district in the South and Moshi Rural district in the North. The district is mainly comprised of the Eastern and Western Lowlands separated by the main Dar es Salaam - Arusha road and the North Pare highlands.

3.1.2 Communication

Communication structure in the lowlands is comparatively worse than in the highlands. Many villages have poor communication systems, such as poor road and lack of telephone. The eastern lowlands are connected to the Dar es Salaam - Arusha road by a gravel road, which runs around the mountains. The western lowlands are located near the Dar es Salaam tarmac road. According to the District Development Programme (1996 – 2000), road communication in the district is very important, it plays a major role in development of the district, but due to lack of funds improvement and maintenance of roads is difficult.

3.1.3 Topography

Mwanga district is divided physio-graphically into two ecological zones. These are the lowlands, which are about 700 – 1 000 m a.s.l. and the highlands about 1300 - 2200 m a.s.l.. The Eastern and Western Lowlands occupy 600 sq. km (22.1 %) and 1233 sq. km (48.2 %) respectively. The lowland areas include the water bodies of Lake Jipe and Nyumba ya Mungu dam. The highland occupies 808 sq. km (29.7 %). A number of small rivers, streams and springs originate from the mountains (Mwanga District Council, 2000).

3.1.4 Geology

The geological formation of Mwanga district can be characterized according to the differentiation of highlands and lowlands. The metamorphic rocks of the North Pare Mountains are similar to the Usagaran system of the Precambrium. The main rock types encountered are of high-grade metamorphic types. According to their mineralogy and fabric they are best described as granulites and granulites gneiss. On the lowland plains,

however, the Precambrian rocks are extensively covered by superficial Neogene deposits, which include carcareous tuffaceous material derived from the Kilimanjaro volcanicity (Mwanga District Council, 2000).

3.1.5 Climate

Although classified in the tropical savannah area, Kilimanjaro region and thus Mwanga district has considerable climatic diversity. This is mainly due to the presence of mount Kilimanjaro and the North Pare mountains, which stand against the lower surroundings of tropical savannah (Kan, 1977).

The climate in Mwanga district is generally semi-arid. This area experiences predominantly easterly winds, which cause more precipitation (700 – 1 000 mm/year) in the mountains and at the Eastern slopes. The Western lowlands are on the leeward side and receive less annual rainfall (500 – 650 mm) with occurrences of severe droughts. The effects on the leeward are worse further away from the foot of the highlands. The overall distribution of precipitation is poor. About 60 % of the yearly rainfall occurs in less than three months period (mid-March to May). September is the driest month with, an average of less than 10 mm of rainfall. Years of observation reveal that overall rainfall is unreliable and a rainfall cycle of about five years predominates in the district. It comprises of roughly two years of good rains and three years of drought or semi-drought in the district (Nguma and Fute, 1983).

The climate in the Western lowlands is semi-arid. The temperature is highest in January and February and lowest in July and August. The minimum Temperature in July is about

16 °C, while the highest is 32 °C in January. The main characteristic of this zone is the rapid decrease in rainfall with increasing distance from the rain-catching Kilimanjaro mountain (Nguma and Fute, 1983).

3.1.6 Vegetation

The main vegetation in the study area is dominated by savannah grass/trees and shrubs with many *Acacia species* and baobabs. Most households have planted drought resistant trees such as *Eucalyptus species*, *Senna siamea*, *Azadriachta indica* and *Schinus molle* mainly for fuel wood, and various fruit trees such as *Tamarindus indica*, and *Mangifera indica*, coconuts and wild date palm (Nguma and Fute, 1983).

3.2 Data Collection Methods

3.2.1 Research Design

A cross sectional survey design was used that allowed data to be collected at a single point in time (Bailey, 1994). The design uses minimum time and resources. Two types of survey were conducted; social economic survey and field inventory survey. The social economic survey involved interviewing sampled respondents in the households, focus grouped discussion, and interviewing sellers and customers of palm craft material products in the market place. The purpose of the interview was to get information on harvested species, quantity harvested, uses, marketing of palm craft materials and information on other sources of income generation in the household.

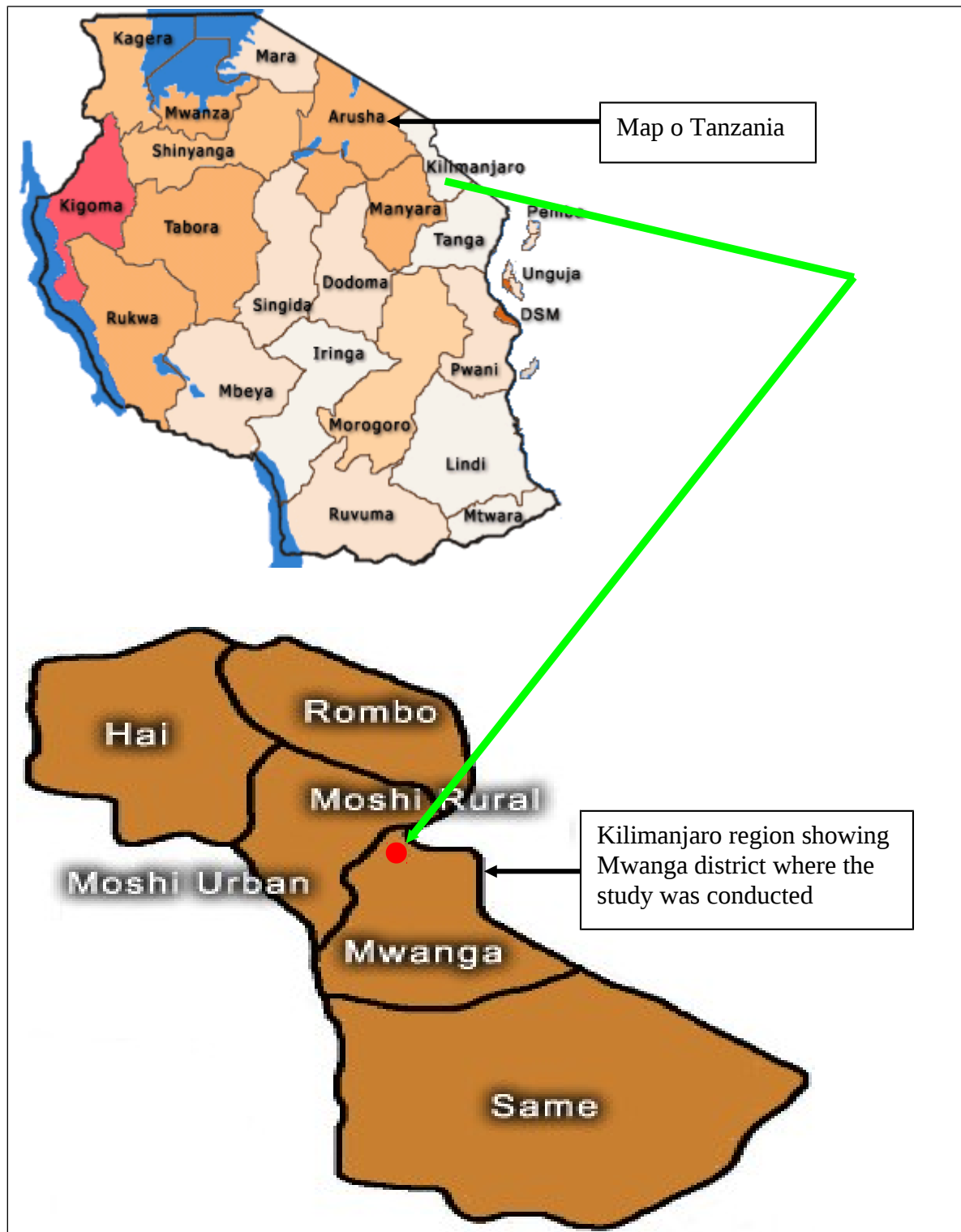


Figure 1: Location of the study area in Mwanga district, Kilimanjaro region

The study was carried in two phases. Phase one constituted a preliminary survey, in which Participatory Rural Appraisal techniques were employed in Kileo, Kivulini, Kituri and Kifaru villages. Pre- testing of questionnaire went alongside PRA exercises to check the reliability and validity of the questions. As a result of the pre-testing, re-arrangement of some questions was done in order to get a good flow of information. The purpose of preliminary survey was to help the researcher to get accustomed to the study area, to plan for the main study, to test the questionnaire and to determine sample size. The second phase was based mainly on questionnaire survey and field inventory survey in Kileo forest reserve and in the general land.

3.2.2 Social Economic Survey

3.2.2.1 Sampling Procedure and Sample size

Multi-stage sampling technique was employed. The choice was based on access to specific individuals in a sample (Babbie, 1995). The division of the population into a frame of primary sampling units characterizes the multi-stage sampling (Philip, 1983). Primary units are selected and each is subdivided into a frame of secondary sampling units. Either final sampling unit is selected or a unit is selected for further subdivision into tertiary stage sampling frames. Multi-stage sampling technique minimizes the costs of accessing specific individual. In this study one division (Mwanga) was selected out of five divisions based on availability of palm craft materials in Kileo forest reserve. Kileo ward was again chosen out of three on the same basis of availability of palm craft materials. Then four villages in Kileo ward were selected. The villages included Kileo, Kivulini, Kituri and Kifaru. A sampling unit in this study was a household. Random sampling of households from the village registers was done. A household here is taken as the unit of analysis

because it is where all decisions about production, collection, investments and consumption are primarily taken (Thomson and Metz, 1997). A household is defined as the members of the family who dwell under the same roof and share the same bowl, and they usually share dwelling houses and may cultivate the same land (Makundi, 1996). Members of the household recognize the authority of one person, the household head, who is the ultimate decision maker (Kajembe, 1994).

According to Boyd *et al.*, (1981) significant population representation is attained when a random sample of at least five percent of the total population is taken from the population. In each household, the household's head was interviewed. However, all other members were encouraged to participate.

3.2.2.2 Participatory Rural Appraisal

Participatory Rural Appraisal (PRA) approach is essentially a process of learning about rural conditions in an intensive and expeditious manner (Mearns, 1994). In each of the four villages (Kileo, Kituri, Kivulini, and Kifaru) a group of twenty-four people formed the PRA group. Methods applied were designed in such a way that they quickly generated information about local conditions and livelihoods.

The method used includes direct observation, participatory resource mapping and modeling, seasonal calendars, semi-structured interviews and local histories. These methods ensured that participants in the discussion were relaxed and thus provided maximum cooperation. These methods were preferred because they assist respondents to evaluate their own situations (Mearns, 1994).

- **Transect walk**

According to Martin, (1995) tribal and non-tribal people who have strong ties to the forest can identify hundreds of productive species and how they are used as source of food, medicine, fibre and construction materials. Having this knowledge in mind, a purposeful selection of at least three people as key informants with the researcher conducted a transect walk through the forest and the general land where palm craft materials grows. Transect walk involved physical observation of presence of palm trees producing craft materials and other products.

- **Questionnaire survey**

Interviews using structured questionnaire were conducted. Both open and close-ended questions were used. In open- ended questions respondents were free to give their own answers. This was used to avoid yes/no answers and to encourage maximum discussion while in close-ended questions alternative answers were provided. Two questionnaire sets were designed for the purpose of data collection from household members and traders of palm craft material and its products (Appendix 3 and 4). Information on species of palm trees producing craft materials, amount of craft material harvested per trees and products produced was recorded. The information collected included also socio-economic variables such as occupation, education, household composition, marketing of palm craft materials (demand of palm craft materials and manufactured products and their prices) and the monthly contribution of palm craft materials and manufactured products to the household. Other information includes alternative household sources of income. A checklist was used to interview key informants such as Village leaders, Ward officer and District Forest Officer (Appendix 5 and 6). Interviews were conducted in Swahili language, the language

understood by all respondents. The time of the interviews was arranged well in advance at the interviewee's convenience to avoid inaccuracy resulting from inconveniencing the respondents.

- **Focused group discussion**

Focused group discussion was conducted in the four selected villages in Kileo Ward. The focused group was comprised of ten men and ten women of different ages, among them were also the Environmental Committee leader and the Village Executive Officer. The meeting discussed on the availability, utilization level, uses, current marketing of palm craft materials and recommending various issues like sustainability of harvesting palm craft material and ways of enhancing contribution of palm craft materials to the household income.

- **Informal discussion**

Informal discussion in form of conversation with local people on utilization of palm craft materials was conducted. Such conversation was held along the ways while walking within the villages, at the shops while taking drinks after work and any other place where it was found appropriate. The information was recorded immediately after the conversation.

- **Participant observations**

Participant observation was amongst the techniques used on arriving at the village in order to overcome problems of orientation in new community. Kajembe and Luoga (1996) explained participation observation as a technique used when entering in a community to overcome feeling of alienation. Much information was obtained by observing what went

on. It provided as initial medium for learning about social and physical environment interrelationships. Curiosity, willingness to learn from other people and ability to adapt to their rhythm and life style were the main tools. This method made people feel comfortable enough with researcher's presence so that more information about their lives was obtained.

3.2.3 Field Inventory Survey

Field inventory survey was done both in the forest reserves where wild date palm were mostly collected and in general land where doum palm grows. Systematic sampling design was used in both areas. After determining the number of plots and transect lines, transect lines were drawn on the map running from East to West. According to Husch *et al.* (1972) the sampling design to meet inventory is determined by the kind of sampling units, their size and shape if on an area basis, the number to be employed and the manner of selection and distribution over the forest area, followed by the procedures for measurements in the selected units and the analysis of the resulting data. Systematic sampling design was chosen mainly because it ensures that all parts of the forests were represented, it results into high precision of estimates and it is easily understood by the inventory team. A Geographical Positioning System (GPS) was used to establish transects and locate sample plots in the field.

Distance from one transect to the next was 200 m sampling intensity of 0.05 % and plot size of 10 m x 10 m for the forest and 5 m x 5 m for the general land were adapted. The difference in plot size studied in forest reserve and general land was caused by spacing between palm trees. In the forest, palm trees were widely spaced while in general land they were closely spaced. A total numbers of 40, 7, 27, 43 and 19 plots were studied in

Kileo forest reserve and in Kileo, Kituri, Kivulini and Kifaru general lands respectively. The distance between plots was 150 m. The number of sample plots was calculated using the following formula:

$$\text{Number of sample plots} = \frac{\text{Forest area (ha)} \times \text{Sampling intensity (\%)}}{\text{Size of the plot (ha)}}$$

Where as: forest area was 191, 37, 215, 135 and 99 ha for Kileo forest reserve and for Kileo, Kivulini, Kituri and Kifaru general land respectively. Sampling intensity was 0.05% and plot sizes was 0.01 ha for forest reserve and 0.0025 ha for general land.

In each plot the information gathered were plot number, position, number of palm trees per plot and number of regenerants.

3.2.4 Secondary Data

Secondary data involved collecting information from different sources including books, journals and official reports in libraries, NGOs, government offices and other institutions. Electronic databases such as CD-ROMs and Websites were also explored.

3.3 Data Analysis

The data from PRA were analysed in the field with the help of the communities. The components of verbal discussion were analysed in detail with the help of content analysis method. Recorded conversations with respondents were broken into smallest meaningful units of information or values and attitudes of respondents and analysed using structured

analysis. Structural analysis seeks to explain social facts, which are related to each other within the social system and by manner in which social system are related in physical surrounding (Kajembe, 1994).

The data collected through structured questionnaire, was coded to facilitate data entry in the computer. Coding refers to systematic organization of data into categories and in this case numerical codes are assigned to responses (Babbie, 1995). For questions that had single answers, the responses were analysed without coding. Data analysis was also conducted using Statistical Package for Social Sciences (SPSS) computer programme. Descriptive statistics such as percentages and frequencies were used for construction of tables.

Forest inventory survey data, were analyzed using Microsoft excel computer programme to obtain the estimated palm craft material per hectare.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Social Economical Survey

4.1.1 Number of Respondents in each study area

The numbers of respondents in each study village are summarized in Table 1. A total of 151 respondents from the four villages were interviewed. The highest representation was Kivulini with 26.5 % and lowest being Kituri 23.8 %. The representation didn't differ much because the number of villagers was almost the same within all four villages. The sample size is above the minimum size of 5 % recommended by Boyd *et al.* (1981).

Table 1: Number of respondents and corresponding percent from each selected village

Village	Total number of villagers	No of villagers interviewed	Percentage of villagers interviewed
Kileo	760	38	25.2
Kivulini	800	40	26.5
Kituri	720	36	23.8
Kifaru	740	37	24.5
Total	3020	151	100.0

4.1.2 Ethnic Groups

The main ethnic group living in Kileo Ward was Pare (74.2 %). Other ethnic groups (Nyamwezi, Nyakyusa, Chaga, Kahe, and Sambaa) constituted about 25.8 % of the respondents. The importance of ethnic groups is to provide indigenous technical knowledge on forest products. Von Liebenstein *et al.* (1993) defined indigenous technical knowledge as the sum of experience and knowledge of a given ethnic group that form the

basis for decision making in the face of familiar and unfamiliar problems. Where as Warren (1988) defined Indigenous Technical Knowledge as a mixture of knowledge created endogenously within the society and that acquired from outside, but then absorbed and integrated within the society. The presence of a number of ethnic groups is advantageous for a society since they can exchange local knowledge on utilization of palm craft materials. The occurrence of other tribes in Kileo ward is due to the fact that formally there was a sisal plantation at Kituri village where many tribes from Tanzanian mainland were recruited for plantation works. Many of these people remained in the ward after the farm was abandoned.

4.1.3 Marital Status of Respondents

Table 2 presents the marital status of respondents. The marital status of respondents has been classified into four main groups that are single, married, separated and widowed. The results in Table 2 indicate that most of the respondents were married (53 %), followed by widowed (21.2 %), separated (14.6 %) and single (11.3 %). These result however, differ from those reported by URT (2004) where 47.4 % were married, 44.2 % single, 4.2 % widowed, 4.0 % separated. The large difference for single group (44.2 % and 11.3 %) could be attributed by differences in religion beliefs. In Kileo ward most of the people were Muslims who according to their faith they are allowed to practice polygamisim. Marital status knowledge was important in assessing how different groups influence the contribution of economic activities especially palm craft production in a household. Married members of a society are responsible to their families thus obliged to work to improve their livelihood.

Table 2: Marital status of respondents

Marital status	Frequency	Percent (%)
Single	17	11.3
Married	80	53.0
Separated	22	14.6
Widowed	32	21.2
Total	151	100.0

4.1.4 Education level of Respondents

Table 3 summarizes the education levels of respondents. It can be noted in Table 3 that 74.2 % of the respondents had primary education, 23.8 % had no formal education, 1.3 % had secondary education and less than 1% had adult education. The study revealed that there were more than one primary schools in each village. The presence of more than one primary school in every village contributed to high percent of respondents with primary education. However, there was only one secondary school in all four villages. This can be one of the reasons of having low percentage of villagers who had secondary education. Other reasons include lack of self-motivation to go to school due to long distance one has to walk to school and early marriage for girls. The high percentage of people with no formal education might be due to historical background that originally people living in the low land of North Pare mountain were pastoralists. Normally nomadic migrate from one place to another thus unable to take their children to school. URT (2003) pointed that pastoralist mobility and a household economy that is traditionally quite dependent on child labour increases the opportunity costs of schooling for pastoral children. This explains the relatively low rates of educational enrolment compared to a national average of 95 %. According to Kamwenda (1998) level of education is considered an important factor in

relation to natural resource utilization and conservation. Kerario (1992) pointed that people with high level of education that is, secondary education and above stand a good chance of adapting and adopting new technologies in conserving, utilizing, processing and marketing of NTFPs. The increasing number of primary schools and the drive by the government for each ward to have a secondary school will improve the situation in the villages surrounding Kileo forest reserve.

Table 3: Education level of respondents

Education level	Frequency	Percent (%)
Primary education	112	74.2
No formal education	36	23.8
Secondary education	2	1.3
Adult education	1	0.7
Total	151	100.0

4.1.5 Household Size

The study indicated that 47.7 % of respondents had households with family sizes ranging between one to four people, 44.4 % had family size ranging between five and eight and 7.9 % had family sizes with more than nine people (Table 4). The average family size for Kileo ward was four people. The results do not differ much with those reported by URT (2004), which indicated that on average most Tanzanian households had three to four members. However, the results differ with those reported by Mhintе (2000) who said that large family of more than eighty members in Kilosa district is common because of extended family network. The small family size in Kileo villages might be attributed by

unfavorable condition for crops production in this area. Most young people out migrate from the village to look for better life elsewhere.

Table 4: Household size in studied village

Household member	Frequency	Percent (%)
1-4	72	47.7
5-8	67	44.4
9-15	12	7.9
Total	151	100.0

4.1.6 Distribution of Respondents by Age

Table 5 presents the distribution of respondents by age. It can be noted in Table 5 that age group of 40-60 years had the highest percentage (49.7 %) followed by age group of 18 - 40 years (30.5 %). The lowest representation was from the age group of greater than 60 years (19.9 %). The age group distribution in the household was important to determine the contribution of each group in production work including palm handcraft. The distribution seems to follow the principle of normal distribution of the population. Household members who could be involved in productive activities are only confined within the age limit of (18 - 60 years). Old members (above 60 years) cannot participate fully in production activities due to their physiological incapacity. The high percentage (49.7 %) of group with age between forty and sixty indicates that most households had high potential of production activities including palm craft production. The findings do not differ much with those reported by Lema (2003) who said that 44 % of the respondent

between thirty-one and sixty years in Morogoro Rural district were engaged in utilization of palm weaving material.

Table 5: Distribution of respondents by age.

Age group (years)	Frequency	Percent (%)
18-40	46	30.5
40-60	75	49.7
> 60	30	19.9
Total	151	100.0

4.1.7 Distribution of Respondents by Gender

Table 6 shows the distribution of male adult group (18 – 60 years) that provide labour in the household. It can be observed in Table 6 that 47 % of the household had one male, 12.6 % had two male and 2 % of household had five male who were actively participated in labour force. The high percentage (47 %) in adult male age group with one male that provided labour was influenced by unfavorable condition in the area for plant growth. When males complete their basic education they are forced to outmigrate from the village to other places in the country to find means of earning income. Large percent (31.8 %) of the household without adult male were those families which were female headed.

Table 6: Average number of adult males and females in a household

Male (18 – 60 years)	Frequency	Percent (%)	Female (18- 60 year)	Frequency	Percentage (%)
0	48	31.8	0	20	13.2
1	71	47.0	1	96	63.6
2	19	12.6	2	23	15.2
3	9	6.0	3	9	6.0
4	3	2.0	4	1	0.7
5	1	0.7	5	1	0.7
9	0	0.0	9	1	0.7
Total	151	100.0		151	100.0

Table 6 also shows the distribution of female adults aged between 18 – 60 years that could provide labour in a household. It can be observed in Table 6 that about 63.6 % of the household had one female, 15.2 % had two females and 6 % of the household had three females who could provide labour. The large percentage (63.6 %) of households with one female were those households headed by female single parent. The high number of households headed by females (23.3 %) observed in the study area might be caused by among other reasons the muslim culture which allows a man to marry up to four wives.

It was also observed that women were the most active group in the palm craft business. A study in Western Bengal reported that women depended to a large extent on NWFPs for self-support and income. According to Rijsoort (2000) women were involved three times more than men in collecting NWFPs.

4.2 Land Ownership and Farm size

The study revealed that about 90.1 % of the respondents owned land and only 9.9 % did not own land (Appendix 1a). Livestock keepers used the communal land while farmers used clan land, rented land or borrowed land. Craftsmen harvested palm craft materials

from the forest reserve and the general land. The 9.9 % of respondents who did not own land were either unable to do farming activities due to either old age or they are visitors. According to Semgalawe (1996) Mwanga district have several types of land tenure systems. These include;

- Village land, which is mostly practiced in the lowlands where land shortage does not exist
- Rented land, which is rented out to individuals in case of shortage of land
- Clan land or inherited land which is owned and controlled by clans through customary laws
- Borrowed land which is borrowed to a farmer who cannot use it due to different reasons like old age, health problems, having several plots and problems in taking care of all in one season
- Communal land which was available for public use and commonly used for grazing purposes and other uncontrolled exploitation.

The study also revealed that 54 % of the respondent had less than one hectare under crop production, 31 % had one to two hectare and 15 % had two to seven hectare under crop production (Appendix 1b). The small farm size in Kileo ward was mainly due to unfavorable climatic condition that does not favour crop production thus forcing villagers to look for other favourable economic activities. The findings are similar to what was reported by Diehl and Omari (1997) for the district that since 1950s, the average farm sizes were declined from 2 ha to less than 0.8 ha because of fast population growth. High population pressure and small field size lead to an intensive land use pattern resulting in decreasing fallow periods and exhausted soils.

4.3 Sources of Household Income

4.3.1 Crop production

The main crops contributed to household income in the study area were maize, beans, and rice. The average maize production was 3.5 bags (100kg/bag) for the household per year. The low and unreliable rainfall is a key factor in causing low maize yield. According to Nkunya (1994) average maize yield lost due to drought in Tanzania was estimated to be 50 % but can be as high as 100 % in dry years. Bagachwa and Maliyamkono (1990) commented that to a large extent weather is responsible for influencing agricultural supply. Maize was not only a food crop but also a cash crop as well. In Kileo ward, the average price of maize was Tsh 24 000 per bag of 100 kg. Beans average production was two bags for a household per year. The average beans price was Tsh 51 000 per bag. Rice production in these farm ranges from 2 to 10 bags. The average rice bag produced was 5.7 bags per year in a household. The average rice price was Tsh 27 500 per bag. The rice production depends on irrigation system which utilized water from Kileo forest reserve. However, the water was not enough hence contributing to low production of rice.

Table 7 shows the income from crop production per month per household. It can be observed in Table 7 that rice contributed Tsh 13 750 per month in a household, beans Tsh 12 750 and maize Tsh 7 200 per month. The high contribution from rice (Tsh 13 750) compared to other crops was mainly due to higher production compared to maize and beans. Maize had minimum contribution (Tsh 7 200) due to low production as well as small selling price compared to beans and rice.

Table 7: Average income from crop production per month per household

Crop	Quantity (kg)	Price (Tsh)	Income (Tsh)
Maize	30	2 400	7 200
Beans	25	5 100	12 750
Rice	50	2 750	13 750
Total			33 700

4.3.2 Livestock Production

Study revealed that 85.3 % of the respondent kept livestock and 14.7 % of the respondents had no livestock. The study shows that most of the respondent (71.5 %) kept chicken, 30.5 % goat, 26.5 % cattle, 13.2 % ducks, and 10.6 % kept sheep. All chickens were kept in free range that is why they are kept by most of the people. Livestock were kept in small quantity in Kileo villages because of draught. Livestock keeping threatened Kileo forest reserve from over grazing. This was also revealed by (Nguma and Fute, 1983).

Table 8 shows the average number of livestock sold and the income accrued from the sales. It can be observed in Table 8 that the highest income (Tsh 80 000) was obtained by selling cattle, followed by the amount obtained by selling three goats (Tsh 48 000). The total income obtained from selling livestock was Tsh 182 000 per year. URT, (1999) pointed that small improvements in productivity per livestock unit on the side of the traditional livestock sub-sector has for a long time been viewed as a proper way of increasing production of livestock in Tanzania. According to (Tanzania National web site, 2006) Livestock production is one of the major agricultural activities in Tanzania. The sub sector contributes to national food supply, converts rangelands resources into products

suitable for human consumption and is a source of cash incomes and inflation free store of value.

Table 8: Annual household income from livestock

	Average Quantity		Average sold	Average sold
	sold per year	Average price	income	income
Livestock		(Tsh)	(Tsh/month	(Tsh/ year)
Cattle	1	80 000	6 700	80 000
Goat	3	16 000	4 000	48 000
Sheep	2	15 000	2500	30 000
Chicken	9	2 000	1500	18 000
Duck	2	3 000	500	6 000
Total			15 200	182 000

4.3.3 Business

The study revealed that 20.5 % of the respondents were engaged in petty business which included selling of sodium bicarbonate salts, bananas, fishing, local brews, shops, barbary, tea shops, quarry, tailoring, charcoal production and bricks making. Table 9 shows that, 44.4 % the respondents earned between Tsh 16 000 and 26 000 per month, 40.7 % earned between Tsh 5 000 and 15 000 per and 14.8 % earned between Tsh 27 000 and 37 000 per month from various business. Variation of income contributed from business was due to business type, in which some are smaller than others. Selling of sodium bi carbonate involves a small capital, as they are feely available hence contributed large profit. The result showed further that the average income from business in the household was about Tsh 24 000 per month. The amount reported in this study is very low compared to that reported by Maximillian (1998) for communities living around North Ruwu Forest Reserve in Kibaha district where business contributed 1 085 960 annually. It was also noted that

those people in Kileo ward who owned business were also engaged in other economic activities like crop production or palm crafting.

Table 9: Household income from business

Income (Tsh)	Frequency	Percent
5 000 –15 000	11	40.7
16 000-26 000	12	44.4
27 000-37 000	4	14.8
Total	27	100.0

4.3.4 Palm Craft Materials

4.3.4.1 Palm Species used as Craft Material

Villagers living in Kileo ward harvest craft materials mainly from two types of palm (Plate 1a and b). The most harvested leaves were from doum palm (*Hyphane compressa*) (83.5%) and a small amount was harvested from wild date palm (*Phoenix reclinata*) (16.5%). Doum palm leaves were harvested in large quantities because they were readily available and there were no regulation restricting their harvest. Also in case of wild date palms which were mostly available in Kileo forest reserve their utilization was controlled by District Forest officers and Village Environmental Committee.

Table 10: Area where palm craft materials were collected

Place of collection	Frequency	Percent
Forest	6	4.0
General land	137	91.8
Public areas and forest	8	5.2
Total	151	100.0

It was found that about 91.8 % of the respondents collected palm craft materials from general land, 4.0 % from the Kileo forest reserve and 5.2 % collect from both general land and forest reserve (Table 10). The reason behind this is the restrictions posed by District Forest Officers and the Village Environmental Committees for products collected from Kileo forest reserve. Unfortunately there is no comparable information in the literature.

**Plate 1a: Wild date palm (*Phoenix reclinata*) found in Kileo forest**



Plate 1b: Doum palm (*Hyphane compressa*) found in general land in Kileo ward

4.3.4.2 Distance Covered to the Harvesting Area

It was observed in Appendix 2a that 77.4 % of the respondents collected wild date palm at a distance of less than 5 km from the household, 19. 4 % harvested at a distance of 5 – 10 km and 3.2 % harvested at a distance longer than 10 km. The results indicated that a large number of respondents who harvested wild date palm were living in the villages close to the forest and very few come from distant villages. These villages included Kileo and Kivulini.

It was also noted that 83.8 % of the respondents collected doum palm at the distance of less than 5 km, 15.4 % harvest at a distance of 5 – 10 km and 0.7 % harvest at a distance longer than 10 km (Appendix 2b). The high percentage of respondents who harvest doum palm at a distance less than 5 km was expected since they were found in general land close to human habitat (Plate 2). The closeness of palm trees to the household makes their

collections easier. These findings differ with what was reported by Leakey *et. al.* (1994) that NTFPs are often dispersed making their collection difficult.



Plate 2: Doum palm around a household

4.3.4.3 Trend of Availability of Palm Craft Material

The study revealed that 45 % of the respondent pointed out that availability of palm craft material was decreasing, 34.4 % pointed out that it was increasing and 20.5 % pointed out that availability of plant craft materials remained constant (Appendix 2c). The reasons advanced for the decrease in the availability of palm craft materials were; increase of population, clearing of general land for farmland, increased incidences of fire, uncontrolled harvesting and increase number of livestock and increase distance to collection area. The high percentage of 45 % of respondents who indicated that the availability of palm craft material was decreasing indicates a need for instituting proper and sustainable use of the resource.

4.3.4.4 Amount of Palm Leaves Harvested from Kileo Forest Reserve and General Land

Table 11 presents the number of butches of palm leaves harvested by households in the studied villages. It can be noted in Table 11 that a total of 456, 324, 250 and 148 butches of wild date palm were harvested per month per household in Kileo, Kivulini, Kituri and Kifaru respectively. A butch consisted of two to three last juvenile leave. It was estimated that four butches of wild date palm and three of doum pam could be harvested per stem per year. The difference in quantity harvested between villages was attributed to the distances from the village to the forest. Kileo and Kivulini villages were close to the forest than Kituri and Kifaru.

The study also showed that the average quantity of doum palm collected per month in four villages were 650, 602, 577 and 279 for Kileo, Kivulini, Kituri and Kifaru respectively. The main reason for the variation between villages is due to availability of doum palm plants and distances to the harvesting area. In Kileo, Kivulini and Kituri doum palm trees were found about four meter walking distance to the household while in Kifaru most of the doum palm trees were found far from the households. Unfortunately there are no comparable information in the literature.

Table 11: Types, average quantity and value of palm leaves harvested per household in different villages in Kileo ward

Palm spp.	Average quantity harvested (butches)				Average price (Tsh)	Average income (Tsh)			
	Kileo	Kivulini	Kituri	Kifaru		Kileo	Kivulin	Kituri	Kifaru
Wild date palm	456	324	250	148	15	14 600	12 000	10 700	5 600
Doum palm	650	602	577	279	12	7 800	7 200	6 600	3 400
Total						14 600	12 000	10 700	5 600

4.3.4.5 Value of Palm Craft Material Harvested from Kileo Forest Reserve and General Land

Table 11 shows the type, average quantity and value of palm leaves harvested per household in different villages in Kileo ward. It can be observed in Table 11 that, the average values of raw wild date palm leaves per month are Tshs 14 600, 12 00, 10 700 and 5 600 for Kileo, Kivulini, Kituri and Kifaru respectively. The average price for one butch was 15 Tsh in all villages. The difference in value between villages was mainly contributed by quantities produced in each village. Kileo village harvested large quantity (456 butches) of wild date palm compared to amount harvested by other villages.

The study also showed that the average income from raw doum palm leaves was Tsh 7 800, 7 200, 6 600 and 3 400 per month for Kileo, Kivulini, Kituri and Kifaru villages respectively. The average price in all villages was Tsh 12. The result also showed that Kileo village earned the highest (Tsh 14 600 per month) from raw palm leaves followed by Kivulini Tsh 12 000. Kituri and Kifaru earned Tsh 10 700 and 5 600 per month

respectively. The income contribution from palm craft materials was very low due to low price per butches. Unfortunately, there is no comparable information in the literature

4.3.4.6 Types, Amount and Value of Weaved Products from Palm Craft Materials

• Type of weaved products

People around Kileo forest reserve produced various products from palm craft materials as shown in Plate 3. The study revealed that a household could specialize in producing one product while others can produce a combination of products to maximize the utilization of raw materials. For example, when making baskets or mats the leftover from the sliced dry leaves can be used for making sweeping brooms. The results in appendix 2d showed that 37 % of the respondents produced soft mats, hard mats, hats, and sweeping brooms. 12.4 % of respondents produced baskets alone, 11 percent produces soft mats, hard mats and basket, and 8.3 % produced hard mat, baskets and brooms. The remaining 31.3 % of the people had various combinations of products. According to Naluswa (1993) different techniques and plant materials are used to weave different products such as granaries, fish traps, seat stools and tables.



Plate 3a: Types of weaved product (large baskets, hard and soft mats, and brooms) from palm craft materials



Plate 3b: Types of weaved product (medium baskets, handbags and winnowing trays) from palm craft materials

• **Amount of weaved products**

Table 12 shows the amount of weaved products produced in Kileo ward. It can be noted in Table 12 that the main weaved products were hard mats, soft mats, baskets, hats and brooms. The average quantity produced per household presented in Table 13 showed that hard mats were produced more in Kituri (14 pieces) followed by Kifaru (10) pieces. Soft mats were produced more in Kileo (15 pieces) followed by Kivulini (7) pieces per household. Baskets were produced more in Kituri (23) followed by Kivulini (21) pieces per household. Handbags were produced in small quantity in all villages i.e. 3, 3, 2, 1 piece per household in Kileo, Kituri, Kivulini and Kifaru respectively. Hats were mostly produced in Kileo (163 pieces) followed by Kivulini (21 pieces) while Kituri and Kifaru did not produce at all. Brooms were almost produced by all villages. Kileo produced more (275) followed by Kituri (233) pieces per household.

The difference in type and amount of product produced between villages might be attributed to availability of palm raw materials, distances to the collection area and skills and local knowledge. Those products that utilize wild date palm leaves as raw materials like soft mats, baskets, and handbags were produced in Kileo and Kivulini villages located near Kileo forest reserve. The products that utilize doum palm leaves as raw material like hard mats and baskets were produced more in Kituri and Kifaru villages with their general land having a lot of doum palm plants. Some products like brooms that utilize both wild date palm and doum leaves were found almost equally in all villages. Unfortunately there is no comparable information in the literature.

Table 12: Amount and value of weaved products produced in the study villages

Product type	Average quantity produced (piece)				Price (Tsh)	Average income (Tsh) per h/h			
	Kileo	Kivulini	Kituri	Kifaru		Kileo	Kivulini	Kituri	Kifaru
Hard mat	9	7	14	10	800	7200	5 000	11 250	8 000
Soft mat	15	5	1	2	5 250	78 750	25 200	5 250	10 500
Basket	14	21	23	18	750	10 500	15 500	17 200	13 800
Handbag	3	2	3	1	550	1 650	1 100	1 400	550
Hat	163	21	0	0	300	48 900	6 300	0	0
Broom	275	49	233	163	55	15 200	2 700	12 800	9 000
Total						162 200	55 800	47 900	41 850

• Value of weaved products

It can also be noted in Table 12 that when compared to other villages Kileo village earned more from palm weaved products (Tsh 162 200 per month), followed by Kivulini (Tsh 55 800 per month), while Kituri and Kifaru earned Tsh 47 900 and 41 850 per month respectively. The average selling price was the same for the same product in all villages. Soft mats contributed more (78 750 Tsh) in Kileo than in all other villages because they were produced in large quantities and also had high selling price compared to other products. The high income from soft mat made Kileo the leading village in income contributed from palm weaved products. However, this product takes more time in its production as it involves more decoration during weaving. It also needs more skill for high quality production than other products. Baskets had more contribution (Tsh 17 200) per month in Kituri than in all other villages because of the large quantities produced and also the close proximity to the raw material. Hats contributed more income in the villages they

were produced (Kileo and Kituri) because its production does not take more time hence could be produced in large quantity per month. Brooms contributed more in household income in villages like Kileo and Kituri because of high production per month. Although brooms had less selling price, they are the easiest in production when compared to other products. Production of brooms utilizes the end sliced leaves used in making other products. The average income contribution from palm weaved products in all villages was estimated to be Tsh 77 000 per month. The total income contribution from both raw palm leave and weaved products in the household was estimated to be Tsh 89 200 per month. The income contribution was above Tanzanian poverty line of Tsh 30 530 per month (Tanzania web site, 2006).

4.3.4.7 Marketing of Palm Craft Materials

- **Status of market**

It was found that 65.9 % of the respondents indicated that the market of raw palm craft material was not good, 24.7 % said that it was good and 9.4 % said the market was satisfactory (Appendix 2e) However, the study revealed that date palm leaves from Kileo forest reserve are highly favoured in regional markets due to its long leaf fibres compared to those from other regions.

For market of weaved products 55.7 % of the respondents pointed out that the market was not good, 23.6 % pointed out that it was good and 20.7 % said that the market was satisfactory (Appendix 2e) The reason given for the unfavorable market condition for both raw plant craft materials and its products were low price in the market caused by few customers and lack of products promotion.

- **Price of raw palm craft materials**

The results show that 98.7 % of the respondents reported a price of raw doum palm to be Tsh 12 per bunch, 14 % reported a price of Tsh 100. The prices differ according to the quality of the doum palm craft material. The result show that 98.7 % of the respondents sold wild date at Tsh15, 0.7 % sold at Tsh 12 and 0.7 % sold at Tsh 50. Like for doum palm the price at the market place differ according to the quality.

- **Prices of weaved palm products**

Table 13 summarizes the prices of weaved products from palm craft materials. It can be observed from Table 13 that soft mat has highest price (Tsh 5 000) per piece compared to other weaved palm products, followed by hard mat and large baskets (Tsh 1 000) per piece. Brooms had the lowest price (Tsh 50) per piece. The reason for soft mats to be sold at higher price was due to high quality and the long time it takes to produce them. Normally one can produce one to two soft mats per month. The reason for broom having the lowest price when compared to all weaved products from palm craft materials might be due to presence of industrial substitutes.

Table 13: Prices of weaved products from palm craft materials

Type of material	Price (Tsh)
Hard mat	1 000
Soft mat	5 000
Basket	
Small	200
Medium	400
Large	1 000
Hat	400
Broom	50

4.3.4.8 Role of Gender in Harvesting and Weaving of Palm Craft Materials

• Contribution from raw palm craft materials

Table 14 shows the Contribution of raw palm leaves to household income by gender. It can be observed in Table 14 that 87.5 % females and 12.5 % males earned an income of more than Tsh 60 000 per month from raw palm leaves, 57.9 % females and 42.1 % males about Tsh 30 001 - 60 000 per month, and 74.6 % females and 25.4 % males between Tsh 1 000 - 30 000 per month. It can also be noted that for all three categories of income females earn more from palm leaves than male. This implies that more female were engaged in harvesting and making palm leaves products. It also implies that female plays a great role in income contributed in the household compared to men. Different studies have showed that women are more involved in NTFPs collection than men. These studies include that by Green and Thrupp (1998) in South Africa, Kessy (1998) in East Usambara, Katani (1994) in Mwanza district and Rijsoort (2000) in Western Bengal.

Table 14: Contribution from raw palm leaves in the household by gender

Contribution of plant leaves to h/hold income/ month (Tsh)	Sex of respondent (%)		Total (%)
	Male	Female	
1,000-30,000	25.4	74.6	100.0
30,001-60,000	42.1	57.9	100.0
> 60,000	12.5	87.5	100.0
Total	26.8	73.2	100.0

• **Contribution from weaved palm products**

Table 15 shows the Contribution of weaved palm products to household income by gender. It can be observed in Table 15 that 2.4 % females and 3.6 % males earned an income of more than Tsh 60 000 per month from weaved palm products, 5.5 % females 12.2 % males earned between Tsh 30 000 and 60 000 per month and about 76.4 % of females and 61 % males earned Tsh 1 000 – 30 000 per month. It can be noted that in making weaved products there is only a small difference between males and females. The reason for this was due to the nature of the work that it does not involve much energy hence it can be done by elder men who could not afford doing other production work.

Table 15: Contribution of weaved palm products in the household by gender

Sex of respondent	Contribution of weaved palm products to h/hold income				Total (%)
	0-999	1 000 – 30 000	30 000 – 60 000	> 60 000	
	Tsh (%)	Tsh (%)	Tsh (%)	Tsh (%)	
Male	24.4	61.0	12.2	2.4	100.0
Female	14.5	76.4	5.5	3.6	100.0
Total	17.2	72.2	7.3	3.3	100.0

4.4 Field Inventory Survey

4.4.1 Stocking of Palm Trees in Kileo Forest Reserve

4.4.1.1 Regenerantes

Table 16 shows the number of regenerates per ha for both date and doum palm. It can be noted in the table that there are more regenerants of wild date palm (25 403) compared to doum palm (8 404). The high number of regenerants indicates that there is a high potential of the plants to survive perpetually if managed well.

4.4.1.2 Stems

The number of stem per ha for both date and doum palm are presented in Table 16. As indicated in Table 16 there were more wild date palm stems per ha (133) than doum palm stem (44 per ha) in Kileo forest reserve. Number of the stems indicates that there is a potential of harvesting palm and doum leaves.

Table 16: Amount of wild date and doum palm which could be harvested in

Kileo Forest per year

Palm plant spp.	No of regenerants	No	Harvestable	Forest area	Total harvestable batches per year
		of stems per ha	batches/stem/y ear		
Wild date palm	25 403	133	4	191	101 612
Doum palm	8 404	44	3	191	25 212

4.4.2 Harvestable Palm Craft Material from Kileo Forest Reserve and in General

Land

4.4.2.1 Harvestable Palm Craft Material from Kileo Forest Reserve

Table 16 presents the amount of wild date and doum palm which could be harvested in Kileo forest reserve per year. It can be observed in Table 16 that the total amount of harvestable wild date palm from the forest were 101 612 butches per year. The total amount of harvestable doum palm from the forest per year were 25 212 butches. Wild date palm was found to dominate the whole forest reserve especially in the northern part. Wild date palm can be harvested four times a year and doum palm three times a year. This is because wild date palm leaves sprout faster than doum palm leaves after harvesting.

4.4.2.2 Harvestable Palm Craft Material from Kileo General Land

Doum palm plants were mainly available in the general land surrounding the villages. Table 17 shows the amount of doum palm which could be harvested in the general land surrounding Kileo villages. The results in Table 17 indicates that among the studied areas the general land surrounding Kivulini village posses the highest amount of harvestable doum palm (64 500 butches) due to its large area, followed by Kituri (27 000 butches) Kifaru (19 740) and lastly Kileo with 3 700 butches per month. The area covered by doum palm in Kileo ward is a continuation of doum palm vegetation belt extending from Moshi Rural district. The general land where doum palm was found is under pressure due to farmland extension and lack of management plan for doum palm. In Kileo village most of the general land has been converted to farmland. In other villages the land covered with doum palm is not favorable for crop production. Unfortunately, there is no comparable information in the literature.

**Table 17: Amount of harvestable doum palm in general land surrounding the
four villages in Kileo ward**

Village	No of stems per ha	Harvestable batches/ stem/ year	Area under doum palm(ha)	Total harvestable batches per year
Kivulini	1 200	3	215	774 000
Kituri	800	3	135	324 000
Kifaru	800	3	98.7	236 880
Kileo	400	3	37	44 400
Total				682 680

4.5. Contribution of Palm Craft Materials to Household Income in Kileo Ward

Table 18 shows the contribution of various sources to the annual household income in the study villages. It can be observed in Table 18 that craft materials had the highest contribution to the household income (56 %) followed by agriculture 21 %, business 15 % and livestock 8 %. The results differ from those reported Nyingili (2003) who pointed that the contribution of NTFPs to household income in Mbozi district was 7.5 percent. This difference might be caused by differences in availability of NTFPs in the two areas. Another reason might be that in Kileo ward working with palm craft material was a daily household core or fulltime job where as collection of NTFPs in Mbozi was done mostly as part time. The contribution of agriculture (21 %) is very low compared to the reported (85.9 %) by Hamza and Msalilwa (2004) for Mgori forest reserve. This might be caused by erratic and unreliable rainfall in Kileo. Kan (1977) pointed that erratic and unreliable rainfall resulting into frequent crop failure and difficult in animal keeping in Kileo ward.

Palm craft material production has significant contribution to household income in the villages around Kileo forest reserve. A t-test for the hypothesis on the contribution of palm craft materials in household income showed that there was significant contribution ($P < 0.01$) of plant craft materials to household income.

Table 18: Contribution of various income sources to the annual household income in the study area

Source of income	Contribution to household (Tsh)	Percentage contribution (%)
Palm craft materials	1 053 400	56
Agriculture	404 400	21
Business	288 000	15
Livestock	182 400	8
Total	1 928 200	100

4.6 Potential of Kileo Forest Reserve and the General Land in Enhancing Household Income

Table 19 shows the number of butches of wild date and doum palm currently harvested and the amount which could be harvested from Kileo forest and the general land. Since Kileo forest reserve is owned by the District council, each village had an equal chance of harvesting wild date palm leaves from it thus each village was allocated an equal amount for the calculations. It was found that Kileo forest reserve and the general land have the potential to supply a total of 8 468 and 114 940 butches of wild date palm and doum palm per month respectively. Currently a total of 1 178 and 2 108 butches of wild date palm and doum palm respectively were harvested per month. This indicates that the villagers harvest only about 13.9 % and 1.8 % of wild date palm and doum palm respectively.

Table 19: Percentage of palm craft material harvested in Kileo forest reserve and the general land

Village	Amount of wild date palm /month			Amount of doum palm /month		
	Currently	Left in the	Percentage (%)	Currently	Found in	Percentage

	harvested	forest	harvested	harvested	general land	harvested (%)
Kileo	456	2117	21.5	650	3 700	17.5
Kivulini	324	2117	15.3	602	64 500	1.0
Kituri	250	2117	11.8	577	27 000	2.0
Kifaru	148	2117	6.9	279	19 740	1.4
Total	1 178	8 468	13.9	2 108	114 940	5.5

It can be observed in Table 19 that all four villages harvested very little compared to what both the forest reserve and the general land could supply. Kileo village had highest percentage (21.5 %) harvested of wild date palm followed by Kivulini (15.3 %), Kituri (11.8 %) and lastly Kifaru (6.9 %) compared to what was available in the forest. The difference in wild date palm harvested between villages was attributed to the distances from the village to the forest where wild date palm was mainly obtained. Kifaru is very far from the forest than all other villages followed by Kituri Kivulini and Kileo. Another reason could be the restriction to harvest in the forest reserve posed by District Forest Office and Village Environmental Committee.

Doum palm leaves were also under harvested in all villages. Kileo village harvested (17.5 %), followed by Kituri (2 %), Kifaru (1.4 %), and Kivulini (1.0 %) compared to what was available in their village general land. The main reasons for under harvested of doum palm in both villages were due to engagement of other production activities and low motivation caused by unfavorable marketing of both raw and weaved products. Both villages still have high potential for doum palm utilization to increase their household income. According to Conserve Africa Foundation (2004) non- timber forest products can provide important community needs for improved rural livelihood. The large quantity of wild date palm craft materials (101 612 butches) per year in Kileo forest reserve implies that the

forest has high potential in contributing to poverty alleviation by increasing household income to the people in Kileo ward. This could be possible if palm craft materials available will be well managed with proper utilization. Also to realize this, villagers should be helped to organize themselves to form production and marketing groups.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The following conclusions were made from the study:

- Palm craft materials contributed significantly ($P < 0.01$) to household income in western lowland zone in Mwanga District.
- The main palm species harvested by Villagers living around Kileo forest reserve were doum palm (*Hyphane compressa*) (83.5 %) and wild date palm (*Phoenix reclinata*) (16.5 %). The palm craft materials were collected for various reasons including provision of household income (76.9 %) and for household use (23.1 %).
- Availability of palm craft materials in certain part of Kileo was decreasing due to increase of population, clearing for farmland, increased incidences of fire, uncontrolled harvesting, increase number of livestock and increasing availability of industrial substitute products such as baskets, trays, mats and brooms.
- Currently utilization of palm craft materials in Kileo is very low compared to what the forest can supply. Thus there is a high possibility to increase the contribution of palm craft materials to household income.

- The market status of palm craft materials was not good due to among other reasons lack of products promotion.
- More females than males were involved in palm craft material utilization. However more female were involved in utilization of palm craft materials.

5.2 Recommendations

From the proceeding conclusions, the following recommendations were made:

- In order to utilize the full potential of palm craft materials product development and promotion should be conducted.
- To enhance marketing of plant craft materials, villagers in Kileo ward should organize themselves into economic groups dealing with their utilization. This will enable them to access loans and funds for the groups.
- Harvesting plan for both general land and the forest reserve should be developed to utilize full potential of the palm craft materials.
- The general land surrounding Kileo ward villages should be managed in a sustainable manner through Participatory Forest Management.
- Further studies on domestication and commercialize the useful palm specie should be carried.

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APPENDICES

Appendix 1: Information on crop production economic activity

Appendix1a: Percentage of respondent who own land

Yes/No	Frequency	Percentage	Cumulative percent
Yes	136	90.1	90.1
No	15	9.9	100
Total	151	100	

Appendix 1b: Percentage area under crop cultivation (ha)

Hectare	Frequency	Percent	Cumulative Percent
0.00	72	47.7	47.7
0.50	10	6.6	54.3
0.75	1	0.7	55.0
1.00	39	25.8	80.8
1.25	4	2.6	83.4
1.50	5	3.3	86.8
1.75	1	0.7	87.4
2.00	8	5.3	92.7
2.50	2	1.3	94.0
2.75	2	1.3	95.4
3.00	5	3.3	98.7
4.00	1	0.7	99.3
7.00	1	0.7	100.0
Total	151	100.0	

Appendix 2: Utilization of plant craft materials in the household

Appendix 2a: Distance covered to where wild date palm leaves are harvested

Distance (km)	Frequency	Percent	Cumulative Percent
< 5	48	77.4	77.4
5-10	12	19.4	96.8
11-20	1	1.6	98.4
> 20	1	1.6	100.0
Total	62	100.0	

Appendix 2b: Distance covered to where doum palm leaves are collected

Distance (km)	Frequency	Percent	Cumulative Percent
< 5	114	83.8	83.8
5-10	21	15.4	99.3
11-20	1	0.7	100.0
Total	136	100.0	

Appendix 2c: Trend for utilization of plant craft materials

Trend	Frequency	Percent	Cumulative Percent
Increasing	52	34.4	34.4
Decreasing	68	45.0	79.5
Neither increasing nor decreasing	31	20.5	100.0
Total	151	100.0	

Appendix 2d: Weaved products from plant craft materials

Weaved product	Frequency	Percent	Cumulative Percent
Hard mat	3	2.1	2.1
Baskets	18	12.4	14.5
Hand bags	3	2.1	16.6
Hats	2	1.4	17.9
Soft, Hard mat & Basket	16	11.0	29.0
Soft, Hard mat, hats, broom, handbag & Basket	55	37.9	66.9
Hand bags, hats & hard mat	2	1.4	68.3
Hand bags & baskets	7	4.8	73.1
Hand bags, baskets & hard mats	7	4.8	77.9
Hard mat & broom	3	2.1	80.0
Hand bags & hard mats	3	2.1	82.1
Basket & hard mats	6	4.1	86.2
Baskets, soft mats & ornamentals	3	2.1	88.3
Hand bags, hard mats & brooms	1	0.7	89.0
Hand bags & hats	1	0.7	89.7
Hard mat, baskets & brooms	12	8.3	97.9
Soft mats & hats	1	0.7	98.6
Hard mat & broom	1	0.7	99.3
Brooms & baskets	1	0.7	100.0
Total	145	100.0	

Appendix 2e Market status of raw palm craft material

Status of raw palm leaves	Frequency	Percent	Cumulative Percent
Good	21	24.7	24.7
Not good	56	65.9	90.6
Average	8	9.4	100.0
Total	85	100.0	

Status of weaved products			
Good	33	23.6	23.6
Not good	78	55.7	79.3
Average	29	20.7	100.0
Total	140	100.0	

Appendix 3: Questionnaire for household's survey

Division.....

Ward.....Village.....

PART 1. General information

1. Respondent's status in the family
 - 0.1 Head of house hold
 - 0.2 Member of household

2. Sex
 - 0.1 Male
 - 0.2 Female

3. Age
 - 0.1 18 –40 years
 - 0.2 40- 60 years
 - 0.3 > 60 years

4. Marital status
 - 0.1 Single
 - 0.2 Married
 - 0.3 Separated
 - 0.4 Widowed

5. Tribe
 - 0.1 Pare
 - 0.2 Not Pare (Name of other tribe)

6. For each age category that I read, indicate the number of people in your household and whether or not they provided labour during the past farming season/year

Age groups of household members	Number	No. Provided labour
< 5 years		
6 – 17 years		
Male 18 – 60 years		
Female 18 – 60 years		
> 60 years		
Total		

9. Do the household members provide enough labour for your crop production activities?

0.1 Yes

Go to 11

0.2 No

10. Explain

11. Do the household members provide enough labour for craft material production?

0.3 Yes

Go to 13

0.4 No

12. Explain.....

13. What is your education level?

0.1 No formal education

0.2 Primary education

0.3 Secondary education

0.4 Post secondary education

PART11: Agricultural Production, livestock production, business and other economic activities in household economy

A. Agricultural production

1. Do you produce your own agricultural products?

0.1 Yes

0.2 No

2. If No why?

Go to B.

.....

3. If yes, what was the total area cultivated in the last crop season/ year?

and fill in the table below

Crop	Area (acres)	Production	Bags	sold	Price/per	Total
type		(bags)	(No.)		bag (Tshs)	income/ year

.....

B. Livestock production

1. Do you own livestock?

0.1 Yes

0.1 No

2. If No why?

Go to C.

.....

3. If Yes, please fill in the table below.

Animals/chicken	No of livestock	No of livestock sold /year	Price/each	Total income/year
Cattle				
Goat				
Sheep				
Chicken				
Duck				

C. Business

1. Do you have business which contribute to your household income

0.1 Yes

0.2 No

2. If No why?

.....Go to **D**.

3. If Yes what type of business?

.....

4. How many months in a year do you conduct that business?

0.1 At least six month

0.2 One year

0.3 Below three month

5. What is the income accrued from the business per month?

0.1 10,000 - 50,000/

0.2 50,000 – 100,000

0.3 Above 100,000

D. Other economic activities

1. Do you have any other economic activities that contribute to the household income?

0.1 Yes

0.2 No

2. If No, why?

.....

3. If Yes, what other activities do you conduct?

.....

4. What is its monthly contribution to the household income?

0.4 10- 50,000/

0.5 50,000 – 100,000

0.6 Above 100,000

Part 111. Utilization of craft materials for the past ten years and current status

1. How long have you been living in this village?

0.1 More than 10 years

0.2 Between 10 to 20 years

0.3 Between 20 to 30 years

0.4 More than 30 years

2. What craft materials do you collect/use from forests? (Mention them)

0.1

0.2

0.3

0.4

0.5

3. What could be the reasons for collecting these craft materials?

.....

4. Where do you collect the craft materials?

0.1 Forest

0.2 General land

5. What seasons do you collect these craft materials?

0.1 Dry season

0.2 Wet season

0.3 Both seasons

6. What do you think are the reasons for collecting on the season selected above?

.....

7. How do you assess the utilization of craft materials for the past ten years.

0.1 Increasing

0.2 Decreasing

0.3 Remained the same

8. What might be the reasons for the above answer?

.....

9. How far is the forest where craft materials are collected?

0.1 Less than 5 km

0.2 Between 5 and 10 km

0.3 Between 10 and 20 km

0.4 More than 20 km

10. How far is the general land where craft materials are collected?

0.1 Less than 5 km

0.5 Between 5 to 10 km

0.6 Between 10 to 20 km

0.7 Greater than 20 km

11. What do you think should be done for sustainable availability of craft materials?

.....

12. Is there any attempt to domesticate plants/trees that provide these products?

.....

13. Is there any specific conditions that favour the growth of craft materials?

.....

B. Utilization level and contribution of craft materials to house hold income per year

1. What is the quantity and contribution of craft material to your household?

Species	where do you collect(forest/public land)	Collection/day(kg/ bunches/each)	No of collections in a month	Quantity sold /month (kgms/bunch/each)	Price per kgms, bunches each	Total income/ year
<hr/>						

2. What is the contribution of weaved craft products to the household income.

Weaved product	Daily production (each)	Production n/month (each)	Months of production in a year	Quantity sold /month	Price/each	Total income/year
----------------	-------------------------	---------------------------	--------------------------------	----------------------	------------	-------------------

D. Uses of craft materials

1. How are the craft materials harvested?

0.1 Part of the tree

0.2 Felling the whole tree

2. What are the parts of craft materials harvested and their uses? (fill in the following table below.)

Species	Part harvested	Uses
---------	----------------	------

3. What is the mostly collected species?

.....

4. What products are made from palm craft materials

Palm species	Products
--------------	----------

G. Processing and marketing of palm craft materials

1. How do you process the craft materials before used for weaving?

.....

2. What do you do to increase the quality of the weaved products?

0.1 Addition of dye

0.3 Other (specify)

3. What is the market status of the craft material?

0.1 Good

0.2 Not good

4. If not good what do you think are the reasons?

.....

5. What is the market status of the weaved products?

0.1 Good

0.2 Not good

6. If not good what do think are the reasons?

.....

7. What do you think can be done to increase the marketing of craft materials and its products?

.....

8. Where do you sale the craft materials

0.1 Local

0.2 Region

0.3 Local and region

0.4 Out side the country

0.5 Local and outside the country

0.6 Region and Outside the region

0.7 Local, regional and outside the region

9. Mention the places where you sell craft materials (fill in the following table below)

Name of local market	Name of region	Name of area out side country
----------------------	----------------	-------------------------------

10. Mention the places where you sell the weaved craft materials (fill in the following table below)

Name of local market	Name of region	Name of are out side country
----------------------	----------------	------------------------------

11. What is the rate of demand of craft materials/products?

0.1 High

0.2 Low

12. What do you think can be done to fetch a market outside the region?

.....

13. Do you think craft material have potential contribution to your household income.

0.1 Yes

0.2 No

14. If No why?

.....

15. If yes what do you think can be done to enhance the contribution of craft materials to your household income?

.....

Appendix 4: Questionnaire for palm craft materials market survey

1. Name of the village market

Date.....

2. Name of Vendor.....

3. Type of Vendor

0.1 Permanent stall

0.2 Temporary stall

4. How long have you been selling in this market?.....years/months

5. Do you produce yourself what you sell or buy and sell?

0.1 Produce and sell

0.2 Buy and sell

6. If you produce yourself, where do you collect the craft materials?

.....

7. If you are buying where do you buy the products?

.....

8. What type of craft materials are you selling (Please fill in the table below)

Craft materials	Price Tsh/unit	Quantity sold (Bunch)	Relative rate of demand	Seasonality	Constraints
-----------------	-------------------	-----------------------------	----------------------------	-------------	-------------

9. What type of weaved products are you selling (Please fill in the table below)

Product/ Weaved materials	Price Tsh/unit	Quantity sold	Rate of demand	Seasonality	Constraints
---------------------------------	-------------------	------------------	-------------------	-------------	-------------

10. How do you compare present sales from to the past five years?

0.1 More

0.2 Less

11. What do you think is the reason for the above answer?

0.1 Availability

0.2 Demand

0.3 Others (specify)

12. What is your comment regarding marketing of craft materials/products?

.....

Appendix 5: Check list for District forest officer

Name of officer.....Title

District.....Division Ward

Village..... Date.....

1. For how long have you been in this district?.....

2. What craft material does people collect/use from forests? (Mention them)

.....

3. What could be the reasons for collecting these craft materials?

.....

4. Are these craft materials from forests reserved or open access?

.....

5. What seasons do they collect these craft materials? (Mention the product and the season)

6. How do you assess the utilization of craft materials from the forests for the past ten years?

.....

7. What might be the reasons for the above answer?

.....

8. For how long do you think the forest will continue to provide craft materials?

.....

9. Is there any management plan for conservation and utilization of craft materials?

.....

10. Is there any licensing system that is used to control extraction of craft materials from the forests?

11. What do you think are the ecological impact on craft material use?

.....

12. What do you think should be done for sustainable availability of craft materials?

.....

13. Is there any attempt to domesticate plants/trees that provide these products?

.....

14. Is there any specific conditions that favour the growth of craft materials?

.....

15. Is there any sustainability in the production of craft materials?

.....

16. What do you think should be done to make it sustainable?

.....

Appendix 6: Check list for Ward/village officers

Name of officer..... Title

District.....Division Ward

Village.....Date.....

1. For how long have you been in this Ward/village?

2. What craft material does people collect/use from forests? (Mention them)
.....

3. What could be the reasons for collecting these craft materials?

4. Are these craft materials from forests reserved or open access?

5. What seasons do they collect these craft materials? (Mention the product and the season).....

6. How do you assess the utilization of craft materials from the forests for the past ten years?.....

7. What might be the reasons for the above answer?
.....

8. For how long do you think the area will continue to provide craft materials?.....
.....

9. What do you think should be done for sustainable availability of craft materials?
.....

10. Is there any attempt to domesticate plants/trees that provide these products?

.....

11. Is there any specific condition that favours the growth of craft materials?

.....

12. Is anyone allowed to owning the area where palm craft materials are collected?

.....

13. What is the market status of the craft materials?

.....

14. Do you think the craft materials have any potential in income contribution to the household?

0.1 Yes

0.2 No

15. What do you think should be done to enhance contribution of craft materials to household income?

.....