

**RURAL WOMEN'S PARTICIPATION IN AGRO FORESTRY
AND ITS IMPLICATIONS ON A SUSTAINABLE
ENVIRONMENT IN NYANDO DISTRICT, KENYA.**

BY

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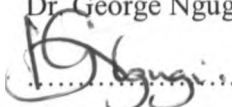
DECLARATION

This Thesis is my original work and has not been submitted/presented for a Degree in any other University.


.....
Leah Akinyi Onyango

17/10/02
.....
Date

This Thesis has been submitted for examination with my approval as a University Supervisor.

Dr. George Ngugi

.....

Date
23/10/02
.....

DEDICATION

To Peter: For what has been and what will be

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ABSTRACT

Poverty has led to a deterioration of the rural environment in Nyando District. This study set out to examine women's participation in agroforestry as a land use approach that can contribute to a sustainable rural environment with a view to recommending appropriate approaches for effective implementation of agroforestry in Nyando District. Research data was obtained from both primary and secondary sources. Relevant Government officials, Non-Governmental Organizations (NGOs) and Community Based Organizations (CBO's) were interviewed throughout the district. Various questionnaires were administered to selected sample groups and several focus group discussions were conducted.. In addition a physical survey of the whole district was carried out. The Data collected was subjected to several analytical techniques.

The study found out that due to historical factors Nyando District has two distinct regions. The settlement schemes with a cash economy and the former "native" reservations with a subsistence economy. This situation continues to be reflected in the people's way of life to date. Consequently agroforestry in Muhoroni Division is more market-oriented whereas in North East Nyakach it is primarily a subsistence activity. The study established that Agroforestry is widely practiced in the District with fruit tree farming being it's most widespread form (81.9%) However, the traditional forms of agro forestry are practiced more than the innovative forms. The study also established that agroforestry is practiced extensively but not intensively, while women practice most forms of agroforestry. Cultural practices and beliefs constrain women's participation in some forms of agro forestry such as live fencing and boundary planting which are associated with land ownership.

The *Orundu* which is a homestead garden is an indigenous practice in which most households in the community are involved (98%). It is the woman's garden and there she has complete autonomy. The most common activity in the *Orundu* is cultivation of traditional vegetables. However, the *Orundu* has potential for agroforestry especially fruit tree growing which is widely practiced in the district.

The study concludes that although agroforestry is widely practiced in Nyando District the full potential is yet to be realized. The current District Development Plan (2002 –

2008) for Nyando has selected agro forestry as a priority area for development which is an indication that efforts are being made towards further developing agroforestry.

There exists a role for women in agroforestry and this is evident in the level of their participation. It can however be enhanced through mainstreaming gender in agro forestry. The *Orundu* can be used as a pilot plot to test agroforestry innovations targeting wome. These can later be replicated in the main farm holdings.

CHAPTER 1 - INTRODUCTION

1.1 Overview

Reducing global poverty is the fundamental challenge of the 21st century (World Bank, 2000), but this must be integrated with environmental concerns, if sustainability is to be achieved (UNCED 1992). This is because environmental deterioration undermines the long-term capacity for sustainable development and poverty reduction. On the other hand, poverty facilitates environmental deterioration.

The Poverty - Environment relationship (Fig No. 2.1) creates a situation where the rich grow richer because they can afford to use the natural resources in an optimal manner, while the poor grow poorer because they must address their immediate survival needs, even when they conflict with the long term needs to preserve the environment. In addition, Poverty and environmental degradation increase susceptibility to natural disasters (Wijkmam and Timberlake 1988). Poverty is more acute in the third world than in the developed countries and is still increasing. A World Bank report (2000) indicates that in 1987, 217.2 million people in sub Saharan Africa were living below the poverty level of one USA dollar (\$ 1) a day. By 1998 this figure had risen to 290 million people.

There are Rural - Urban differences that reflect the scale and nature of poverty. Rural areas in the third world in general and Africa in particular, are characterized by acute poverty and environmental deterioration. Since rural economies are agro-based (with both cash and subsistence agriculture), the quality of the environment is a fundamental factor in maintaining and improving the living standards of the growing population (ICRAF, 2000), Environmental deterioration in the rural areas is a result of the rural poor using inappropriate farming methods and over exploiting the environmental resources in an effort to meet their basic needs such as sanitation, food, shelter, and clothing.

In Kenya poverty levels are equally high. According to the National Poverty Eradication Plan of 1999- 2015 comparatively, there is more poverty in the rural areas than in the urban areas. The report indicates that more than 4/5 of the Kenya's population is located in the rural areas and the bulk of this population is dependent on agriculture. This implies that to address rural poverty in Kenya, one must address agriculture on which most of the rural populations depend. Nyando District has an

economy based on agriculture and fishing. In the areas of Nyando bordering the shores of Lake Victoria (Lower Nyakach Division and parts of Nyando Division), fishing is carried out on both subsistence and commercial levels. The fishing industry in Lake Victoria has suffered severe drawbacks as a result of the lake being colonized by the water hyacinth, over fishing and introduction of the Nile perch.

According to the 2002-2008 District Development Plan for Nyando District, the agricultural sector has been performing poorly. The cash crops in the district which are cotton, rice and sugar cane have experienced problems of mismanagement. The cotton industry and the rice industry have since collapsed. The sugar industry is barely operational. Some of the problems which affect these cash crops are caused by unfair competition from cheap imports allowed into Kenya as a result of liberalization.

The observed trends in the district indicate increasing rural poverty and environmental deterioration. This is a trend, which, if not arrested on time can have far reaching consequences on the livelihoods of the local populations. The problems of poverty and environmental deterioration are inter-twined and therefore, one cannot be addressed without the other. In that respect, it becomes necessary to seek ways of reducing poverty that are integrated with sound environmental practices.

One of the ways of reducing rural poverty is in this manner which is compatible with environmental conservation is through agroforestry. Agroforestry can be viewed as a collective name of all land use systems and practices in which woody perennials (trees and shrubs) are grown/managed on the same land management unit as other crops and/or animals (Nair, 1993).

The International Centre for Research in agroforestry (ICRAF) conducts research in partnership with farmers, scientists and policy makers to help alleviate poverty and increase food security while protecting the natural resource base (ICRAF, 2000). Its findings have confirmed that agroforestry has the capacity to trigger both economic and social development while at the same time promoting environmental protection. Agroforestry can be practiced at both large scale and small scale. In the light of the above, the study set out to examine the rural women's participation in agroforestry and its implications on a sustainable environment.

1.2.1 Statement of the Problem

Poverty alleviation and environmental protection are both leading global concerns. The two are intertwined and one cannot be addressed without the other. In 1992 at the Rio Conference, the world governments adopted Agenda 21 as a blue print for sustainable development. It advocated for development hand in hand with environmental protection. Areas of concern included alleviating poverty, conserving natural resources, producing food, fighting desertification, and protection of forests, amongst others. In line with these global concerns this study set out to address the same issues but at a local level, confirm the saying that because though we think globally we must act locally.

At the national level, the incidence of poverty is increasing and this has been addressed by the National Poverty Eradication Plan (1999 – 2015). Issues of Environmental protection which arose from the Rio Conference have been taken up by the government and results are visible in the newly enacted Environmental Management and Coordination Act In Sessional Paper No. 6 of 1999 on Environment and Development, the Kenya government acknowledges that though economic growth is necessary for poverty alleviation, it must go hand in hand with environmental protection.

Poor natural resource management has led to the destruction of forests in Kenya. Forests are necessary for the environment because they act as carbon sinks and they conserve bio diversity (Thirwall 1994). They also provide fuel wood, poles and construction material for domestic and commercial use. There is need to increase the forests but due to increasing population, there is intense competition for productive land. This issue is addressed in the Kenya Forestry Master Plan. It indicates that further expansion of forestry will have to be done through farm forestry (agroforestry).

Poverty levels in Nyando District are high and continuing to rise with the collapse of the sugar industry, the cotton industry and the fishing industry which were the economic base of the district. The fishing industry has declined in recent years as a result of several problems. Introduction of the Nile Perch species led to an extinction of many varieties of fish as they were eaten by the Nile Perch thus reducing diversity. The increasing demand for fish also led to over fishing which further reduced the existing stock of fish. To make a bad situation worse the lake was invaded by the

water hyacinth. The invasion was caused by “sedimentation and nutrient run off, urban and industrial pollution and biomass burning” (ICRAF, 2002). This problem of sedimentation and nutrient run off is caused by poor land management systems. It can therefore be addressed through proper land management systems that prevent erosion. At a basic level one of the appropriate interventions recommended by ICRAF is to increase vegetation cover over large areas of fragile land including headwaters, shallow soils and hill slopes. The decline in the fishing industry has led to unemployment and reduced income for many families. This continues to increase the incidence of poverty in Nyando District. Not only poverty but also food security. Agroforestry as a land use approach can contribute to reducing eutrophication of lake and by extension improve prospects of reviving the fishing industry.

Rice farming which was coordinated by the National Irrigation Board (NIB) has since collapsed and Ahero Irrigation Scheme which is one of Kenya’s pioneer commercial irrigation projects. Presently, the Rice irrigation scheme does not produce any rice. The NIB have also closed their offices. The only rice being produced in the district now is cultivated by individual farmers. Plate. 3.10 shows the current state of Ahero Irrigation Scheme. Farmers who depended on the NIB for assistance now have to fend for themselves and many are not able to cultivate the land and purchase inputs. The result is reduced income for rice farmers and increased poverty in the district. These farmers need a more cost effective production system which can be offered by agroforestry.

Cotton farming in the district collapsed several years ago and farmers stopped growing cotton. In areas like lower Nyakach Division where cotton was the main cash crop, the incidence of poverty has increased and no other cash crop has been introduced. The land in these areas is marginal and food production is not sufficient. The people, therefore, need money to purchase food. With no cash crop they do not have such source of income. This compounds the poverty issue. As they strive to cultivate food crops, they use poor farming techniques on fragile environments and the result is a degraded and deteriorating environment. An extreme example can be seen in the erosion gulleys of Katuk. There is need for a land use approach that will yield marketable products and at the same time protect the fragile environment. Agroforestry as a land use has the potential to do this.

The sugar growing belt of Nyando District enjoys a cash economy. There are three sugar factories each with a nucleus farm to cater for the minimum cane requirements of the factory, while the farmers who are out-growers provide the extra cane required. Before problems set in, the farmers were able to cater for their basic needs and their standards of living were generally higher than for people in other parts of the district. However, there was over dependence on sugarcane. These problems have led to drastically reduced income for the sugar cane farmers.

The mono culture of sugar cane farming over the years has also had adverse environmental impacts due to practices like setting the sugar cane field on fire before harvesting it. This practice destroys trees and does not allow new ones to grow. Trees have also been cleared to create more land for sugar plantations. The final result is a reduction in the tree population of the area which is a contradiction to international and national objectives of increasing trees and improving the environment.

The above facts call for an alternative land use to remove the over-dependence on sugar cane only as a cash crop. It also calls for a land use approach that is more friendly to the environment and contributes to attaining the goals of the Rio Conference. Agroforestry as a land use approach can reduce the farmers over dependence on sugar cane as cash crop and it is also more environment friendly because it has potential for sustainable development.

One of the principles of the Sessional Paper No. 6 of 1999 states that "Public participation, including women and youth is essential in proper environmental management" hence the study's selection of women's participation as a justifiable topic. Studies have shown that most men leave the rural areas in search of paid employment. As a result, the majority of the rural population is made of women, children and the old (Khasiani, 1995). The women, therefore, form the largest part of the rural labour force because the children go to school and the old have less energy.

Other studies have shown that women interact extensively with the physical environment as they go about their day to day activities (Kameri, 1992). They interact with the environment as they cultivate their fields, as they search for fuel wood, as they search for water, as they search for subsistence food and as they

maintain their homes. This makes them an ideal choice as environmental managers and stakeholders.

The study examines women's participation in agroforestry since agroforestry has the capacity to trigger socio-economic development (by providing employment and increasing purchasing power) and environmental conservation simultaneously. These are the basic ingredients for sustainable development hence it's suitability as an intervention. Agroforestry also directly addresses some basic needs of the rural woman such as wood fuel, building materials, income and subsistence.

Extensive research which has been done by ICRAF and other research organizations on agroforestry has demonstrated that such interventions can contribute to poverty alleviation and protection of the environment. According to ICRAF, the challenge is in identifying appropriate approaches and institutional arrangements to effectively implement and sustain the viable options.

The purpose of the study is to examine women's participation in agroforestry in Nyando District as a land use system that can contribute to a sustainable rural environment with a view of establishing appropriate approaches for effective implementation of agroforestry. In that respect, the study examines the role of women in agroforestry on the farm in general and the women's activities specifically in the *Orundu*. Finally, the study examines the impact of culture and history on women's adoption of agroforestry.

1.3 Research Questions

- 1 Can agroforestry contribute significantly to a sustainable rural environment in Nyando District?
- 2 Is there a role for rural women in agroforestry in Nyando District?
- 3 Is the *Orundu* concept a significant practice that can be used to test/integrate agroforestry technologies specifically designed to target women?
- 4 Do culture and historical factors influence women's adoption of agroforestry innovations in Nyando District?

1.4 Research Objectives

1. To establish an inventory of existing agroforestry practices in Nyando District.
2. To examine the role of women in planting and managing trees and bushes in Nyando District.
3. To establish the potential of the *Orundu* for agroforestry interventions.
4. To examine the impact of culture and history on women's adoption of agroforestry technologies.
5. To make policy recommendations and strategies that promote a sustainable environment through gendered agroforestry.

Hypothesis

1. Agroforestry as a farming method is not significantly practiced in Nyando.
2. Women in Nyando do not have a significant degree of freedom to plant trees, and manage bushes and trees.

1.5 Assumptions

The study seeks to establish the potential of women's participation in agroforestry as a tool to alleviate poverty and at the same time conserve their environment. The findings of this study will then be used to recommend appropriate approaches to effectively implement agroforestry technologies. In this regard, the study assumptions are:

1. That the environment is a common good available to all
2. That poverty and environmental degradation have a direct relationship. An increase in one leads to an increase in the other and vice versa.
3. That rural women interact extensively with the physical environment in their day to day activities such as cultivation, fetching water, collecting firewood, herding livestock, obtaining domestic food supply, and managing the homestead.
4. Proper natural resource management will lead to the interaction contributing to an improved environment. On the other hand, poor natural resource management will lead to this interaction contributing to environmental deterioration.
5. Poverty increases the incidences of poor natural resource management thus increasing environmental deterioration.

6. Poverty and environmental deterioration are intertwined and one cannot be solved without addressing the other. The solutions lie in alleviating poverty and implementing proper Natural Resource management.

1.6 Justification of Study

Kenya, like other developing countries, has a high incidence of poverty. It has been noted that poverty may lead to poor natural resource management. This is manifested in practices such as over-cropping, overgrazing, deforestation, amongst others. These practices destroy the natural resource base (Atchia, et al 1995). They cause the soil to succumb to erosion and reduce its productivity gradually to zero. In the final analysis, desertification may set in if no intervention is put in place. The magnitude of the problem is indicated in the UNEP report which states that the desert is encroaching on other lands in Africa at a rate of 8 – 10 km per annum.

In Nyando District the high incidence of poverty has increased with the decline of production of the major cash crops such as rice, sugar cane and cotton (GOK, 2002). The need to address poverty is therefore more imperative. Environmental problems such as floods, soil erosion, and deforestation are becoming more acute as evidenced by gulleys at Katuk and more severe flooding of Nyando River. Agroforestry as a land use approach can offer an alternative farming system, which addresses the people's basic needs and promote environmental conservation. Based on the assumption that rural women interact more extensively with the physical environment in their day-to-day activities (Kameri, 1992) and that substantial proportion of men leave rural areas in search of employment (Khasiani,1995), the study focused on women's participation in agroforestry because they have the "hands on" experience on issues pertinent to this study. Findings of the study will help in assessing the level of agroforestry being practiced in Nyando District with a view to developing more effective approaches for implementing the same in the district.

1.7 Scope of the Study

The study covers Nyando District. General information was gathered covering the whole district. However, household questionnaires were administered only in selected locations i.e. Koru Location in Muhoroni Division and North East Nyakach location in Lower Nyakach Division. The purpose of the study is to examine women's participation in agroforestry as a land use approach that can contribute to a sustainable

rural environment. The study puts forward five research objectives that when fulfilled will establish the above. The first objective is to establish an inventory of agroforestry activities in Nyando district. This inventory covers governments district development priorities on agroforestry, the actual agroforestry practices and the common tree species used for agroforestry systems in Nyando District. Finally, the study aimed at identifying tree planting constraints and their possible solutions. The information in the inventory forms a baseline against which women's participation is examined to meet the second objective of the study.

In examining the role of rural women in planting and managing tress and bushes, the status of women in Nyando is first established. The study then examines agroforestry practices where women are allowed to plant trees, sell tress products and initiate tree planting with a view to establishing where they have the highest degree of freedom. The activities of women groups are examined to establish their involvement in agroforestry. Special focus is put on women's activities in the *Orundu* where women have autonomy with a view to establishing its agroforestry potential. These activities all take place within a community with a given history and culture, therefore, the impact of these attributes on women's adoption of agroforestry is examined before recommendations are made on ways to promote a sustainable environment through gendered agroforestry.

1.8 Definition of Key Terms and Concepts

Orundu

Orundu is a term used by the Luo speaking community of Nyanza Province Kenya to refer to the home garden. The same may change slightly from one region of Nyanza to another. For instance, in some areas, it is referred to "Nyakirundu". This term is used to refer to the small garden just behind the house within the homestead. It is important to note that the *Orundu* is normally a small garden and hardly ever a big one. The *Orundu* is cultivated by the women folk of the home. In a monogamous home, it is located behind the house and on the periphery of the homestead. In a polygamous home every wife cultivates the back side of her house/hut. Activities in the *Orundu* are determined and controlled by the women but governed by cultural norms. The essence of the *Orundu* is to carter for subsistence foods which need keen attention and could not be grown on large scale. For instance, these include some variety of vegetables and medicinal plants. However, it's use is not limited to only these. The *Orundu*

serves as a kitchen garden where mixed cropping is practiced in an effort to provide a variety of foods for family subsistence.

Poverty

The World Bank defines poverty as the inability of people to attain a minimum standard of living (Thirlwall, 1994). The most obvious measure of living standards is an individual's/household's income or expenditure – per capita income. Poverty lines are calculated using per capita income. This varies from country to country. Measures of living standards based on per capita income do not include level of nutrition. Life expectancy, infant mortality, level of education, etc which are an integral part of “standard of living”. The United Nations Development Programme (UNDP) attempted to develop a Human Development index which takes these factors into account.

The Environment

The term environment can be defined in a simple manner as “everything that surrounds us”. Park (1986) gives it a more scientific definition as “the sum total of the biological, chemical and physical status and character of the natural world”. Huxley et al (1997) defines the environment as “The totality of external conditions affecting a living organism or a community (biocoenosis) of organisms in their habitat (biotope)”.

Agroforestry

The Glossary for Agroforestry (Huxley et al 1997) defines Agroforestry as “a dynamic ecologically based natural resources management system that through the integration of trees in farm land and rangeland diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels”. It describes an agroforestry system as “a land-use system in which woody perennials (trees, shrubs, palms, bamboos) are deliberately used on the farm with agricultural crops (woody or not) or animals or both, either in some form of spatial arrangement or temporal sequence”. Both economic and ecological interactions occur between the different components of an agroforestry system.

Gender

The word gender is a grammatical distinction between masculine (male) and feminine (female) characteristics of living things. It can be seen as a socio-cultural construct

referring to the roles and responsibilities of men and women and the responsibilities between them (Mwangi, 1999).

Development

Development can be broadly defined as material change brought about by human activities. Development is based on economic growth (Todaro, 1977). However, development is more than economic growth (Alderman, 1997). Development has to do with the well being of people. Economic growth is not an end in itself, but must serve the wider purpose for it has to be seen as development. Economic growth without the well being of the people is not development

Sustainable development

The term sustainable development became a popularly accepted term after the world commission on Environment and Development – the Brundtland Report of 1987. In this report Development was considered sustainable if it ensured that the needs of the present were met without compromising the ability of future generations to meet their own needs.

1.9 Research Methodology

This section on research methodology lays out the approaches used in this study to collect, analyze, and present data. It also describes the data needs and the sources of data.

1.9.1 Data Needs

The study required both primary and secondary data. Primary data was obtained from field surveys while secondary data was obtained from published materials.

1.9.2 Primary Data and Survey Instruments

a) Household Questionnaires

There are several sets of questionnaires. One set administered to the head of household of the sample. Another set was administered to the case examples obtained from the sample. There was a questionnaire addressing only the cultivation of traditional vegetables and another for sisal as a plant. The last two were only administered in North East Nyakach.

Table 2 shows that Muhoroni Division held 21.2% of the Districts' population. Lower Nyakach held 16.4%. The ratio with which the 100 cases in the sample were to be shared between the 2 locations was 21:16. Using this ratio a sample of 57 cases was drawn from Koru Location in Muhoroni Division and 43 from North East Nyakach location in Lower Nyakach Division. Map 3 and map 4 shows the location of the sample locations within the divisional setting.

Distributing the sample within the chosen Locations

A list was obtained from the Land Registry with the following information:-

- 1) The entire plot numbers of land within the 2 Locations.
- 2) The area of each of the plots.

For each Location the data on area was ranked in ascending order and divided into 3 categories as follows:-

- Category A - Less than 10 acres (< 4 Ha)
 Category B - 10 – 50 acres (4 – 20 Ha)
 Category C - More than 50 acres (> 20 Ha)

The total number in each category was taken and it's percentage calculated out of the total number of plots in the location.

In Koru the total number of registered plots is 1230.

These percentages were used to calculate the sample size in each category. In Koru location there were 44 cases in category A, 9 cases in category B and 4 cases in category C. To determine which household to interview, systematic sampling was used.

Table 1.2 – Distribution of the sample in Koru Location into categories and finding the interval between each sample

Category	Total Number of farms in Category	Total number of farms falling in Category	The interval between each sample
A	44	956	$\frac{956}{44} = 21.7 \approx 22$
B	9	190	$\frac{190}{9} = 21.1 \approx 21$
C	4	84	$\frac{84}{4} = 21$

Source: Field Survey

- Category A - Every 22nd plot was selected from the list.
 Category B - Every 21st plot was selected.
 Category C - Every 21st plot was selected.

In North East Nyakach location the total number of registered plots was 5334 at the time the study began. In North East Nyakach Location the sample size was 43 all in category A

Table 1.3 – Distributing the sample in North East Nyakach into categories And finding the interval between each sample was determined as follows:-

Category	Total number of farms falling in Category	Interval between each sample
A	5309	$\frac{5309}{43} \quad 123.46 \cong 123$
B	2	$\frac{5310}{2}$
C	0	$\frac{5311}{0}$

Source: Field Survey

Category A - Every 123rd plot was selected from the list.

N.B. Two plots were selected in Category B for purposes of comparison with Koru.

Using the sampling procedure a list of the plots to be visited was prepared before the researcher went out to administer questionnaires.

Locating the households on the ground

Registry Index Maps (RIM) were purchased for the two Locations.

Using these maps, it was possible to locate the farms on the ground.

In Koru the map was adequate.

In North East Nyakach the names of the registered owners were necessary.

b) Interview schedules for Government officers

The interview schedules were prepared and used to guide the researcher through interviews with relevant Government officials. The Government Officials were interviewed at the District level the Divisional level and then the Location.

c) Interview schedule for Non Governmental Organizations (NGO's) and Community Based Organizations (CBO's)

These interview schedules were prepared and used to guide the researcher through interviews with the NGO's and CBO's.

d) Focus Group Discussion Guidelines.

There were 4 Focus Group Discussions. Two in Muhoroni Division and two in Lower Nyakach Division. The schedules were prepared and used to guide the Discussions. Each Location had one focus group composed of only women and the other composed of both men and women.

e) Case Examples

Case examples were drawn from the sample served with Household Questionnaires. From administering the Household Questionnaire, it was possible to identify farmers who practiced agroforestry intensively and those who did not practice agroforestry at all. From each of these categories case examples were drawn. They were served with a questionnaire containing more detailed inquiries than those in the general Household Questionnaire. Most of the Questions were open ended to encourage discussion. Case examples were drawn from both Koru and North East Nyakach Locations.

f) Sisal and traditional vegetables Questionnaire.

This was prepared after administering the household and case example questionnaire. It was administered only in North East Nyakach to traders and producers of the two items.

g) Seminars**h) Agricultural Field days**

i) Observation Sheets: These were used to carry out the physical surveys.

j) Camera: A camera was used to take photographs because the pictures taken captured the environmental condition better than the description.

1.9.3 Secondary Data

Secondary data was obtained from published and printed materials such as relevant books and journals, Project documents for any relevant project carried out in the study area and Government publications from various relevant ministries.

1.9.4 Techniques of Data Analysis

Information gathered during the study was analyzed and presented using various techniques. Diagrammatic and graphic presentations such as bar charts, multiple bar charts, percentage bar charts, pie charts and line graphs are used to provide vivid

charts, percentage bar charts, pie charts and line graphs are used to provide vivid illustrative of this features Descriptive statistic, such as frequency tables, frequency distributions, measures of central tendency and dispersion are used to summarize, compare and analyzed data.

1.9.5 Analytical Framework

Table 1.4 – Analytical framework

Objective	Statistical Analysis	Spatial Analysis	Environment Impact	Social cultural
	Which activities Practised by how many? Practiced how far	Where in district Where on the farm? Where in the homestead?	How do they affect the environment? positive or negative	How do they affect the people's lives and well being? How do the people view them?
1. Establish an inventory of existing agroforestry in Nyando	X	X	X	X
2. Examine role of women in plating trees and bushes in Nyando	X	X	X	X
3. To establish the potential of the orundu for agroforestry innovations.	X	X	X	X
4. Examine the role of culture and history on women's adoption of agroforestry technologies			X	X

Source: Field Survey

1.10 Limitations of the Study

The study is based in Nyando District which covers a large geographic area. A survey of the district required a lot of time and cost a lot of money. This became a constraint to the study because time and funding for the study were limited. Two provisions of the district were selected as representative and subjected to detailed survey. The creation of new administrative units such as districts, divisions, locations, and publications brought about inconstancies in baseline data. For instance, Nyando District was curved out of Kisumu District in 1998. Therefore, statistics for years prior to 1998 combine both Nyando and Kisumu Districts. Some of the recent boundaries are not yet mapped.

In the Settlement Schemes, land was allocated in two parcels which are separately located. A subsistence plot for residence and food production and a sugar plot for sugar cane production. Each had a separate number. During the sampling procedure some sugar plots were included in the plot numbers to be issued with household questionnaires. Locating the corresponding subsistence plot proved extremely difficult. This factor also interferes with calculation of average farm size because the farms are in two parcels and not one. The use of Registry Index Maps (RIM) for locating the sample households was made difficult by the fact that on subdivision the new numbers issued interfere with the flow of the old numbering sequence. For instance, on subdivision plot number 10 can become plot No. 217 and 218 and will be next to plot No. 9. One would expect numbers 9, 10, 11, 12, etc, to be in the same neighbourhood. Subdivision mixes up the numbers. In Nyando District government offices are not centrally located due to lack of office space at Awasi, the districts' headquarters. The D.C. is at Awasi, the District Agricultural Officer is at Boya , some 20 km away, the District Culture and Social Services Officer is at Ahero and so on. This resulted in increased travelling during the study. The office of the Chief was used to mobilize people for the focus group discussions. This caused apprehension amongst some of them who thought they were being summoned for an offence.

1.1.1 Structure of the Study

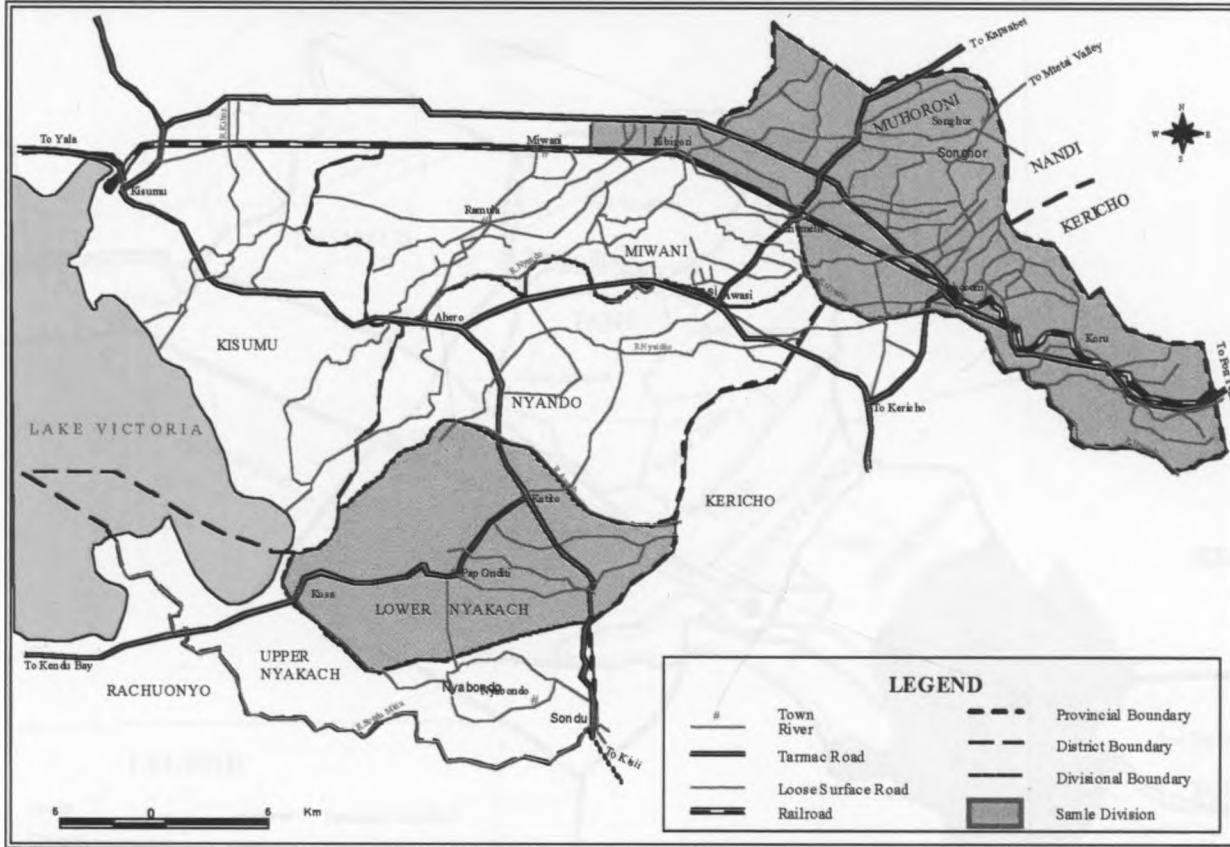
The study consists of seven chapters.

Chapter One focuses on introduction. It includes the Statement of the problem, Research questions, Research objectives, Assumptions, Scope of the study, Definition of key terms and concepts, Research Methodology and Limitations of the study.

Chapter Two focuses on literature review on issues pertinent to the study such as Development and underdevelopment, Poverty rural development, the Development/environment relationship, Gender issues, agroforestry and Conceptual framework. Chapter Three focuses on the background of the study are. It covers the physical and socio-economic profile of Nyando District. Chapter Four focuses on Analysis and findings related to agroforestry in Nyando District. Chapter Five examines womens participation in agroforestry. Chapter Six focuses on activities in the *Orundu* as a "niche" in the farm holding where women have complete control. Chapter Seven summarizes the findings of the study, and then makes recommendations and conclusions.

MAP 1

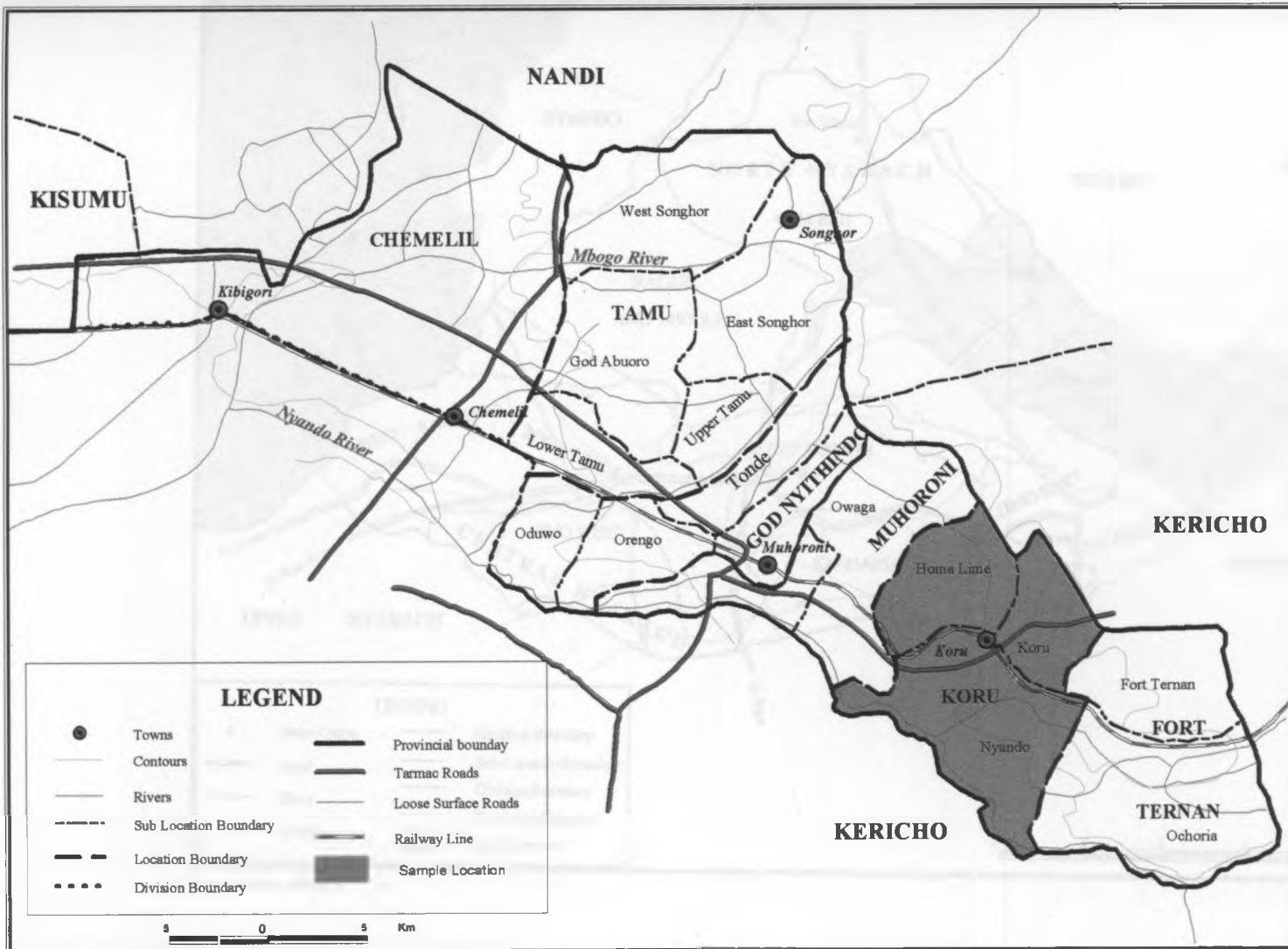
NYANDO DISTRICT- SAMPLE DIVISIONS



Source: Survey of Kenya

MAP 2

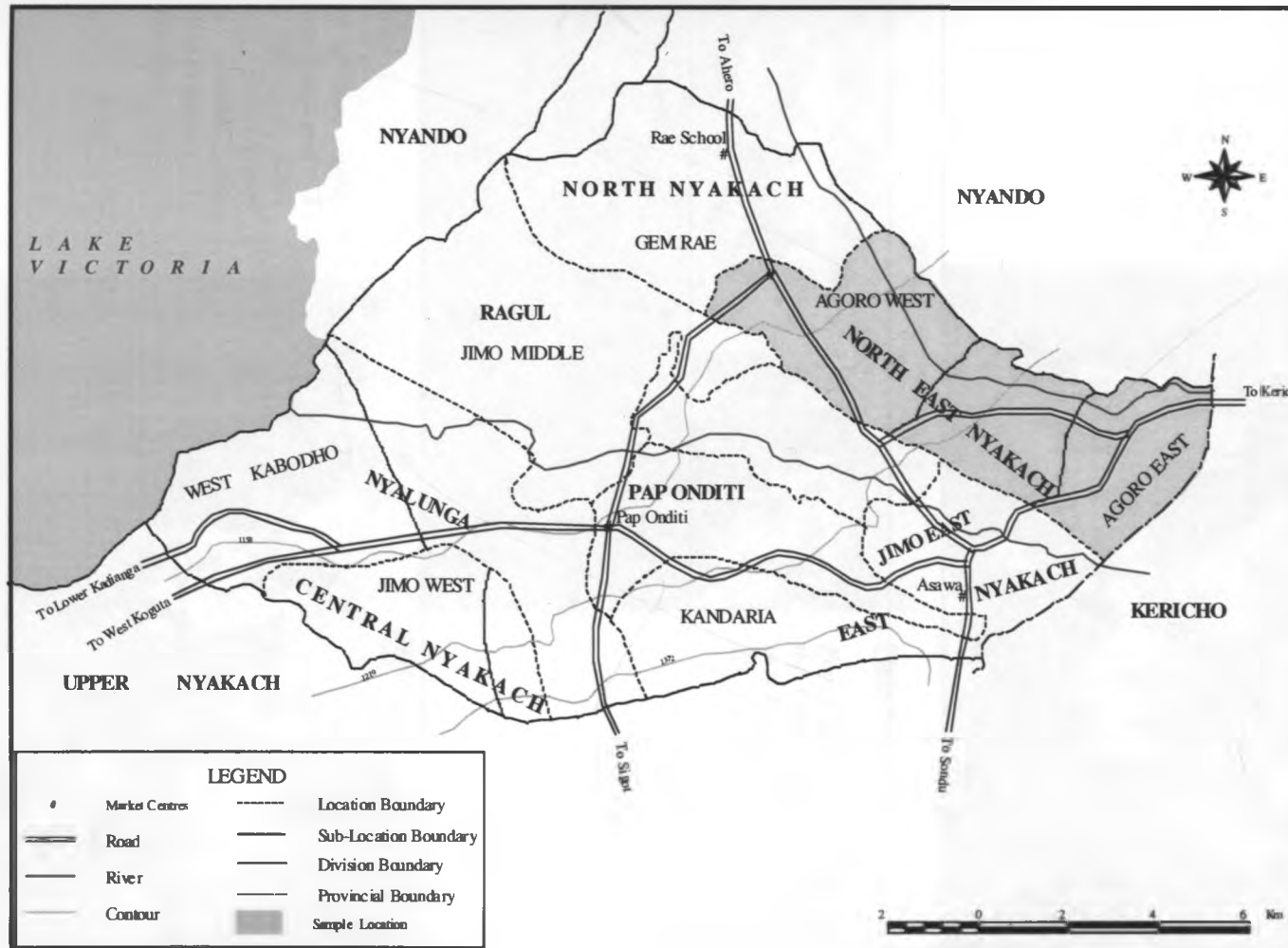
MUHORONI DIVISION SAMPLE LOCATION



Source: Survey of Kenya

MAP 3

LOWER NYAKACH DIVISION: SAMPLE LOCATION



Source: Survey of Kenya

Plate No. 1.1

*Focus group discussion at
Chiefs Office in Koru
18th January 2002*



Plate No. 1.2 .

*Focus group discussion at
the Chief's Office at Katito
in N E Nyakach
26th January 2002*



Plate No. 1.3

*The Chief of Koru (right)
the Researcher and 3
Assistant Chiefs of Koru
after the 1st Focus group
Discussion outside the
Chief's Office in Koru
18th January 2002*



CHAPTER 2 – LITERATURE REVIEW

2.1 Overview

The research problem in this study is poverty and a deteriorating environment. Poverty in Nyando District affects the men, women, and children. It also has negative impacts on the environment. The study looks at women's participation in agroforestry to see if it can have any impact on the poverty situation and in so doing, create a more sustainable rural environment. This section on literature review begins by discussing development which is the desired situation against underdevelopment which is the existing situation. It then goes on to describe theories/concepts such as dualism and dependency that best explain the existing situation in the study area. It then reviews the basic needs concept and how if it is applied by women through agroforestry can be used to find solutions to the problems of underdevelopment that are experienced in the area. The literature review also covers issues that are pertinent to the study such as the development - environmental relationship, rural development and gender issues.

2.2 Development and Underdevelopment

Defining development

Development can be given a general definition to mean "material change brought about by man's activities." Chambers' dictionary defines development as "to bring to a more advanced more organized state."

Development is based on the level of economic growth. Todaro (1977) describes economic growth as "steady process through which the productive capacity increases to bring about rising levels of income".

However, development is more than economic growth. Average income per head in the third world grew rapidly in the 1960's and 1970's but so did unemployment, famine, malnutrition, abject poverty and hunger. (Alderman, 1997). Economic growth without the well being of the people is not development. It must serve the wider purpose for it to be seen as development. International development goals are reduction of poverty by half, universal provision of primary education, increased gender equality in education; reduce infant and child mortality, reduction of maternal mortality and expansion of access to reproductive health services (World Bank 2000). Development encompasses institutional changes including distribution of national incomes, knowledge and the power to make decisions (UNCHS, 1996). Countries that have achieved high levels of economic growth accompanied by corresponding

institutional changes, changes are referred to as the developed world. On the opposite side are countries still struggling with issues of low economic growth and poverty. These are referred to as the developing countries, the less developed countries or the third world. Kenya is one of the developing countries. Its economy is based on agriculture, which caters for 25% of the GDP. Current trends indicate a declining economic growth rate. The Economic Survey (2002) indicates a growth rate of 2.4. Incomes are low, unemployment levels high and the incidence of poverty increasing.

“Development and underdevelopment”

The sentence can be reworded as “Development and Poverty”. If development implies change geared towards ensuring the well being of people, then it can be argued that at one end where the situation is ideal will be found “development” and at the other end where the situation is the reverse will be found poverty”.

Three basic components of development are life-sustainable, self, esteem and freedom (Goulef, 1971). Life sustenance is concerned with the provision of basic needs. No country can be regarded as a fully developed if they cannot provide its entire people with such basic needs as housing, clothing, food and minimal education. A major objective of development must be to raise people out of primary poverty and to provide basic needs simultaneously (Thirwall, 1994).

Self esteem is concerned with the feeling of self respect. No country can be regarded as fully developed if it is exploited by others and does not have power and influence to conduct relations on equal terms. Developing countries seek development for self esteem to eradicate the feeling of dominance and dependence which is associated with inferior economic status. Freedom refers to freedom from the three evils of “want”, ignorance and squalor so that people are more able to determine their own destiny. No man/woman is free if he/she cannot choose; if he/she is imprisoned by living on the margin of subsistence with no education and no skills. Material development expands individuals and societies. Underdevelopment is the reverse of development.

Dualism Theory

Dualism refers to economic and social divisions in an economy. A dual economy is one characterized by a difference in social customs between the subsistence and exchange sectors of an economy. There exists a gap in the level of technology between the rural subsistence sector and the industrial monetized sector. There can also exist a gap in the per-capita income of the two. Dualism can take the form of Geographic, social or technological (Thirwall, 1994). All three forms of dualism exist in Nyando District. Geographic dualism is manifested in the regional differences between Muhoroni Division which is a settlement scheme and Lower Nyakach Division which is a former native reservation. In Muhoroni, there is a cash economy with sugar cane as the main cash crop. This represents the modern sector where income levels are relatively higher. In Lower Nyakach Division, there is a traditional subsistence economy with low income levels. The level of technology used in the cash economy is higher. Modern farming techniques and heavy machinery is used in the sugar industry. On the other hand, traditional farming methods are used in the subsistence economy. The ox plough is more cost effective than modern machinery. This is evidence of the technological dualism.

Social dualism is seen in the different way of life found in the settlement former native reservations. In the settlement schemes, people are from diverse origins and although many speak the Luo language kinship. The capitalists idea of production is embraced enabling the economy of progress towards maturity. If the sugar industry had not suffered mismanagement, it would have served this purpose of the imbalances created. According to Mrydal (1957) the initial differences in prosperity are equalized over time by spread and back wash effects. In the past development planning in Nyando District emphasis on improving the modern sector. The spread and backwash effects have not led to a significant. Spread of development benefits. Muhoroni division has developed more than the rest of Nyando District. In spite of the high levels of poverty, the division enjoys a higher standard of living, better employment opportunities, and better provision of infrastructure and services. There is also better access to factors of production such as land labour capital. The reverse applies to other regions of the district. Figure 2.1 which is a conceptual model illustrating development and underdevelopment can also be used as a model to explain the concept of dualism. Development can be seen as characteristic of the modern sector in a dual economy while underdevelopment is characteristic of a traditional economy.

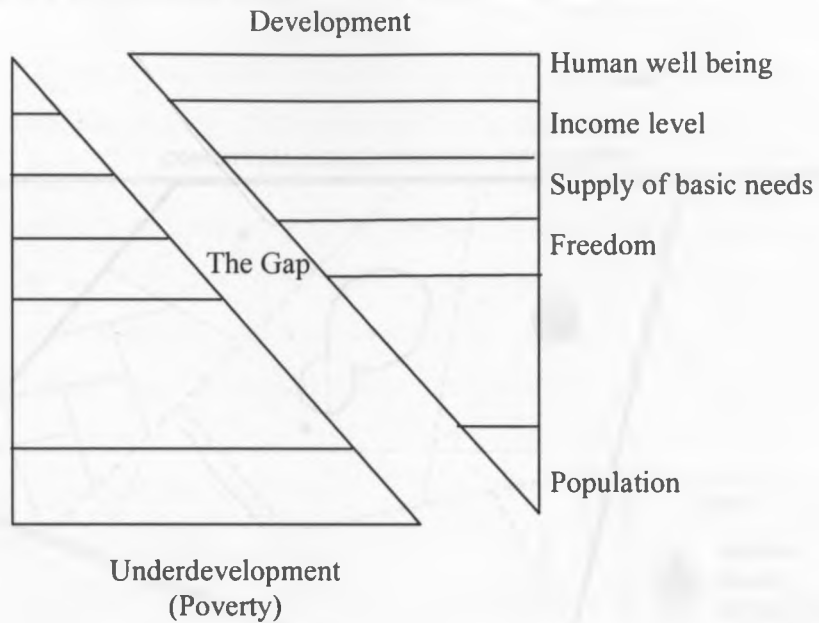
A gap existing between the two is shown in the diagram. In this study women's participation in agroforestry is put in the gap to see how much it can contribute to reducing the gap towards a sustainable environment.

Dependency Models

The second half of the 1960's saw growing dissatisfaction with the results of development using dualism. This led to another school of thought. It emphasized the role of external causes of underdevelopment. It argued that external cause had overriding influence on the internal situation of underdeveloped countries. The existing inequalities tended to lead to the transfer of resources from the most backward sectors and regions to the most dominant. This is an exploitative relationship and explains inequalities. The models transform inequality to a necessary structural requirement in the total world economy (Dos Santos, 1969). This theory concentrates on phenomenon like export dependency, deteriorating trade and import substitution as indicators of inequality. It uses this to explain the poverty and stagnation of the underdeveloped countries. The dependent economy is characterized by profound difference in wage levels as a consequence of available cheap labour and the use of capital intensive technology. This restricts the size of the internal market (Amin, 1973). The dependency theory concentrates on the manner which the developing countries are merely part of the world economy. It argues that decisions of the world economy form the majority of causes of underdevelopment because no economy is a closed system.

This theory when applied to the study area can explain why the cash economy has not led to development as expected. The price of sugar is determined by external markets which form part of the larger world economy. When prices drop it automatically affects the conditions in Kenya adversely. These prices can be manipulated to sustain a condition of dependency of the less developed countries by the developed countries that control the world economy. Liberalization has also allowed importation of cheap sugar. Since the cost of producing sugar locally is high, the price must be high. Local sugar becomes more expensive than imported sugar and is not bought thus depressing the sugar industry.

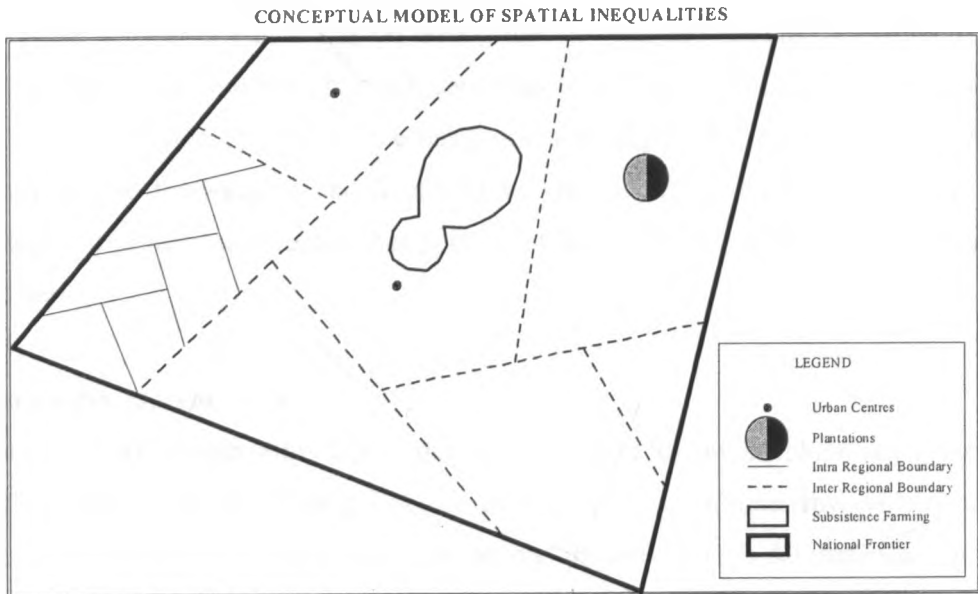
Figure 2.1 Conceptual Model of Development and Underdevelopment



Source: Author's Conceptualization

Figure 2.1 conceptualizes development and underdevelopment (poverty) as one moves away from poverty towards development the undesired characteristics of underdevelopment reduces and the desired characteristics of development increase. This study puts agroforestry in the gap to see if it can contribute to reducing the gap.

Figure 2.2 Conceptual Frameworks of Spatial Inequalities



Source: Slater, D (1975)

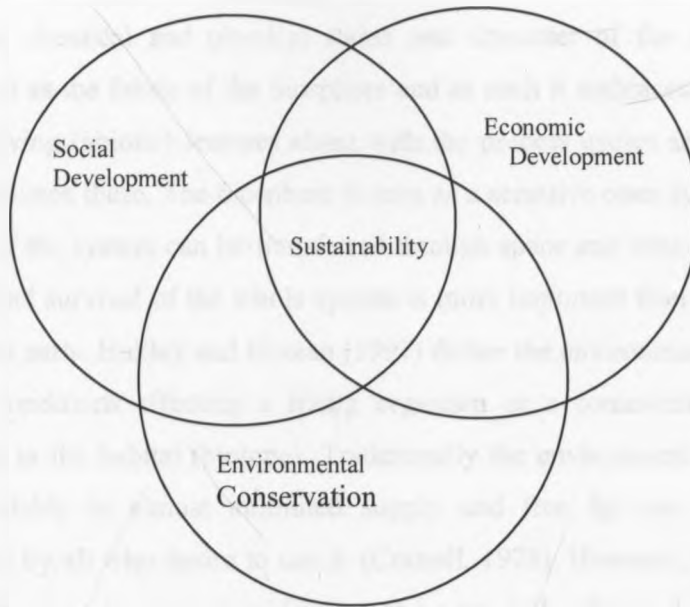
Slater's conceptual model (Figure 2.2) on spatial inequalities explains regional differences within Nyando District. The regional inequalities found between Muhoroni Division and the other divisions of Nyando District are similar to Slater's 'intra-regional' inequalities.

The Basic Needs Concept

The basic needs approach to economic development involves the provision of health services, education, housing, sanitation, water supply and adequate nutrition. It was supported by the World Bank and the United Nations. The rationale of the approach was that the direct provision of such goods and services is likely to relieve absolute poverty more immediately than alternative strategies which simply attempt to accelerate growth or which rely on raising the incomes and productivity of the poor. Agroforestry as a land use approach conforms to the basic needs concept because it addresses provision of some of the basic needs amongst other things. Agroforestry contributes to food supply and food security. It increases the supply of building material, it protects and replenishes sources of water and it provides medicinal trees and herbs.

Sustainable Development

The concept of sustainability argues that it is important for any development to sustain itself. It keeps in mind that there is a tomorrow. The people of tomorrow will still need the same environment. It is sensitive to the impact of any development on the environment. Development programmes must therefore be designed to tally with the limits of the environments capacity. Community participation is seen as an essential part of the sustainable development. The term sustainable development became a popularly accepted term after the world commission on Environment and Development in 1987. In this Report (often referred to as the Brundtland Report after its chairman), development was considered sustainable if it ensured that the needs of the present were met without compromising the ability of the future generations to meet their needs. From this point the concept of sustainability has been further developed. The United Nation's conference on Human settlements (Habitat II) held in Istanbul in 1996, recognized the three elements of that make up sustainable development as Economic development, social development and environmental protection. This clearly indicates a relationship between development and the environment. In 1997 an international conference was held in Australia on 'Pathways to Sustainability', which highlighted how sustainability merged environmental economics and social parameters.

Figure 2.3: Sustainability

Source: Proceeding from International Pathways to Sustainability, Australia, 1997.

After 50 years of development experience the World Bank (2002) they had come to the conclusion that Macroeconomic stability is an essential prerequisite for achieving the growth needed for development. Secondly growth does not trickle down therefore development must address human needs directly. Thirdly, no one policy will trigger development therefore, a comprehensive approach is needed. Finally it concluded that institutions were of great importance therefore sustained development should be rooted in processes that are socially inclusive and responsive to changing circumstances. The ecological models are very important in this study because the models address the of man-environment interaction. The study also addresses the man/environment interaction with specific reference to women's agroforestry activities and the implication on the environment. In this study agroforestry is put forward as a development strategy based on the ecological concept that man and his environment are part of the same ecosystem. Agroforestry is seen as able to take care of man's development needs such as generation of income, food supply, wood fuel supply etc and at the same time take care of environmental needs such as soil and water conservation, carbon sequestering etc.

2.3 Development - Environment

Environment can be defined in a very simplistic way as “all that is around us”. However, according to Park (1986), “Environment is taken to refer to the sum total of biological, chemical and physical status and character of the natural world”. He describes it as the fabric of the biosphere and as such it embraces both living (biotic) and non living (abiotic) features along with the process cycles and interrelationships which influence these. The biosphere is seen as a sensitive open system and change in one part of the system can be transferred through space and time to other parts. The integrity and survival of the whole system is more important than the conservation of component parts. Huxley and Houten (1997) define the environment as “the totality of external conditions affecting a living organism or a community (biocoenosis) of organisms in the habitat (biotope). Traditionally the environment is seen as a public good available in almost unlimited supply and free for use (generally without restriction) by all who desire to use it. (Cottrell, 1978). However, this is not the case. The environment is an exploitable asset to be carefully allocated amongst competing users. The environment offers natural resources (tangible practical values) e.g. minerals, water, and non utilitarian resources such as landscape and wilderness and others.

The environment has three functions.

- 1) It serves as a public good providing air, landscape, etc.
- 2) It provides basic inputs for production processes e.g. raw material.
- 3) It is used as a receptor for waste e.g. air and water pollution (Siebat et al 1980).

Environmental management is required because of the wide range of demands being made on all parts of the environmental stem (Oranda, 1971). Many of these demands are not compatible with each other. Environmental problems are not new, what are new is the accelerating pace and the changing character of human impact on the environment. Malone (1976) argued that new hazards are more than ever side effects of human activities. Human activities may so completely destroy the life support system of our planet that its carrying capacity for humanity may be reduced to zero. Pesticides like DDT are a threat to the life of man and animals; air pollution affects climate; natural resources are over exploited. Environmental deterioration and resource depletion are interfering with the natural ecosystems. Imbalances in ecosystems make them weak and unsustainable. It is because of these conditions that scholars saw the need to come up with ecological models for development to ensure that mans development activities take on board environmental considerations.

Global concern for the environment/development relationship was manifested in the formation of the World Commission on Environment and Development, (1987). The Commission's findings led to the United Nations Conference on the Human Environment held in Stockholm Sweden in 1972 – often referred to as the Stockholm Conference. The deliberations at this conference led to the formation of United Nations Environmental Programme (UNEP) whose headquarters is in Nairobi. UNEP was charged with spear heading and coordinating sound global environmental practices to enhance a healthy and good quality environment for mankind. The conference generated interest in environmental degradation, worldwide. This resulted in declarations, strategies resolutions plans and programmes. Nations became aware of the need to take a balanced and integrated approach to environmental and development questions. In 1992 the world's nations came together in Rio de Janeiro, Brazil at the United Nations Conference on Environment and development (UNCED). 178 governments adopted Agenda 21 – a programme of action for sustainable development worldwide, the Rio declaration on environment and development and the statement of principles for the sustainable management of forests.

The mandate of the (UNCED) was to devise integrated strategies that would halt and reverse the negative impacts of human behaviour on the physical environment and promote environmentally sustainable economic development in all countries. Underlying these was the idea that humanity had reached a turning point. Existing policies, deepened economic divisions within and between countries which increased poverty, hunger, sickness and illiteracy had caused continuing deterioration of the ecosystem on which life on Earth depends. There was therefore need to act to improve the living standards of those who were in need, to manage and protect the ecosystem and bring about a more prosperous future for all. Since no nation can achieve this on its own, the conference came up with a global partnership for sustainable development.

Rio Declaration on Environment and Development

Principle 4 of the Rio Declaration on Environment and development states that “In order to achieve a sustainable environment, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it”. Principle 5 states that “All states and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable

development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world”.

Principle 11 states that “States shall enact effective legislation effective environmental legislation; environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social costs to other countries in particular developing countries. These principles bring out the importance of the environment/development relationship.

Agenda 21 is studied in conjunction with both the Rio Declaration which provides a context for its specific proposals. Kenya is part of the global partnership for sustainable development. Its position as host to UNEP headquarters in Nairobi puts Kenya in the fore front of the environmental campaign. Kenya’s environmental policies were until recently found in Ministerial Statements, development plans, Sessional Papers and various legislation. The adoption of the NEAP in 1994 was the first attempt at a strategic approach, integrating environmental concerns into the development planning process. The 1994 – 96 National Development plan calls for a Sessional paper on sustainable development to set comprehensive guidelines and strategies for government action. Sessional Paper No. 6 of 1999 on Environment and Development sets out a comprehensive policy guideline towards achieving sustainable development in response to the increasing concerns regarding the effects of development on the environment. All the principles of the Sessional paper are relevant to this study but some are more central to the theme.

Principle (a) states that “Environmental protection is an integral part of sustainable development”.

Principle (b) states that “The Environment and its natural resources can meet the needs of present as well as future generations if used sustainably”.

Principle (d) states that “Poverty reduction is an indispensable requirement for sustainable development”.

Environmental protection, basic needs and poverty reduction are at the centre of the study and they form part of the principles of the Sessional paper as areas of government concern. The study is in line with government concern and policy.

Principle (9) states that “Indigenous /traditional knowledge and skills are vital in environmental management and sustainable development”.

Principle (i) states that “Public participation including women and the youth is essential in proper environmental management”.

The study focuses on women’s participation in agroforestry on the farm in general and specifically in the *Orundu*. The *Orundu* is an indigenous practice so in this area the study is once more in line with the principles of the Sessional paper.

The overall goal of the Sessional paper is to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development. Specific goals include incorporating indigenous knowledge, skills and interest for effective participation of local communities in environmental management and sustainable development”. This study seeks to find out if the *Orundu* is a significant practice that can be used to test/integrate Agroforestry innovations.

The objectives of the Sessional Paper include the promotion of environmental conservation with regard to soil fertility, soil conservation, biodiversity and fostering afforestation activities. Agroforestry which is the subject of this study has been scientifically proved to have the capacity to do all the above, hence the existence of ICRAF to research and promote it as one of the viable options for sustainable development.

The Environmental Management and Coordination Act of 1999,

Established an appropriate legal and institutional arrangement to manage the environment and natural resources. It also improved the legal and administrative cooperation of the diverse sectoral functions. This in turn improved the national capacity for management of the environment and natural resources.

The findings of this study can be of use to the District Environment Action Plan Committee. One of the components of the District Environment Action Plan is operational guidelines for the planning and management of the environment and natural resources. If the study establishes that women’s participation in agroforestry has positive environmental impacts then the committee can recommend and promote it

a strategy for natural resource use and environmental management. Nyando District Development Plan (2002 – 2008) indicates that one of their development strategies is to mainstream gender. The results of the study can supply them with statistics to lobby for development funds from the central government for agroforestry projects that mainstream gender. This would serve a double purpose because another of the objective of Nyando District is afforestation and increase of tree cover in the district.

2.4 Poverty

Defining poverty

“Poverty is like heat; you cannot see it; you can only feel it; so to know poverty you have to go through it.” Adabayo Ghana (World Bank, 2000). Poverty implies deprivation of human needs that are not met (GOK, 2002). The poor are defined as those members of society who are unable to afford minimum basic needs comprising food, shelter and clothing (GOK, 2002). Another definition views poverty as deprivation. This encompasses dimensions such as isolation, vulnerability and powerlessness. This definition considers people deprived if they lack the goods and services that are ordinarily available in their society, such as food, clothing and housing. It views powerlessness as important in that it weakness peoples capacity to bargain (UNCHS, 1996).

Poverty is also defined as vulnerability which means defenselessness insecurity and exposure to risk shocks and stress. This definition holds that many low-income households have sufficient income to avoid deprivation until they have to cope with a sudden shock, for instance a serious injury or illness for the income earner. It also notes that poor housing and living conditions and lack of basic services makes people particularly vulnerable to illness and injury (UNCHS,1996).

No single definition can exhaustively capture all aspects of poverty. It is perceived differently by different people. This study will adopt the definition which views poverty as “human needs that are not met” (AMREF, 1997). It will view poverty as the flip side of development. *Development is about providing basic needs while poverty is about the inability to met human needs.* At one end is a situation where human needs are met – this can be described as a state of development. At the other end is a situation where there exists inability to met basic human needs – this can be

described as a state of poverty. The state of development can be defined by describing its attributes such as high income levels, easy and adequate access to services, etc. Since this study will view poverty as the flip side, then the opposite of these attributes will define poverty. This definition will capture most aspects of poverty. This definition is also appropriate for this study because it deals with a broad appraisal of poverty and not specific aspects of poverty. It is easy to use for purposes of generalization.

The measurement of poverty is a means of monitoring development. Simple and quantifiable definitions of poverty are needed to permit its measurement hence the choice of the above definition. However, definitions that set a poverty line dividing the population into the "poor" and the "non poor" are often inaccurate because they simplify and standardize what is highly complex and varied. An income level is set as the poverty line and those with per capita incomes below this line are considered to be poor. (GOK, 1999). The link between income level and level of deprivation is often weak as many people with incomes above the poverty line suffer serious deprivation while some below the poverty line do not. A WHO report noted that poverty defined solely by level of income cannot cover health, life expectancy, literacy or access to public goods (WHO,). **Absolute poverty** is defined in terms of the requirements considered adequate to satisfy minimum basic needs. The absolute poor have no means to meet their needs. The absolute poverty line seeks to identify people who are destitute, whose lives are threatened by the level of deprivation.

Relative poverty

There is a second poverty line that seeks to identify those living in relative poverty. It defines a minimum "basket" of goods and services about which there is general agreement in the society that all citizens should have. People are viewed as relatively deprived if they cannot attain this.

Food poverty refers to those whose expenditures on food are insufficient to meet the FAO/WHO recommended daily allowance of 2,250 calories per adult.

The overall poor are defined as those whose expenditures on both food and non food items do not meet the recommended minimum.

The hardcore poor are those who could not afford the minimum recommended food energy requirement even if they devoted their entire income on food.

Between 20% and 25% of the world's population live in absolute poverty without adequate clothing and shelter. More than 90% of these people are in the developing world (UNCH, 1996). Increasing concern about poverty which has led to it being addressed at international forums. Principle 5 of the Rio Declaration on Environment and Development states that "All states and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world". The World Summit for Social Development (WSSD) held in Copenhagen in 1995 brought together more than 100 world leaders who committed themselves to an ambitious set of goals and targets for the eradication of poverty. The second report on poverty in Kenya (2002) indicates that the absolute poor in Kenya number 13.3 million. 80% of the National incidence of poverty is in rural areas. The Welfare Monitoring Survey of 1997 indicates that the overall poverty line in rural Kenya is Kshs. 1,239.00 and the hard core poverty line is Kshs. 927.00. In urban areas the overall poverty line is Kshs. 2,648 while hard core poverty line is Kshs. 1,254.00 (GOK, 2000). For purposes of international comparison a poverty line of US \$1 per capita per day has been established. In the light of this, Kenya's poverty line is well below the international poverty line.

Since attaining independence in 1963, Kenya has tried to combat poverty using several methods. Combating poverty through National Development Plans initially focused on government intervention to ensure rapid economic growth which was expected to alleviate poverty. Later National development plans focused on liberalization and private sector participation. However, the objectives were too macro in their focus and did not address the micro problems of equity, access to economic opportunities and social services for the poor.

The District Focus for Rural Development strategy which was launched in 1983 was another strategy used by the Kenya government to combat poverty. Its main objectives were to allocate resources on a geographically equitable basis. Even handedness in a geographic sense was felt by some to offer the possibility of social and economic equity and poverty alleviation. Funds were to be allocated to the less developed regions which were then encouraged to submit project proposals for funding. However, due to poor preparation, the unfamiliarity of district staff with methods of participatory planning, the absence of monitoring and evaluation and weak

commitment of sector staff to inter sectoral initiatives, projects were poorly conceived and designed. Corruption led to the procurement of unsuitable material equipment and machinery.

The target beneficiaries who were the poor and vulnerable were largely excluded from direct involvement therefore they did not identify with the projects. Instead they saw the projects as government projects. Little effort was made to strengthen social administrative structures below the district level although these structures were much closer to the people than those at the district level. Priorities for district projects were often set by politicians and district level staff. As a result there has been weak local support ownership or commitment to projects. DFRD has not established the participatory and poverty alleviation processes it was meant to promote.

The Social Dimensions of Development (SDD) Program was yet another strategy for combating poverty. It was launched in 1994 and was intended to address a broad range of economic and social problems experienced by low income and vulnerable groups. Other recent initiatives towards poverty alleviation include the Rural Development Trust Fund (RDTF), National Youth Development Fund (NYDF), Disabled Fund (DF) and National Women Development Fund (NWDF). These are high profile fund raising initiatives.

The main problems in achieving poverty reduction lie in failure in implementation rather than design of plans. The key difficulties are in the understanding of supporting social and institutional context and the underlying assumptions about targeting and sectoral feasibility.

The National Poverty Eradication Plan (NPEP) 1999 – 2015 provides a national policy and institutional framework for urgent action against poverty in Kenya. The need for a poverty eradication plan arises from the persistence of poverty despite past efforts to combat it. This plan bridges the gap between the National Development Plans and their macro objectives on one hand and the imperative to address the needs of the poor. It focuses on policies and sets operational priorities on the poor seeking to achieve pro-poor economic growth and service delivery. It has been formulated in line with the goals and commitments of the world summit for social development. Poverty

eradication strategies can best serve the poor when they focus on results and not platitudes (World Bank 2000).

The plan has 3 major components each setting out a frame work for further action by government, civil society, private sector and donor partners.

- 1) A charter for social integration.
- 2) Improved access to essential services by low income household that currently lack basic health, education and safe drinking water.
- 3) A strategy for broad based economic growth.

A central component of the larger effort towards economic growth, poverty reduction and increased employment is the strategy for the balanced development of rural and urban areas.

The plan sets specific targets such as:

1. Production of the poor in the total population by 20% by 2004 and a further 30% by 2010.
2. Universal access to primary health care to within 5 km of all rural households or within an hour of local transport by 2010.
3. Increase by 8% each year until 2004 access to safe drinking water by poor households.
4. By 2010 create universal access to safe water.
5. Reduce time spent by women on fuel wood and water collection.
6. publish best practice guidelines for rural and urban social development by 2002
7. 20% of communities to draw up action plans by 2004.
8. 40% of all extension messages to be relevant to very poor farmers.
9. 15% increase in enrollment rates over the 1st 6 years of the plan.
10. 19% increase in completion rates especially for girls in the 6 year period.

The NPEP implementation is in three phases. The first phase is 1999-2004, the second phase is 2005 – 2010 and the third phase is 2011 – 2015. Each phase is to be implemented through the Poverty Reduction Strategy Papers (PRSP) and Medium Term Expenditure Framework (MTEF).

In the first phase was to include settling local poverty reduction priorities and establishing management structures and appropriate financing mechanisms. The immediate goal of NPEP is to reduce the numbers of households living in absolute poverty by 20% by 2004. This was to be achieved through pilot demonstrations and implementation of community action plans. The study is relevant to this phase of the national poverty eradication plan because its findings can be incorporated especially so in establishing management structures and drawing community action plans.

The second phase will be devoted to consolidating the gains of the first phase and expanding or replicating the experiences gained from pilot poverty interventions to over most of the poor districts in Kenya. If the recommendations of the study which formed part community action plans are found to be effective in poverty reduction, then the same can be replicated in other districts especially where there are similar socio-cultural traits.

The final phase will be devoted to increased monitoring and evaluation of poverty eradication initiatives, impact assessment and policy refinement.

Poverty and the Environment

Poor people engage in such activities such as poor farming practices, burning of tress to make charcoal, poor sewer disposal etc. These activities affect the environment negatively and reduce the lands potential especially in marginal lands leading to the over exploitation of land and water resources.

However, people must address their immediate survival needs even when they conflict with the long term need to preserve the integrity of the environment. Sessional Paper Number 6 of 199 on Environmental and Development Summarizes the relationship between poverty and the environment by stating that "Poverty leads to overuse and destruction of the environment where short term development goals and practices are pursued at the expense of long term environmental sustainability". Since poverty and environmental concerns are enter-twined they need to be addressed simultaneously.

The study topic – Agroforestry has the capacity to address both poverty reduction and environmental concerns. It has potential for income generation which address income poverty. It has potential for food production which addresses food poverty. It has potential for environmental protection, conservation and enhancement.

The need for a poverty eradication plan arises from the persistence of poverty despite past efforts to combat it. This plan bridges the gap between the national Development plans and their macro objectives on one hand and the imperative to address the needs of the poor. It focuses on policies and sets operational priorities on the poor seeking to achieve pro-poor economic growth and service delivery. It has been formulated in line with the goals and commitments of the world summit for social development. Poverty eradication strategies can best serve the poor when they focus on results and not platitudes (World Bank, 2000).

Poverty and the Environment

Sessional paper number 6 of 1999 on Environmental and Development Summarizes the relationship between poverty and the environment by stating that “Poverty leads to overuse and destruction of the environment where short term development goals and practices are pursued at the expense of long term environmental sustainability”. Since the strategy views poverty as the flip side of development, then the discussion on the Development – Environment relationship applies to poverty and environment but applies in the reverse.

2.5 Rural Development

The development requirements of the rural areas differ from those of the urban areas because of their different characteristics. Rural areas cover extensive geographical space where as urban areas cover relatively smaller geographic space. Urban areas are concentrations of population, services, activities, etc, while in the rural areas these are dispersed. In the developing countries the disparities between development in the rural areas and the urban areas are great. This can be explained in part by the existence of dual economics where there is an urban based modern sector on one hand and a rural based traditional sector on the other hand. The rural areas experience a high rate of out migration as people move to urban areas in search of better life, and employment. They are characterized by low levels of development and service provision. Primary production such as forestry, mining and agriculture are the main sources of employment in rural areas and these attract lower wages compared to urban. The end result is a higher incidence of poverty in the rural areas. Several **regional development theories** have been put forward to try and address the spatial dimensions of development. The regional development theories of Hirschman (1968), Mrydal

(1957) and Friedman (1959) lead to polarized development and can be described as top down development strategies. They use the urban centres as the nucleus for development. Development decisions are made by the central government and communicated to the people.

Regional planning in Kenya began during the colonial era.

Colonial Kenya had a dual economy with commercial farms of the Europeans forming the modern sector and the substance African farms forming the traditional sector. After independence more emphasis was put on industrialization. Capital funds were pumped into the industrial sector because it was believed the spread and backwash effects would diffuse the benefits of development to the entire region. This was not the case. Rural areas continued to lag behind and by 1970s the government realized the need to seek other strategies that would address the regional differences of development. Since the top down approach was not generating the desired results, an alternative approach was designed. This was the bottom-up approach to development. In 1983, the District Focus for Rural Development was launched. This was an attempt at bottom up approach. In this approach development needs are established at the community level and communicated back to the central government.

2.5.1 Rural development and agriculture

Rural development constitutes a broader subject than the economics of agriculture as a sector. It has a spatial rather than a sectoral definition. It includes resource allocation, income strategies and levels, poverty and inequalities, income and food security, satisfaction of basic needs and quality of life for rural households. In the developing countries rural underdevelopment is a fundamental determinant of over all underdevelopment. Nearly 75% of the world's poor who subsist on less than one dollar a day live in rural areas (World Bank, 1997). Nearly 75% of the worlds underfed also live in rural areas. Levels of poverty are typically much deeper in rural areas and despite rapid urbanization, the majority of the world's poor and underfed are in the rural areas. There is public under-investment in rural areas with corresponding low levels of provision of amenities, such as health, education, portable water and sanitation.

The United Nations Programme of Action from Rio (Agenda 21) included promoting sustainable agriculture and rural development (SARD). This was in response to the

growing global population especially in the developing countries whose demands for food and other agricultural commodities was also growing and required to be met. The main objective of SARD was to increase food production in a sustainable way and enhance food security.

Agriculture in Kenya

The economic base of Kenya is agriculture and it contributes about 25% of Kenya's G.D.P. However, agricultural production has been declining over the years. According to the Economic survey (2001), the growth rate of the agricultural sector went down from 1.2% in 1999 to negative 2.4% in 2000

Table 2.1 - Distribution of G.P.D. by Productive Sector %

	1964 – 73	74-79	80-89	90-95	96-2000
Agriculture	36.6	33.2	29.8	26.2	24.5
Manufacturing	10.0	11.8	12.8	1.6	13.3
Public Services	14.7	15.3	15.0	15.7	14.8
Other services	38.7	39.7	42.4	44.5	47.4
Total	100.00	100.00	100.00	100.00	100.00

Source: National Development Plan 2002 – 2008

Table 1 above indicates the importance of agriculture to the economy of Kenya. Since independence it is the single highest contributor to the countries G.D.P. In the rural areas people depend on agriculture more than in the urban areas. Development in the rural areas inevitably revolves around agriculture. It is the single most important source of income, employment and food. Declining agricultural production implies increasing poverty in the rural areas, and an increase in rural poverty leads to environmental degradation as the people strive to meet their immediate survival requirements. Only 18% of Kenya's land is suitable for agriculture. The remaining 82% is arid and semi arid. This puts more stress on the small arable area. Nyando district like the rest of Kenya relies on agriculture as its economic base. The main cash crops in this region are sugar cane, cotton and rice. All these have faced problems which have led to their decline and near collapse increasing the incidence of poverty. In the light of rising concern for poverty eradication, this study addresses issues of alternative and/or complimentary farming methods/systems that can be used to contribute to rural development and at the same time protect the environment. Agroforestry can be alternative farming method

2.5.3 Food supply

Food is a basic human need. Lack of adequate food supply combined with rudimentary health facilities leads to low life expectancy (Thirwall, 1994). Food security is therefore an important component of rural development. One of the targets of rural development is to ensure that there is adequate and reliable food supply in the rural areas.

The FAO and WHO recommend a minimum food energy requirement for adults to be 2,250 calories. The monetary value of this minimum food energy intake is called the food poverty line. Food poverty therefore, refers to those whose expenditures on food are insufficient to meet this minimum food requirement. (GOK, 2000).

Food is produced through agriculture. Where the region cannot be self sufficient in food supply, the commodity must be purchased from outlying areas. This implies that if the rural people cannot produce their own food, then they must have money to purchase the food. As was discussed in earlier section, the incidence of poverty is higher in the rural areas than in the urban areas. Rural incomes are also lower. As a result of these factors most rural people try to obtain their food from their farm holdings. Rural areas also have to provide food for urban settlements. Food commodities command a higher market price in the urban areas than in the rural areas. This has led to a great demand for food commodities. As people in the rural areas strive to meet the demand for food commodities, they interact with the environment. This interaction can lead to environmental degradation if the methods of production are not sustainable. It is therefore important to find appropriate farming systems that can lead to an increase in food production but at the same time conserve the environment.

Agroforestry as a farming system has the potential to contribute to food production and at the same time conserve the environment. In Kenya the food poverty line in the rural areas was estimated at Ksh 927 per adult. The incidence of food poverty in rural areas was 51%. The second report on poverty in Kenya (2000) indicates that expenditure for food accounts for the largest share (72%) of consumption in rural areas. Own-food consumption contributes 30% of food consumed in rural areas (GOK for 2000). Since 70% of food consumed is purchased and not own-produced, price

increases in food would have negative impact on the welfare of the poor. It is therefore important to increase the share of own-food consumed in the rural areas.

2.5.4 Wood fuel supply

Wood fuel refers to both fuel wood and charcoal. In the developing countries the main sources of energy in the rural areas are fuel wood, crop residue and manure (UNCED,1992). In Kenya 80% of the population is dependant on wood fuel for domestic energy needs. The economic survey (2001) indicates that wood fuel supplies over 70% of Kenya's energy demands and provides 93% of rural household energy requirements. In urban areas charcoal is more predominantly used than fuel wood. At least 80% of urban households wood fuel demands are met by charcoal. The current policy on wood fuel emphasizes provision of adequate supplies of wood to satisfy demand through a sustained yield, while at the same time conserving the environment. To achieve this objective, programmes aimed at promoting and developing efficient energy appliances like improvised varieties of stores have been adopted. Agroforestry is also encouraged for sustainable firewood supply.

2.5.5 Rural water supply

"Water is life" summarizes the importance of water supply as a component of development. The World Health Organization advocates for access to clean water for all. However, in the developing world, large proportions of the population do not have access to clean water. In Kenya only 20% of the population has access to piped water (GOK, 2000). The remaining 80% relay on water from rivers, boreholes, shallow wells and rain catchment. Pana to sustain the flow of rivers and constantly replenish underground aquifers there must be proper management of the river catchment areas. Part of this catchment management includes maintaining adequate tree cover. (ICRAF,2000). It also involves soil and water conservation among other things. Agroforestry systems can contribute to increasing tree cover in a region. It can also contribute to soil and water conservation. The study area is drained by rivers such as Nyando, Awach and Sondu-Miriu. Parts of the district serve as catchment for Nyando River. Flooding is common in the lower parts of the river. This is caused in part by erosion in the upper regions (Timberlake, 1988). Agroforestry is therefore, an appropriate intervention in the study area.

2.6. Gender Issues

The word gender is a grammatical distinction between masculine (male) and feminine (female) characteristics of living things. It can be seen as a socio-cultural construct referring to the roles and responsibilities of men and women and the differences between them (Mwangi I. K., 1999). Gender roles are learnt and vary widely between cultures. Gender roles can change. They are categorizations based on social processes and are not necessarily connected to biological sexual differences (UNEP, 2000). Larson and Schlyter (1993) define gender contracts as “invisible social contracts regulating the relationships between men and women at all levels of society”. Gender contracts when taken together form gender systems which are dynamic and change over time.

Gender roles and relations focus on the socially constructed role expectations for men and women in diverse settings. They also focus on women and men do and the differences in access to and control over income and other resources (Parker, 1995). Gender roles and relations spell out power relations between women and men in different activity setting. Over and above all, they reveal the underprivileged status of women and their relative deprivation in various sectors of livelihood compared to the men. Gender sensitivity therefore means being sensitive to the needs of women, men, boys and girls the ultimate goal being the achievement of equity. Gender sensitivity entails searching considering and accommodating social relation between women and man in their context, in any analysis of policy, planning and programming. (Humbly, 1999)

Mainstreaming gender makes gender a routine concern in development processes in organizations and policies. The United Nations defines gender mainstreaming as the process of assessing the implication's for women and men of any planned action, including legislation, policies, programmes, in any area and at all levels. Its main goal is gender equality (access to resources opportunities and rewards of labour) with the objective of ensuring a positive impact on women and men and bridging gender disparities.

Gender analysis is a critical examination of women, men, boys and girls in the development process; it ensures that consideration is given to the different needs of women and men at all levels of policy, planning and programming. The insights

gained through gender analysis are used to tailor development processes in order to improve productivity and ensure sustainability (UN, 2000). Practical gender needs are issues addressed to assist women in their existing subordinate position in society. They do not challenge the rooted gender divisions of labour or women's subordinate position in society. Practical gender needs respond to an immediate perceived necessity and are often concerned with inadequate living conditions such as family food or employment. Men also have practical gender needs. For example they are expected to be bread winners (Parker, 1995). Strategic gender needs challenge existing and unfair subordinate relationships between men and women for strategic reasons. For example, they relate to gendered division of labour power and control and may include issues such as legal rights, property control/ownership, and domestic violence (Parker, 1995).

The increasing awareness for the need to integrate women in the development process has led to gender analysis and mainstreaming gender. By 1980 two major approaches have emerged through which women participated in the process of development. One approach was WID (Women in Development) and the second one was GAD (Gender and Development). WID promoted the logic that helping women help children and therefore the family to prosper. It addresses the basic or practical needs of women and their families but poses no threat to more strategic needs and interests of women in society (Hambly, 1999). WID policies and policies can do little to address violation of women's natural resource rights. GAD differs from WID in that it seeks to address both practical and strategic gender needs and interest including issues such as women's lack of legal political representation and greater social and economic value for women's labour and knowledge (World Bank, 2000).

Mainstreaming gender in the process of development planning and implementation is a global trend. Principle 20 of the Rio declaration on Environment and development states that "women have a vital role in management and development. Their full participation is therefore essential to achieve sustainable development". This is echoed in Kenya's Sessional paper No. 6 of 1999 on Environment and development. "Public participation, including women and youth, is essential in proper environmental management". In Kenya both National Development plans and District development plans mainstream gender as a means of achieving sustainable development.

Gender analysis will be applied to this study with a view to obtaining a better understanding of the level of women's participation in agroforestry and its implications. Gender disaggregated information reveals what rural men and women know. Both are the sources of knowledge and sustainable resource management practices but each may be knowledgeable on different practices. Building on indigenous knowledge is a way to enhance programme success. Gender-disaggregated information also reveals what rural men and women do and what they need (Wilde & Matila, 1995). The study also examines the practical gender needs which are addressed by agroforestry such as food supply, wood fuel, and income generation. Agroforestry does not address strategic gender needs.

2.7 Agroforestry

2.7.1 Defining agroforestry

Nair (1993) describes agroforestry as a collective name for all land use systems and practices in which woody perennials (tree and shrubs) are grown/managed on the same land management unit as crops and/or animals. This integration of trees and shrubs in the land use system can be either a spatial arrangement e.g. trees growing e.g. trees growing in a field at the same time as the crop or in a time sequence e.g. shrubs grown on a fallow for restoration of soil fertility. Both ecological and economic interaction takes place in an agroforestry system.

Huxley and Houston (1997) define agroforestry as "a dynamic ecologically based natural resource management system that through the integration of trees in farm land and range land diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. Trees in an agroforestry system are not necessarily planted. Natural regeneration of trees may be protected or mature trees may be deliberately left in the fields for pastures.

In recent times the renewed interest in research in agroforestry has risen because of its potential to sustainable agricultural production especially in developing countries CABI (1988). Agroforestry conserves natural resources while enhancing agricultural output from farm land. In the 1970's research priorities were directed by major international bodies such as FAO and the International Development Research Centre (IDRC) towards integration of forestry with agriculture in order to more fully exploit the potential of an integrated approach to land use. The IDRC initiatives led to the

formation of the International Council of Research in agroforestry (ICRAF) in 1977. ICRAF'S business is agroforestry – growing trees on farms along side crops and livestock to improve livelihoods of the rural poor and protect the natural resource base (ICRAF, 2002).

Plate 2.1 – Agroforestry (Agrisilviculture)



Source: Rocheleau et al (1988)

Date palms over sorghum, and a typical home

Agroforestry is one of the most widespread land use systems in the tropics. Traditional forms of agroforestry have been going on in many forms. Innovative agroforestry involves a more scientific application of the technologies linking indigenous knowledge with modern science. Traditional and innovative agroforestry technologies hold considerable promise for alleviating three critical problems facing the developing world – rural poverty, natural resource conservation and sustainable development (ICRAF, 2000). The major types of agroforestry systems are agrisilviculture, silvo pastoral and agro silvo pastoral. Agrisilviculture is the practice of combining trees and crops. Silvo pastoral is the practice of combining trees and animals/pasture. Agrosilvo pastoral is the practice of combining trees, crops and animals/pasture.

Other minor types of agroforestry include agro silvo fishery (Aquasilviculture) Apiculture with trees and entosisilviculture (e.g. silkworm). Within the major systems are several agroforestry practices. Attributes of agroforestry systems are productivity, sustainability and adaptability. Rocheleau (1988) argues that if agroforestry is to serve peoples needs in a variety of rural settings, it is important to view it as an approach to

land use approach rather than a fixed arrangement of plants or particular combination of species.

Plate 2.2 – Agroforestry – (Silvo Pastoralism)



Boran bull under acacia shade at midday.

Rocheleau et al. (1988)

Agroforestry practices in cropland

The most widely practiced agroforestry is based on trees dispersed in cropland. In some cases, farmers plant or maintain trees in their cropland primarily to obtain valuable tree products. In other cases, the trees seem to increase the production of the surrounding crops and improve the soil and water conditions for crop growth.

Contour vegetation strips with multipurpose trees and tree crops provide another example of an agroforestry practice usually introduced in order to prevent soil erosion on sloping croplands, while at the same time providing useful products such as food, fodder or wood. These living barriers may consist of grasses or ground cover only, but it is often desirable to include trees and shrubs.

Multipurpose trees, grasses and other stabilization of conservation structures. Herbaceous plants are often combined along the edges and uncultivated spaces of soil and water conservation structures, ranging from small contour bunds and ditches to bench terraces on cropland. These plant combinations can produce useful items for home use or sale, while helping to stabilize and protect conservation structures from direct exposure to rain and wind.

Alley cropping, or hedgerow intercropping, is perhaps the best known but least understood of all agroforestry practices used on cropland. Alley cropping most often consists of dense hedges of multipurpose trees planted in rows between wider strips of annual crops. The hedges are lopped to produce mulch, which is applied to the cropped areas to fertilize and cover the soil.

Multistorey tree arrangement. Closely spaced trees intercropped with annual plants. In contrast to dispersed trees in cropland, this arrangement is often based on shade-tolerant under storey crops and on a greater diversity of tree and hedgerow species. It resembles home gardens, except that it usually occurs in cropland and the trees are more widely spaced. This practice is more common in humid areas, but may occur in the drier zones of Africa in both rained and irrigated croplands.

Biomass transfers. – Green manure. The practice of mulching, composting or mounding cropland with tree leaves does not necessarily require the presence of trees in cropland, but it is still an agroforestry practice, using tree leaves to protect and improve the soil and to increase crop yields.

Fallow cropland

Fallows are croplands left without crops for periods ranging from one season to several years. The objective is to control insect pests, diseases and weeds associated with previous cropping and to recover depleted soil nutrients. Once the soil has recovered, crops are reintroduced for one or more seasons, after which the fallow is repeated. Improved fallows may involve only the selective cutting and weeding of the natural vegetation, additions to the natural vegetation or even the replacement of the natural vegetation with trees, herbaceous plants or animals. Normally, improved fallows can be expected to restore the cropland more quickly than natural fallows, allowing a shorter fallow period before cropping begins again. It is also possible to introduce permanent trees and shrubs which will be maintained through future cycles of cropping and fallows.

Pastures and rangeland

Sylvopastoral systems combine woody plants with grasses and other herbaceous fodder plants. Extensive sylvopastoral systems on rangeland usually involve the

selective protection and management of naturally occurring trees and shrubs of particular value for animal fodder. Trees may also be purposely planted with existing grasses, either dispersed as individuals, in clumps or in rare cases in lines or blocks. In addition to high-protein fodder for livestock, the trees may provide building poles, fuel wood, fruit or cash crops such as resins. More intensive sylvopastoral systems are found in natural or improved pastures in farming areas. Naturally occurring trees may be managed selectively or multipurpose trees and fodder shrubs may be planted.

Agroforestry practices on boundaries and border space

Living fences and living fencepost are used in Africa to protect people and their dwellings, crops, animals and other property. They may be designed to fence animals in or to keep people and animals out of a particular space. Plants may form the entire fence structure, or living trees may be used as fence posts while the rest of the fence is made of wire or dead branches and reeds.

Boundary markers are different from living fences, as their main purpose is to make boundaries clear, without necessarily enforcing them.

Windbreaks are often, but not always, located on boundaries between properties or fields. Their main function is to protect homes, crops, pastures and soil and water resources from damage by wind.

Agroforestry practices along waterways

Floodplain gardens are located in isolated depressions, along the flatter and more stable portions of river and stream banks or on the edges of lakes and ponds. These sites have a unique production potential because of their access to water and fertile soils.

Erosion Control. Multipurpose trees, shrubs and grasses may be planted to help stabilize rock and wooden structures across gully channels. They may also be planted in lines to form living structures across the lower reaches of shallow channels or to help to stabilize the areas behind erosion-control structures once these areas have filled in with soil and debris. Once stabilized, such sites may be highly productive because of the controlled drainage of surface and subsurface water into the filled sections behind the structures. Timber, fuel wood and fodder can all be produced from woody plants growing in these sites and in some cases farmers may eventually

develop small fruit and vegetable plots. Multipurpose trees and tree crops may also be established with grasses on the sloping banks of streams, gullies or channels. In such sites, they serve to protect the soil on the slopes, to shade the watercourses and to provide fuel wood, fodder, fruit or other products which do not require removal of the trees or ground cover.

Agroforestry practices in home compounds

Home gardens occur in some form in almost every ecological zone and farming system. Agroforestry practices in home gardens can range from a few trees and shrubs in a small vegetable and herb garden to a dense multistoreyed plot of fruits, vegetables, herbs and cash crops with trees planted for timber, fuel wood and/or fodder. A home garden may serve as a specialized plot within a larger production system or it may represent the main cultivated plot and a major source of food and cash income, especially for a poor family with little arable land.

Decorative and shelter planting (Homestead planting) around houses may also include agroforestry practices. For example, fruit-bearing vines may be mixed with large ornamental trees or vegetable gardens may be combined with rows of flowering or decorative trees. The bases of large shade trees or fenced fruit trees can provide safe, convenient spaces for small nurseries of tree and vegetable seedlings. Living fences can also be an integral part of a home compound, whether to control animals or simply to define spaces for different purposes. These are often decorated with flowering or fruit-bearing vines or shrubs. Even when home-compound plantings do not directly include agroforestry practices, they can provide a testing ground and display case for new agroforestry species and techniques for tree establishment and management.

Public and shared spaces

Decorative, symbolic and shelter planting in public places may take many forms, most of which do not include agroforestry practices. However, such places may be excellent sites to demonstrate new agroforestry practices or species to the local community. Trees that provide shade, fruit or fodder may be planted in sites such as public markets, wells, clinics or places of worship.

Public spaces also include community plots for the production of wood, fodder, food or cash crops. Most community plots have the potential to include agroforestry practices, either within the plot or as living fences.

Roadside plantings resemble other plantings in public places. They may include ornamental and shade trees or trees that provide useful products for local consumption. Roadside plantings may also be used to demonstrate agroforestry species and practices. Roadsides are particularly well suited to combinations of grasses and trees or fully developed agroforestry production systems. Government agencies or residents may plant trees along roadsides for shade, fodder, fuel, oilseeds, fruit or other products. In many situations, people harvest the grasses or cultivate annual crops in these tree-lined strips of public land.

Forests, Woodlands and Woodlots

Forest enrichment can make wooded areas more useful by protecting and improving soil and water resources, by increasing the production of tree products or by adding new productive plants and animals. Where trees are planted to prevent or reverse erosion in forest clearings, they may be combined with soil and water conservation structures as well as herbaceous plants for ground cover.

The taungya agroforestry system (Shamba system) combines the establishment of new forest plantations with food and cash crops. Farmers clear and prepare a site, plant their crops along with tree seedlings and maintain both trees and crops for a few years until the tree canopy begins to close. They then repeat the process in a new site. This approach can reduce the cost of reforestation, but in most cases farmers and forest dwellers work for low wages and eventually lose access to agricultural land and forest products. *Taungya* systems can, however, incorporate secure terms of use and access for rural communities to pursue farming as well as forest development over the long term.

Woodlot enrichment is similar to forest enrichment, although it usually involves more intensive management of trees and other plants in a smaller area. Permanent woodlots may be sited almost anywhere in the landscape, from cropland to pastures, but once an area becomes a woodlot it is a landscape feature in its own right with many qualities similar to forests.

Tree-crop plantations do not necessarily include agroforestry practices, but may do so. For example, some farmers combine citrus and coconut groves with planted pastures subjected to controlled grazing. In other cases, coffee and tea plantations benefit from dispersed shade trees that improve soil fertility and provide fuel wood and timber.

Benefits of agroforestry

Agroforestry trees produce a variety of products and services. These can be put into 2 categories as follows:-

1. Tree products
2. Services for other factors of production.

Tree products include food, fruits, fodder and forage, fuel wood, charcoal, farm construction material, medicine, raw materials for household/cottage industry and cash from sale of the same products. Farm construction material include timber, posts, poles, and other fencing material while cottage industries include productions of items such as utensils, handicrafts, tools, fibers, honey, beeswax and chemical (Tannin and Resins). Services for other factors of production include soil fertility, improvement of soil erosion control, water conservation, improved water infiltration and retention stream/river bank stabilization, water purification, improved drainage in waterlogged soils, environmental conservation, weed control, farm protection, wind breaks recreation and shade, ornamental and cultural value, ritual and social function.

2.7.2 Environmental benefits of Agroforestry

Agroforestry systems provide numerous benefits to the environment. They can help stabilize and enhance already degraded environments. Trees are natural protectors of the environment. Most conservation problems such as erosion, declining soil fertility, degradation of grazing land vegetation can be solved by better management through the integration of agroforestry systems in these lands. Where the trees protect the soil by reducing rain drop velocity and provide litter which decomposes and make it possible for other plants to grow which in turn help in controlling erosion. The roots of trees improve water infiltration capacity of the soils thus reducing erosion and water loss (ICRAF, 2000).

Plant litter decomposes and releases nutrients into the soil which recycle back into the plants.

The litter also provides mulch, compost and humus. These improve soil nutrient status, reduce erosion and water runoff, lower evaporation rates and reduce need for tillage and weeding thus enhancing higher productivity. Trees and shrubs produce more litter than grass and other agricultural crops. Leguminous species are nitrogen fixing and can add up to 500 kg of nitrogen to the soil per Ha per year. Trees are deep rooted (60 cm and more) (Njuki, 2000). They are able to tap nutrients and moisture at depths not reached by other agricultural crops. These trees can keep green even during drought and in this way supply fodder for livestock when grass dries up. This also creates an atmosphere of minimal competition for food and nutrients between trees and crops. Trees draw from the deeper layers while plants draw from the upper layers. Nutrients deep down are brought out by the roots. The nutrients move to the leaves. When the leaves fall and decompose these nutrients are available to other crops that drawing nutrients from the upper soil layers. This increases compatibility of trees and crops.

2.7.3 Agroforestry and development

There is rising global concern about the effects of development on the environment. Pressing global environmental problems such as climate change, loss of biodiversity, desertification, depletion of fish stock, spread of organic solution need to be addressed. At the same time there is global focus on poverty reduction. (World Bank, 2000). This calls for development strategies that promote economic growth, social advancement and environmental protection. The link between people and trees include food security, nutrition, energy, off-farm employment, income, medicine and sustainable agriculture and livestock production (Wilde and Matito, 1995). These links are especially vital to the rural poor.

During the 1980's forestry development policies began to move away from a strict production and industrial sector focus towards a rural development approach which incorporates the links between trees and people. Community participatory forests were designed to address the inter related problems of environmental degradation and rural poverty, promoting local people as the agents and beneficiaries. Research carried out by ICRAF – recently renamed World agroforestry has established the scientific basis for advocating agroforestry as a practical and beneficial land use approach for small holders in developing countries (Denning, 2001). Evidence of this is seen in Western Kenya where short term leguminous fallows and Biomass transfers are being used by peasant farmers to improve the fertility of depleted yet high potential soils. (Mango,

2002) In Embu district of Eastern Kenya farmers are planting legumes in fodder banks for use as an inexpensive protein supplement for their dairy cattle (Wambugu et al, 2001). In Zambia more than 10,000 farmers are using short rotation improved follows to restore soil fertility and raise maize crop yields. In the ASALs of West Africa hundreds of farmers are adopting live hedges to protect dry season market gardens from livestock. In South East Asia degraded sloping land has been planted with contour hedgerow systems based on natural vegetative strips. These examples from diverse ecoregions illustrate the emergence of sustainable agroforestry solutions to problems of land degradation, poverty, and food security in rural areas (Denning, 2001). Agroforestry addresses specific needs of society and the environment. Forests are shrinking yet the population and the demand for forest products is increasing. There is a need to seek alternative sources of tree products. On the other hand conventional forests cater mainly for industrial purpose such as pulp and paper and saw milling. They do not focus on other wood needs. Agroforestry products address non industrial uses of trees such as wood fuel, fruit production. The beneficial role of trees in tropical land use systems is increasingly being recognized. Many rural farmers own small farms which must be used for both settlement and farming. Agroforestry is an appropriate farming system for them because it integrates maximization of production and environmental conservation. In Kenya the demand for tree products is steadily growing. The Kenya Forest master plan predicts that by 2005 the demand for wood will outstrip supply if current trends continue. Because of the growing population and conflict in land use it is not possible to increase gazetted forest area in most parts of Kenya. The master plan recommends farm forestry or agroforestry as the future hope for increasing tree products in Kenya.

At independence Kenya concentrated on expanding forest plantation. However in each progressive national development plan more emphasis was put on growing trees outside the gazetted forest area. The Permanent Presidential Commission on Soil conservation and Afforestation (PPCSCA) was also established in 1981 to co-ordinate, review and assess progress in the area of environmental conservation. Research on Farm Forestry/Agroforestry is carried out by Kenya Forest Research Institute (KEFRI) and the International Centre for Research in agroforestry (ICRAF) whose headquarters in Nairobi. These institutions work in collaboration with development partners to create a Research – development continuum. The research findings are used by development agents who bring feed back to the research institutions on the relevance

and suitability of their innovations to the client community (ICRAF 2002). This permits their research to be development-driven as it tries to address the development needs of the community.

2.7.4 Gender and Agroforestry

Studies have shown that there are distinct gender roles within the farming system and these vary from one society to another. (Lee-Smith, 1994). In most African communities women have less access to resources such as land and capital. Women also provide most of the labour required on the farm (above 60%) and 93% of domestic labour. (Njuki, 2000). Women tend to concentrate their agricultural activities around the homestead, primarily because of their domestic and reproductive roles. They play a critical role in food production, post harvest activities, livestock care and increasingly in cash cropping. The dominant gender contracts in most African communities attributes all important decision making to men (Larson & Schlyter 1993). The implications of this on agroforestry is that most of the important decisions are made by the men despite the fact that women will do most of the work. Studies have shown that women view agroforestry as increasing their labour requirements (Mango, 2002) and (Hambly, 1999). They engage in collective action as a strategy to reduce their work load and increase their access to resources.

There are a limited number of niches on the farm holding where women can practice agroforestry. However, the men being the decision makers can practice agroforestry anywhere. These are determined by the communities culture and vary from one place to another. Rocheleau (1988) identified boundary lands as possible areas for women to practice agroforestry. Gender roles in agroforestry are determined by culture and are not the same in all communities (Mango, 2002). However, it is important to note that agroforestry like any development activity cannot be sustainable without incorporating existing gender systems (Wilde & Matilo, 1995). Traditional agroforestry systems evolved around the gender systems of each community. Innovative agroforestry must also be developed with this in mind so that they can easily be adopted by the target communities.

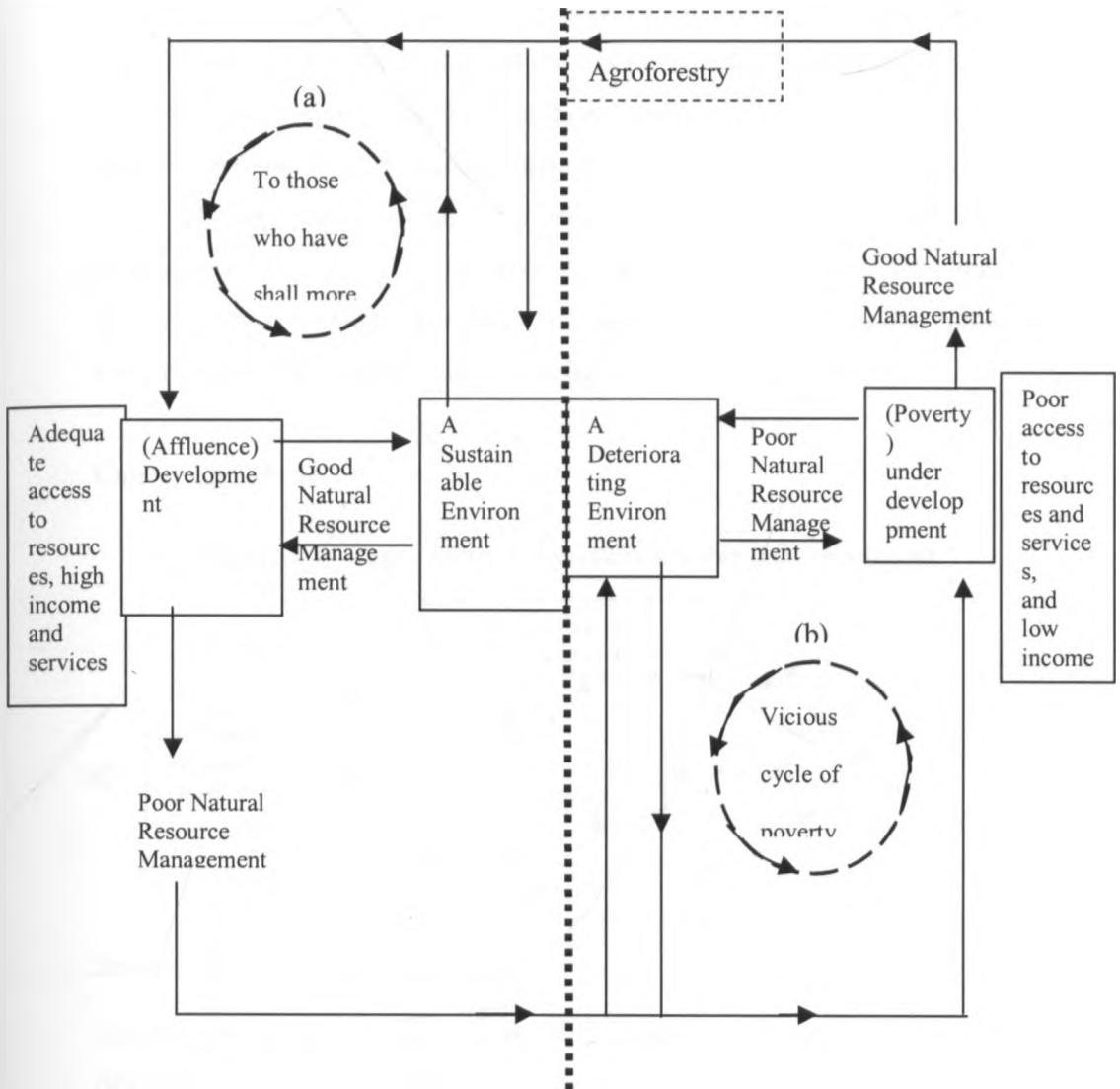
2.8 Conceptual frame work

The Poverty - Environmental relationship.

Rural areas in the developing world experience high levels of poverty and increasing environmental degradation. The environmental degradation is caused by poor natural resource management. Poor natural resource management is perpetuated by poverty because the poor must meet their immediate survival needs even where they conflict with the long term need to preserve the integrity of the environment. This creates a vicious cycle of poverty and environmental degradation as shown at (a) in figure 1. To break this vicious cycle poverty must be addressed. Agroforestry is one way of addressing poverty. It is a sound natural resource management system which can contribute to development through income generation, food supply, wood fuel supply and environmental protection.

Once the people get access to resources, higher income and services then they can obtain their immediate survival needs without comprising the integrity of the environment. It is then possible to have sustainable rural environment. This is shown at (b) Figure 2.4

Figure 2.4 The Poverty – Environment Relationship

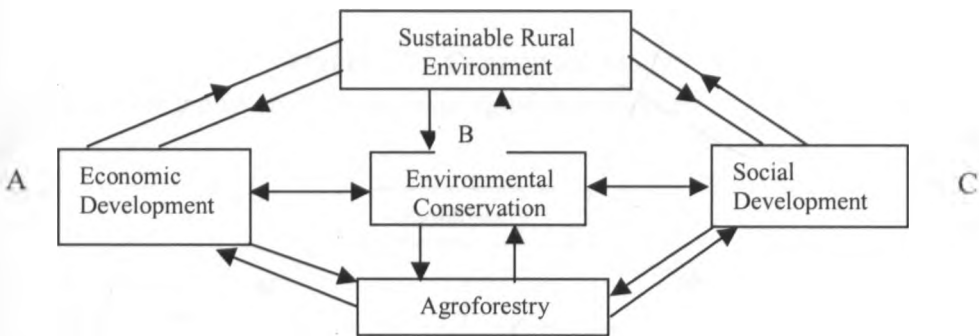


Sustainability through Agroforestry

To create a sustainable rural environment there are 3 basic ingredient required; economic growth, social advancement and environmental protection as shown in Figure 2.3 Ecological development models are the most suitable for achieving this. Agroforestry as an approach to land use has the potential to generate economic growth (at A) because at the household level it can generate income and provide employment. It can contribute to social advancement (at C) because with income and employment the purchasing power of the rural people is raised. It also contributes to social advancement because it has potential to increase food supply thus reducing food poverty. Agroforestry also has the capacity for environmental protection and conservation. This concept is shown in figure 2.

Conceptual Model

Figure 2.5 - Ingredients for sustainable rural development



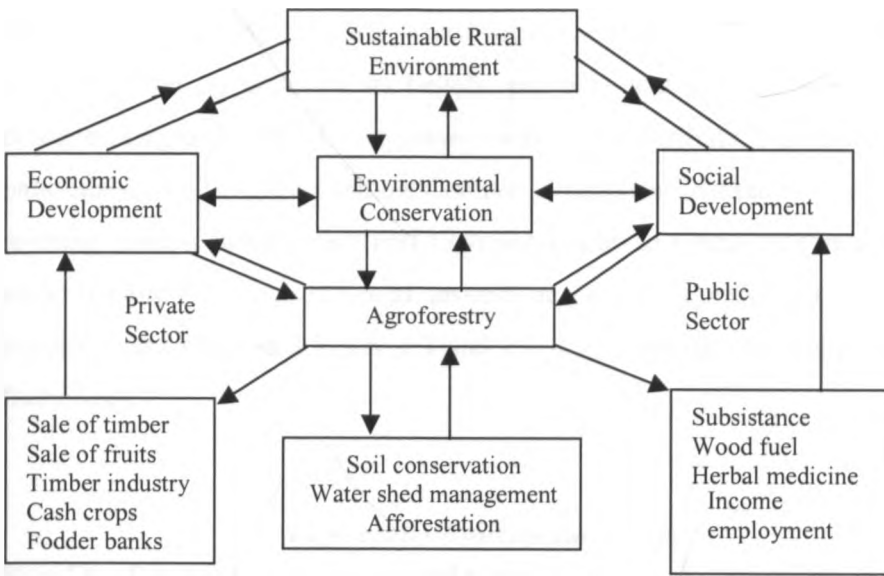
Source: Author's Conceptualization

Agroforestry as a land use is part of the process of rural development. In rural development both the private sector and the public sector are involved. The private sector is driven by the need to maximize profits therefore it is likely to be involved in the economic aspects of development. The public sector will cater for social and environmental aspects of agroforestry. Economic aspects of the agroforestry will revolve around products such as timber industry, fruits for sale, cash crops, fodder, and livestock. Social aspects will revolve around factors such as employment, income generation, wood fuel production, food production, herbal medicines, etc.

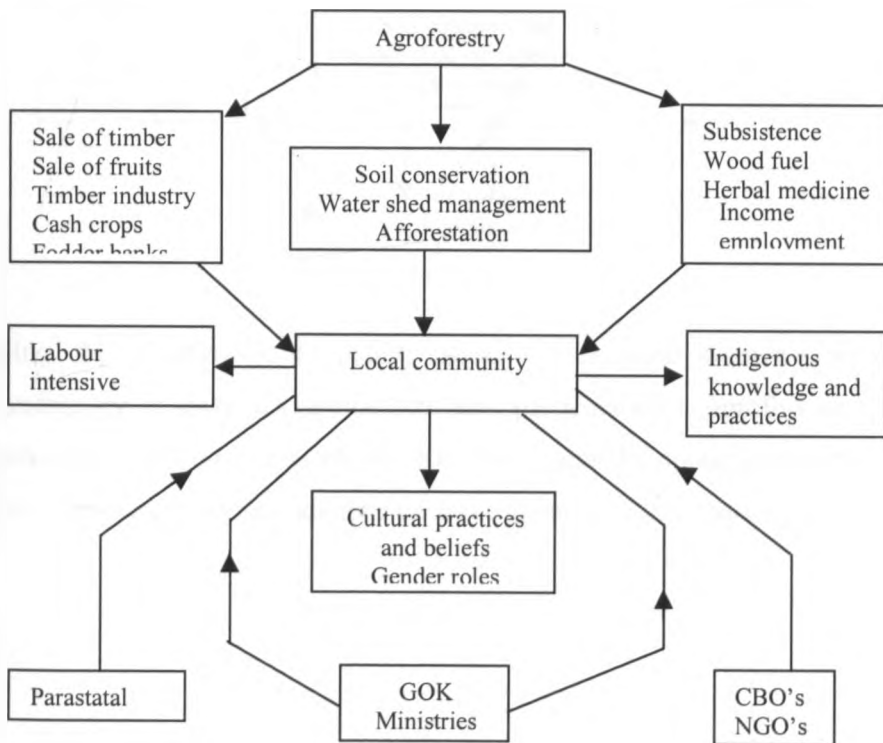
Environmental conservation issues will revolve around soil conservation, water shed management afforestation etc. These are illustrated in Figure 2.6.

Figure 2.6- Conceptual Model

The role of agroforestry in a sustainable rural environment

**Figure 2.7 - Conceptual Model**

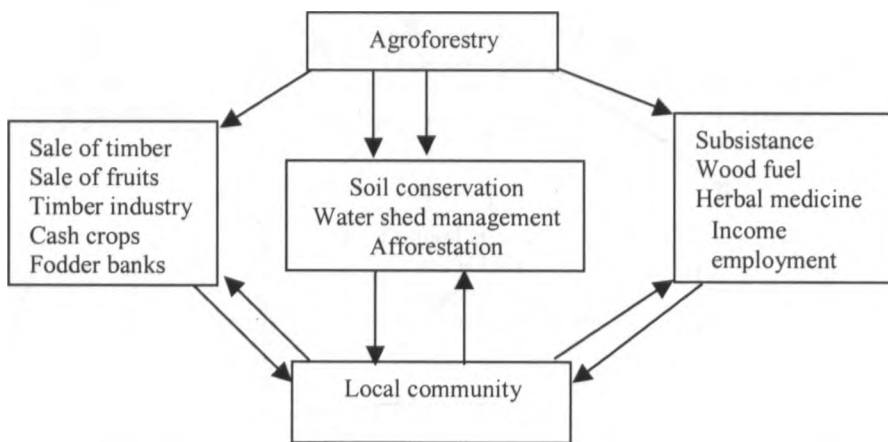
Interaction of inputs and outputs in an agroforestry system.



At the center of all these activities is the local community. Figure 5 shows how the community relates to the agroforestry outputs and inputs in an agroforestry system. The community has indigenous knowledge and practices. It also provides labour. Most agroforestry practices are labour intensive. The community will operate within its cultural set up therefore its beliefs, practices and gender roles will affect their practice of agroforestry. Other players who will contribute to rural development are parastatals, NGOs, CBO's and the Central Government. All these actors work together to bring about a sustainable Rural Environment by fostering economic growth, social advancement and environmental protection through agroforestry. Figure 2.9 is a combination of Figure 2.5, 2.6, 2.7 and 2.8 It is gives the comprehensive conceptual framework.

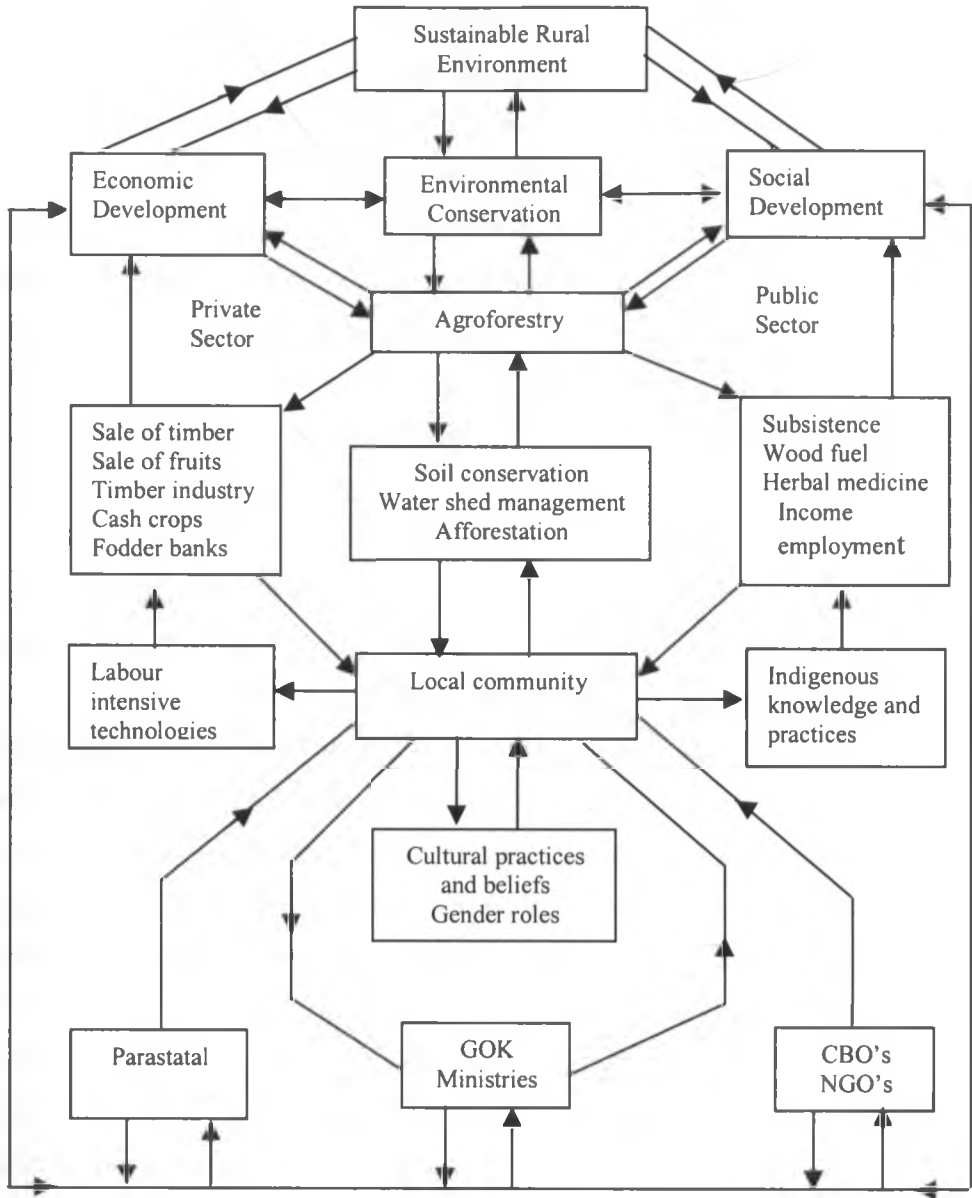
Figure 2.8 - Conceptual Model

Benefits of agroforestry to the local community



Using this framework the study seeks to examine women's participation in agroforestry. It seeks to examine how their participation in agroforestry contributes to sustainable rural environment, the constraints and the opportunities that exist with a view to making recommendations on ways to enhance their participation.

Figure 2.9: A Conceptual Framework of Agroforestry as a land use approach for a sustainable rural environment



CHAPTER 3 – THE STUDY AREA

This chapter of the study introduces the study area which is Nyando District. It describes its size and location in relation to the rest of Kenya. It then examines the physical features such as relief, drainage and how they affect agroforestry. Climatic elements such as rainfall and temperatures are also examined in their relation to agroforestry in the district. The soils of the district are also examined. The emerging Agro ecological zones are determined by the physical features, the climate and the soil. The zones indicate the activities that can be carried out in each zone based on the natural endowment. The natural vegetation is also examined because it is a manifestation of the plant life that can grow naturally in any given region. The chapter examines other variables such as demography, migration, land issues, culture, economy, infrastructure and social services and how they affect or are affected by Agroforestry in Nyando District.

3.1 Location and Size

Nyando District is one of the 12 districts of Nyanza Province. The District was carved out of Kisumu District in 1998 and is therefore a relatively new District. Its administrative Headquarter is Awasi town. It is further divided into 3 constituencies, namely, Nyando, Muhoroni and Nyakach. It covers an area of 1164 km². Nyando District is located to the East of Lake Victoria. The district has a small shoreline to the South-West where it touches, Lake Victoria. It lies between longitude 34° 30'E and 35° 30'E on the East-West axis. On the North-South axis it lies between the Equator 0° 23' and latitude 0° 50' South. Map – shows the location and size of Nyando District in relation to the rest of Kenya. Nyando district is divided into 5 administrative boundaries namely Nyando, Muhoroni, Miwani, Lower Nyakach and Upper Nyakach. Table 3.1 below indicates the locations and sub-locations in Nyando District.

Table 3.1 - Administrative Units in Nyando District

Administrative Units Division	Area km ²	No. of locations	No. of sub-locations
Upper Nyakach	176	6	11
Lower Nyakach	182.6	8	17
Miwani	225.7	3	14
Muhoroni	3334.8	6	17
Nyando	249.3	6	17

Source – District Commissioner's office 2001

Nyando District has 3 parliamentary constituencies namely Nyakach (covers both upper and lower Nyakach), Muhoroni (covering Muhoroni and Miwani) and Nyando.

3.2 Relief

The relief of Nyando District can be divided into 3; the lake shores, the plains and the highlands.

3.2.1 The Kano plains

The Kano Plains covers a vast part of Nyando District. They stretch from the shores of Lake Victoria to the foot of the Nandi Escarpment in the Northern boundary, the Nyabondo plateau to the Southern boundary and the hills of Kericho District to the East and South East. The plains rise from the lake shore to 1,100 m above sea level. The Kano Plains is an extensive region of extremely flat land. This area is subjected to constant floods due to its terrain. Floods here occur in 2 different ways, that is

- 1) When there is heavy rainfall in the region, the water stands on the land for long periods because the gentle of gradient does not allow the water to flow to the lake quickly. At the same time, the black cotton soils of the Kano Plains do not allow the water to percolate easily into the ground. This results in floods.
- 2) When the rivers overflow their banks, the surrounding areas are flooded. Due to the flat terrain the overflowing water spreads over large areas.

The rivers in Nyando tend to overflow their banks because of the heavy rainfall in the neighboring Districts where the rivers originate e.g. the Nandi Hills.

The rivers also overflow their banks because their channels are silted up as a result of erosion in the source areas.

Since the Kano Plains cover most of the District its characteristics are of importance to this study. The nature of the plain will determine the types of agroforestry practice for this region. Agroforestry practices designed for this region must be tolerant of flood conditions.

3.2.2 Highlands

Nyabondo Plateau

The Nyabondo Plateau is in the Southern region of Nyando District. It rises to a height of 1800 m above sea level. It serves as a source of some of the tributaries of the Sondu River which marks the Southern most boundary of Nyando District. The plateau covers a small portion of Nyando district. Due to its height above sea level it receives more rainfall than the plains. This affects the types of trees that can be grown and has implications on the adoption of agroforestry and a wider variety of trees can be grown on the plateau.

Map 1

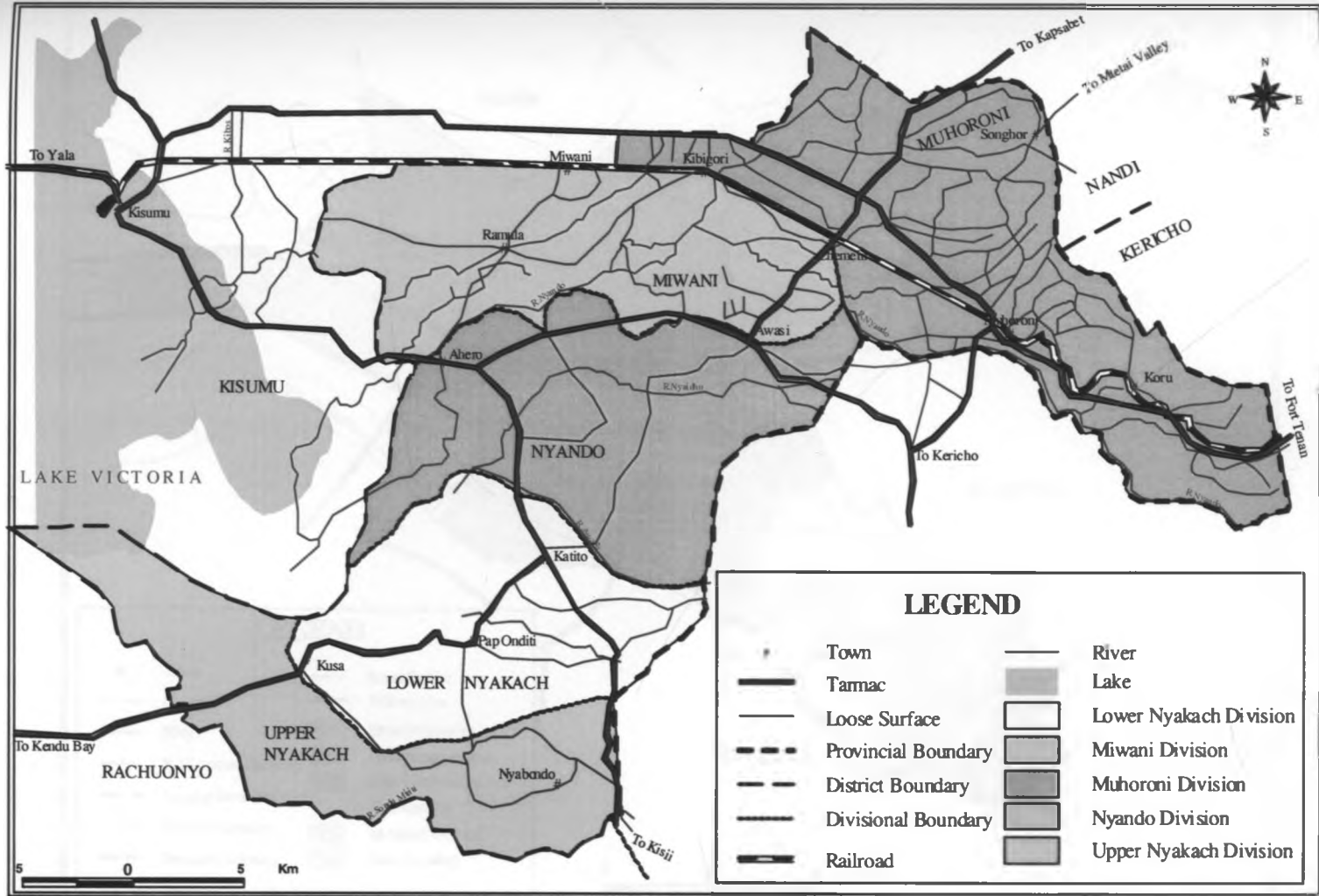
KENYA ADMINISTRATIVE DISTRICTS



Source: Adapted from Almanac Characterisation Tool

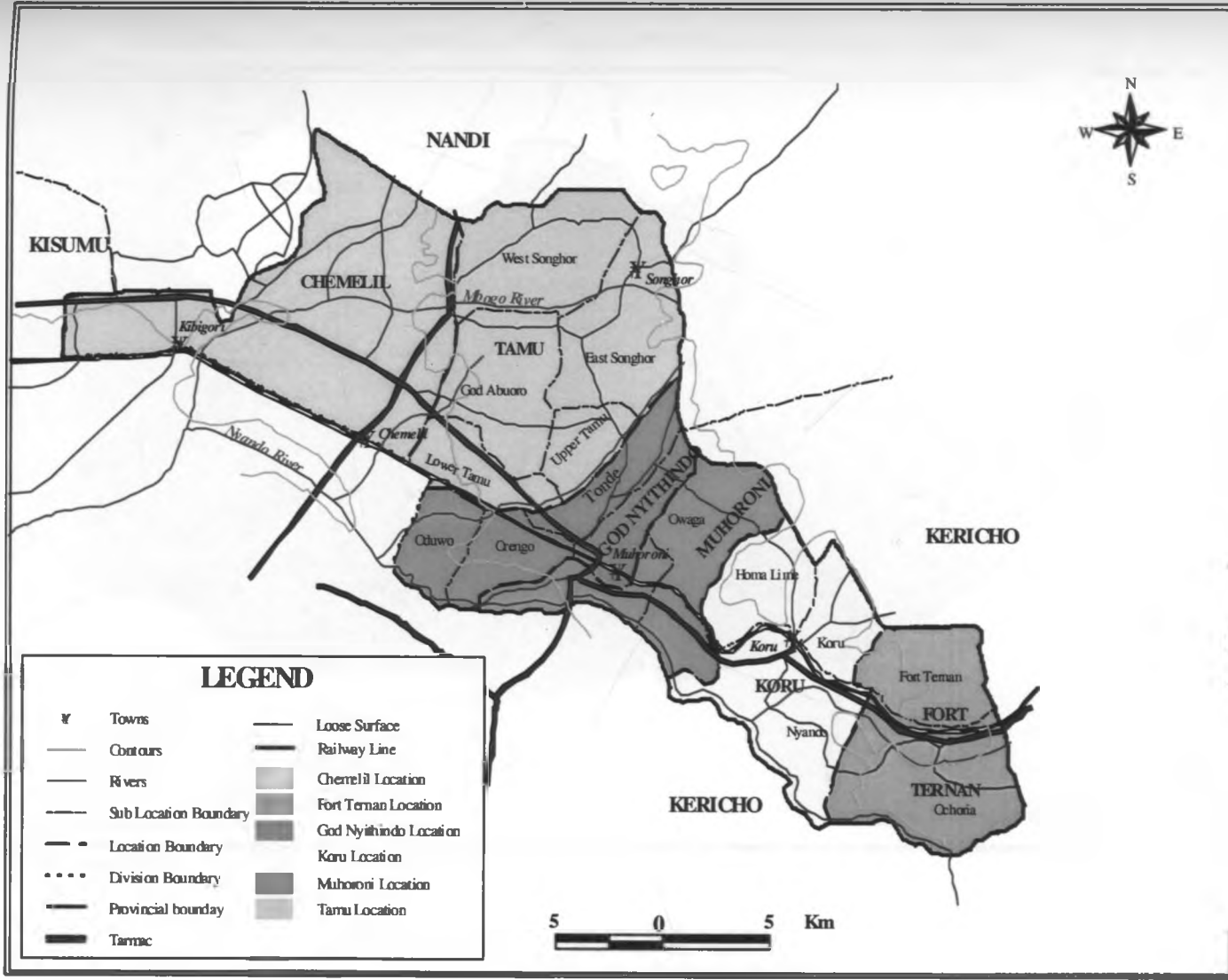
MAP 5

NYANDO DISTRICT - ADMINISTRATIVE DIVISIONS



Source: Survey of Kenya

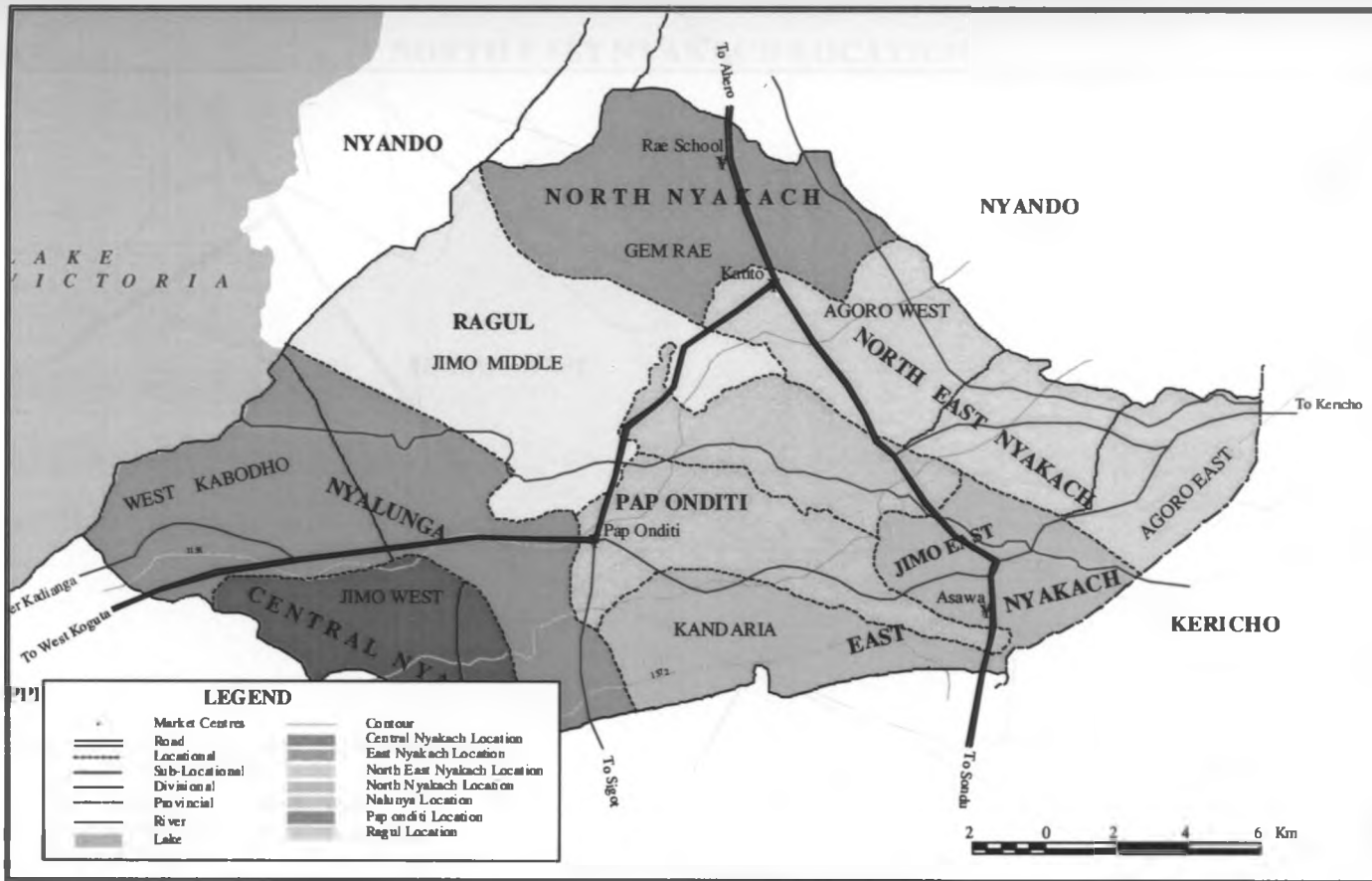
MAP 6: MUHORONI DIVISION - ADMINISTRATIVE LOCATIONS



Source: Survey of Kenya

MAP 7

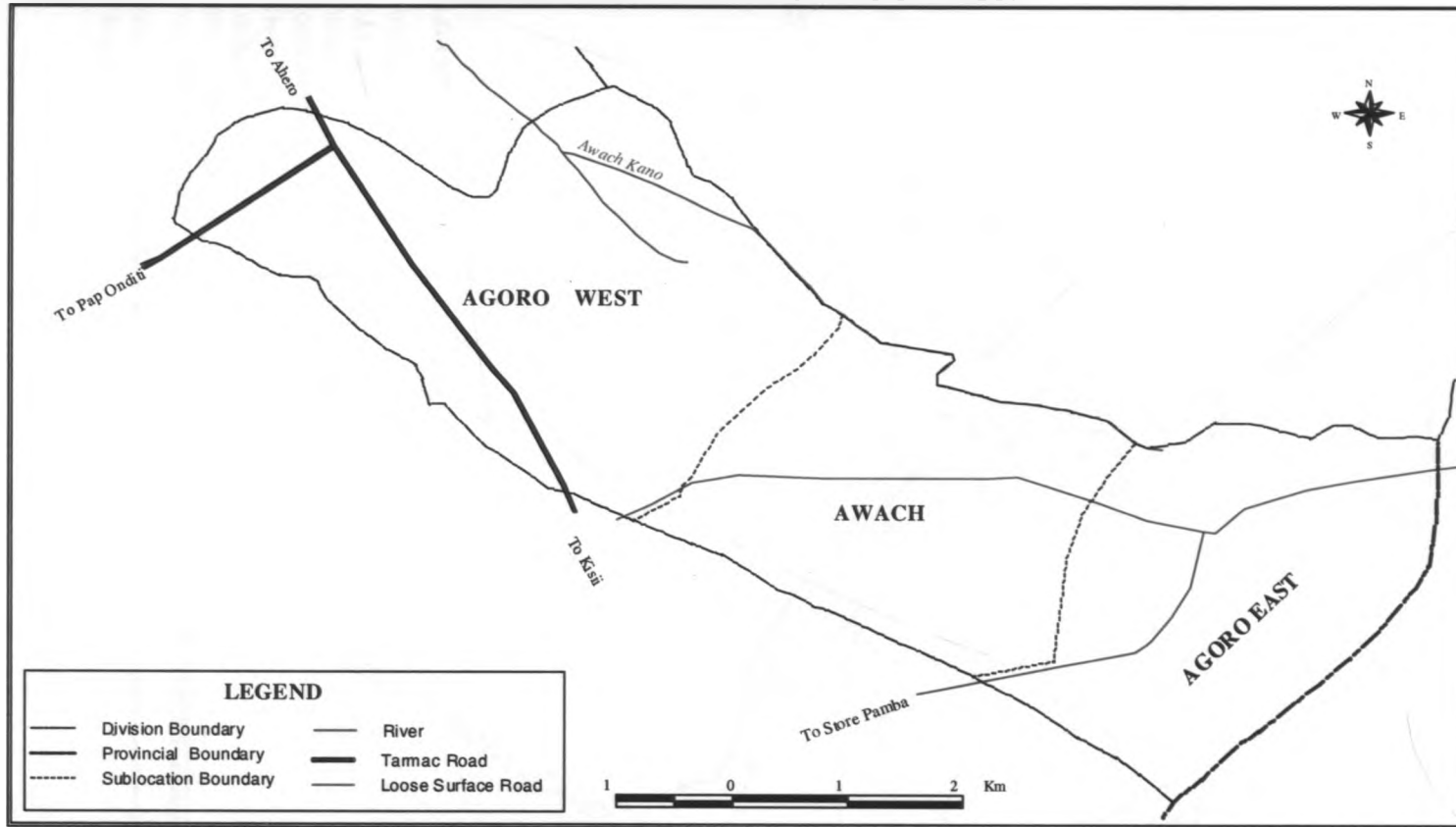
LOWER NYAKACH DIVISION - ADMINISTRATIVE LOCATIONS



Source: Survey of Kenya

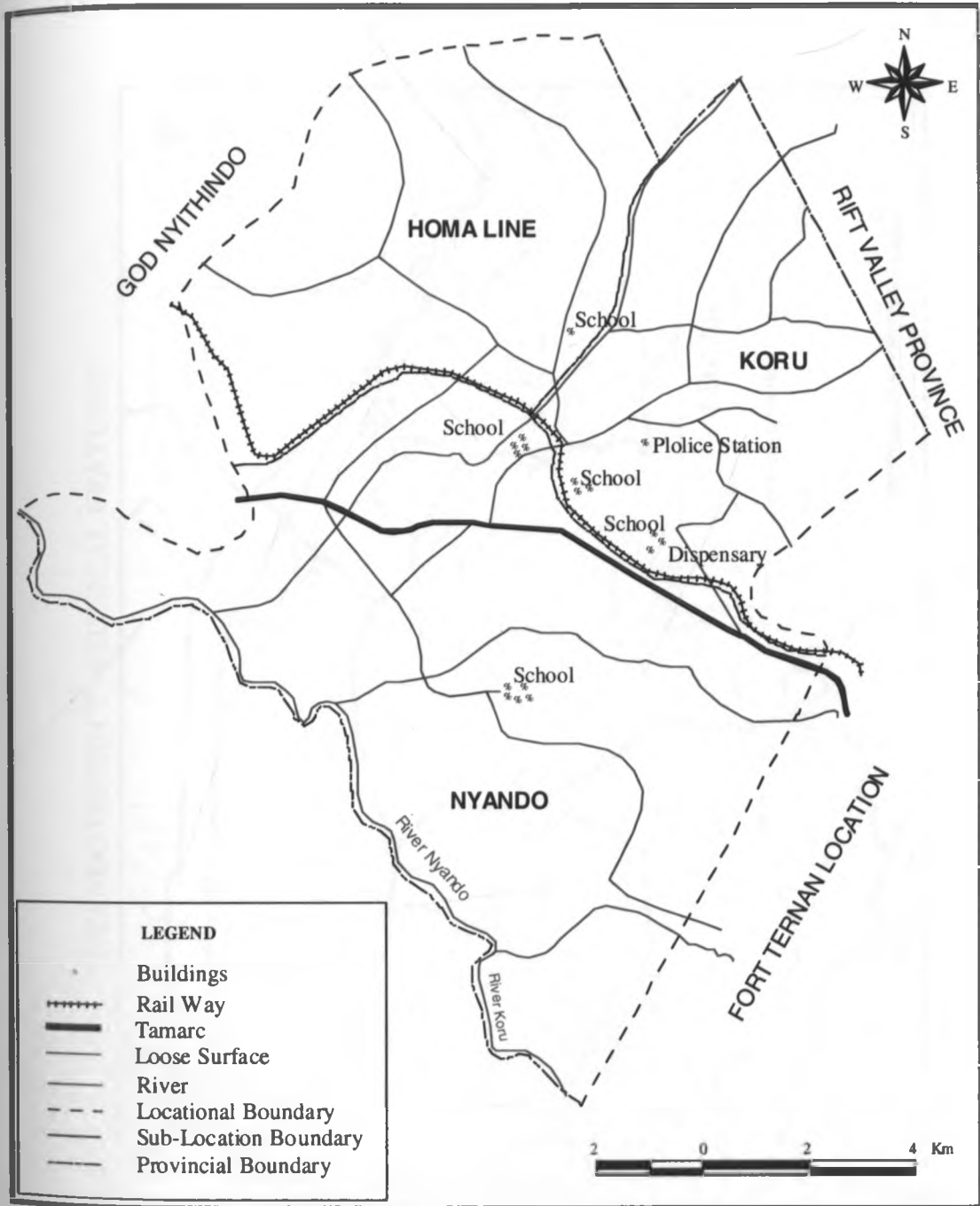
MAP 8:

NORTH EAST NYAKACH LOCATION



Source: Survey of Kenya

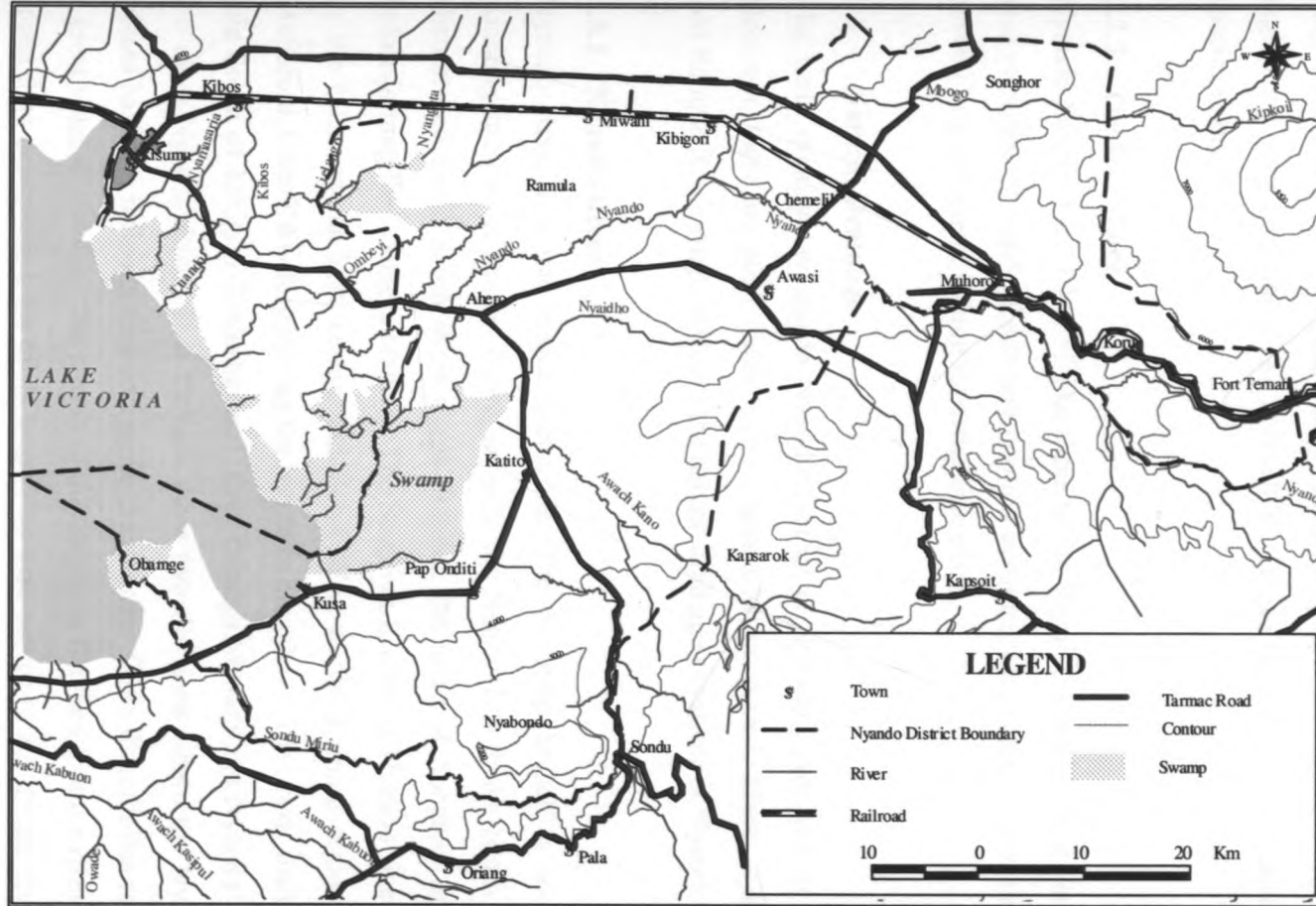
KORU LOCATION



Source: Survey of Kenya

MAP 10

NYANDO DISTRICT - PHYSICAL FEATURES



Source: Farm Management Handbook, 1983

Highlands to the north and east

The Eastern edge of Nyando District is Hilly. These include areas such as Songhor, Koru etc. These form the Eastern boundary of Nyando District and blend into the Nandi Hills and the Hills of Kericho District. They serve as sources of some of the major tributaries of Nyando River. This region received relief rainfall because of its height above sea level. The undulating hills allow proper drainage of soils. Soils in the region are very productive. As a result this region has the largest number of the species in the district.

3.2.3 The lake shore

Nyando District has 11 km of lake shore to the West. The land here is very flat. This area experiences heavy floods and is often occupied by swamps. However, there are several beaches where fishing activities take place.

3.3 Natural Drainage

The main drainage system in Nyando District is Nyando River and its tributaries. However, there are other rivers such as Sondu Miriu, Awach River, Nyaidho River and Ramula River. Map 10 shows the natural drainage - systems of Nyando District.

3.3.1 Nyando River

Nyando River has two major tributaries. The Northern branch is locally called Ainobngetuny at its source. It originates in the Nandi Hills to the North of Nyando District and flows South West wards draining the areas of Songhor, and Kibigori before joining the Southern branch. The Southern branch of Nyando river originates in the hills around Fort Terran and flows West-wards draining regions of Koru, Muhoroni, Chemilil before joining the Northern branch. The two main branches join South of Kibigori Township and flow through Miwani and Nyando Division as the main Nyando River. It is through these two divisions where the Nyando River causes havoc as it floods time and again. As the river flows through this region, it has a great volume of water. The terrain of this region is flat therefore the river reduces its speed thus depositing a lot of its load. This load serves to silt up the river channel. This leads to flooding because the volume of water becomes too much for the silted river channel. Since the land is very flat, these flood waters spread over very extensive areas. The lower course of the Nyando River is therefore constantly prone to floods which have devastating effects on the local communities.

3.3.2 Sondu Miriu

The Sondu Miriu River serves as the Southern boundary of Nyando District, separating it from Rachuonyo District. The source of the river is in Kericho District. The river is important because it is on this river that the Sondu Miriu hydro power station is being constructed. It flows through a region that is well drained and does not cause any flooding.

Awach River

Awach River originates from Kericho Districts and flows west-wards towards the lake draining parts of Lower Nyakach Division and Nyando Division around Katito and Gem Rae. The point at which this enters the lake is not distinct because it flows through a swamp before entering the lake. The river is subjected to heavy floods during heavy rains. It also serves as the boundary between Lower Nyakach Division and Nyando Division. It also provides water for irrigation.

River Nyaidho

River Nyaidho is one of the smaller rivers. It originates in Kericho District and flows westwards draining areas of Nyando Division South of Awasi. It joins Awach River before disappearing into the swamp on the lake shore.

River Ramula

Ramula River is a small river which originates in the Nandi Hills and flows southwards towards the lake. It drains Miwani Division South of Miwani town. The river flows in and out of swamps several times before it enters the lake a few kilometers west of Ahero town.

3.3.3 Swamps

Swamps are common phenomena in Nyando District. This is mainly due to the flat terrain of the land which hinders the flow of water. The development of swamps is also encouraged by the black cotton soils prevalent in Nyando District. These soils are poorly drained and do not allow water to percolate into the soil. Map 10 shows the areas of Nyando District that have swamps. Drainage of the land is important because it affects the types of agroforestry adopted in the area. There is a difference in tree species grown in the swamp environment compared to those grown in well drained areas. In permanent swamps trees grown must be flood-tolerant thus limiting the range of trees that can be used there.

Plate 3.1
Flooding in Kano
plains (Home)



Plate 3.2
Flooding in Kano
plains (farmland)



Plate 3.3
Flooding in Kano
plains (Road)



3.4 Soils and Geology

The soils in Nyando District are related to the relief of the land. Map 12 shows the various soil fertility levels in the district. The north and the south regions of the district have variable soils while the central region has moderate to high fertility soils.

Soils in the Kano Plains

The Kano Plains which are flood prone, occupy the major part of the district as shown on map 11. Here soils are on former lake sediments. They have high to moderate fertility but are subjected to water logging. In the western part of the plain the soils are associated with swampy and have a variable fertility. On the slightly higher topography, are piedmont plains and alluvial soils of moderate to low fertility with some drainage problems. The soils of the Kano Plains generally referred to as black cotton soils.

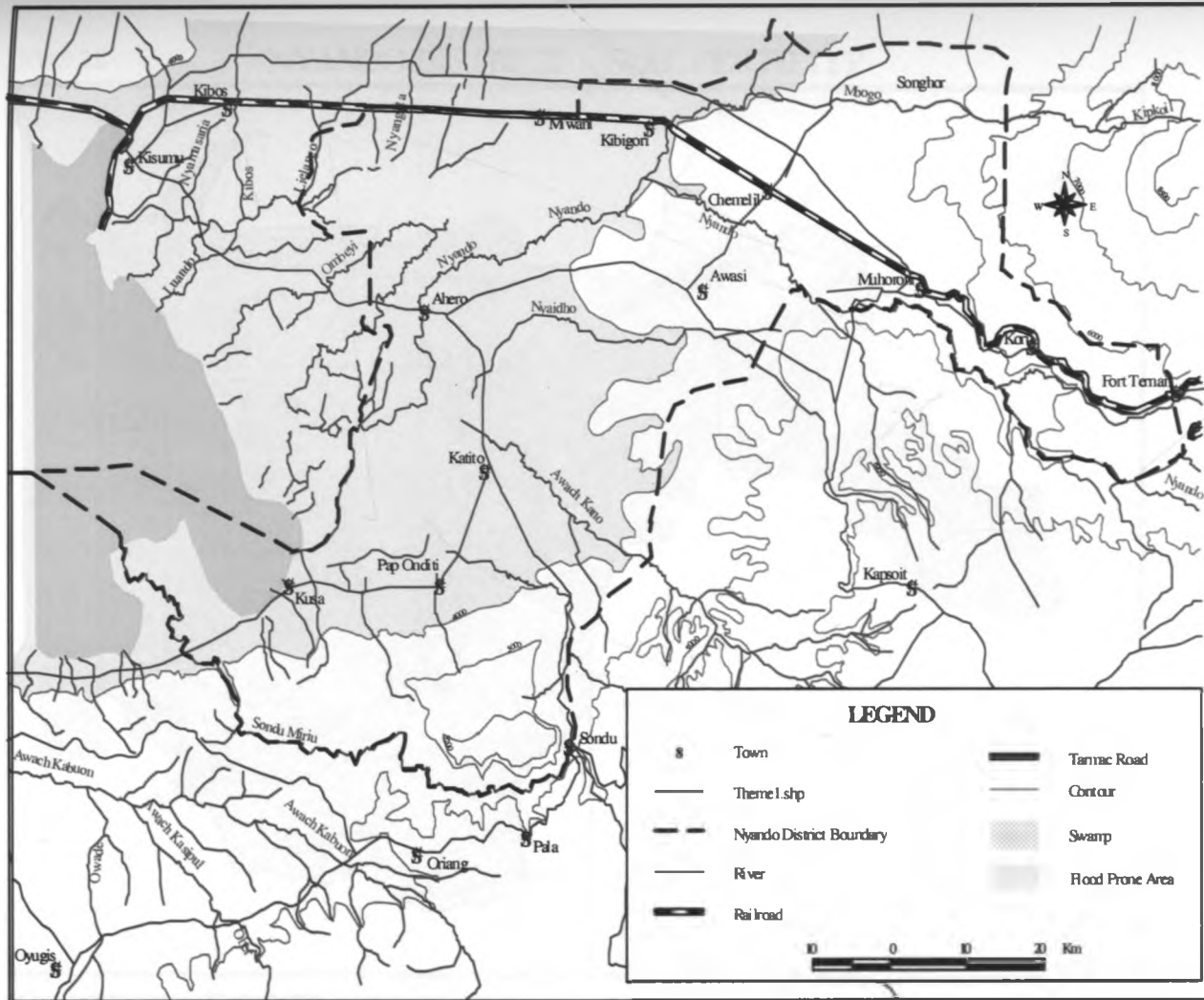
Soils on plateaus and high level structural plains

These are well drained soils which vary in depth from moderate to deep. These soils are found mostly in Muhoroni division and Upper Nyakach division. Their fertility varies from moderate to high in Muhoroni as shown on map 12 to variable on the Nyabondo Plateau. Map 13 indicates that most parts of Nyando district have deep soils. Shallow soils are only found on the slopes of the Nyabondo plateau, the slopes of the Nandi escarpment and the western board of the district.

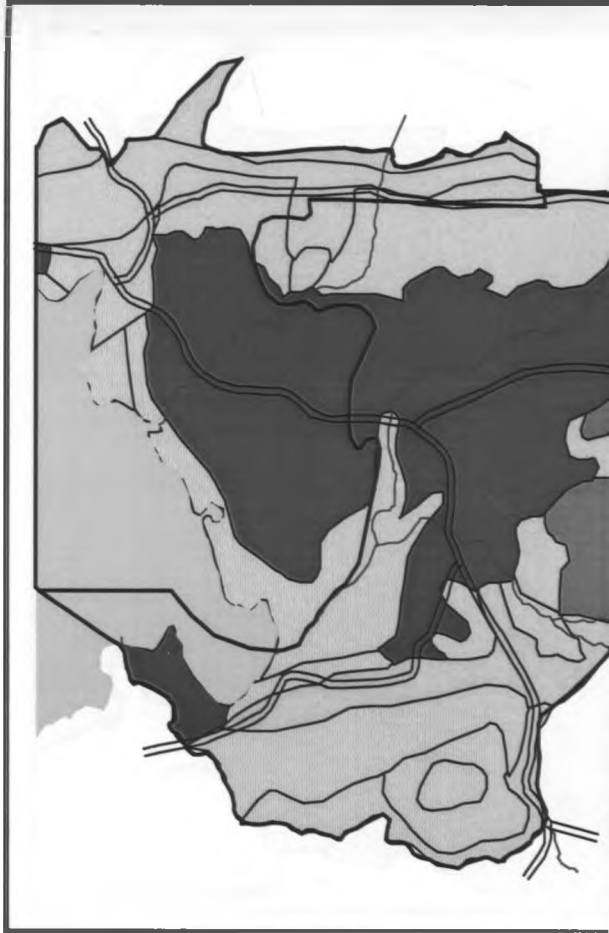
Soils types are relevant to our study because they support plant life and our study is about trees. Fertile soils support more plants and are less fragile. Poor soils on the other hand support less plant life and are more fragile. They therefore need to be protected from over use and also from agents of erosion. Agroforestry in such fragile soils must target improving the soil nutrient cycle and protecting soils from agents of erosion if a sustainable environment is to be attained. Knowledge of soil characteristics helps in designing the most appropriate agroforestry practice for any given region. The soils in Nyando should not be a constraint to agroforestry because although they vary in depth and fertility Agroforestry is flexible and it can be designed to suit the various soil types. Map 12 indicates that only a very small portion of the district has low soil fertility. Map 13 shows that an equally small portion of the district has shallow soils. Therefore, soil fertility and depth in them are not a significant constraint to agroforestry in Nyando District.

MAP 11:

NYANDO DISTRICT- FLOOD PRONE AREAS

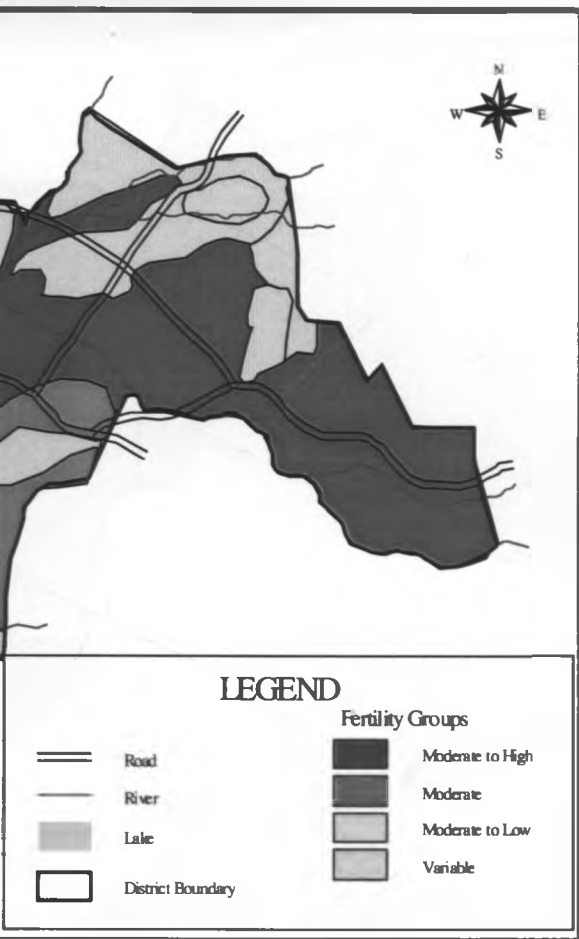


Source: Survey of Kenya



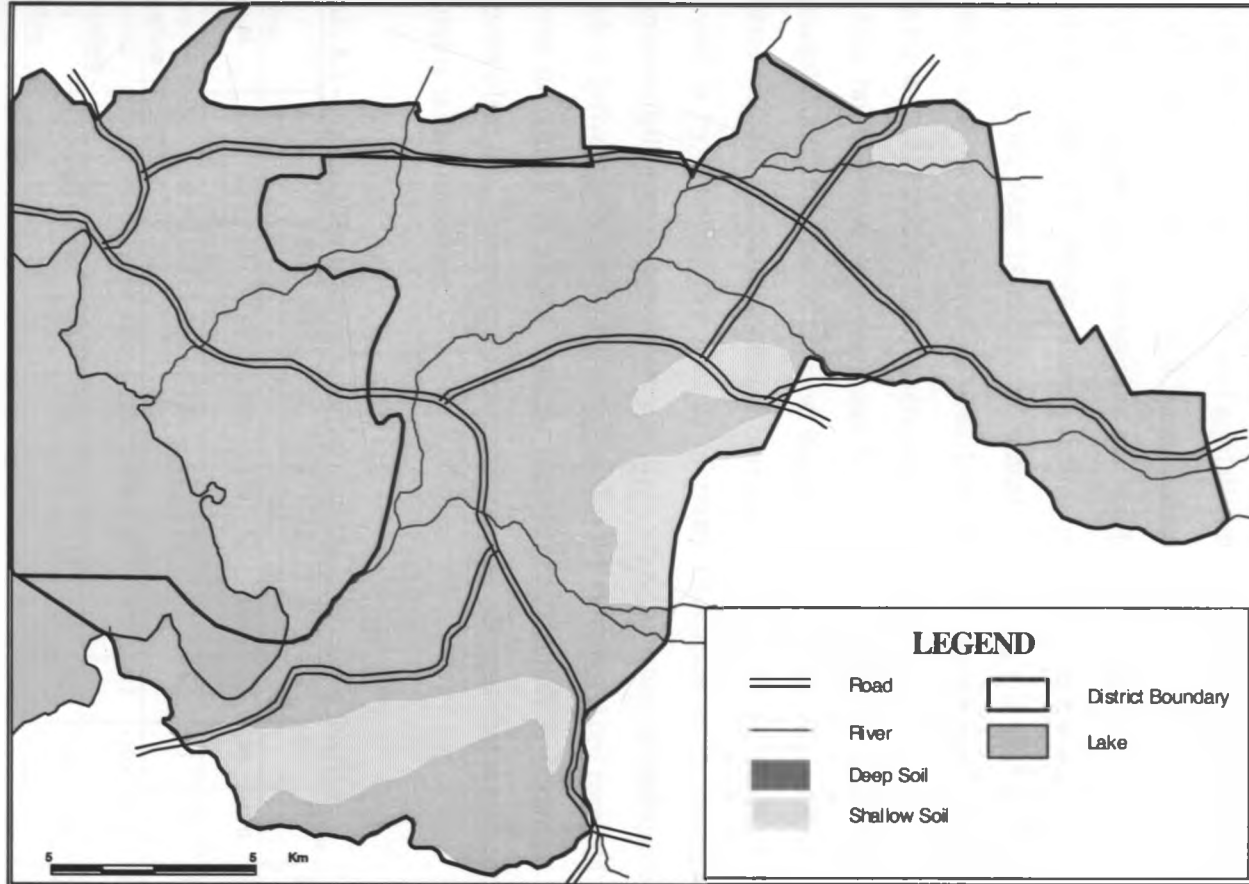
Source: Farm Management Handbook 1983

SOIL FERTILITY



MAP 13

NYANDO DISTRICT - SOIL DEPTH



Source: Farm Management Handbook 1983

3.5 Climate

The climatic conditions in Nyando vary depending on the relief. The lowlands tend to be hotter and drier while the high lands are wetter and cooler.

3.5.1 Rainfall

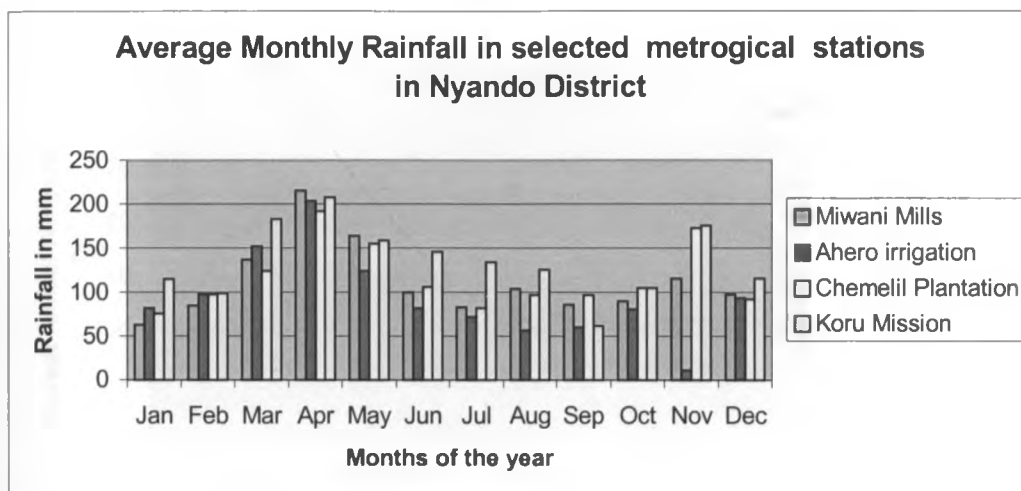
Nyando District receives a bimodal rainfall pattern. The long rains fall between April and May while the short rains fall between August and September. The annual rainfall varies with altitude and proximity to the highlands along the Nandi Escarpment and Tinderet. Table 3.2 shows rainfall figures of selected meteorological stations in Nyando District. Map 14 shows the annual average rainfall in Nyando district. The Southern side of the district receives less rain than the West. It implies that tree growing is made easier in the Western side where rainfall/water is not a constraint. To the East rainfall/water is a constraint because the rainfall amounts are low (1000-1200mm). Rainfall is one of the most important ecological constraints to tree growing because without adequate moisture trees can not grow. One way of solving this problem is by adopting dry land agroforestry (Rocheleu et al. 1988) which uses techniques that promote agroforestry in areas where moisture is inadequate. Table 3.1 which is derived from Table 3.2 indicates that the month of April received the highest amount of rainfall in all the stations represented. Rainfall is important because it supports plant life. However, it is not only rainfall amounts that are important but its reliability is also important.

Table 3.2 - Annual Rainfall in selected stations in Nyando District

Met. Station	J	F	M	A	M	J	J	A	S	O	N	D	Ann. Ave.
Miwani Mills	63	85	137	216	164	100	83	104	86	90	116	98	1341
Ahero Irrigation	82	98	152	204	124	82	72	57	60	81	11	94	1219
Chemelil Plantation	76	98	124	192	155	106	82	97	97	105	173	92	1396
Koru Mission	115	99	183	208	159	146	134	126	62	105	176	116	1650

Source: Farm management Hard Book 1983

Figure 3.1: Average Monthly Rainfall in Selected Metrological Stations in Nyando District



Source: Farm Management Hard Book 1983

3.5.2 Temperatures

Temperature rises as altitude reduces therefore the low lying regions are hotter than the higher regions especially since Nyando lies along the Equator.

Table 3.3 and Figure 3.2 shows average annual temperatures for Kano irrigation station

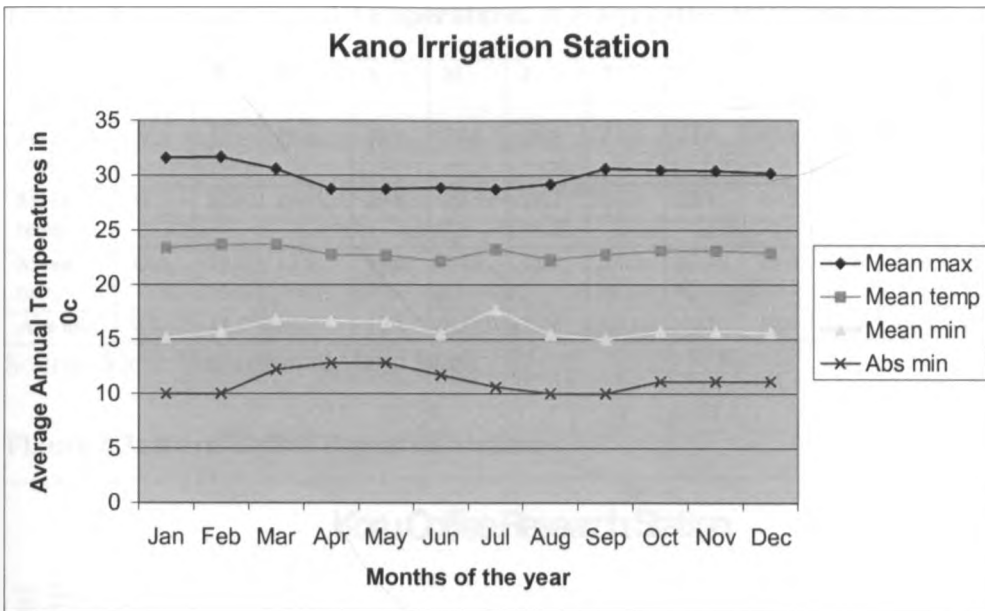
a) Kano Irrigation Station

Table 3.3 Average Annual Temps in °c at Kano Irrigation Station.

Met. Station	J	F	M	A	M	J	J	A	S	O	N	D
Mean max	31.6	31.7	30.6	28.8	28.8	28.9	28.8	29.2	30.6	30.5	30.4	30.2
Mean temp	23.4	23.7	23.7	22.8	22.7	22.2	23.3	22.3	22.8	23.1	23.1	22.9
Mean min	15.1	15.7	16.8	16.7	16.6	15.5	17.7	15.4	15.0	15.7	15.7	15.6
Abs min	10.0	10.0	12.2	12.8	12.8	11.7	10.6	10.0	10.0	11.1	11.1	11.1

Source: Farm Management Hard Book

Figure 3.2 - Average Annual Temperatures at Kano Irrigation Station.



Source: Farm Management Hand Book

Temperature variations affect agroforestry. It is therefore important to know the characteristics of temperature as an element of climate to enable proper design of appropriate agroforestry innovations. The Kano plains which cover the larger part of our study area experiences high temperatures.

Table 3.3 shows average annual temperatures for Kano Irrigation station which are highest in January and February (31.6 & 31.7°C) and lowest in July/August (10.6 C & 10.0°C). Table 3.4 shows average Annual temperatures for Koru Coffee Research Station which is on higher altitude than Kano plains. Temperatures are relatively lower with maximum temperatures in the months of January (29.8°C) and February (29.9°C). Maximum temperatures are in May (6.9°C). High temperatures increase the rate of evapo-transpiration thus increasing the plants demand for moisture. In designing Agroforestry systems it is necessary to know temperatures patterns and to select trees that have in built mechanism for surviving in high temperatures. *Euphorbia (Eurphorbia Tirucalli (Ojuok))* is one such tree hence it's common use for boundary planting in the region.

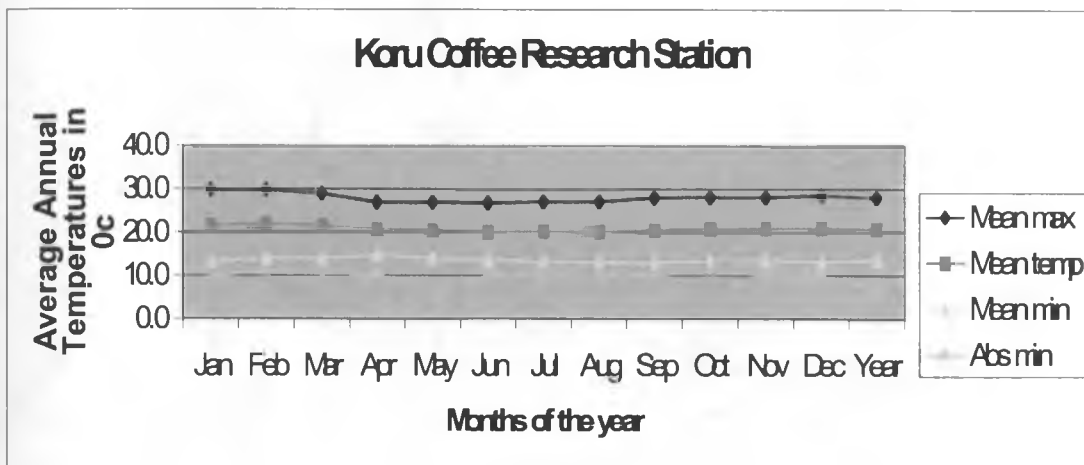
Koru Coffee Research Station

Table 3.4 Average Annual Temperatures at Koru coffee Research Station.

Met. Station	J	F	M	A	M	J	J	A	S	O	N	D	Year
Mean max	29.8	29.9	29.0	26.9	26.9	26.8	27.0	27.0	27.9	28.1	28.1	28.6	28.0
Mean temp	21.5	22.0	21.5	20.8	20.5	20.2	20.2	20.0	20.5	20.8	20.9	20.9	20.8
Mean min	13.2	14.0	13.9	14.6	14.0	13.5	13.3	13.0	13.0	13.4	13.6	13.1	13.5
Abs min	9.7	11.0	10.3	10.1	6.9	10.0	10.1	10.0	10.0	11.1	10.0	10.0	6.9

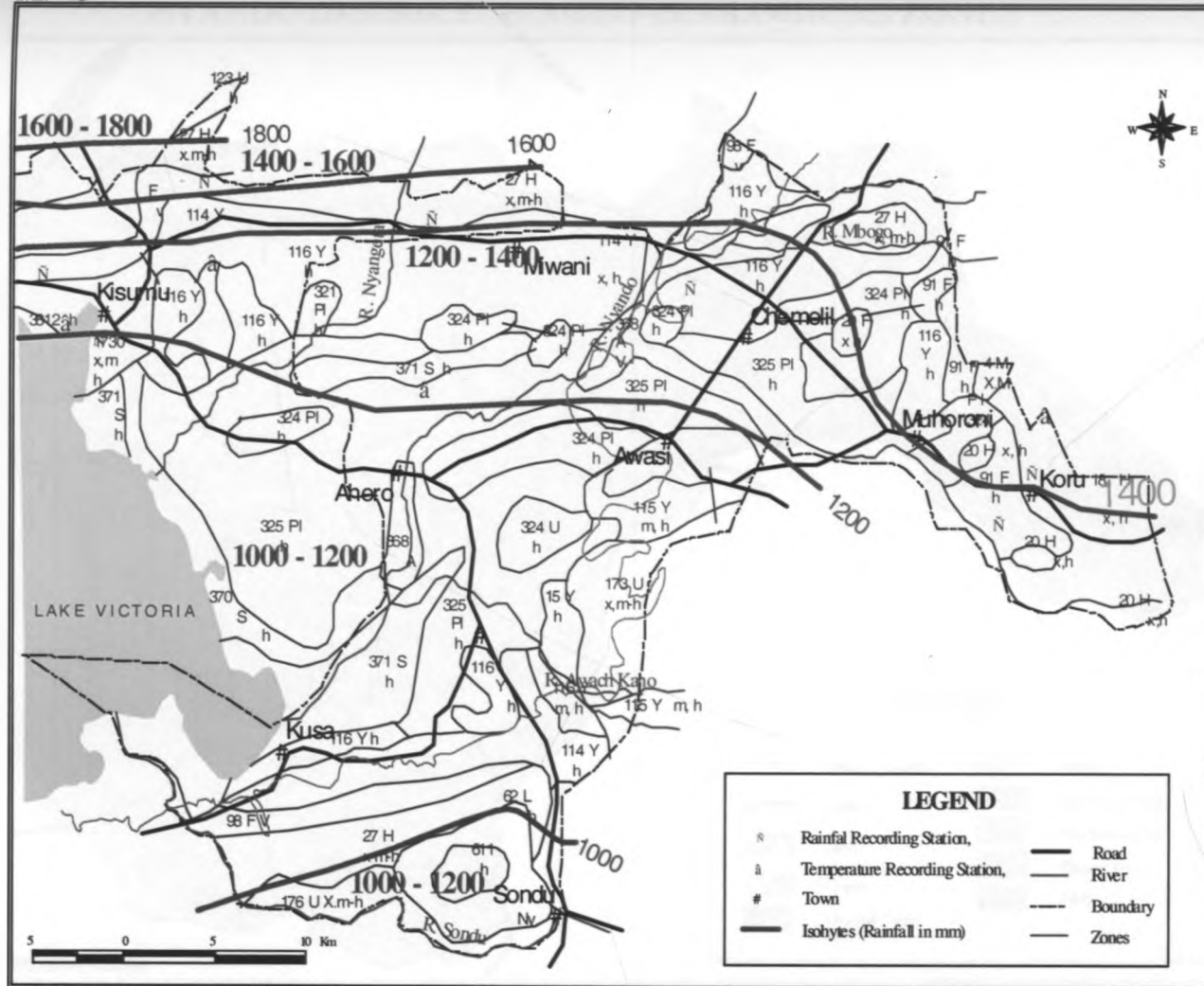
Source: Farm Management Hand Book

Figure 3.3: Koru Coffee Research Station



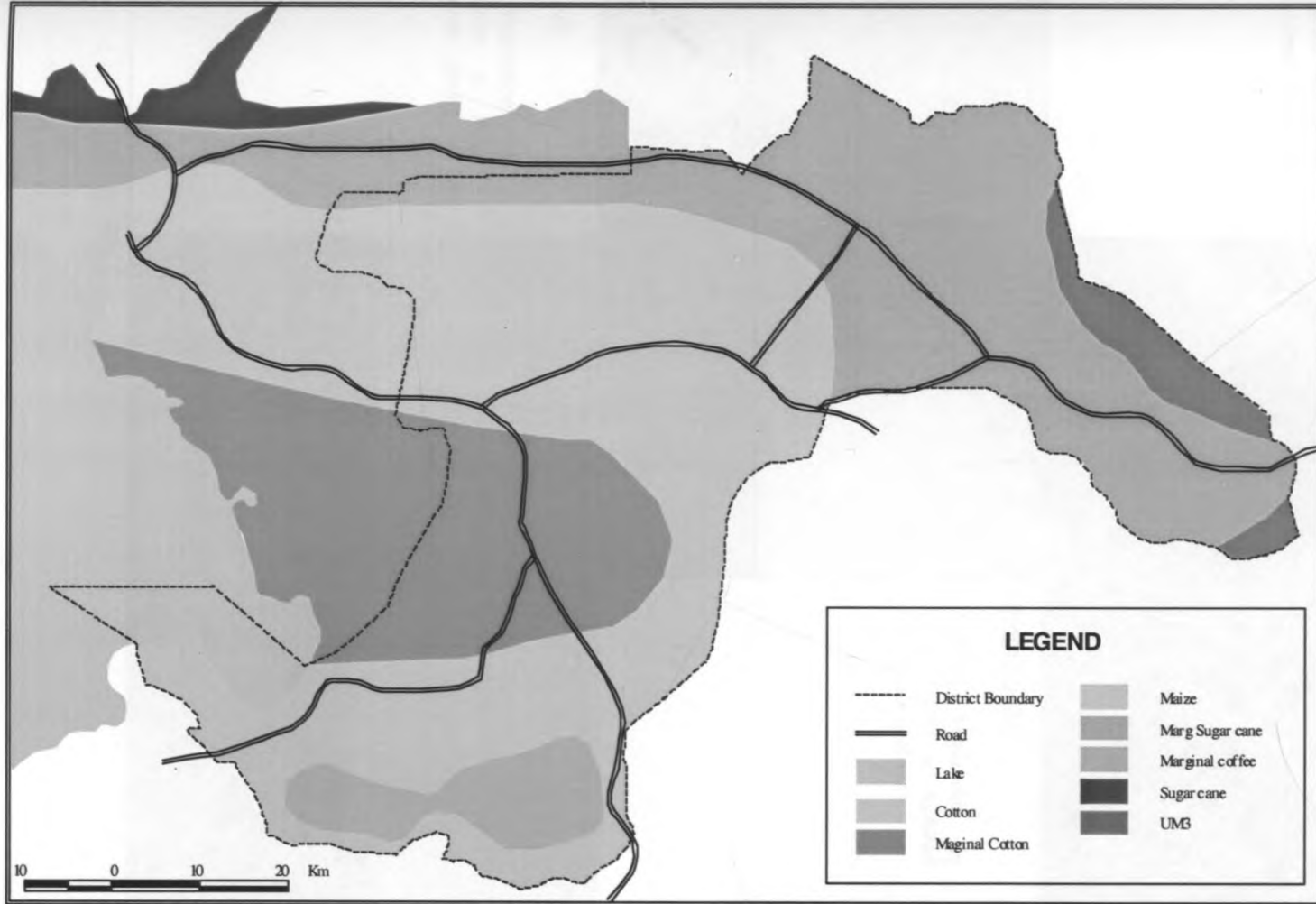
Source: Farm Management Hand Book

NYANDO DISTRICT - AVERAGE ANNUAL RAINFALL



Source: Farm Management Handbook

NYANDO DISTRICT - AGRO-ECOLOGICAL ZONES



Source: Farm Management Handbook, 1983

Plate No. 3.4

*The Natural Vegetation
in the highland region in
Koru*



Plate No. 3.5

*Natural Vegetation in
Kano Plains a habited
area prone to floods*



Plate No. 3.6

*Natural Vegetation in
Kano Plains a non-
habited area prone to
floods*



3.7 Vegetation

The vegetation of Nyando correspondent with the relief, soil types and the climate. The Kano plain which low-lying, has black cotton soils, little rain and high temperatures, does not have much vegetation cover. The natural vegetation for this area is open grassland (short grass) and a variety of thorn trees e.g. *othoo*, *obino*, (*Balanites Sae*, *Alli Aegyptica*). Trees found here are those that can tolerate flooding in their early stages of growth. They can also tolerate drought alternating with floods. The eucalyptus trees although not an indigenous tree is common feature of the vegetation in these regions. Plate 3.6 and 3.7 shoe the natural vegetation of Kano plains.

Some parts of Upper Nyakach and Lower Nyakach divisions have sandy soils. The sandy soils support even less vegetation. In these areas the trees commonly found are those that can tolerate low moisture levels since the soils are excessively drained. The trees are far apart and the grass is short and sparse. The highland region to the East of the district where rainfall is highest exhibits more dense vegetation where the natural vegetation has not been cleared to make room for cultivation of crops. Indigenous trees here include Siala (*Markhamia Lutea*), Sangla (*Clerodendrum Myriloides*). Common exotic species include, cypress, whistling pine (*Casuarina*) Eucalyptus, *Grevillea Robusta*.

The natural vegetation is a good indicator of tree species that grow easily in a given environment. These can be studied and domesticated as part of Agroforestry. The natural vegetation can also be used as a source of seedlings i.e. wildlings. As seeds drop and germinate, the people can collect these seedlings and transfer to nurseries or plant in their farms directly. It is a cost effective way of increasing supply of seedlings. Wildlings do not require a lot of attention to grow.

3.8 Demography

According to the 1999 census Nyando District had a total population of 299,930 people. Out of this total 153,295 (51%) were female and 146,635 (49%) were male. The population density was found to be 257 people per sq. km. Table 10 shows the population figures for the 5 divisions and how they compare with the District, Provincial and National figures.

Table 3.5 Nyando District population figures by Divisions.

Division	Total Population	Male	% of total	Female	% of total	Area Sq. Km	Density	Households
Muhoroni	63,450	33,516	53%	29,934	47%	334.8	190	15119
Nyando	64,511	30,571	47%	33,940	53%	249.3	259	14,029
Miwani	58,029	28,128	48%	29,901	52%	225.7	257	13,982
Lower Nyakach	49,247	23,395	47%	25,852	53%	182.6	270	1,149
Upper Nyakach	64,493	31,025	48%	33,668	52%	176	368	14,092
Nyando District	299,930	146,635	49%	153,295	51%	1,168.4	257	

Source: National Population Census 1999

Life expectancy in Nyando District is 49 years. The total No. of household in Nyando is 68,371 and the average Household size is 4.4 persons. Demographic parameters can be used to assess land use conflict. For instance high population density in rural areas is an indicator of land use conflict between human settlement and agriculture. It is also an indicator of increasing pressure on the environment. They can be used to make appropriate plans.

Table 10 indicates that upper Nyakach has a population density of 368 persons per km which is higher than the Nyando District population density which is 257 persons per km. The implication is that more land is used for settlement leaving less for agriculture and agroforestry. From the census report it emerges that the female population is slightly larger than the male population at the National level, the Provincial level and the District level. However, at the Divisional level Muhoroni Division has a larger male population than a female population. This can be explained in part by the immigration of male labourers to work in the sugar cane plantations and the sugar factories.

Muhoroni Division also has a relatively lower population density than the other divisions. This is explained by the fact that it is mainly settlement schemes and has large sugar plantations. The cultivation of sugar cane in Muhoroni Division does not

encourage tree growing within the sugar farms because they set the cane ablaze before harvesting. As a result, large tracts of sugar cane farms exist without trees.

Migration

The regions that have cash crop farming are a source of employment therefore they attract population. These are areas such as the sugar growing areas and the rice growing areas.

The regions that have subsistence farming suffer from out migration as people move out in search of employment. Most agroforestry practices are labour intensive. However, when many people move out of an area it reduces the labour force. Agroforestry if developed can also be a source of employment if properly developed. It can then serve to retain some of the population who more out in search of employment.

Temporary Daily Migration

The sugar plantations constantly need a large labour force to plant, weed, and harvest. The population density does not provide an adequate labour force. As a result the sugar factories organize for labourers to be transported using trucks from areas with high population density and subsistence farming. They obtain labour from all parts of the District on daily basis and return them in the evening.

3.9 Land Issues

Land in Nyando District can be put in 2 broad categories based on historical factors. On one hand are lands that fall in the former native reservations as designated by the Carter Commission of 1934 e.g. Lower Nyakach, Upper Nyakach, and Nyando Divisions. On the other are lands that were part of the large scale white farms. Such as Muhoroni Division.

In colonial Kenya, land in the native reservation was administered under Trust Lands Act Cap 288. The large scale white settler farms on the other hand were leased to the farmers for specified periods under the Crown Lands Ordinance which was later replaced by the Government Lands Act Cap 280.

After independence, land in the native reservations was consolidated, adjudicated and registered as freehold for the local people under the Land Consolidation Act Cap 283, Land Adjudication Act Cap 284 and Registered Lands Act Cap 300. In the native

reservations there emerged a dispersed human settlement pattern which is shown on figure 3.4 and Plate 3.4

At independence the Government embarked on a settlement programme and established the Settlement Fund Trustee (SFT) to over see the process. Many of the large scale farms were taken over by the government and the owners compensated (GOK). These were then turned to settlement schemes to settle the landless Africans, and also to boost agriculture production. The settlement schemes in Nyando District include Muhoroni, Tamu, Soghor, Koru, God Nyithndo, and God Abuoro among others. The settlement schemes in Nyando District are all in Muhoroni Division with the exception of Kibigori settlement scheme which is in Miwani Division. This settlement was initiated to resettle people who had been displaced by the floods of 1961/62 from Kabonyo a region prone to flooding in the lake shore regions. In the settlement schemes the land was planned to suit both sugarcane production and human settlement.

The settlers were given a subsistence plot measuring approximately 5 acres on which they were to put up their homestead and cultivated food crops. They were planted sugar cane as a cash crop. The subsistence plots were located in clusters on high ground near sources of water and provided with roads. The sugar plots were located in clusters away from the subsistence plots and served with feeder roads. As a result this land use planning there emerged a clustered human settlement pattern as shown in Figure 3.5 and Plate 3.8.

The settlement schemes were registered as freehold land and administered under the registered lands. There were other individuals who purchased large scale farms from the white settlers outside the SFT set up. These lands were administered under the Registration of Titles Act Cap 281. They convert to freedom on subdivision to smaller units. The field survey revealed that the current average land size in North East Nyakach is 0.620 Ha as indicated in table 3.6.

Table 3.6 Statistics on land sizes in North East Nyakach Location.

Statistic	Area in Ha
Mean	0.620
Standard error	0.010
Median	0.370
Mode	0.600
Standard deviation	0.751
Sample Variance	0.564
Kurtosis	20.910
Skewness	3.608
Range	10.390
Minimum	0.010
Maximum	10.400
Sum	3,245,308
Count	5,231,000
Confidence level (95.0%)	0.020

Source: Field Survey

Most land parcels in North East Nyakach are small. The homestead and the production unit are often on the same parcel. The field survey revealed that most of the people do not know their plot numbers and most of them have not collected their title deeds despite the fact that they are available.

The field survey also revealed that the average land size in Koru is 4.940 Ha as indicated in Table 3.7.

Table 3.7 Statistic on land sizes in Koru Locution

Statistic	Area in Ha
Mean	4.940
Standard error	0.288
Median	2.040
Mode	2.70
Standard deviation	10.097
Sample variance	101.953
Kurtosis	26.436
Skewness	4.573
Minimum	0.028
Maximum	103.000
Sum	6086.245
Count	1232.000
Confidence level (95.0%)	0.564

Source: Field Survey

Some farms in Koru are very large as shown by the maximum statistic (103 Ha). Sugar cane is grown away from the homes. The two settlement patterns that emerge (clustered versus dispersed) have serious implications on the practice of agroforestry in Nyando district.

In the dispersed settlement pattern which is found in most of the district, trees are grown all over the farm holdings. However, in the clustered settlement pattern found in the sugar growing areas trees are grown around the subsistence plots but not in the sugar plots. This is because the sugar cane is set on fire before it is harvested as a means of reducing the labour cost at harvest time. These fires are not friendly to tree growing. They destroy every plant that is growing in the sugar plantation.

A visual survey of the area indicated that more land is under sugar cane than settlement. As a result most parts of the farm holding do not have trees. As long as these fields are under cane production the soils are protected. However, problems in the sugar industry have led to an increasing number of farmers moving away from sugar cane production. This means that these trees-less fields are left without vegetation cover for part of the year making them susceptible to agents of erosion. The monoculture of sugarcane also contributes to making soils more fragile as specific elements are continuously used up in the soil.

Agroforestry in this region must be designed to address the existing land use problems of the area. It must also take into account the existing settlement pattern. Trees which are cut down to create more land for sugar cane farming are not replaced and the tree population continues to reduce. Ways must be found of increase the tree population. In North East Nyakach the homesteads are dispersed everywhere. Trees are therefore planted everywhere. However, due to the absence of productive fencing and practice of tree ranging the trees are often destroyed by livestock.

Plate 3.4
Dispersed human settlement pattern

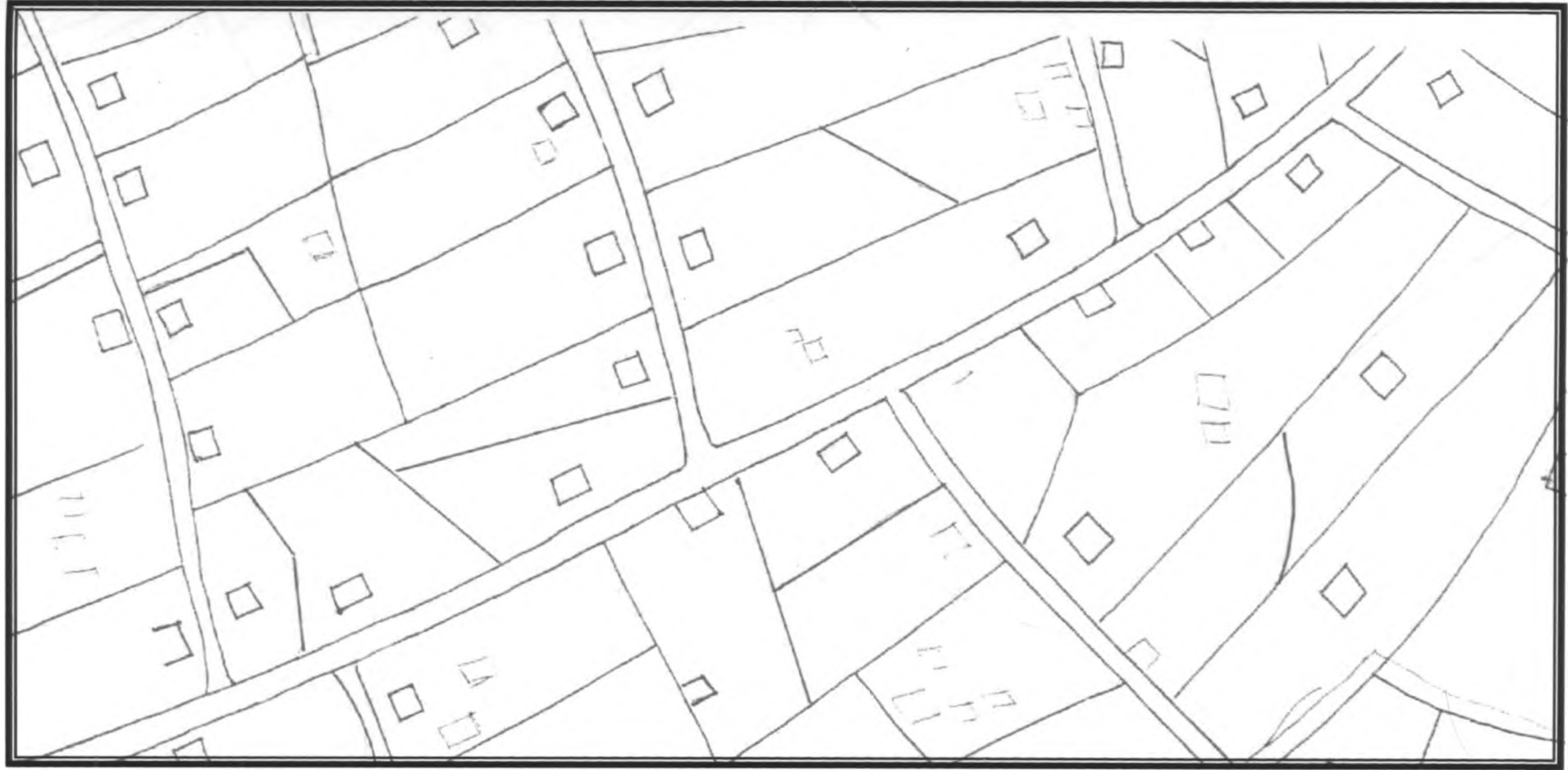


Plate 3.5

Clustered human settlement pattern



3.10 Culture

The natives of Nyando District are the Luo speaking, Lake Nilotes of Kenya. In the former native reservations the population is almost entirely Luo apart from people who have moved into the urban centres for business or are employed by firms operating in the regions. In the settlement schemes the picture is different. Although the Luos form the majority, there are people from all parts of the country because the settlement schemes were open to all Kenyans. Table 3.8, 3.9, 3.10 on migration trends indicate that in North East Nyakach the number of people who have come from outside Nyanza are less than those in Koru.

Table 3.8 - Migration Trends in Nyando District

Region origin	Frequency	%
Nyanza	81	89.0
Outside Nyanza	10	11.0
Total	91	100

Source: Field Survey

N = 105

Table 3.9 - Migration Trends North East Nyakach

Region origin	Frequency	%
Nyanza	37	92
Outside Nyanza	3	7.5
Total	40	100

Source: Field Survey

N = 46

Table 3.10 - Migration Trends - Koru

Region origin	Frequency	%
Nyanza	44	86.3
Outside Nyanza	7	13.7
Total	51	100

Source: Field Survey

N = 59

Luos are traditionally fishermen and farmers. Those living along the lake shores and the rivers practice fishing while those further inland are farmers. The Luo community is patrilineal. Land ownership and property inheritance is through the male members of the community. Other cultural practices follow the same pattern. Most day to day

activities are controlled by cultural beliefs and practices. In the past these beliefs and practices were strictly adhered to and failure to comply led to dire consequences. However as times change, these practices are becoming less significant.

3.11 Economy and Human Settlements

The economy of Nyando District is based on Agriculture (DDP 2002 – 2008). There is both subsistence agriculture and commercial agriculture. However, there are a few industries in the Region and these are also agro-based. Fishing activities are also carried out in the lake shores.

Nyando District covers a total area of 1,168 km² out of which 1,118 km² is arable. Only 50.4 km² is not arable while 3.2 km² is gazetted forest and 71.0 km² is water mass. (DDP, 2002 – 2008). Agriculture is important because it caters for 52% of household incomes in the district. According to the District Development (2002-2208) 182 km² of the land in the district is under food crops while 240 km² is under cash crops.

The vision of the agriculture and rural development sector is “Sustainable and equitable rural development for all” Its mission is “to contribute to poverty reduction through the promotion of food, security, agro-industrial development, trade, water supply, rural employment and sustainable utilization of natural resources”. It is the main source of employment. Agriculture employs 125,348 people while 83,700 people are employed in the livestock sector. (GOK, 2002).

Commercial Farming

Commercial farming in the region includes the cultivation of crops such as rice, cotton and sugar cane. The rice is grown in the low lying swampy areas. Sugar cane is grown in the settlement schemes in Muhoroni Division and some parts of Nyando Division and some parts of Nyando Division. Map 15 showing the Agro-ecological zones indicate the location of these activities in the District.

Rice Farming

Rice is grown in the flood prone zone indicated on Map 11. Rice farming in Nyando District goes back to the establishment of the Ahero Irrigation Scheme. This was a pilot scheme from which others in the region were to borrow good practices. The scheme was managed by the National Irrigation Board. For many years it was a

success. As a result rice growing spread to many areas in the lake basin especially in the swampy areas. The farmers were able to grow rice on their own. However, due to mismanagement, the Ahero irrigation scheme has since stopped operations. Individual framers are still growing rice in the wetlands. Plate 3.0 shows the current state of Ahero irrigation scheme. A once flourishing scheme has completely disintegrated and the cultivation of rice has been abandoned.

Cotton

Map 15 on the Agro ecological zones shows that most parts of Kano Plains are good for cotton growing. In the past, cotton was a major cash crop. It was managed by the cotton lint and Marketing Board. Due to the mismanagement and lack of political good will the cotton industry in Nyanza collapsed and most farmers stopped cultivation of cotton. It is only in recent years that it is being promote once more. At present very little cotton is grown in the district.

Sugar Cane

Map 15 shows the sugar cane growing areas which are to the western board of the district where rainfall is highest and soils are deep. Sugar cane cultivated on both small scale and large scale. It is then sold to the 3 sugar factories in the region. Each sugar factory has a nucleus farm from which it produces the basic amount of cane required to operate the pants. The remaining cane is produced by the out-growers. The factories advance farm inputs to the farmers on credit and debit their accounts on delivery of cane. However, the sugar industry in general and the sugar factories have faced serous management problems. Farmers are overcharged for farm inputs advanced to them, mature cane is not harvested on time and goes to waste, and farmers are not paid on time. As a result many farmers have become poor and no longer favour it as a cash crop.

Capital investment in sugar cane farming is very high and the lost of crop of cane can devastate a farmer and he may never regain financial equilibrium especially if the crop lost was cultivated on loan. The loan must be repaid despite the crop loss. This has greatly contributed to increasing levels of poverty in the sugar growing region that for many years enjoyed a prosperous economy. Farmers grow less and less sugar cane and seek alternative cash crops. Over reliance on sugar cane led to the neglect of other cash crops. Agroforestry as a land use has the capacity to generate income therefore; it can be an alternative or complimentary farming system in the area. Since the people are looking out for alternative production system, they will be more willing to receive

new ideas because they have a pressing need. The promotion of Agroforestry will be better achieved.

Dairy farming

The higher altitudes provide a good environment for dairy farming. However, the favourable zone is small. Not many farmers practice dairy farming. Some of the ones who do engage in zero grazing while others use open pastures. Agroforestry incorporates livestock keeping through sylvopastoral systems where woody plants and grasses are grown in the pastures and range-lands to improve them. The dairy potential of the district is not fully utilized. It can be enhanced by sylvopastoral systems.

Subsistence Farming

Maize, bean, sorghum, fruits and vegetables are grown all over the District for subsistence. However, because of the extreme poverty level, some of these are sold to generate income. The district is not self sufficient in food. It has to rely heavily on food from neighbouring districts. Livestock is also kept mainly for subsistence apart from in the high altitude areas where dairy farming is practiced. The district relies more on traditional animal rather improved ones that would be more productive.

Fishing

Fishing is done for both subsistence and income generation. The limited shoreline indicates that fishing activities are not very extensive in Nyando District. Fish yields have reduced over the years due to over-fishing in the lake. Introduction of the Nile perch (Mbuta) into Lake Victoria has led to extinction of some smaller fish species that are eaten by the Nile Perch. The lake has also been invaded by the hyacinth weed which has made fishing very difficult.

Industries

Most of the industries are agro-based. The sugar industry has several sugar factories. *Miwani Sugar Factory* is the oldest sugar factory in the province. It crushes cane from Miwani and Nyando Divisions. *Chemelil Sugar factory* crushes cane from Muhoroni Division. *Muhoroni Sugar Factory* is the most recent of the factories. It receives cane from Muhoroni Division. It is important to note that these factories have experienced serious problems of mismanagement and are therefore not performing at their best. The sugar industry in general has also been experiencing problems at a national level due to large imports of sugar at lower prices than the locally produced

sugar. There are several *rice mills* in Nyando. All of them are in Nyando Division. The National Irrigation Board had a mill at Ahero but it has since closed down. There are two private mills in Ahero town to mill rice from the rice grown in the area. *Homa lime* is an industry that mines and processes calcium products. It is located in Koru and produces items such as construction lime, plastering lime, agricultural lime, building stones, ballast. It also carries out large scale farming of sugar cane and dairy farming.

Plate No. 3.7

Dispersed Settlement pattern in Nyakach with Lake Victoria in the background



Plate No. 3.8

Koru Settlement Scheme cluster of human settlement and expansive sugarcane fields



Plate No. 3.9

Deforestation to create more Land for sugarcane in Koru



Agro-Chemical and allied products

This factory is located in Muhoroni next to the sugar factory. It uses the by-products of the sugar factories to produce agrochemicals.

Sand Harvesting

Sand harvesting is an economic activity in many areas of lower Nyakach. The sand is harvested in river beds and banks and sold to lorries for transit to distant areas to be used in the construction industry. It is claimed to be very good quality sand hence the high demand. This activity however, has negative environmental impacts because it scars the landscape and increases the land susceptibility to erosion. The scared and eroded landscape can be rehabilitated through agroforestry.

Stone Quarries: These are found mainly in Muhoroni Division in the hilly areas near Homa Lime and at Fort Terran and at Kipsamwe. They are mined by the locals.

Human settlements

Human settlements in Nyando District are dispersed in the rural areas and concentrated in the urban areas. The main urban areas or towns in the district are (shown on map 5) Ahero, Awasi, Miwani, Chemelil, Muhoroni, Koru, Katito, Nyabondo and Sondu. These are not very large towns, however due to the concentration of people who do not primarily engage in agriculture, they provide a market for agroforestry products.

The centres are spread all over the district and are connected by a network of tarmac road. This facilitates easy transportation of produce from one point to the other. The surplus produce that is not consumed within the district can be transported outside the district to larger urban centres such as Kisumu where the demand for the products is higher by virtue of the high population. In Kisumu, there is a periodic market at Kibuye which converges every Sunday and draws goods and customers from all over Kenya. It can be used as an outlet for agroforestry products.

The Nairobi road passes through several towns in Nyando district. These towns can be used as collecting centres for agroforestry products which can then be transported for marketing outside the region as far as Nairobi and Mombasa. This is currently going on in connection with some forms of traditional vegetables such as cow peas

cultivated in the swamps during the dry season. These are collected at Ahero from various swamps and transported to Gikomba market in Nairobi where demand is very high. This practice can be expanded.

3.12. Infrastructure and Community Services

Map 5 shows the road and railway network in Nyando District. Roads are the most important means of transportation in Nyando district.

Railway

The Kenya Uganda Railway passes through Nyando District on its way to Kisumu. Railway stations include Koru, Muhoroni, Chemelil, Kibigori, and Miwani. In the past both passenger and goods services were operating this route but the passenger services have since been discontinued due to the many problems faced by the railway corporation.

Roads

Tarmac Roads

Map 5 shows the tarmac roads found in the study area. The Nairobi, Kisumu road passes through Ahero to Kisumu. The Ahero Oyugis Road passes through Katito through Sondu to Ahero. These are the busiest roads in the district. Awasi, Chemelil to Nandi Hills is also on a tarmac road but has less traffic. Kisumu, Miwani, Chemelil, Muhoroni to Fort Terran is a tarmac road up to Fort Terran. It is most used up to Muhoroni. Beyond this point traffic is low.

Muhoroni Kericho is also tarmac and is used as a by pass for traffic heading towards Kisumu-Nairobi road but avoiding Awasi. The tarmac roads in the district are not in good condition. They have a lot of pot-holes especially the Nairobi Kisumu road and the Kisumu, Miwani, Chemelil, Muhoroni road.

Other Roads

In the sugar growing the sugar roads form an extensive network to facilitate transportation of sugar cane. The farmers pay cess to the country council for maintenance. However the roads are in very poor shape. In the non-sugar growing zone areas; the road network is not extensive. In the Kano plains even the few roads that exist are rendered impassable during the rainy season because of the black cotton soils. Road transport and network is important for transportation of goods. Therefore the existing network is an advantage because it can be used to transport agroforestry products.

Water Supply

There are several rural water supply projects in the District; Muhoroni water supply, Nyakach water supply, Ngere Kagoro water supply and Awasi water supply. These serve the rural population and the towns nearby. There are also private water projects such as those of the sugar factory, Homa Lime, the Catholic Mission in Koru etc. These also serve part of the population. The total numbers of households in Nyando District with access to piped water are 11,624 according to the current District Development plan. The numbers of households with access to portable water are 22,110 and the average distance to portable water is 1 km. The district has 263 boreholes, 184 shallow wells, 32 protected springs, 5 dams, and 5 permanent rivers as then major sources of water. Rain is also a source of water. 848 households have roof catchments. All these sources of water can benefit from agroforestry. Tree cover reduces the rate of runoff thus allowing better percolation of rain water into the soils where they replenish underground water from which boreholes, springs and wells draw their supply of water.

Education

According to the current District Development Plan (2202-2008), Nyando District has 316 pre-primary schools, 291 primary schools, 45 secondary schools and 7 tertiary institutions. The teacher-pupil ration is 1:31 in pre-primary school, 1:31 in primary school and 1:15 in secondary schools. Girl enrolment is 24% while boy enrolment is 47%.

Table 14 - Level of education in Nyando district.

Level of education	Frequency	%
No education	10	7.9
Primary education	66	52.0
Secondary education	48	37.8
College education	3	2.4
Total	127	100

Source: Field Survey

Table 14 indicated that 52% of the population have primary education and 7.9% have no education. The implication is that 60% of the population have primary education and below. These low literacy levels must be taken into consideration when planning strategies and approaches to rural development. The strategies must be appropriate. Agroforestry technologies and innovations are often very simple and this increases their appropriateness for communities where levels of education are generally low.

Education increases access to employment and income. Prevailing low levels of education in the district do not therefore offer much hope for increasing access to employment and income, as a poverty reduction strategy. It is therefore necessary to seek alternate ways of reducing poverty hence the choice of agroforestry. It does not require high literacy levels for one to be able to practice agroforestry

Health

The current District development plan indicates that the most prevalent diseases in Nyando District are Malaria, URTI, diarrhea, skin diseases and worms. To deal with these the district has 36 health facilities. Amongst these are 1 GOK hospital, 2 Sub-district hospital, 2 Private hospital, 9 Health centres, 16 Dispensaries, 5 Nursing /Maternity homes. The average distance to the nearest Health centre is 5 km and the doctor-patient ratio is 1:50,000. The problem of access to health facilities can be addressed by agroforestry because some of its products are medicinal trees and herbs. They are used to cure both man and animals. Plate 4.10 shows a photograph of some medicinal herbs that are grown and used in the district that is Ober, *Prunus Africana*, and Mwarubini. The use of these medicinal trees and shrubs will reduce the people's reliance on conventional health services and help fill the gap existing in health service provision.

Energy

The main sources of domestic energy in Nyando are electricity, wood fuel, kerosene and solar. According to the District Development Plan (2002 – 2008), 10 trading centres have electricity while 1,801 families have electricity connections. Only 2% of the rural households have solar power. The most widely used form of energy is wood fuel. It is used by 90% of the households. 20% of the population use kerosene, gas and biogas. There is a great dependence on wood fuel as source of domestic energy. The implication of this is that trees and bushes are steadily being cut down and to provide wood fuel. Plate 3.9 shows pictures of hills that were once covered by trees but have now been cleared as people increase farm land and also as they seek wood fuel. The soil no longer gets the protection it once enjoyed from the trees. There is increased runoff, less percolation of water in to the ground water reserves and soils erosion which leads to silting of rivers and floods in their lower courses (Wijkman and Timberlake 1988).

Agroforestry as a land use system allows for the use of land for crop production and at the same time tree growing. In this way it increased land under agriculture and also provides for a sustainable supply of wood fuel. The environmental benefits of trees such as soil conservation are also not lost.

CHAPTER 4 – AGROFORESTRY IN NYANDO DISTRICT

4.1 Agroforestry Practices in Nyando District

This chapter addresses the first objective which is to prepare an inventory of agroforestry in Nyando. It establishes the position of agroforestry as viewed by the DDC, its priorities and its activities. It then goes further to establish the existing agroforestry practices both traditional and innovative that go on in Nyando. The section examines common tree species and their uses before establishing the constraints to tree growing. The information in the inventory is used as a base line on which the case for agroforestry is built.

4.1.1 Forest and environment sub-sectors in Nyando district (DDP)

Forestry as a sub-sector contributes to the Environmental conservation, creation of employment, income generation and provision of fuel wood. However, the area of gazetted forest land in Nyando is only 3.2 km². There is a constant conflict between forests and human settlements. The gazetted forest area is not likely to increase. According to the Kenya Forest Master Plan, the future of increasing tree cover and tree products is through farm forestry hence the promotion of agroforestry. In line with national objectives as expressed in the Kenya Forest Master Plan, Nyando District's priorities are to promote rural afforestation and agroforestry.

The District development plan intends to use the following strategies:

1. Sensitize the local communities on the importance of conservation.
2. Train at least 20 farmers in each division on tree nursery establishment.
3. Establish one command nursery in each division.
4. Establish one demonstration farm per division.
5. Encourage farmers to establish their own wood lots.
6. Conservation of fragile areas for example Koguta – Miriu Hills, Nyando and Miriu rivers.

Constraints to the implementation of the programme include lack of interest and laxity by community members on environmental management. They also include poor protection of planted seedlings leading to a low survival rate for the planted seedlings. Few grow to be of any benefit. Over stocking and overgrazing lead to soil erosion

which worsen the situation and increases the urgency for an appropriate land use system. Rural afforestation through extension is going on throughout the district.

The objectives of this are to increase tree cover in the whole district, reduce the rate of environmental degradation, and reduce soil erosion. The target is to afforest the whole district. Activities aimed at achieving the objectives include planting trees in the whole district, sensitizing the locals to plant trees on the farms and tree nursery establishment. Afforestation of part of Koguta forest where Sondu Miriu hydro power project being constructed is also ongoing. The objective of this project is to rehabilitate the degraded sites of the forest. The Target is to rehabilitate all the area which will be degraded as a result of the project. Activities in this project include raising at least 10,000 seedlings for planting, planting all these seedlings in the degraded areas of Koguta forest.

Another ongoing programme is tree Nursery Establishment. The objectives are to raise enough seedlings for rural afforestation, to enable farmers to have small tree nurseries for their own domestic use, and to increase awareness on tree planting and protection. The Target is to have one communal tree nursery in each division. Activities in the programme include training farmers on tree nursery establishment, and establishing at least one communal tree nursery in each focal area where Lake Victoria environmental Programme (LVEMP) is working.

Table 4.1 - New projects proposals: Environment – Nyando DDP.

Project Name Location/Division	Priority Ranking	Objective	Targets	Description of activities
Afforestation/ Agro-forestry Nyando /Miriu River flood Control / afforestation project (Nyando, Miwani and Upper Nyakach Divisions)	1	To increase tree cover in the district; Provide farmers with an alternative source of income by marketing tree products to wood based cottage industries; Conserve soil and water in order to increase food productivity	To have at least over 50 per cent of the planned areas afforested at the end of the planned period; Organize one training per division to train farmers on site; Organize farm visits once per month in all divisions; Organize and provide communities with free seeds to enable them establish tree nurseries.	Afforest hilltops; Train farmers on Agroforestry ; Increase the vegetation cover on the fragile banks so as to stabilize the embankment and control floods to increase food production; Control soil erosion and conserve the environment Justification: The river banks are prone to soil erosion and need vegetation cover for protection.
Establishment of Central Tree Nurseries Miwani, Nyando and Lower Nyakach Divisions	2	To raise seedlings for divisional tree planting.	Raise at least 15,000 seedlings for divisional tree planting	To bring tree seedlings nearer to farmers; Provide seedlings for divisional and communal national tree planting exercises. Justification: There is need for increased access to tree seedlings
Tree planting along the High-ways District wide	3	To plant trees along the highway for environmental and aesthetic purpose.	To plant trees at least in all the highways	To improve vegetation cover along the high ways. Justification: To prevent soil erosion.
To construct 6 Offices, one for each Division and DFOs Office. District wide	4	To create office accommoda tion	6 offices constructed	To improve running of afforestation activities and administration activities from a central place. Justification: Lack of office space.

Source: Field Survey

Table 4.1 above is extracted from the current Nyando District Development Plan. It indicates that agroforestry and afforestation are part of their programmes and are ranked first in terms of priority. The objective is to increase tree cover in the district with a view to providing farmers with alternative source of income and protecting the environment. This study addressed the issue of women's participation in agroforestry. The District Development Plan has indicated the importance of agroforestry so the study sets out to find the role of women in this practice with a view to making recommendations on appropriate approaches through which optimum participation of the rural women can be achieved.

4.1.2 Inventory of agroforestry practices in Nyando District from the field Survey

Agroforestry is a new name for old practices that combine the use of trees and shrubs with crop and livestock production (Rocheleau, 1988). This section of thesis discussed the findings of the field survey on existing land use systems in Nyando District that can be termed as Agroforestry. For ease of reference these practices are placed under any of the 10 categories selected for this study as shown in Table 4.2.

Table 4.2 – Agroforestry Practices in Nyando District

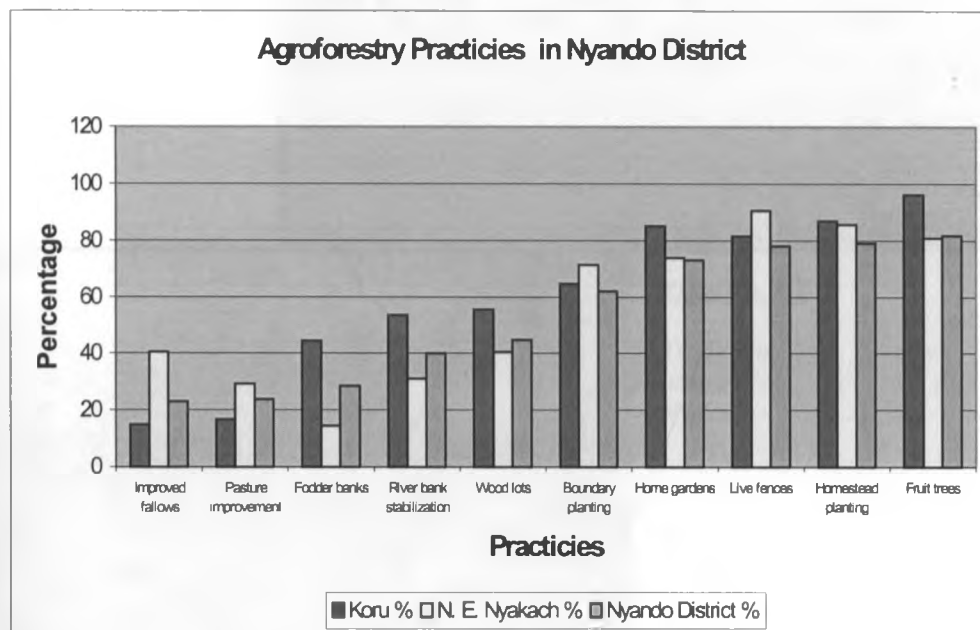
Agroforestry activity	Koru		N. E. Nyakach		Nyando District	
	Frequency	%	Frequency	%	Frequency	%
Improved fallows	8	14.8	17	40.5	25	23
Pasture improvement	9	16.7	12	29.3	25	23.8
Fodder banks	24	44.4	6	14.3	30	28.6
River bank stabilization	29	53.7	13	31	42	40
Wood lots	30	55.6	17	40.5	47	44.8
Boundary planting	35	64.8	30	71.4	65	62
Home gardens	46	85.2	31	73.8	77	73
Live fences	44	81.5	38	90.5	82	78
Homestead planting	47	87	36	85.7	83	79
Fruit trees	52	96.3	34	81	86	81.9

Source: Field Survey

Table 4.2 indicates the frequency of the Agroforestry practices within the sample. It indicates that fruit trees are the most widely practiced (81.9%) form of Agroforestry in Nyando. It is followed by homestead planting (79%), Live fences (78%) and home gardens (73%). All these are traditional forms of Agroforestry. This may have contributed to its high level of adoption. The Least practiced frequencies are improved fallows (14.8%) and pasture improvement (16.7%). These are both scientific

innovations of agroforestry. In the traditional society fallows and pastures were natural. The concept of improving them is relatively new. The short period in which the community has been exposed to the idea may explain the reason for its low rate of adoption.

Figure 4.1: Agroforestry Practices in Nyando District



Source: Field Survey

a) Wood Lots (Farm Forestry)

Wood lots are a feature of agroforestry in Nyando District. Table 4.2 indicates that 44% of the respondents had wood lots. The level of adoption of this agroforestry practice appears to be more in Koru (55.5%) than in North East Nyakach (40.5%).

Farmers in Koru practice farm forestry with established wood lots. Timber from these wood lots is sold to the Homa Lime factory. Some timber is sold as poles while the rest is used for domestic purposes such as construction, fencing and fuel wood. The Eucalyptus tree appeared to be the most popular tree for wood lots. However, many farmers do not favour this tree because they claim it competes unfairly with other crops for water. People with very large farms are more comfortable growing it. The small holder prefers other species. Small holders do not have extensive wood lots. Plate 4.1 shows a commercial wood lot in Koru. In

Plate No. 4.1

*A commercial woodlot in
koru*



Plate No. 4.2

*Traditional sylvo
pastoralism in N E
Nyakach*



Plate No. 4.3

Sylvo pastoralism in Koru



North East Nyakach few homesteads have wood lots. Most are of indigenous trees, but a few are of exotic species. They supply timber for local constructions and wood fuel. They also enhance the environment.

Wood lots can exist where the natural trees are tended and protected without introducing new seedlings. Wood lots can also involve cultivation of a field and planting of seedlings at specified intervals for specific tree products. The former are found in Nyakach. They are not market oriented. In Koru both forms of wood lots are found. Wood lots in Koru are market oriented and the products are sold to Homa Lime Company.

b) Fruit Trees

This is the most practiced form of Agroforestry in Nyando District according to the field study. Fruit trees of various types grow in Nyando District. The common fruit trees include mangoes, bananas, avocados, paw paws, lemons and guavas. Table 4.2 derived from the field survey indicates that 81.9% of the respondents grow fruit trees. In Koru more people are involved in fruit tree growing (96.3%) than in North East Nyakach (81%). Plates 4.4, 4.5, and 4.6 show some fruits grown in Koru.

This variation can be explained in part by the fact that climatic and environmental conditions in Koru are more conducive for plant growth than in North East Nyakach thereby making fruit tree growing easier in Koru. Koru has high rainfall amounts, well drained soils and more fertile soils compared to North East Nyakach. Fruit tree planting in Koru is more market oriented than in North East Nyakach. This is shown by the area /space devoted to fruit tree farming and the efforts put into nurturing the fruit.

Guava: These fruits grow everywhere in Koru. They form the common bush. No one grows them and no one sells them. All have free access to the fruits. They are of no economic value to the community but they are of great subsistence value. They supplement the people's diet at no cost and no effort. Guavas trees are used for construction by the local population. Small poles are improvised from the guava tree especially for people who cannot afford to buy the poles. The guava also provides protective cover for the soil because it forms thickets.

Paw paw: Paw paws grow easily in Koru and can yield fruits within the first year. However, farmers noted that current varieties of paw paws have a very short life span. The trees died within 5 years of planting. One woman stated that when she married 15 years ago, she found paw paw trees in the home and that to-date, they were still producing fruits. However, the ones she planted 3 years ago have started dying off. This experience was not unique to her alone. Not so many farmers grow them as a commercial enterprise because they view them as highly perishable and too risky to plant in large quantities. One Joseph Osoo of plot number 295 Koru has a good number of paw paw trees. Paw paws are sold in the local markets and also supplement the family diet. In North East Nyakach, paw paws do not do well due to climatic extremes. During the rains there are floods while at other times it is too dry. Paw paw seedlings are delicate and many die due to these extreme climatic variations.

Mangoes: Mangoes grow very well in Koru. In the focus group discussion many farmers are quoted as having many mango trees from which they generate income. Most of their customers collect the fruits from the farmer to sell in the local markets. Joseph Bonyo of plot number 299 is an example of the mango farmers. Mangoes supplement the family diet and also provide wood fuel as its extended foliage is seasonally trimmed. Mangoes grow well in North East Nyakach.

Avocado: Avocados are also grown well in Koru Location. One Dominicus Okoko of (Mnara) plot number 213 Koru had 16 avocado trees. These fruits are sold in the local markets through local traders who purchase them from the farm. Avocados are not widely grown in North East Nyakach. Farmers complain that most plants died before maturing. For those that survived the yields were good. Avocados supplement the family diet and provide wood fuel when their branches are trimmed.

Bananas: Bananas are the most widely grown fruit in Koru. Most homes have bananas especially those with farmland bordering a river bed. Bananas are also favorites of the home garden. The bananas are used extensively for subsistence but an appreciable quantity is sold on the local market. Bananas will grow in North East Nyakach if planted using appropriate techniques.

Plate No. 4.4

Agro-forestry and soil conservation - Terrace made of gathered stones - stabilized with trees and fruit trees in Koru



Plate No. 4.5

Agro-forestry - fruit growing in Koru



Plate No. 4.6

Agro-forestry - alley cropping in Koru



Lemons: Not many farmers grow lemons for commercial purposes. Lemons however grow easily in Koru. Most homes have a three or 2 for domestic consumption. Lemons are also grown in North East Nyakach for subsistence. In both regions the yields are good.

Custard Apples: Custard Apples have been tried by a few and have been a success. Fruit trees provide income when sold, they supplement the family diet and when trimmed provide fuel wood. They enhance the environment by providing shade and beauty. Finally they provide protective cover for the soil and replenish the soils organic mater.

c) Live Fences

Live fences are widely grown in Nyando District. Table 4.2 derived from the field survey indicates that 78% of the respondents had live fences. For purposes of our study live fences refer specifically to the protective fence around the homestead or a specific area and should not be confused with boundary planting which for this study means planting trees/shrubs along boundaries to mark them but without the objective of creating a protective fence. Many homes in Koru have live fences because the hedges grow easily. The people also feel that the live fences make their homes more beautiful. The common trees used for fencing are Cyprus and Kei Apple. When these hedges are trimmed they provide wood fuel. If the cypress is left to grow tall it can in future be cut down to provide timber for domestic use or for sale.

In North East Nyakach, live fences are common in many homes. The traditional fence in most homes is a live hedge of *Eurphobia Tirucalli* (*Ojuok*). However, other trees and bushes are also used. The live hedges serve as a source of fuel wood. They also serve to enhance the environment. They protect plants within the homestead from destruction by unattended livestock. In Koru live fences around the homesteads are supplemented by wire fences. In North East Nyakach there is hardly any use of wire fencing. This can be explained in part by the fact that wire fences are expensive and since income levels in North East Nyakach are very low, most people are not able to afford wire fences. Live fences in North East Nyakach are a major source of wood fuel. As a result of over harvesting of trees from the fence to meet the ever increasing demand for fuel wood, these fences have gaps

Plate No. 4.7

*Agro-forestry – Boundary
planting in Koru*



Plate No. 4.8

Live fence in Koru



Plate No. 4.9

*A typical Luo homestead
with a typical Ojuok fence
in N E Nyakach*



and lose their protective qualities. For instance, when there is a death in the home, the demand for firewood goes up. Because of high poverty levels most people are not able to purchase it. They therefore resort to obtaining this from their live fence by cutting down several *Eurphorbia Tirucalli* (*Ojuok*) trees. This particular tree is the traditional tree used for fencing. It is ideal as a source of fuel because even when not well dried, it can be used. With increasing deaths and increasing demand for wood fuel, many homes have destroyed *Eurphorbia Tirucalli* (*Ojuok*) fences. Plate 4.9 is a photo of a traditional *Eurphorbia Tirucalli* (*Ojuok*) fence. In Koru the live fences are not a major source of wood fuel because there are alternative sources such as Guava and dried sugar cane stalks. Plate 4.7 shows a photo of a live fence in Koru still intact. Other agroforestry practices require protection from livestock. Live fences are a cost effective way of protecting large areas where trees/crops are grown. It is therefore a more sustainable way of protecting trees and crops. If widely used, it has multiple gains and can lead to an increase in the level of adoption of other agroforestry innovations. It will increase the survival rates of seedlings because they will be protected especially from livestock.

d) Home Gardens

In this study home gardens are taken to mean any form of crops production within the homestead. Basically all homes were said to have home gardens where common fruits are bananas, paw paws and lemons amongst others. Vegetables of various types are also grown in the home gardens. The home gardens provide supplements for the family diet and also produce surplus for sale. Statistics indicate that 85% of the respondents in Koru had home gardens and 73% in North East Nyakach. 73% of the total respondents had home gardens. In the Luo culture the home garden is called *Orundu* and it is the domain of the women. Each married woman in the home has an *Orundu*. Plate 4.11 and 4.12 shows fruits growing in a homestead.

e) Home Stead Planting

For purposes of this study homestead planting refers to planting trees and shrubs within the home. It is a subset of home gardens.. Most homes practice this to provide shade and make the homes beautiful. Fruit trees and timber yielding species are sometimes included. In North East Nyakach it is less elaborate with

Plate No. 4.10

*Agro-forestry – medicinal tree
(Prunus Africana) and
Albisinia Coriaria (Ober)*



Plate No. 4.11

*Fruit growing in
homestead in Koru*



Plate No. 4.12

*Boundary planting
combining timber bearing
trees and passion fruits in
Koru*



fewer tree species. There is more use of indigenous trees. Homestead planting requires time. From the focus group discussion, it emerged that poor people spend most of their time doing casual labour to earn income or working in the fields to produce food crops therefore they have less time to indulge in homestead planting. As a result the homes of the poor do not have elaborate forms of homestead planting. The poor view homestead planting as luxury. Although most people practice it, the intensity is very low in most cases. However homestead planting can be practiced in such a way that it generates multiple benefits to the household. These benefits include fruit production for consumption and for sale, wood fuel, timber, shade, beauty and environmental conservation. There is need to increase this awareness. Statistics from the field survey indicate that 87% of the respondents in Koru practiced homestead planting and 85.7% from North East Nyakach. 79% of all the respondents practiced homestead planting.

f) Fodder Banks

The field survey revealed that only 28.6% of the respondents grew any form of fodder. It also revealed a marked regional variation where in Koru 44% grew fodder and in North East Nyakach only 14% grew fodder. This is because Koru is favoured with climatic conditions conducive to livestock farming. Dairy farming is practiced and fodder is planted to supplement cattle feed, particularly for those farmers who keep graded cattle. In North East Nyakach most livestock is of the indigenous type because the harsh climatic conditions do not favour exotic species. These traditional animals are left to pasture in the open fields. Napier grass is the most common fodder grown in the district. However, leuceana is being introduced to the farmers through agricultural extension workers. Fodder crops are also used to reinforce conservation structures such as terraces and benches. Fodder growing is not an indigenous practice and this may explain the low level of adoption. Free Ranging is very rampant in most parts of Nyando therefore the need to provide fodder is not very pressing. Areas where free ranging is restricted like in Koru, the need for fodder is higher and this is reflected in the field survey. Free ranging has negative effects on agriculture since the animals destroy crops. The more it is restricted, the more it is expected that fodder growing will be required.

g) Pasture Improvement

Pasture improvement is not a common practice in Nyando District. Only 23.8% of the respondents practiced some forms of pasture improvement. This low level of adoption can be explained by the prevalence of ranging. In North East Nyakach 29.3% and in Koru only 16.7% practices pasture improvement. It is worth noting that while in Koru fodder banks are grown by more people than in North East Nyakach, pasture improvement is practiced more in North East Nyakach than in Koru. The focus group discussion revealed that free ranging is the order of the day in North East Nyakach but in Koru it is very limited. It can therefore be urged that in North East Nyakach, pasture improvement is a more appropriate approach to solving their problem because it leaves them the option of open range grazing which is the indigenous form of livestock feeding. Fodder growing is a new innovation and is designed to promote zero grazing, which is also not an indigenous practice. These are designed to increase production and the income of the farmer. They are therefore, more suitable for a cash economy where the economics of production guide land use hence their greater level of adoption in Koru where there exists a cash economy. In North East Nyakach, there is a subsistence economy and livestock keeping is viewed as a way of life more than an economic activity. From the focus group discussion, it emerged that the livestock are seen as a status symbol. They are used to pay bride price, to slaughter during burials and feasts and finally they provide subsistence for the family. Livestock is sold only when the family is cash trapped. Plate 4.2 and 4.3 shows sylvo pastoral system in Nyando District.

h) Improved Fallows

The field survey indicated that 23% of the respondents practiced improved fallows. There was a big regional variation in the level of adoption. In Koru only 14.8% practiced improved fallows, while in North East Nyakach 40.5% practiced improved fallows. This is explained by the fact that soils in Koru are more fertile and less fragile therefore, the need for improved fallows is not critical. However, in North East Nyakach the soils are less fertile and more fragile, there is therefore, a need to find ways of improving the soil nutrients cycle. There has therefore been a more intense campaign by research and extension workers to promote the use of improved fallows in North East Nyakach. Plate 4.15 shows gully at Katuk Odeyo which are formed by water. It shows the extent of how fragile the soils are and

how susceptible they are to agents of erosion. If interventions are not put in place in time, the repercussions are far reaching. Plate 3.13 shows the researcher and 2 old women whose land has been taken over by the gulleys. They were forced to move away as the gulleys reached their homes. They now have no source of livelihood. More and more people continue to be victims as the gulleys continue to claim more land. Plate 4.14 shows another home in the background which may soon have to relocate as the gulleys are already at their doorstep.

i) River Bank Stabilization

Cultivation along the river beds is a favourite practice in Koru. In the process river bank stabilization is practiced. Bananas were the most common plants used in river bank stabilization. Other plants used are napier grass and sugar cane. Plants used to stabilize river banks can also have economic value. Plate ___ shows an extensive banana plantation along the banks of river Nyando. In Koru 53.7% of the respondents cultivated river beds and practiced river bank stabilization techniques whereas in North East Nyakach 31.0% did the same. In North East Nyakach fewer people practiced river bank stabilization because cultivation of river banks was less popular. Instead harvesting was more popular because it had immediate cash returns. The high sand contents in the river bed soils also made the soils less productive thus discouraging the farmers. Instead they cultivated the swamps where the soils had more of clay than sand. The high levels of poverty makes them opt to harvest sand from the river bend for their immediate survival needs at the expense of the long term environmental gains of river bank stabilization. This is a clear illustration of the negative impact of poverty on the environment.

j) Boundary Planting

In the settlement schemes subsistence plots there are sugar plots and trees planted along the boundaries of subsistence plots are a common practice. However in the sugar plots no trees are planted on the boundaries. As a result few subsistence plots had boundary disputes while many sugar plots had disputes because they have neither boundary trees nor any form of fencing. Popular trees for boundary fencing are indicated as eucalyptus, Gravilea, Cyprus, and Siala. These are timbers producing tree of economic value. They also provide wood fuel. In North East Nyakach boundary planting is done in some homes and not in others. Sisal is the most common plant in the boundary planting. The sisal provides poles when

Plate No. 4.13.

River bank stabilization using timber providing trees in Koru



Plate No. 4.14

River bank stabilization using banana plant in Koru



Plate No. 4.15

Erosion gullies at Katuk - Odeyo in N E Nyakach Environmental hazard. The roots appear to arrest gully formation



mature. It also provides raw material for weaving industry and rope production. Since wood fuel is a big problem, the sisal leaves are dried and used for fuel. The field survey indicated that 62% of the respondents practiced boundary planting. In North East Nyakach 71% and in Koru 64.8%. Boundary planting is practiced throughout the district. Since it is equally popular it is a good practice to capitalize on for promoting agroforestry throughout the district. The people can be sensitized on the gains possible from boundary planting. It was observed that although boundary planting was widely practiced optimum gains were rarely obtained. The economic potentials of the practice were not been exploited. Plate 4.7 shows boundary planting.

k) Tree planting in vulnerable areas of the rural landscape

In the rural landscape there are many vulnerable areas. The study selected water points, steep slopes, river banks, roads/reserve, pastures, farm land and homesteads as samples of areas that are vulnerable and examined the level at which the community planted trees in these areas.

Table 4.3 Tree planting in vulnerable areas of the rural landscape

Vulnerable areas	%
Water points	30%
Steep slopes	56%
River banks	63%
Roads/Paths	46%
Pastures	20%
Farm land	76%
The Homestead	93%

Source: Field survey

Table 4.3 indicates that of the selected vulnerable areas the one in which most of the respondents plant trees are the homestead (93%), farm land (76%), river banks (63%) and steep slopes (56%). Despite the fact that many respondents plant trees in these areas, a field survey showed that not enough trees are planted in these areas for optimum returns. Although pastures are very vulnerable and suffer from overgrazing and eventually soil erosion, only 20% of the respondents plant trees in the pastures. This is an area that needs serious planning for an increase in tree planting for pasture

Plate No. 4.16

Erosion gullies at Katuk - Odeyo in N E Nyakach – the farms that has been eroded belongs to these two women in the photo



Plate No. 4.17

Erosion gullies at Katuk - Odeyo in N E Nyakach displacing homes and taking over farmland

Plate No. 4.18

Erosion – a road eroded 2m below the surface level. Plant roots protecting roadsides from erosion – Katuk Odeyo in N E Nyakach



Plate 4.15 shows an erosion gully. It is evident from the picture that the roots can arrest erosion. Plate 4.16 shows erosion along a road and plate 4.17 shows erosion on what was a farm land.

4.1.3 Common trees/plants used in Agroforestry in Nyando District.

Table 4.4 - Common trees/plants used in Agroforestry in Koru - incomplete

English/botanical Name	Swahili Name	Luo Name	Uses
Exotic Species			
◆ <i>Gravilea Robusta</i>	—	—	Timber, wind break
◆ <i>Eucalyptus Saligna</i>	—	<i>Bao/ndege</i>	Timber, wood fuel
◆ <i>Markhamia Lutea</i>	—	<i>Siala</i>	Wood, fuel, timber
◆ <i>Senn Siamea</i>	—	<i>Obino</i>	Wood, fuel
◆ <i>Terminalia Brownii</i>	—	<i>Manera</i>	Timber, wood, fuel
◆ <i>Casia Siamea</i>	—	<i>Oyieko</i>	Wood, fuel, beauty
◆ <i>Jacaranda</i>	—	—	Beauty, lightning arrestor
◆ <i>Mimosifotia</i>	—	<i>Asao</i>	Construction, soil nutrient
◆ <i>Sesbania Sesban</i>	—	—	Medicine
◆ Nandi flame	—	—	Wind break
◆ <i>Casuarina</i>	—	—	Timber, live fences
◆ Cypress	—	—	
◆ <i>Leucaena</i>	—	—	
◆ <i>Leucocephda</i>	—	<i>Lusina</i>	Fodder, soil nutrients
◆ <i>Napier grass</i>	—	<i>Ogada</i>	Fodder
Fruit Trees			
● <i>Mangoes Mangifera Indica</i>	<i>Maembe</i>	<i>Mwembe</i>	Food
● <i>Guava. Psidium guajava</i>	<i>Mapera</i>	<i>Mapera</i>	Food
● Avocado	—	—	Food
● <i>Lemon/oranges</i>	—	—	Food
● <i>Citrus Sinensia</i>	<i>Ndimu</i>	<i>Ndimu</i>	Food
● Paw paw	<i>Papaya</i>	<i>Apoyo</i>	Food
● Banana	<i>Ndizi</i>	<i>Rabolo</i>	Food, fodder
Indigenous trees			
❖ <i>Tithonia diversifolia</i>	—	<i>Akech</i>	Medicine
❖ <i>Euphorbia tirucalli</i>	—	<i>Ojuok</i>	Livefencing, fuel, wood

Source: Field Survey

This record of common tree species was obtained from the focus group discussions in Koru. Of the exotic trees *Gravillea* and *Cyprus* were the most popular. Farmers do not like *Eucalyptus* because they claim it does competes with crops for nutrients and water.

Table 4.5 - Common Trees/plants used in Agroforestry in North East Nyakach

English/ <i>botanical</i> Name	Swahili Name	Luo Name	Users
Exotic Species			
◆ Eucalyptus	<i>Mti mbao</i>	<i>Ndege/bao</i>	Timber, wood, fuel
◆ <i>Gravillea Robusta</i>	<i>Mutaragwe</i>	<i>Muteragwe</i>	Nitrogenfixing, timber
Fruit Trees			
• <i>Mangoes/Mangifera Indica</i>	Maembe	<i>Maembe</i>	Food
• <i>Persea Americana/Avocado</i>	Avocado	<i>Avocado</i>	Food, Shade Food/fodder Food
• Bananas	Ndizi		
• <i>Lemon/citrus sineysis</i>	<i>Ndimu</i>	<i>Rabolo</i> <i>Ndim</i>	
Indigenous trees			
❖ <i>Euphorbia tirucalli</i>		<i>Ojuo 'k</i>	Live fencing, wood fuel
❖ <i>Balanites aegyptica</i>		<i>Othu</i>	Charcoal, browse
❖ <i>Accacia gerrardii</i>		<i>Sae</i>	Wood fuel, timber, and shade
❖ <i>Markhemia Lutea</i>		<i>Siala</i>	Timber, fuel wood
❖ <i>Accacia Lahai</i>		<i>Alii</i>	Fencing, fuel wood, wood fuel
❖ <i>Senna siamea</i>		<i>Obino</i>	Building, medicine, wood fuel, timber
❖ Sisal	Makonge	<i>Korga</i>	Rope making
❖ <i>Sonchus shwenfurthii/compositae</i>		<i>Achaki</i>	Trad. Vegetables, medicine, fodder

Source: Field Survey

This record of common tree species in North East Nyakach was obtained from the focus group discussions held in North east Nyakach and a physical survey of the location. Eucalyptus is the most popular exotic tree in this area. The farmers like it because its survival rate is higher than other exotic trees. It grows quickly and yields income generating timber.

4.14 Tree Planting constraints and possible interventions

Table 4.6 - Tree planting constraints and possible interventions

Constraints	Possible interventions
1. Drought (Low and erratic rainfall)	<ul style="list-style-type: none"> • Train farmers on all water harvesting techniques • Provide water for irrigation from the lake, dams and boreholes. • Dig shallow wells to utilize ground water.
2. Low soil moisture retention capacity leading to stunted growth	<ul style="list-style-type: none"> • Increased organic matter • Use more manure
3. Excessive runoff destroys seedlings	<ul style="list-style-type: none"> • Build check dams at appropriate sites to reduce quantity and speed of runoff water
4. Floods during the wet season	<ul style="list-style-type: none"> • Make proper drainage canals to allow trees to establish well • Plant tree species that can survive flooding conditions. • Dig drainage canals to drain excess water from the farms
5. Livestock damage	<ul style="list-style-type: none"> • Formulate rules for protecting trees from livestock • Plant trees in areas protected from livestock • Fence area of trees/shrubs after planting • Farmers should guard their livestock all the time as they do during the long rains cropping season. • Find permanent solution for free ranging.
6. Lack of appropriate tree seeds and seedlings	<ul style="list-style-type: none"> • Establish group and individual tree nurseries in the village • Train farmers on the use of wildlings • Introduce tree species that do not compete with crops
7. Small land sizes	<ul style="list-style-type: none"> • Make farm plans to harmonize land use • Plant smaller trees that occupy little space • Plant trees and shrubs on farm boundaries, borders, soil conservation structures and homestead
8. Lack of knowledge on how to manage trees	<ul style="list-style-type: none"> • Provide advice on tree management • Train villagers on tree propagation techniques
9. Pest and diseases	<ul style="list-style-type: none"> • Provide advice on pesticides and their application particularly for fruit trees
10. Low soil moisture retention capacity leading to stunted growth	<ul style="list-style-type: none"> • Increased organic matter • Use more manure
11. Excessive runoff destroys seedlings	<ul style="list-style-type: none"> • Build check dams at appropriate sites to reduce quantity and speed of runoff water
12. Floods during the wet season	<ul style="list-style-type: none"> • Make proper drainage canals to allow trees to establish well • Plant tree species that can survive flooding conditions. • Dig drainage canals to drain excess water from the farms
13. Shallow soils in some areas	<ul style="list-style-type: none"> • Adopt soil conserving structures to build soil depth
14. Myths, legends and inhibitive some tree species traditional taboos against some tree species	<ul style="list-style-type: none"> • Select appropriate tree species from the many species identified in the catchments
15. Competition between trees and food crops	<ul style="list-style-type: none"> • Introduce tree species that are less competitive with crops
16. Land tenure problems: youth do not own land	<ul style="list-style-type: none"> • Parents should allocate land early enough for their sons to plant trees

Source: Field Survey

Constraints to Agroforestry in Koru as indicated by the focus group

Time: Rural women have a lot of duties which they must on a daily basis. They have very little time to spare. So for them, there must be motivation in all activities. The end must justify their time allocation. Poor people do not have money to employ others to help them out with their labour requirements. Many times they cannot afford machinery. Therefore they must rely on their own labour. This takes most of their time.

Water: North East Nyakach receives inadequate rainfall, so the trees even after being transplanted needed to be watered. The women whose time was already over-stretched found it a problem searching for water for domestic use and at the same time for the trees. This limited the number of trees they could grow especially if the source of the water was far away. The nurseries also need to be watered. The same case applies to watering tree nurseries.

Inadequate Public Awareness of Agroforestry Technologies: During the Focus group discussion it emerged that the majority of the rural women were not fully aware of Agroforestry technologies and their benefits. However, they had some level of awareness but it was not enough to motivate them to embrace agroforestry fully. They indicated that they were interested in further discussions in the future with a view to trying out some of the technologies especially those with income generating capacities.

Lack of Fences: Fencing in North East Nyakach was extremely inadequate. Nearly all farm holdings did not have any form of fencing. Some had boundaries planted with sisal or some form of trees/bushes. These did not keep away livestock. As a result any passing livestock had easy access to the fields. Animals grazing in the neighboring fields could easily stray into the fields because there were no fences. In so doing they damaged whatever was planted. This was especially so with goats who love eating growing trees. Many homes were also not adequately fenced. The problem of fencing, especially in the homes was more compounded by the fact that the culture prohibited women from fencing the homesteads. Fencing the homestead is done by the men. All the women in the focus group indicated that they were not willing to fence the homestead with the *Eurphorbia Tirucalli* (*Ojuok*) (*Euphorbia*). However, they said that if the fence was one of bared wire they could employ someone to put up the fence. The implication is that women who have some source of income may have some influence on fencing the home. Those without

income must wait for the men to fence the homes because the men can plant hedges which are cost effective.

Livestock Menace – Free Ranging: The absence of proper fencing made livestock a menace to Agroforestry. The livestock on the other hand were not tended. Many times they were left on their own after the first harvest. The Chief was in a position to punish the offenders but it was not culturally acceptable for kin to report one another to the authorities. The community shunned anyone who took his kin to court therefore, these offences went unpunished. The Chief could not prosecute if there was no complainant. No one in the community wanted to be shunned so no one came up as a complainant. Therefore the livestock continued to be a menace. They simply eat all the seedlings. The obvious solution in case where the livestock cannot be restrained is to protect the individual seedlings but the women do not have the resources.

Supply of Seed and Seedlings: There exist very few tree nurseries in the area therefore; the source of seedlings was a constraint. The tree nurseries that existed did not have the variety of seedlings that were of interest to women. The supply of seeds would enable the number of tree nurseries to increase. Seeds for indigenous were available but not for the other types of trees especially the fruits that required grafting for quicker yields.

Small size of land: The problem of small size of land was not very widespread. However, in North East Nyakach the average plot sizes were smaller than in Koru. Where the land is small most people prefer to dedicate it to production of food crops even when it is not the most economical land use. In Koru the average plot size is large but people prefer to dedicate the land to sugar cane growing or production of other food crops.

Lack of knowledge on how to manage trees: Different tree species need different methods of management to order that they grow quickly and produce optimum yield. This information is not widespread in Nyando District. Most people use poor planting techniques on planting and managing trees therefore they do not obtain optimum yields and trees take long to mature.

Pest and disease: Trees are often attacked by disease and pest. Paw paws, oranges and Cyprus trees are reported as the most vulnerable. The cost of pesticides is high and most

farmers are not able to afford them so they often lose their plants. Some use traditional remedies.

Cultural constraints: The culture discourages women from growing some trees such as the *Eurphorbia Tirucalli* (*Ojuok*). There are also myths and legends associated with some trees that make people fear planting them. For instance the umbrella tree is believed to be a carrier of death. Anyone who planted it in their homestead was supposed to lose his entire son's through death.

Poor soils: In some regions soils are poor and on others the soil moisture retention capacity is low. Therefore the growth of trees in these regions is stunted.

Land Tenure: Trees are perennial so their occupancy of land is long term. The owner of the land must therefore give consent for a tree to be grown. Children and most women do not own land therefore they must rely on goodwill of the owner who is often the male head of tree household.

CHAPTER 5- RURAL WOMEN IN AGROFORESTRY

5.1 Rural Women's Participation in Agroforestry in Nyando District

This chapter addresses the second objective which seeks to establish the role of rural women in Agroforestry. It begins by establishing the status of women in Nyando and the District Development plan's priorities in mainstreaming gender. It then examines women's participation in agroforestry practices, the impact of cultural beliefs on agroforestry, and addresses extension services offered to the farmers. Finally, it examines women groups to find out their role in agroforestry.

5.2 The status of women in Nyando District

The 1999 population census indicates that Nyando District has 153,295 women and 146,635 men. The district has a male female ration of 100:104. According to the District Development Plan, women in Nyando District have less access to resources than men. They have limited enjoyment of socially valued goods, opportunities and rewards. Traditional ownership and inheritance patterns continue to marginalize women and girls and prevent them from having access to and gaining control of productive resources such as land. In addition, the traditional division of labour over burdens women.

In the current plan period the District recommends that adequate financial allocation be made to activities that benefit women directly such as enhancing small scale enterprises that promote women's access to productive resources thereby addressing their social, educational and health issues. Table 5.1 indicates the Districts project proposals for the plan period 2002-2008 for mainstreaming gender.

**Table 5.1 - New Project Proposal" Culture, Recreation and Sports – Nyando District
Development plan 2002 – 2008**

Project Name Location/Division	Priority Rankin	Objectives	Targets	Description of Activities
Gender Mainstreaming and Empowerment of Women District wide	1	To establish training needs for groups	Women groups self/help groups for handicapped and orphans	Carry out a baseline survey on existing women entrepreneur; Avail systems and credit Options in the district Justification: Women are disadvantaged especially when accessing credit from financial institutions
Capacity Building District wide	2	To improve the managerial competencies	Women groups youth handicaps and orphans	Train groups in managerial, leadership skill. Justification: Lack of managerial skills

		capacities of groups		among women.
Credit Provision District wide	3	Provide credit to groups for employment	Women, men youth, orphans, handicap.	Identification of viable groups. Justification: Problems of accessing credit for group activities
Development of Monitoring and Evaluation Systems District wide	4	To be able to monitor the progress of activities undertaken	District Level and community level	Identifying Information needs for M & E Justification: Need to take corrective measures in good time

Source: Nyando District Development Plan 2002 - 2008

Table 5.2 - Marital Status of women in Nyando District

Marital Status	Frequency	Percentages
Married	60	42%
Single and never married	32	22.4%
Divorced	3	2.1%
Widowed	16	11.2%
1 st wife in a polygamous marriage	23	16.1%
2 nd wife in a polygamous marriage	8	5.6%
3 rd wife in a polygamous marriage	1	0.7%
TOTAL	143	100%

Source: Field Survey

Table 5.3 - Women's Access to Land in Nyando District

	A lot of freedom /access	Average freedom /access	A small degree of freedom /access	No access	Total freedom/a ccess.
The Status of Women					
Married women living in a monogamous marriage (with living husband).	13%	47.8	4.3	13	21.7
Widows (in their own homestead)	30	13	4.3	13	39.1
Single women (Head of household)	16.7		4.2	16.7	62.5
Educated women.	2.5	33.3	20.8	12.5	8.3
Less educated women (below 30 years)	4.5	13.6	40.9	31.8	9.1
Middle aged women (30 – 55 years)	17.4	30.4	30.4	8.7	13.0
Old women (55 and above)	27.3	13.6	9.1	31.8	18.2
Married women with a living husband who are not first wives but are in a polygamous marriage.	9.1	13.6	50.0	18.2	9.1
Married women with a living husband who are first wives in a polygamous marriage.	22.7	31.8	13.6	18.2	13.6

Source: Field survey

Table 5.3 indicates that 42% of the women are married and 22% are in polygamous marriage. This is a relatively high incidence of polygamy. Table 5.3 indicates that 47.8% of married women in a monogamous marriage have average freedom or access to use of land while 50% of married women who are not first wives in a polygamous marriage have only a small degree of freedom to use land. Women's access to land determines to a large extent the women's level of participation in agroforestry.

Table 5.3 also indicates that widows have the highest degree of freedom to use land (30% of the respondents said widows have a lot of freedom. This is explained by the absence of the husband. However, this freedom only exists where there is no dispute over land and the widow lives within their own homestead.. Where there is dispute they are often denied access. On the hand less educated women (below 30 years) have the least access. Table 5.4 indicates that women in Nyando do not attain very high educational levels. 59.8% of the women have only primary school education while 4.8% have no education at all. The implication of these statistics is that they have little access to formal employment because of their limited education levels. They must therefore rely more heavily on production from land as many land based production systems do not need high literacy level. On does not need high education levels to practice agroforestry hence its appropriateness.

Table 5.4 - Education levels in Nyando District

Level of education	Male		Female	
	Frequency	Percentage	Frequency	Percentage
No education	7	10.8%	3	4.8%
Primary School	29	44.6%	37	59.8%
Secondary School	27	41.5%	21	33.9%
College	2	3.1%	1	1.6%
	N = 65		N = 62	

Source: Field Survey

Table 5.5 - Income Levels in Nyando District

Annual Income	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Less than 20,000	5	31%	8	57%
20,001- 40,000	4	25%	3	21.4%
40,001 – 60,000	-	-	1	7.1%
60,001- 80,000	2	12.5%	-	-
80,001 – 100,000	1	6.25%	-	-
Over 100,000	4	25%	2	14.3%
	N = 16		N = 14	

Source: Field survey

Tables 5.6 indicate that 57% of the women in Nyando earn less than Kshs 20,000 per year. This translates to Kshs 1,667.00 per month or Kshs 55.00 per day. This is well below the poverty line of a dollar a day. However, it is not below the absolute poverty line for rural areas in Kenya which is Kshs 980.00 per capita a month (NPEP).

Table 5.6 - Types and levels of occupation in Nyando District

Types of occupation	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Business	7	11.5%	10	16.7%
Teacher	4	6.6%	-	-
Students	8	13.1%	7	11.7%
Farming	36	59%	25	41.6%
Boda boda	3	4.9%	-	-
Housewife	-	-	15	25%
Veterinary officer	1	1.6%	-	-
Unemployed	2	3.3%	3	5%

N = 61

= 60

Source: Field Survey

The Table 5.6 above indicates that farming is the occupation in which women are most involved in. 41.6% of the female respondents are employed in farming. The implication of this is that any strategy designed to target the maximum number of women with a view to improving their livelihoods must focus on farming because this is the occupation in which most women are involved in. Agroforestry is a farming system therefore it can be used to change the livelihood of many women.

5.3 Cultural beliefs and practices surrounding the Luo women and the tree

In pre-colonial Kenya when tradition and culture were strong, there existed sets of rules and practices on how the Luo women related to trees. There were trees that women could not plant. There were also trees that women could manage and utilize. These rules were to uphold various cultural values of the time. However with the dawn of independence and influence from the Western world, the rural communities have undergone changes to the point that some of the practices and beliefs no longer uphold any values. It is still important to understand the original practices and beliefs because it explains some of today's practices.

Table 5.7 What the Luo culture says about women planting trees

	What the Luo culture says about women planting trees	%
1	Luo tradition does not allow women to plant trees	25%
2	Women are treated as visitors therefore there are some trees they were not allowed to plant	20%
3	Only married women could plant trees in their husbands homes. It was taboo for unmarried women/girls to plant trees	5%
4	Women were not allowed to plant trees that were poisonous or considered to have evil spirits	5%
5	Culture dictated which trees women could plant	10%
6	If women did not follow cultural beliefs they could plant all trees	5%
7	Tree planting is viewed as men's work while women do other chores	5%
8	There are some tree species that the Luo culture does not allow women to plant	25%

Source: Field Survey

Table 5.7 is a summary of what the respondents indicated as their cultural beliefs concerning women and trees. It emerges that there are cultural constraints to women planting trees. When asked about the seriousness with which cultural beliefs concerning the women and trees are practiced in the district, 66.7% of the respondents indicated that they did not follow them while 33.3% said they followed them. 33.3% of the respondents said they do not follow the cultural beliefs on women and trees because the respondents were Christians. 16.7% of the respondents did not follow them because they felt these beliefs hindered development. Another 16.6% did not follow them because they saw nothing wrong with women planting trees.

Trees women could not plant (Focus Group Discussion Proceedings)

Eurphorbia Tirucalli (Ojuok)

This tree was used for fencing the homestead. The society was patrilineal therefore the home was seen to belong to the man. The women were seen as people from the outside. To use a local terminology “*wat angie'wa*” translated to mean, “a relationship that has been purchased”. As opposed to the relationship between father and son which was considered stronger. The fence was associated with ownership. Only the owner of a property knows his boundary and therefore it followed that only he – the owner was eligible to fence it. *Eurphorbia Tirucalli (Ojuok)* was for fencing and fencing was for men so the women had no business with the tree. Boundaries were associated with boundary disputes. Women were discouraged from involvement in boundary disputes therefore they had no business with boundary fencing. The *Eurphorbia Tirucalli (Ojuok)* produces a milky sap which is dangerous especially to the eye. Women were supposed to keep away from the tree for their safety and for the safety of the children who were always around them. Since the homes were fenced with *Eurphorbia Tirucalli (Ojuok)* and the women and children were always in and

around the home, it was essential to make the rules strict to safe guard the women and the children. This was emphasized so much that even to date most rural women will not plant the *Eurphorbia Tirucalli* (*Ojuok*) tree.

Chwa (Mukwaju Tamarind)

This is a fruit bearing tree. It produces brown pod used to ferment porridge. It can also be consumed as a fruit. The fruit however, does not command a high market value.. The tree is very large and is viewed with a lot of suspicion. In the distant past this tree could only be grown out in the gardens but in recent times it can be grown within the homestead. It is more commonly found in locations of former homesteads i.e. *Gunda*. There is a myth associated with this tree that claims it houses evil spirits. For this reason, women are not supposed to plant or manage it. For the same reason it is not encouraged within the homestead. These old beliefs are still very strong amongst the rural communities.

Orembe

This is wild tree that bears red flower. It is used as treatment for anthrax. The women were not able to say why then tradition did not allow them to plant or handle the tree.

Sunga Rwa

This tree produced a sap that discouraged the healing of wounds on both man and animals. For this reason the women were made to keep away from it.

Bondo

This is not a timber bearing tree. It also produces a dangerous sap. There are myths that claim any woman who handles this tree will develop complications during delivery. The tree also has thorns which are dangerous. However, due to scarcity of wood fuel, the tree is now a source of wood fuel for rural women. It is however never grown. It grows wild.

Onera/Manera

This is a timber bearing tree that can grow very large. The tree harbours large worms seasonally. These were thought to be dangerous and the women were made to keep away. They were told that this tree brought death. Today this tree is in great demand as a source of indigenous hard wood. The myths surrounding it have not prevented people from harvesting and planting it.

Umbrella tree

The umbrella tree is not an indigenous tree. It was introduced to the area in the 1980's. This tree is viewed with a lot of suspicion. Most people do not want to plant it despite the fact that it grows very well. It is believed that this tree brings death. For every ring of branches that grow, it is believed that one member of the family dies. The reason behind this belief is that this tree was being popularized at the same time that the aids scourge was starting to have an impact on the local communities. The people linked the trees with the aids related deaths and a myth evolved claiming the tree was the bearer of death. Currently most rural communities in North East Nyakach do not want to plant this tree. Even in homes where the tree had been planted and had grown, they were cut down. The women were affected because the myth claimed that this tree killed sons in particular. In an effort to safe guard their sons, the women cut down this tree.

Suspect Trees (Yiend Nawi)

Some new tree species were subject to the communities suspicion. This is because these trees were associated with medicine men. Medicine men in the past often traveled and came back with new species of trees (often exotic types). These trees they planted in their homes. When these trees are later introduced for planting, the people suspect them because the only person they had seen with it was a medicine man. Since the Luo community believe in African chemistry – such trees are said to harbour spirits and as such not good to plant unless you have the power to harness the spirits. If you can not harness them then they use you as they wish and destroy your home. Women are associated with procreation and the community preferred to safe guard them from harm, therefore they were to keep away from suspect trees.

It emerged from the focus group discussion and interviews with elderly members of the community that tree panting was related to property ownership. The community is patrilineal and property is inherited through the male members of the community. Land is handed down from father to son. The wives can use the land that belongs to their husbands. They take charge when the husband dies. Women do not inherit land from their parents. It is assumed and required that all women get married. A single woman is viewed as a misfit and she does not have a place in the cultural setting. Polygamy is common and is encouraged so that no women go without a husband. To illustrate the seriousness with which marriage is considered a necessity is the fact that an adult woman who dies before she is married is not supposed to be buried in her

parents home. They try to get a brother-in-law to bury her so that her spirits do not haunt the home. If no in-law is forthcoming, then the girl is buried inside the farmland and not inside the homestead and the grave is unmarked so that it is eventually lost. Because in the cultural setting the women do not own the land they must seek permission from their husbands to use the land. If she does not get this permission it becomes a constraint to farming in general and also to agro-forestry. However, the men in the focus group discussion argued that if the women sought permission using the right protocol they often got this permission. Single women who can afford to often move away from their homes areas and purchase land on which to build themselves a home. They often move to towns or to peri-urban areas where the stigma of being a spinster is less. As heads of their households, they are free to use their land as they wish so they can participate fully in agro forestry. In the settlement schemes people are from diverse origins and kinship ties are less so spinsters are less stigmatized unlike in the former native reservations where everyone is kin.

In a polygamous marriage the first wife is given the responsibility of being a pace setter. Following the practice of seniority where everything must first be done by the eldest before the others follow, the first wife must also lead. For instance, she must cultivate her fields before the other wives can do the same. She must plant her crop before the others, etc. As a result her position is more advantaged than the other wives. The other wives are disadvantaged because they live in a condition of perpetual dependency. This can retard development. If the first wife is malicious, she can cause deliberate delays for the other wives. They often do not have as much access to land as the first wife.

Widows who have already moved out of the husbands parental home become the head of their households. They therefore do not need to seek permission. They have a lot of access to their husbands land and can participate in agro forestry. On the other hand widows still within the husbands parental homestead do not have much access. They are often disadvantaged. It emerged from the focus group discussion that there are cultural constraints to women's participation in agro forestry. These constraints discourage women from involvement in certain forms of agro forestry and from planting certain tree species. The constraints also come in form of restricted access to land. The group agreed that current trends indicate reducing cultural constraints. Economic conditions tended to downplay the need to hold fast to cultural practices at

the expense of economic gain. 93% of the respondents indicated that women should be allowed to plant trees.

The men felt that some women were lazy and were quick to quote culture as prohibiting them from practicing agro forestry. The men said that the economic conditions were very difficult for them as the heads of the households and they appreciated any help they got from their wives. For this reasons they felt that if their wives wanted to plant trees that would help relieve their financial burdens, they were more than ready to put aside their cultural practices that constrained women from planting and managing trees. Their request was that they be approached properly on these issues of development.

Women's Views

Women acknowledged that their income levels were very low. They expressed a desire to find ways of increasing their income generating capacity through agro forestry. They defended their position and refuted the men's claims that they were lazy. They viewed the problem as not laziness but one of time management given the number of chores to be done in any given day against the time available. Rural women do not have mechanical aids to assist them in daily chores. For instance, water is fetched from the river and rarely from a tap, cooking is done using wood fuel which often has to be fetched, washing is done by hand, ironing is done using charcoal iron box, food is often obtained straight from the gardens, etc. These consume a lot of time and they are repeated for every day of the year. The gardens must be attended and sometimes animals too. All this work leaves the women with very little time on their hands and should not be mistaken for laziness. The women said that they would like to use this little time they have on activities they are sure have worth while returns.

The women said they were not well informed on issues of Agro forestry and its economic potentials. Had they been aware of the income generating capacity of Agro forestry, they would have devoted more time to planting trees. It appeared that the women were most keen on the trees capacity to generate income. They were aware of agro forestry's capacity to provide subsistence.

The General Views

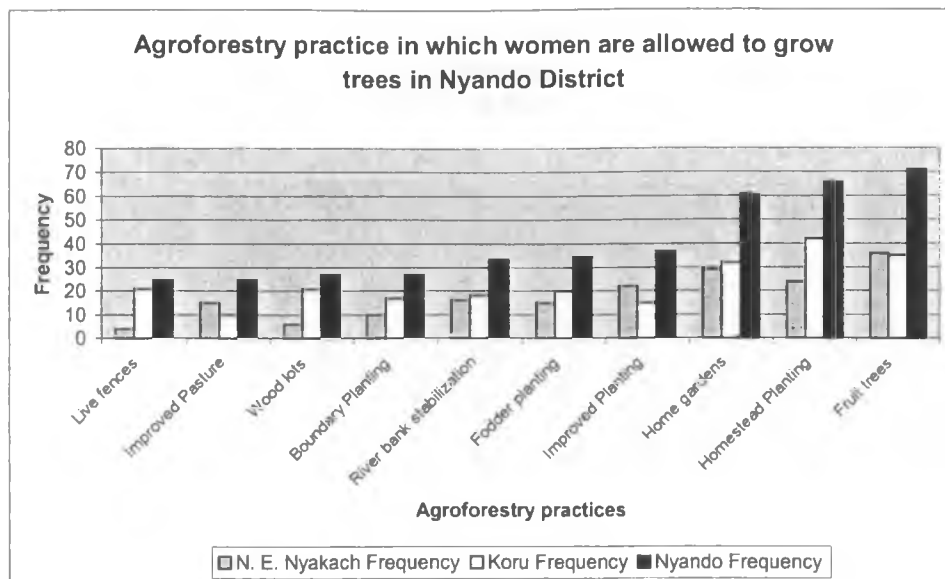
In the focus group for women only they expressed their doubts over some issues. Most of them were not comfortable with planting the Euphorbia tree so none of them planted it. The tree is traditional used for planting a hedge around the homestead. This is a job done by men only so even liberated rural women are not comfortable planting Euphorbia. They did not seem to have any problem with other trees. The women agreed with the men that using the proper approach, which one lady explained to us, they were generally able to plant and manage basically all trees and shrubs. However, at harvest time, they said many of them had to go back to the negotiating table again to be given the extent to which they could harvest and sell the tree products especially timber. Again the correct approach had to be used. Fruits and domestic fuel wood did not generate conflicting interests between the men and the women.

The argument behind this logic it appears is the fact that timber production requires the felling of a tree whereas fruit harvesting and fuel wood procurement can be done without major interference with the tree. Timber also fetches a lot of money and money is equated to controlling the home. This is seen as a man's role hence the need to negotiate so that the men can reaffirm their position. All in all the women agreed that with the right approach, they actually got the required permissions. My conclusion is that in this community, the men allow the women to negotiate for more space within the gender system but not to demand/fight for it. The implication of this is that WID (Women in development) development strategies would be more acceptable to the community than GAD strategies.

Widows

In the women's only focus group discussion, it emerged that there were very many widows in Koru. Over 70% of the women present were widows. Widows did not have to negotiate with their husband before planting trees. They felt their sons were not an obstacle since most of them were away anyway. The case sample questionnaires posed a question that asked "If a widow wants to plant a tree, whom does she need to ask for permission?" The answers are in table 5.8

Figure 5.1: Agro forestry Practices in which Women are allowed to Grow Trees in Nyando District



Source: Field Survey

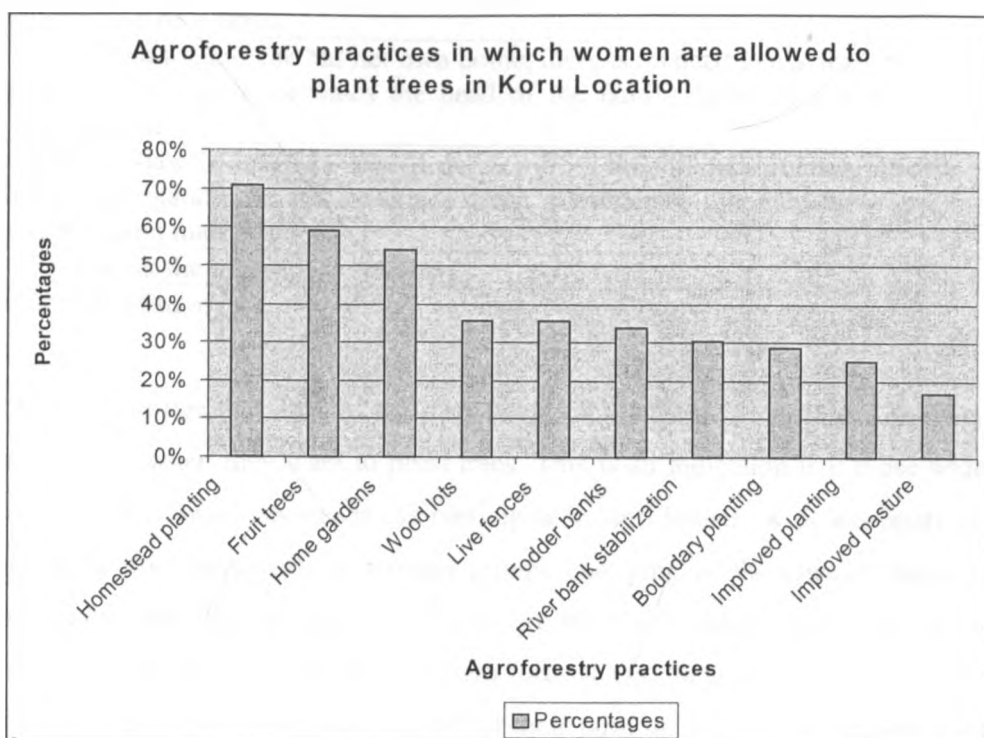
Table 5.7 indicates that 67% of the respondents said in North East Nyakach it was 78% and in Koru 59%. 62.8% of the respondents indicated that women were allowed to participate in homestead planting and 58% indicated that they were allowed to cultivate home gardens. For the rest of the listed agro forestry practices less than 50% indicated that women were allowed to plant. The practices in which they are allowed to practice least are, pasture improvement 23.8% and live fences 23.8%.

Table 5.10 – Agro forestry practices in which women are allowed to plant trees in Koru

Agro forestry practice	Percentage
Homestead planting	71%
Fruit trees	59%
Home gardens	54%
Wood lots	35.6%
Live fences	35.6%
Fodder banks	33.9%
River bank stabilization	30.5%
Boundary planting	28.8%
Improved planting	25%
Improved pasture	16.9%

Source: Field Survey

Figure 5.2 Agro forestry Practices in which Women are allowed to Plant Trees in Koru Location



Source: Field Survey

Table 5.11 - Agro forestry practices in which women are allowed to plant trees in North East Nyakach

Agro forestry practice	Percentage
Fruit trees	78%
Home gardens	63%
Homestead planting	52%
Improved planting	47.8%
River bank stabilization	34%
Fodder banks	32.6%
Improved pasture	32%
Boundary planting	21.7%
Wood lots	13%
Live fences	8.7%

Source: Field Survey

Table 5.8 Persons from whom a widow may seek permission to plant trees

Answers	%
1. She can not plant any trees in her husband's parental homestead, it is considered to be a taboo.	15.4%
2. So long as she has her own home, there is no need to ask for permission. A widow becomes the head of the family therefore she is independent	50%
3. Bother-in-law or inheritor here is derived from the cultural practice of wife inheritance. On her husbands death a woman is inherited by another person male relatives	26.9%
4. She can ask the inheritor or the son	7.7%

Source: Field Survey

Table 5.8 indicates that 50% of the respondents felt widows do not need permission from any one when they want to plant trees. This is an indication that those widows who are in their own homesteads can participate in agro forestry with less restrictions. Since there are many widows women groups emerging in the District these have potential for expanding the practice of agro forestry. Since widows do not need to seek permission they can adopt the form of agro forestry that they feel is convenient. They can also extend agro forestry to any part of their farm holding. However, for widows who are still within the parental homestead, the condition is not the same. They often have to seek permission most of the time.

Trees that are of interest to women

Fruit trees such as Mango trees, Avocado trees, Lemon trees, Banana trees, Lemon trees, and Custard Apple. They interest women because they supplement the household diet, they generate income, they can provide wood fuel and they enhance the environment.

Sisal is of interest to women because it provides raw material for making ropes and weaving baskets which are sold. This generates income and also helps with controlling livestock. The sisal also provides cheap building poles for local utilization or sale. Finally sisal provides wood fuel.

Gravillea Robusta is of interest to the women because they inter-crop it with their food crops without compromising either. It grows quickly and as such can quickly provide them with wood fuel and shade.

Indigenous Trees such as *obino*, *siala*, *otho*, etc are of interest to the women because they grow easily without much attention. They provide timber, wood fuel and they also enhance the environment. At most times there are not much competition between the men and women for control of these trees as opposed to the Eucalyptus which is a source of income therefore a source of conflicting interests.

Guavas provide fruits. No one else is interested in it so the women can do whatsoever they please with it. Guavas need no attention for them to grow and are a source of wood fuel and food. Twigs obtained from the guava are used for construction.

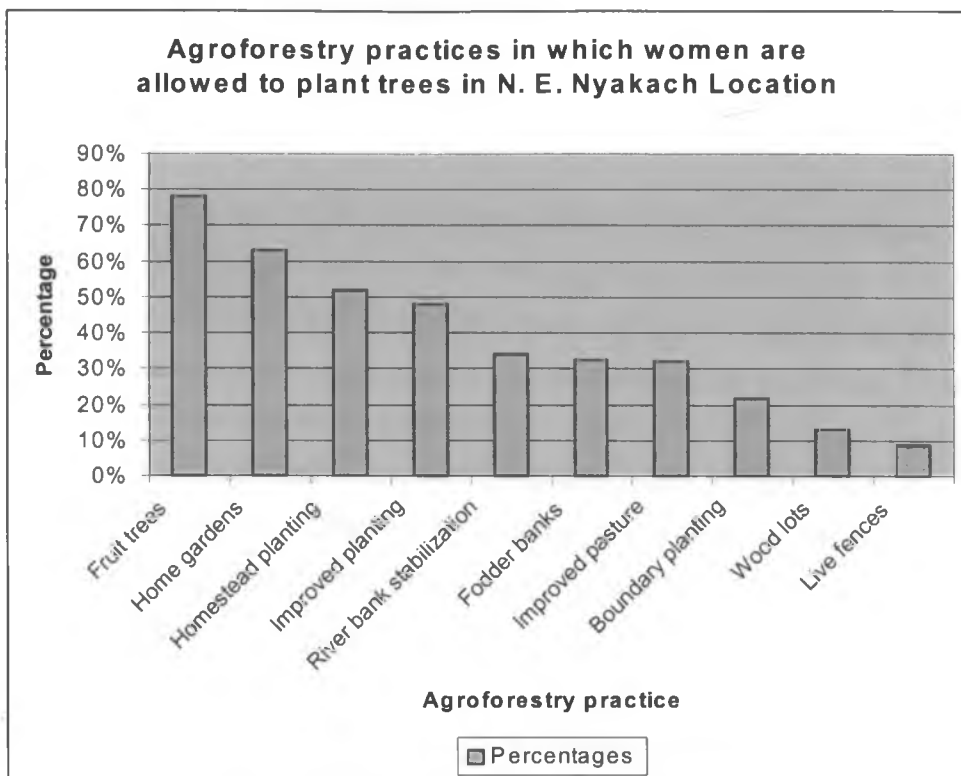
5.4 Agro forestry practices that women are involved in

Table 5.9 - Agro forestry practices in which women are allowed to grow trees in Nyando District.

AF Practice	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Live fences	4	8.7%	21	35.6%	25	23.8%
Improved Pasture	15	32%	10	16.9%	25	23.8%
Wood lots	6	13%	21	35.6%	27	25.7%
Boundary Planting	10	21.7%	17	28.8%	27	25.7%
River bank stabilization	16	34%	18	30.5%	34	32%
Fodder planting	15	32.6%	20	33.9%	35	33%
Improved Planting	22	47.8%	15	25%	37	35%
Home gardens	29	63%	32	54%	61	58%
Homestead Planting	24	52%	42	71%	66	62.8%
Fruit trees	36	78%	35	59%	71	67%
	N = 46		N = 59		N = 105	

Source: Field Survey

Figure 5.3 Agro forestry Practices in Which Women are allowed to Plant Trees in N.E. Nyakach Location



Source: Field Survey

Table 5.7 summarizes statistics on Agro forestry practices where women are allowed to grow trees and the regional variation found in Koru and North East Nyakach.

Fruit Trees

67% of the respondents indicated that women are allowed to plant fruit trees in Nyando District. This is the Agro forestry practice where most women are allowed to grow trees as shown in the Table 5.7. In Koru 59% of the respondents indicated that women could grow fruit trees and in North East Nyakach 78%. When compared to Table 4.2 on section 5.1.2 on overall Agro forestry practices in the District, it is found that fruit tree growing is still the most practices form of Agro forestry. 81.9% of the respondents said they grew fruits trees. Despite the fact that many women grow fruit trees, a physical survey of the district indicated that the intensity of fruit tree growing is low. There is need to promote intensification of fruit tree growing. Since many women grow fruit trees, it can be used as a strategy to improve their livelihood. Since they already grow fruit trees, this will enhance the chances of their adoption of Agro

forestry innovations along similar lines. Fruit trees address women's direct needs such as provision of food for the family. They can also obtain wood fuel from the fruit trees. Finally, they can generate income from the sale of fruits and in this way improve their livelihood.

Live Fences

Table 5.7 shows that only 23.8% of the respondents indicated women could grow trees in live fences. This contrast with the live fence growing in the district shown in Table 4.2 where 78% of the respondents said they grew live fences. It shows that although live fences are a common feature, women are not encouraged to participate. From the focus group discussion, it emerged that fences are associated with property ownership and women are not supposed to own land in the community. In the traditional setting, women used their husbands land but did not own it. Although women can now own land, they are still discouraged from issues of fencing. In North East Nyakach, women's participation is extremely low.

Table 5.7 shows only 8.7% of the respondents grew trees in live fences while in Koru 35.6%. It appears cultural constraints are stronger in North East Nyakach than in Koru. This can be explained by the fact that most people in North East Nyakach are of local origin whereas in Koru a higher percentage of people are from outside, thus diluting their culture. From these statistics, it emerges that live fences are not a good Agro forestry practices targeting women because there are cultural constraints to their participation. However, since it is a widely practiced form of Agro forestry, it can be further developed to target men. At the end of the day, the community stands to benefit. It is essential to develop this Agro forestry practice because it addresses some of women's needs such as wood fuel and protection of their crops from free ranging livestock.

Wood Lots

Table 5.7 indicates that only 25.7% of the respondents said women could grow trees in wood lots. In Koru the figure rose to 35.6% but in North East Nyakach, it dropped to 13%. Table 4.2 indicates that only 44.8% of the respondents planted wood lots. Again the incidence in Koru (55.6%) was higher than that in North East Nyakach (40.5%). This high incidence in Koru is caused by the ready market for wood provided by Home Lime Company which buys wood to fuel its furnace. Wood lots require setting

aside land for establishing it. Women's low access to land may be a possible explanation for low levels of participation.

Wood lots address women's problems of wood fuel. They are also a source of income. However, as we saw from the focus group discussion there is conflict of interest between men and women for timber producing trees such as blue gum (*Eucalyptus*). If the wood lots are designed to target women as beneficiaries, then the tree species should be those that generate the least conflict and are of interest to women. For instance indigenous trees.

A physical survey of the district showed large tracts of land was left under natural vegetation in the Kano plains. The natural vegetation is thorn tree which is not of much economic use. The tracts of land are so left because they are difficult to cultivate and have low yields. However, they can yield trees. It is therefore, necessary to carry out surveys on which tree species grow best in these regions and encourage the establishment of individual wood lots because market for tree products are ever increasing. This must be accompanied by public awareness campaign to inform people that a tree is as much a cash crop as sugar cane or cotton. It emerged from the focus group discussion that this information was lacking amongst the community hence their limited exploitation of tree growing as an economic activity.

Women expressed their interest in pursuing tree planting as an economic activity and requested guidance. If the vast lands left unexploited in the Kano plains are put under Agro forestry, it can help alleviate poverty by providing employment and income. It will also enhance the environment. Women can participate as individuals and as groups depending on the magnitude of the projects.

Boundary Planting

Table 5.7 indicates that 25.7% of the respondents said women could plant trees on boundaries. This figure increased in Koru to 28.8% and reduced in North East Nyakach to 21.7%. Table 4.2 shows that boundary planting is common in the district with 62% of the respondents having them. It is clear that though boundary planting is widely practiced in the district, women's participation is low. This is because boundary planting and live fences are viewed in the same way by the community. Similar cultural constraints exist constraining women from participating.

Sisal

The economic value of sisal is evident in North East Nyakach where one of the major income generating activities for women is basket weaving. It is done by both individual women and women groups. Plate 5.1 shows a group of women at Katuk Odeyo in North East Nyakach location busy weaving baskets. They also make ropes from sisal. These they sell. The demand for ropes is very high and increases during the period crops are in the field. Livestock are tethered because of the absence of proper fences to protect the crops. A short structured questionnaire addressing sisal only was administered in North East Nyakach and the results are indicated in table 5.12. There were no questionnaires on sisal administered in Koru because there is hardly any sisal in Koru.

Table 5.12A The status of sisal in North East Nyakach

The status of sisal in North East Nyakach	%
Farms with sisal	92.7%
Husbands who have planted sisal	90.2%
Wives who have planted sisal	29.3%
Husbands who use sisal	87.5%
Wives who use sisal	80.5%
Those who sell sisal	51.2%

Source: Field survey

Table 5.12 indicates that 92.7% of the households in North East Nyakach have sisal on their farms. However, a physical survey showed that these households do not have large quantities of sisal. The rate at which sisal is grown is low yet the demand is high. As a result there is over harvesting from the existing sisal. Since both men use sisal extensively, there should be an effort to increase growing of sisal to cater for this demand. It will boost the income generating capacity of both men and women since 50% can be used and also sold. From table 5.12 only 29.3% of the women grow sisal.

There is a cultural constraint because sisal growing is commonly done along boundaries and this is associated with land ownership. Women are therefore not encouraged to participate. However, from the focus group discussion, it emerged that when sisal is grown in non boundary areas, this constraint does not apply. The use of sisal along boundaries can therefore still be encouraged but it will be best suited for men. For women, there should be sisal growing introduced in non boundary areas. This is viable especially where the land is fragile and marginally productive. The sisal roots can contribute positively to soil conservation and at the same time, provide sisal for income generation. Plate __ shows erosion along a road. The sisal roots along the

boundary have held the soils together on the sides. Where there is no vegetation erosion has formed a 2 ½ meters gully.

There are vast lands of North East Nyakach that are so marginal that no crops are cultivated on them. Sisal growing on these lands can be a productive land use and it can contribute to poverty reduction by increasing the income generating capacity of the people and conserving the environment.

Fodder Planting

Table 5.7 indicates that only 33% of the respondents said women can plant fodder crops. Table 4.2 indicates that 28.6% of the respondents had fodder banks, In Koru, there were more 44.4% while in North East Nyakach less 14.3%. From the above statistics, we can conclude that although fodder planting in the district is low, women's participation corresponds positively. It implies that it can be used to target women. Developments that increase the demand for fodder can result in women producing more fodder both for sale and for personal use on their livestock. One such development can encourage zero grazing. Women can grow fodder to feed their own livestock or sell to their needy neighbours. Fodder planting combines well with soil conservation structures so it can be used to promote soil conservation at the same time. Since women have many chores and their time is constrained this is a way through which they can "kill many birds with one stone" i.e. Increase fodder planting, generate income from it, obtain feed for their livestock, and also practice soil conservation

Home Gardens

Table 5.7 indicates that 58% of the respondents said women can plant trees in the home gardens. In North East Nyakach, it was 68% and in Koru 58% which is an indication that most women are allowed to plant trees in the home garden in the district. Table 4.2 indicates that 73% of the respondents had home gardens, 73.8% in North East Nyakach and 85.2% in Koru. Home gardens are therefore, a common practice in the district and in them most women are allowed to plant trees. The home gardens most important function is provision of food for the family. This is often the role of the woman. It can also address other needs of the women such as provision of wood fuel and it can contribute to enhancing the environment. However, the home gardens can be used to generate income by selling its produce. It is therefore important to select crops with the required qualities for desired products. Agro forestry practices

can be incorporated in the home garden e.g. fruit tree growing. Since home gardens are a common practice, agro forestry innovations focusing on it have good chances of being adopted and in this way and many livelihoods can be changed. Women's participation in home gardens is high therefore, agro forestry innovations focusing on home gardens target women.

Homestead Planting

Home stead planting shows that 62.8% of the respondents said women could plant trees in the home stead. In Koru, it was 71% and in North East Nyakach, it was 52%. Table 4.2 indicates that 79% of the respondents practice homestead planting. In Koru, it was 87% and in North East Nyakach 85.7%. It can be seen from the above that homestead planting is a common agro forestry practice in Nyando district and most women are allowed to plant trees within the homestead. The implication of this is that it is a good practice to develop to promote agro forestry in the district because the level of adoption is bound to be high. At the same time, it can be used for agro forestry innovations that target women because their participation is high. Homestead planting can address women's needs such as food production for the family, income generation, supply wood fuel, and enhancing the home environment where the rural women live and work most of their times.

River Bank Stabilization

Table 5.7 indicates that 32% of the respondents said women could grow trees for river bank stabilization. Table 4.2 shows that 40% of the respondents practiced river bank stabilization. This can be explained by the fact that it can only be practiced where there is a river. It addresses women's need to provide food for the family because bananas are the major crops used for river bank stabilization. Some of these bananas are sold and generate income for the family.

Improved Planting

Table 5.7 indicates that 35% of the respondents said women can plant trees for improved planting. In Koru it was 25% and in North East Nyakach, it was 47.8%. Table 4.2 shows that 23% of the people practiced improved planting. In Koru it was 14.8% and in North East Nyakach it as 40.5%. The statistics indicate that improved planting is more in North East Nyakach than in Koru. A possible explanation is that soils in Koru are more productive therefore the farmers can produce crops easily. In

Nyakach, soils are less productive therefore; the farmers have to seek ways of improving production. Women in North East Nyakach participate more than those in Koru. Improved planting addresses women's need to increase food production for their family and for generation of surplus for sale. Cost effective methods of improved planting are possible through agro forestry technologies such as Biomass transfers (green manure), improved fallows, etc. These help the poor to get more produce so that they have food security and have surplus to sell to generate income. Rural women do not have a lot of access to resources therefore, cost effective techniques targeting women can go along way in improving their farm produce.

Improved Pasture

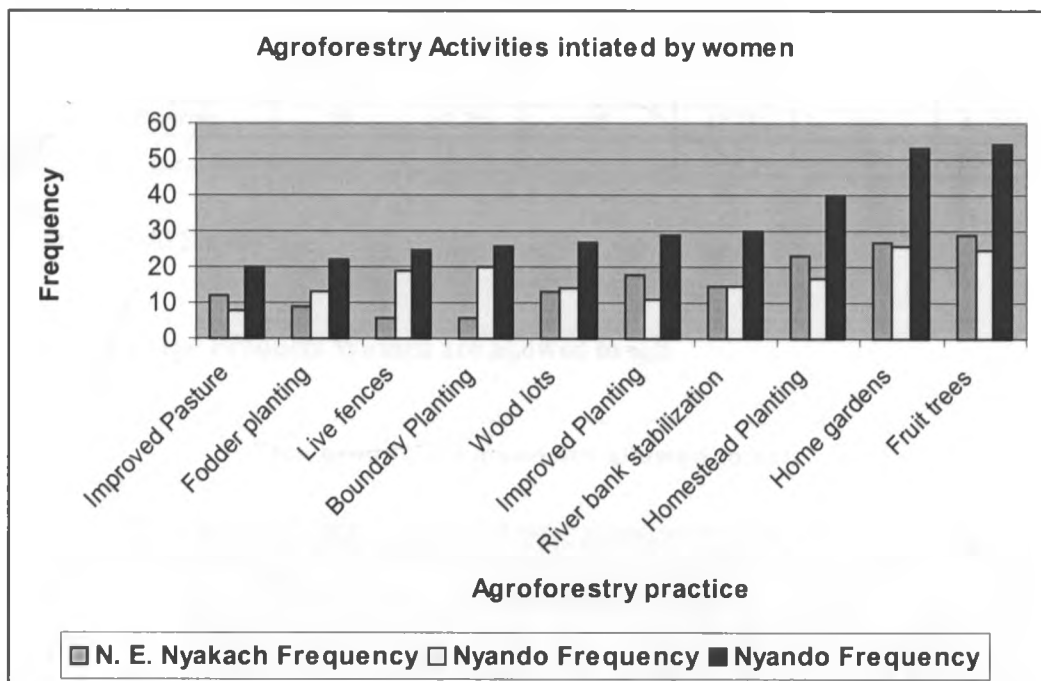
Table 5.7 indicates that 23.8% of the respondents said women were allowed to plant trees in improved pasture. In Koru it was 16.9% and in North East Nyakach 32%. Table 4.2 shows that 23.8% of the respondents had improved pasture. In Koru, it was 16.7% and in North East Nyakach 29.3%. The above statistics show that improved pastures are practiced more in North East Nyakach but the general level is low. Women participation is low although it is higher in North East Nyakach than in Koru. This can be explained by the fact that free ranging which the regular way of livestock is keeping in North East Nyakach is compatible with improved pasture therefore, it is practiced more. This is extended to the women. Improved pasture addressed women's needs for food by increasing livestock output. Trees planted in the pastures are a source of wood fuel for the women. Agro forestry technologies for improved pasture can be used to address women's needs more.

The men are often more interested in the livestock and not in other products of the land use systems. Agro forestry innovations for improved pastures can include fast growing trees to increase the supply of wood fuel, fruit bearing trees for food and income generation.

Table 5.12 - Agro forestry Activities Initiated by Women

AF Practice	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Improved Pasture	12	26%	8	13.5%	20	19%
Fodder planting	9	19.6%	13	22%	22	20.9%
Live fences	6	13%	19	32%	25	23.8%
Boundary Planting	6	13%	20	33%	26	24.8%
Wood lots	13	28%	14	23.7%	27	25.7%
Improved Planting	18	39%	11	18.6%	29	27.6%
River bank stabilization	15	32.6%	15	25%	30	28.6%
Homestead Planting	23	50%	17	28.8%	40	38.1%
Home gardens	27	58.7%	26	44%	53	50.5%
Fruit trees	29	63%	25	42%	54	51.4%
	N = 46		N = 59		N = 105	

Source: Field Survey

Figure 5.4 Agro forestry Activities Initiated by Women

Source: Field Survey

To establish a degree of freedom women have in planting and managing trees a research question was posed asking whether the woman was the initiator of the recorded agro forestry practice. The results indicate that 51.4% of the women initiated fruit growing, 50% initiated home gardens, and 38.1% initiated homestead planting. These are the practices where the women had the highest degree of freedom.

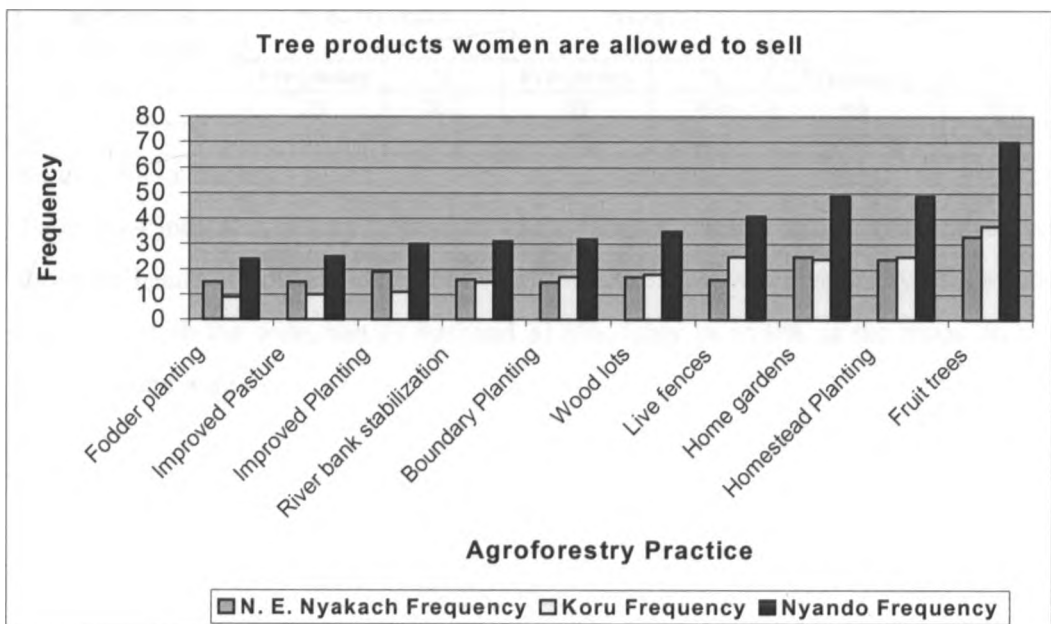
The survey statistics also indicate that women's participation and freedom was low in improved pasture, fodder banks, live fences and boundary planting for reasons already explained. Fruit trees and home gardens address domestic food supply. It is an indicator that this is the area where women are most interested. Food is a basic need and no one can negotiate with hunger therefore, food must be sought. The existing gender role in the Luo community assigns the role of providing food on the women.

Table 5.13- Tree products women are allowed to sell

AF Practice	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Fodder planting	15	32.6%	9	15.3%	24	22.9%
Improved Pasture	15	32.6%	10	16.9%	25	23.8%
Improved Planting	19	41.3%	11	18.6%	30	28.6%
River bank stabilization	16	34.8%	15	25.4%	31	29.5%
Boundary Planting	15	32.6%	17	28.8%	32	30.5%
Wood lots	17	36.9%	18	30.5%	35	33.3%
Live fences	16	34.7	25	42.3%	41	39%
Home gardens	25	54.3%	24	40.7%	49	46.7%
Homestead Planting	24	52.2%	25	42.3%	49	46.7%
Fruit trees	33	71.7%	37	62.7%	70	66.7%
	N = 46		N = 59		N = 105	

Source: Field Survey

Figure 5.5 Tree Products Women are allowed to sell



Source: Field Survey

Table 5.13 indicates that women have the highest level of freedom to sell products of fruit trees. 66.7% of the female respondents indicated that they were free to sell products of fruit trees.

Trees Products Women Can Sell

From the group discussions, it emerged that timber from the Eucalyptus is sold by the men at most times except in homes where the husband is dead or the income level of the man is very high and he sees this as petty cash. Small branches of all trees that are trimmed can be sold by the women. However, in most cases the home needs it for wood fuel so it is not sold. Fruits from the trees are sold by the women unless in a case where the fruit farming is set up by the man as a commercial enterprise. Medicinal trees and bushes. These can be sold or administered by the women. Even in the case where the man is a herbal healer, the women still have access.

5.5 Agricultural extension Services in Nyando District

Extension workers are the government's vehicles for spreading new techniques to farmers. The study established that agricultural extension workers visit 75.6% of the farms as seen on Table 5.10.

Table 5.14 - Visits of Agricultural extension workers to farmers in Nyando District

Visits from agricultural extension workers	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Yes	29	70.7	39	79.6	68	75.6
No	12	29.3	10	20.4	22	24.4

Source: Field Survey

Table 5.14 indicates that on their visits to the farms these extension workers deal with the male heads of households in 24.6% of their visit. However, majority of the times they deal with the wife, son or husband 31.9%. Only in 15.9% of the times do they deal with the wife.

Plate No. 5.1

Women weaving baskets to sell in N E Nyakach



Plate No. 5.2

Sisal planted as boundary markers within N E Nyakach



Plate No. 5.3

Brick making in Nyabondo Plateau



Plate No. 5.4.

Women who have to seek alternative means of livelihood because the farms have been taken over by the gully at Katuk Odeyo in N E Nyakach



Plate No. 5.5

Erosion along a road attempt to arrest it using sisal plant



Plate No. 5.6

Ahero Irrigation Scheme in the Kano plains (no longer operational)



Plate No. 5.7

HomeStead – Planting in a modern home in Koru



Plate No. 5.8

Homestead planting in a typical Luo homestead – the orundu can be seen in the background



Plate No. 5.9

Indigenous trees used for shade in dry hot areas of Kano Plains



Table 5.15 Persons dealt with by agricultural extension workers in Nyando District

Agro forestry Practice	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
The husband	6	20.7	11	27.5	17	24.6
The Wife	4	13.8	7	17.5	11	15.9
The son			0	0	2	2.9
Husband & son	2	6.9	2	5	2	2.9
All the above	9	31.0	13	32.5	22	31.9
Husband & wife	7	24.1	6	15	13	18.8
The wife and son	1	3.4	1	2.5	2	2.9

Source: Field Survey

North East Nyakach 70.7% of the respondents received visits from agricultural extension workers while in Koru 79.6% did as indicated in tables 33 and 34. In North East Nyakach 13.8% of the time they dealt with the women while in Koru they dealt with the women 17.5% of the time as indicated in Table 1.24.

5.6 Women Groups and their Activities in Nyando District

The study wanted to examine the extent to which women participated in Agro forestry through the women groups. Members of the women's only Focus Group Discussion were asked to list the names of women groups they belonged to and the activities that these groups were involved in. These were used as a basis for analyzing women groups and their activities in the region.

Women groups in Koru that had members in the focus group discussion include the following groups: Nyando Pharmacy, Widows Group, Homa Mnara Welfare, Nyakach Welfare, Ogwedhi Welfare, Ziwani Welfare, Nyakach Women Group, Od Wadu Women Group, Bad Nyando Women Group, Wajane Group, Ongalo Welfare, Jenimo, Ziwani Widows, Owaga Women Group, Wananchi Women Group, Huruma Women Group, Boya Dip Women Group, Sasumwa, Omako Women Group and Mawe Women Group.

Several Issues Emerged from women groups in Koru. There are very many women groups and welfare groups in Koru, all women belong to at least one women group or more, all the groups come together to mobilize funds, and the average monthly contribution per member is very low.

Table 5.16 - Monthly contribution of women groups in Koru

Contribution in Kshs	Frequency	Percentage
10	1	5.5%
20	5	27.8%
30	3	16.7%
50	2	11.1%
60	1	5.5%
70	1	5.5%
80	1	5.5%
160	1	5.5%
200	1	5.5%

N = 18

Source –Field Survey

Table 5.16 indicates that 27.8% of the groups make monthly contributions of Kshs 20.00 while 61% of the groups make monthly contributions of Kshs 50.00 and less. All the groups hold monthly meetings. The range of activities in which they involve themselves is very limited. Table 5.17 indicates the activities that the women groups are involved in.

Table 5.17 - Activities of women groups in Koru

Activity	No. of Groups involved	Percentage
1. Collecting money	20	100%
2. Collecting maize and beans	8	40%
3. Cultivation of maize	3	15%
4. Cultivation of onions	1	5%
5. Rental units	1	5%
6. Harambee	2	10%
7. Purchase of nets	1	5%
8. Cattle dip	1	5%

N = 20

Source: Field Survey

The groups all aim to generate income and take care of members welfare especially at times of bereavement. Table 5.18 shows tribal/clan affiliation as a prerequisite for membership is observed in 15% of the groups in the following groups i.e. Nyakach Welfare, Nyakach Women Group, and Sasumwa Women Group. It also shows geographic location as a criteria for membership is observed in most groups i.e. 55% of the groups and common interest as criteria for joining the group in 30% of the groups. Out these, 15% of the groups had widowhood as a common interest, i.e. Wajane Women Group, Ziواني Widows Group, and Widows group.

Table 5.18 - Criteria for membership in women groups of Koru

Criteria for group membership	Frequency	Percentage
Tribal/clan affiliation	3	15%
Same geographic location	11	55%
Common interest	6	30%

N = 20

Source: Field survey

Women Groups of North East Nyakach and their activities.

This inventory was derived from the focus group discussion of women only in North East Nyakach. Each member of the discussion indicated which group she belonged to and the activities that they were involved in as a group. It does not cover all women groups in North East Nyakach. It is a sample and covers Oyoo, Kauma, Kamango, Kanyidera, Mano, Nduga, Obure, Klera, Improve your business, Ngonglo, Wariga, Magunga, and Kowire,

Emerging Issues

There are many women groups in North East Nyakach and all women belongs at least one women group. Table 5.19 indicates that 66% of the women groups collect money (mobilize funds) through the merry go round system, 80% of the groups are involved in basket weaving while 40% are involved in cultivation of vegetables. Most of the women groups have a tribal/clan affiliation. Women groups activities in North East Nyakach are involved in a wider range of activities than those in Koru. Their activities are geared more towards income generation than welfare. This can be explained by the fact that poverty is more severe in North East Nyakach. The agriculture productivity of land is also very low. The end result is severe food shortage coupled with low income. This makes it more urgent for the women to generate income in order to purchase food.

Table 5.19 - Activities of women groups in North East Nyakach

Activities of Women Groups	Frequencies	Percentage
1. Cultivation of cotton	3	20%
2. Cultivation of vegetables	6	40%
3. Cultivation of sorghum	2	13.3%
4. Cultivation of maize	1	6.7%
5. Cultivation of ground nuts	1	6.7%
6. Cultivation of green grams	2	13.3%
7. Basket and rope weaving.	12	80%
8. Pottery	3	20%
9. Tailoring	1	6.7%
10. Rental houses	1	6.7%
11. Sale of paraffin	1	6.7%
12. Sale of bore hole water	2	13.3%
13. Goat keeping	1	6.7%
14. Sheep keeping	4	26.7%
15. Bee keeping	1	6.7%
16. Poultry keeping	1	6.7%
17. Merry go round	10	66.7%
18. General business	3	20%

N = 55

Source: Field Survey

From the analysis of women groups and their activities, there is no indication that these groups participate in Agro forestry. However, it is evident that they use Agro forestry products for basket weaving and rope making. They also practice agriculture which can be integrated with trees to become Agro forestry to make their production more sustainable.

CHAPTER 6 - *ORUNDU* THE HOME GARDEN

6.1 Overview

This chapter addresses the third objective which seeks “to establish the potential of the *Orundu* for agro forestry interventions” targeting women. It begins by introducing the *Orundu* then goes on to examine the activities that go on within its view to establishing its agro forestry potential and making appropriate recommendations.

6.2 *Orundu*

Introducing the *Orundu*

Orundu is the name used by the Luo tribe of western Kenya to refer to the small garden within the homestead in the rural setting. Some may refer to it as a home garden. The *Orundu* is always relatively small and located behind the house in the background.

Orundu is called Nyakirundu in some areas of Luo land. Every married woman has an *Orundu*. In a monogamous marriage there is one *Orundu*. In a polygamist marriage every woman has her *Orundu* at the back side of her house. Where the land is extremely small, the boundary of the homestead forms the boundary of the farm holding are not distinct therefore the *Orundu* and the main farm blend into one another. The *Orundu* is the woman’s garden. Here the woman is free to choose whatever she wishes to grow unlike the rest of the farm where the male head of household makes decisions on crops to be grown. Activities in the *Orundu* are carried out the year round unlike the main farm holding that is farmed periodically.

Location of the *Orundu*

The use of space in a traditional homestead is governed by cultural norms. Houses are located in a particular position within the homestead depending on the owner. Figure 18 shows the layout of a traditional Luo Homestead showing the locations of the house belonging to the owner of the homestead, his wives and sons. It also shows the location of the *Orundu*. Plate 6.3 shows a photograph taken from Nyabondo plateau of a typical Luo homestead. The photograph shows the house belonging to the owner of the homestead and these of his two sons. It also shows the *Orundu* for each of the houses – planted with bananas and other crops.

Plate 6.1 A typical Luo Homestead (Traditional)

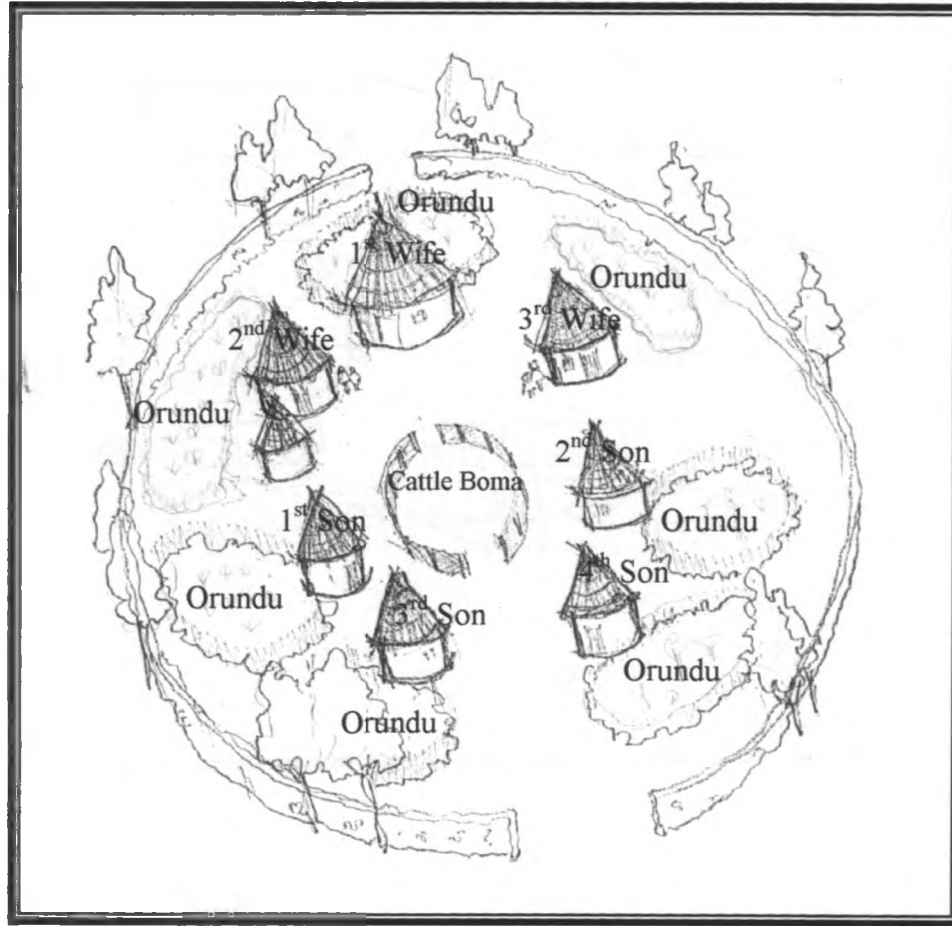


Plate 6.2 A typical Luo Homestead (Modern)

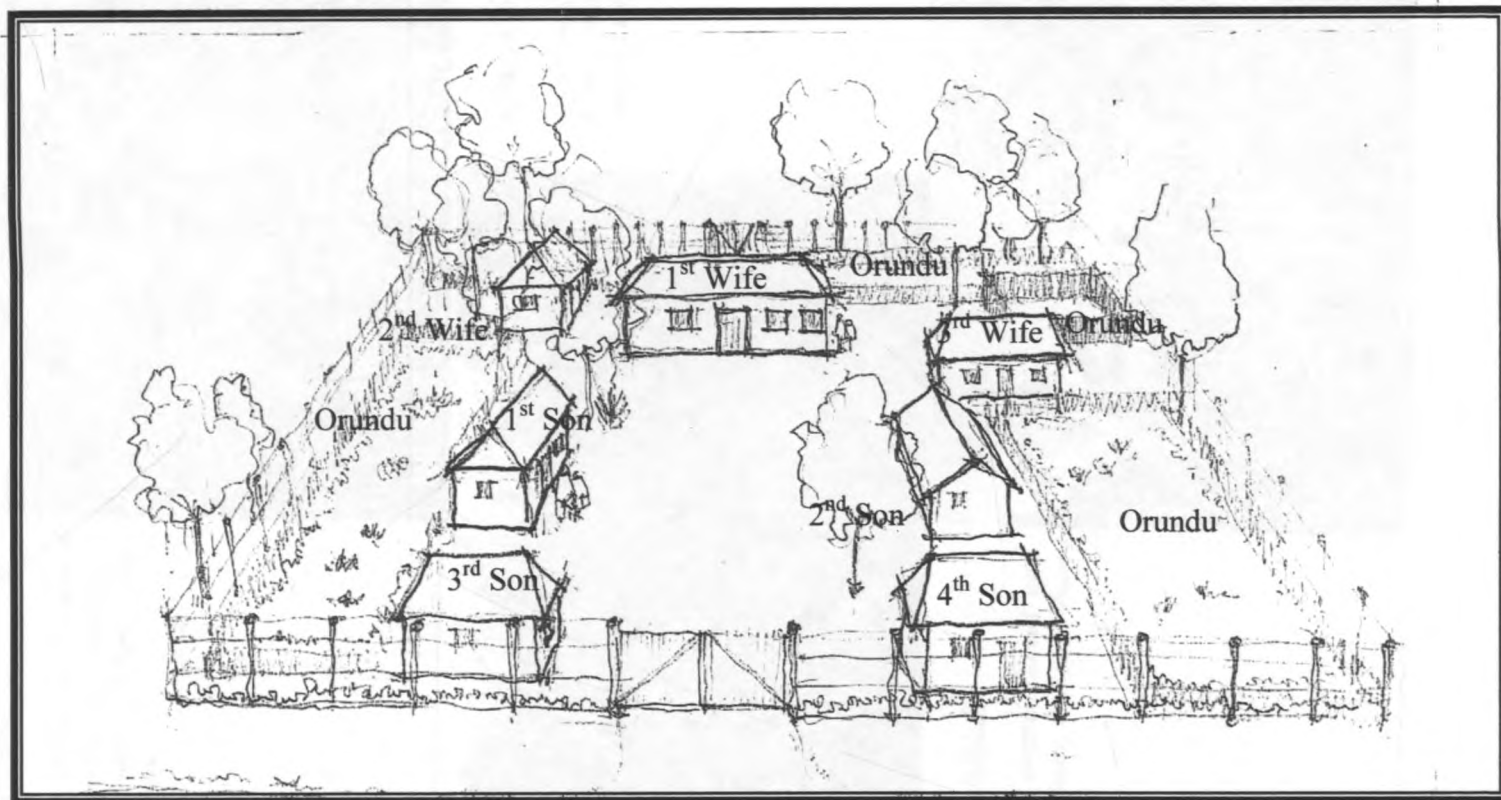


Plate No. 6.3

A typical Luo homestead showing the location of Orundu behind each house



Plate No. 6.4

An Orundu planted with sweet potatoes pigeon peas and sorghum



Plate No. 6.5

An Orundu planted with bananas, Paw paw, Maize etc



Size of *Orundu*

The *Orundu* is always a small garden.

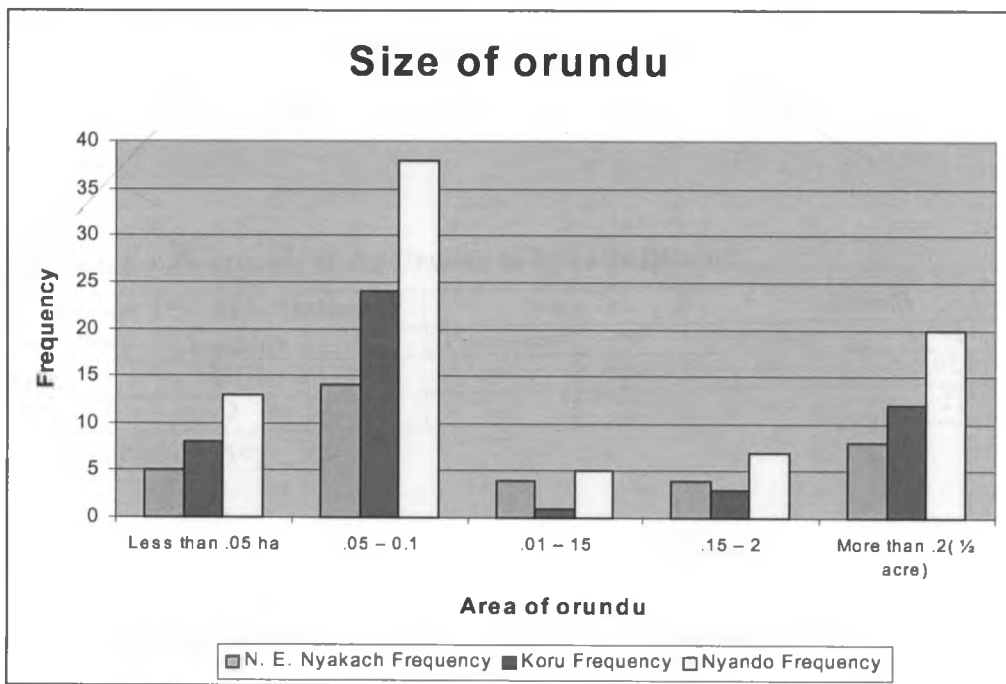
Table 6.1 indicates the sizes of the *Orundu* derived from the field survey. 45.8% of the *Orundu* measured 0.05 ha to 0.1 ha.

Table 6.1 – Size of *Orundu* in Nyando District

Size of <i>Orundu</i>	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Less than .05 ha	5	14.3	8	16.7	13	15.7
.05 – 0.1	14	40.0	24	50.0	38	45.8
.01 – 15	4	11.4	1	2.1	5	6.0
.15 – 2	4	11.4	3	6.3	7	8.4
More than .2(½ acre)	8	22.9	12	25.0	20	24.1

Source: Field Survey

Figure 6.1: Size of *Orundu*



Source: Field Survey

The size of the *Orundu* is determined by the size of the homestead where the homestead covers a large area, then the *Orundu* is also large. The size of the homestead is to a large extent determined by the size of the farm. When the farm is small, the homestead tends to be small and vice versa.

The field survey confirmed that the size of the *Orundu* is always relatively small. 45.5% of the respondents interviewed had an *Orundu* measuring 0.15 – 0.1 Ha. In North East Nyakach the average farm size is 0.62 Ha, 40% of the *Orundus* measure 0.15 – 0.1 Ha whereas in Koru where the average farm size is 4.94 Ha 41% of the *Orundus* measure 0.15 – 0.1 Ha.

Practice of the *Orundu*

From the field survey it emerged that the *Orundu* is very common practice. *Table 6.3* indicates that 97.7% of the respondents knew about the practice of the *Orundu* while *Table 6.4* shows 93% of the respondents have an *Orundu*. In North East Nyakach 92% of the respondents have an *Orundu* whereas in Koru, 95% of the respondents have an *Orundu*.

The variation can be explained in part by the fact that the average farm size in Koru is larger. It emerged from the focus group discussion that the small size of land is a constraint to this practice because where the land is small, the homestead is also small. In small homestead, most of the space is taken up by housing thus constraining the practice of *Orundu*.

Table 6.2 – Awareness of the *Orundu* in Nyando District

Awareness of <i>Orundu</i>	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Yes	37	94.9	49	100.0	86	97.7
No	2	5.1			2	2.3

Source: Field survey

Figure 6.2

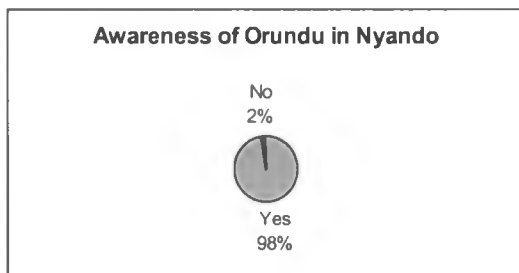
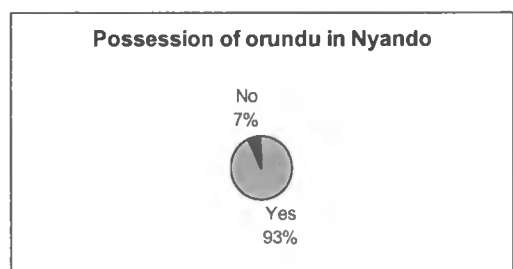


Figure 6.3



Source: Field Survey.

Table 6.3 – Possession of *Orundu* in Nyando District

Possession of <i>Orundu</i>	N. E. Nyakach		Koru		Nyando	
	Frequency	%	Frequency	%	Frequency	%
Yes	36	92.3	46	93.9	82	93.2
No	3	7.7	3	6.1	6	6.9

Source: Field Survey

6.3 Some Cultural Practices and Beliefs Associated with Cultivation and Their Implications on Women Participation

From the focus group discussion it emerged that the main activities in the *Orundu* are farming activities therefore the cultural values and practices to be considered are those to do with farming or cultivation. Cultivation is governed by the rainfall pattern. In North East Nyakach the rainfall pattern is bimodal with the long rains called “*Chira/Chwiri*” falling in February, March and the short rains “*Kodh Opon*” falling in August /September. These two are the planting seasons. It is the practice of the people in Nyando that planting is done in order of seniority. That is to say the first wife must plant her fields before the second wife and the first son of the home must plant his fields before his younger brothers. Failure to adhere to this pattern is believed to have dire consequences. The much discussed phenomena of *Chira*” sets in. *Chira* is a condition where one wastes away and eventually dies because of contravening a taboo. Traditionally there is a way of absolving one self. This is by undergoing a ritual and taking “*manyasi*” (a concoction). However, failure to do this is believed to led to death.

The practice of seniority is applied to planting during the long rains i.e. the main crop growing season (*Chira*). During the second planting season (*Opon*) this order of seniority is not necessary followed. People have the option to grow a second crop or not to grow it. It appears the society makes it mandatory for all to plant the first crop especially if you are a first wife or a first born son to ensure food security. The *Orundu* is a miniature of the farm holding. This practice also applies to the *Orundu* but not in it’s totality. It only applies to the *Orundu* during the main planting season (*Chira*) and only if specific crops are grown in the *Orundu*. These crops are maize, sorghum and cow peas. Any other crops grown in the *Orundu* do not have to follow the set protocol.

Implications

The implication of this practice is that if the eldest son or wife does not cultivate/plant then, the others are all held at ransom. This practice can be taken advantage of by

rivaling relatives/siblings. One woman complained that the previous year she did not plant her fields because the first wife went to Nairobi to visit her daughter and did not get back in time to plant her fields. Since the *Orundu* is not completely subject to this protocol, it gives the women much more freedom in terms of when to plant. Failure to plant has serious consequences for rural folks because they often do not have money to purchase food. They rely heavily on their own production

Most women tended to prefer to hold to this set practice. This is because the community is predominantly polygamous. In polygamous marriages the husbands tend to ignore the older wives and pay most attention to the younger wives. The protocols set to guide agriculture had the additional role of ensuring the husbands did not ignore their older wives. The first wife was required to plant first. It was mandatory for the husband to spend the night in her house when she did this thus ensuring that she was not neglected. By letting go of these practices, the women feel threatened because the community is still polygamous.

6.4 Activities in the *Orundu*Table 6.4 is a summary of activities that are carried out in the *Orundu*.

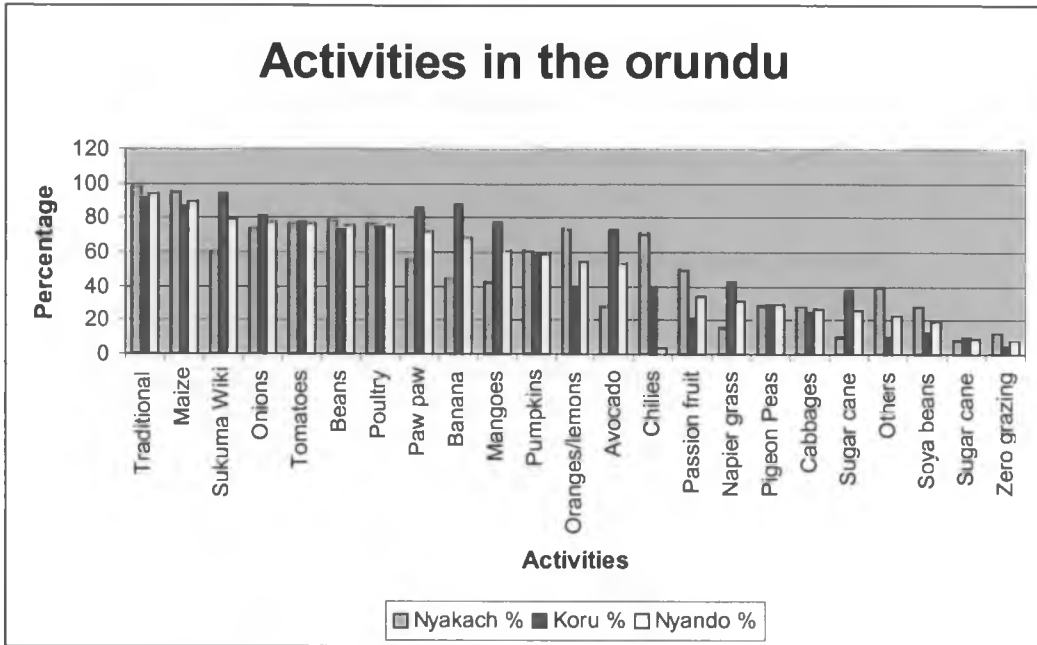
Activities in the <i>Orundu</i>	Nyakach		Koru		Nyando	
	Freq.	%	Freq.	%	Freq.	%
Traditional vegetables	37	97.4	44	91.7	81	94
Maize	36	94.7	42	87.2	78	90
<i>Sukuma Wiki</i>	23	60.1	45	93.8	68	79.1
Onions	28	73.7	39	81.3	67	77.9
Tomatoes	29	76.3	37	77.1	66	76.7
Beans	30	78.9	35	72.9	65	75.6
Poultry	29	76.3	36	75	65	75.6
Paw paw	21	55.3	41	85.4	62	72.1
Banana	17	44.7	42	87.5	59	68.6
Mangoes	16	42.1	37	77.1	53	61.2
Pumpkins	23	60.5	28	58.3	51	59.3
Oranges/lemons	28	73.7	19	39.6	47	54.7
Avocado	11	28.9	35	72.9	46	53.5
Chilies	27	71.1	19	39.6	46	3.5
Passion fruit	19	50	10	20.8	29	33.7
Napier grass	6	15.8	21	43.8	27	31.4
Pigeon Peas	11	28.9	14	29.2	25	29.1
Cabbages	11	28.9	12	25	23	26.7
Sugar cane (soft)	4	10.5	18	37.5	22	25.6
Others	15	39.5	5	10.4	20	23.3
Soya beans	11	28.9	6	12.5	17	19.8
Sugar cane (Hard)	3	7.9	5	10.4	8	9.3
Zero grazing	5	13.2	2	4.2	7	8.1

N = 38

N = 48

N = 86

Source: Field Survey

Figure 6.4: Activities in the *Orundu*

Source: Field Survey

a) Cultivation of traditional vegetables

Luo traditional vegetable includes *Mitto*, *Boo* (cow peas), *Akeyo*, *Osuga*, and *Apoth* among others. Cultivation of traditional vegetables is the most common activity in the *Orundu*. These vegetables provide subsistence for the households. They are treasured more than conventional vegetables such as cabbage and *sukuma wiki*. They are actually considered as delicacies and their preparation considered an Art. Many of them have medicinal qualities. They command higher market values than the regular vegetables. It is not easy to grow most of them on large scale. Their cultivation is extremely labour extensive and is best managed on small scale. (Show a picture of traditional vegetables in a *Shamba*)

The demand for these vegetables is always high and when sold they provide a source of income for the women. The climate of North East Nyakach does not favour the growth of the conventional vegetables such as cabbage and *sukuma wiki* therefore the households must buy the conventional vegetables or relay of the traditional vegetables. A questionnaire on traditional vegetables administered in North East Nyakach and the findings are indicated in table 6.5

It indicates that 100% of the respondents grow traditional vegetables but Table 6.5 clarifies that only 97.4% grow it in the *Orundu*.

This implies that although most people grow traditional vegetables in the *Orundu*, a small group also grows it on the other parts of the farm. From table ____ it can be seen that all traditional vegetables are widely grown. However, only a small percentage sells traditional vegetables. 75.6% use traditional vegetables for domestic purposes. 43.9% sell some of the vegetable.

Table 6.5 status of traditional vegetables in North East Nyakach

Activity	%
Cultivation of traditional vegetables	100
Cultivation of <i>Osuga</i>	87.8%
Cultivation of <i>Boo</i>	95.1%
Cultivation of <i>Deg Akeyo</i>	82.9%
Cultivation of <i>Mitto</i>	53.7%
Cultivation <i>Susa</i>	63.4%
Cultivation of <i>Apoth</i>	87.8%
Cultivation of others	67.9%

Source: Field Survey

Due to the fact that 100% of the households grow traditional vegetables it is a good practice to develop because the grains will be felt by almost the total population. It can go a long way in improving food security as far as vegetables are concerned. For that group that sells, market oriented traditional vegetable growing can be encouraged.

Market for tradition

nal vegetables exist in all urban centres both small and big. Katito a market centre within Lower Nyakach has a market where people bring traditional vegetables from as far as Kisii to sell. If local women produce traditional vegetables they can sell them in the local market. Kisumu which is about 30 km from Katito is the Provincial Head Quarters of Nyanza Province. It has a large periodic market at Kibuye which convenes every Sunday. Traditional vegetables are brought from all over Nyanza, parts of western and even Rift Valley.

Should Nyando overproduce, then they can sell their produce at Kibuye. The market for traditional vegetable extends to Nairobi, the capital city of Kenya. Women from Ahero produce cow peas (*boo*) from the swamps and transport them to Nairobi using country buses. This goes on throughout the year. Their collecting point is Total Petrol Station at Ahero town. This is confirmation that there is

market for traditional vegetables. It can therefore, be used to address poverty reduction. *Table 6.4* indicated that 94% of the respondents cultivated traditional vegetable in their *Orundu*. It is the most common activity in the *Orundu*. This implies that if developed, it can be of help to many households. Agroforestry practices can be integrated with production of vegetable therefore as an activity it does not hinder Agroforestry in the *Orundu* but can form part of the Agroforestry system designed for the *Orundu*.

b) Conventional Vegetables

These include cabbage, sukuma wiki, tomatoes, and onions. These are grown for the households use but surpluses are sold to supplement the family income. *Table 6.4* indicates that 26.7% of the respondents planted cabbages in the *Orundu*. This low percentage is explained by the fact that the ecological conditions in the district do not favour the cultivation of cabbage. *Table 6.4* indicates that 79% of the respondents grew sukuma wiki in their *Orundu*, 77.9% grew onions and 76.7% grew tomatoes. The level of cultivation is high. This implies that if Agroforestry innovations are integrated with cultivation of conventional vegetables they have high chances of being adopted. Conventional vegetables provide food for the family and can also be a source of income when surpluses are sold. Since the district is not self sufficient in food production and has to import food stuffs from outlying districts it is important to promote agriculture that increases food production in the district.

c) Growing of spices and food additives

These include such items as chilies, ginger, etc. They are grown for the households consumption. However, small quantities are sold. The items command a good market price which can add to the family income. *Table 6.4* indicates that 71.1% of the respondents cultivated spices and food additives in North East Nyakach while only 39.6% of the respondents in Koru did the same. This can be explained by the fact that the ecological conditions in Koru favours cultivation of wider variety of crops than that of North East Nyakach. The need to create variety in flavour has led to a greater need for spices and additives in North East Nyakach.

d) Cultivation of grains /Cereals

These form the staple foods for the community. Cereals such as maize and sorghum are planted in the *Orundu* - more of maize than sorghum. This is done to provide the household with an advance crop for subsistence. Usually the maize in the *Orundu* is planted with the very first rains. It is well spaced so as not to interfere with other crops in the *Orundu* especially the vegetables. The stalks of maize and sorghum in the *Orundu* are used for fuel. Sometimes they are used to reinforce the fencing of the *Orundu*. Table 42 indicates that 90% of the respondents grow maize in the *Orundu*. Because maize is a staple crop and is consumed in large quantities the maize produced in the *Orundu* does not have any impact on the families requirements. When sold, it fetches very little money, so it is not worth selling. The study recommends that cultivation of maize/cereals in the *Orundu* be discouraged because they take a lot of space and the benefits they generate are low. Cereals are not high value crops. One gogogoro (2 kg tin) cost Ksh 10.00 when prices are at their lowest like this year and kshs 40.00 at it's highest. This compared to the price of beans which is Kshs 35.00 at it's lowest and Kshs 150.00 at its highest.

e) Cultivation of Beans and other Legumes

Regular beans are grown at least once a year. But sometimes twice when the short rains are reliable.

Pigeon peas are grown by a small group for food. The legumes are good for the soil because they are nitrogen fixing they sustain the fertility of the soil.

Soya beans are also cultivated by some people. These are ground to provide a beverage close to cocoa which is used by Seventh day Adventist as an alternative beverage to tea.

Legumes provide food for the household. They are rich in proteins and also improve soil fertility, by fixing nitrogen in the soils. Legumes command a higher market value than cereals and as such better prospects for income generation. Legumes are a cheaper source of protein. They can therefore help improve nutrition for the poor of Nyando who cannot afford other expensive sources of protein such as meat. They can also be used to improve and sustain soil fertility in a cost effective manner for the poor farmers of Nyando. Legumes can be easily be intercropped with trees therefore Agroforestry interventions in the *Orundu* do not conflict with cultivation of legumes.

f) **Fruit growing**

Table 4.2 indicated that fruit tree growing were the most practiced form of Agroforestry with 81.9% of the respondents planted fruit trees. *Table 6.4* shows that 72% of the respondents planted paw paw in their *Orundu*, 68.6% planted bananas, 61.2% planted mangoes. 54.75 planted oranges/lemons and 53.5% planted Avocado and 33.7 planted passion fruits.

Many of the women grow a fruit or two in their *Orundu*. The common fruits include bananas, mangoes, avocado, lemons/oranges, paw paw and passion fruit. These fruits are used to supplement the households subsistence and at the same time some of the fruits are sold to supplement family income. The fruit trees especially the mango tree provides the household with wood fuel when the branches are trimmed. The trees also enhance the environment by providing shade. Fruit trees are widely grown on the farm as a whole and also in the *Orundu*. Fruit trees growing in Nyando District is an Agroforestry practice with a lot of untapped potential since most farmers grow just a few trees. There is therefore, need to develop Agroforestry innovations focusing on fruit trees. These are bound to have high levels of adoption because fruit trees are already grown. Those targeting women should be designed such that the fruit tree species is compatible with activities in the *Orundu*. The success of fruit trees in the *Orundu* can be replicated in other parts of the farm because even there fruit trees are widely planted. Plates 6.4 and 6.5 show the *Orundu* planted with a mixture of crops. Plate 4.5 shows a well tended *Orundu* planted with a variety of fruits.

g) **Wind breaks and shade trees**

The *Orundu* is behind the house so when trees are planted in a line along the edges of the *Orundu*, they also served as wind breaks. These trees also serve as a source of timber and a source of wood fuel. The trees also enhance the environment.

h) **Other crops grown in the *Orundu* include**

Sugar cane (soft), sugar hard, pumpkins, napier grass. Poultry and zero grazing are also carried out in the *Orundu*. Poultry is widely kept. *Table 6.4* indicates that 76.3% of the respondents in North East Nyakach keep poultry in the *Orundu* while in Koru 75% of the respondents keep poultry. Most of this poultry is of the indigenous type and is kept mostly for domestic consumption. In view of the high

levels of poverty in the district, this practice can be further developed to make it an income generating activity. Droppings from poultry can also be used to improve soil fertility. Table 6.4 indicates that only 13.2% of the respondents practiced zero grazing in North East Nyakach while 5.3% practiced zero grazing in Koru. This is not an indigenous practice and this explains the low levels of adoption. Zero grazing requires a high capital input which most people in the district do not have since they are poor. As long as people remain poor, zero razing does not have good chances of being very widely practiced.

Table 6.6 Activities in the *Orundu* Against the Size of the *Orundu*

Activity	Size of <i>Orundu</i>										TOTAL
	< 0.05		.05-0.1		0.1-0.15		0.15-0.2		> 0.2		
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	
Traditional Veg	11	14	35	44	5	6	7	9	20	25	78
Cabbage	0	0	11	68	0	-	3	19	2	13	16
Sukumia wiki	13	20	28	42	2	3	6	9	17	26	66
Onions	12	19	25	39	4	6	6	9	17	27	64
Tomatoes	11	17	26	41	4	6	6	9	17	27	64
Maize	10	13	3	4	5	7	7	9	19	25	75
Beans	8	13	26	41	0	0	7	11	17	27	63
Bananas	9	16	24	42	2	4	6	11	16	28	57
Sugar cane (soft)	0	0	9	69	1	8	3	23	0	0	13
Sugar cane (hard)	2	25	3	38	1	13	1	13	1	13	8
Napier grass	5	19	7	26	1	4	3	11	11	41	27
Mangoes	10	67	22	147	2	13	4	27	13	87	15
Ornges/ lemons	7	16	19	42	3	7	6	13	10	22	45
Avocado	6	13	1	2	2	4	6	13	13	28	46
Poaw paw	1	2	27	44	2	3	5	8	17	28	61
Passion fruit	8	29	11	39	0	0	3	11	5	18	28
Pigeon peas	5	20	11	44	0	0	3	12	3	12	25
Chillis	7	16	15	34	0	0	5	11	12	27	44
Soya beans	0	0	6	35	3	18	2	12	3	18	17
Poultry	10	16	2	3	4	6	6	10	15	24	62
Zero grazing	3	43	2	29	0	0	1	14	1	14	7
Pumpkins	0	0	22	45	4	8	4	8	1	2	49

Source: Field Survey

The activities in the *Orundu* are shown in Table 6.6 do not indicate any relationship with change in size of the *Orundu*.

6.5 The Agroforestry Potentials of the *Orundu*

Women can use the *Orundu* for agroforestry because the crops in the *Orundu* such as fruit trees, vegetables, poultry, gram, etc can be intercropped with trees.

a) Fruit trees

Although the *Orundu* is small the women can grow fruit trees here. It can not hold many but just a few selected fruit trees – may be just one or two depending the on the space requirement of the tree. Fruit trees tend to take much space therefore their location is important if optimal utilization of the *Orundu* is to be realized.

Some fruits like paw paw, lemons, and passion fruits do not require a lot of space is therefore ideal for cultivation in the *Orundu*.

b) Medicinal trees and herbs

High levels of poverty in Nyando district implies that any people are not able to afford to go to hospital therefore; medicinal helps become an alternative to meeting their medical requirements. These can effectively be planted in the *Orundu*. They must be selected according to their space demand because the *Orundu* is small. Shrubs are preferred to trees because they occupy less space. When the herbs are near the homes because then they are more easily accessible for use when required.

c) Wind Breaks

By virtue of being behind the house, the *Orundu* is strategically placed for planting trees to shield the house from wind blowing from that direction. These trees would have the advantage of close attention in terms of weed control and watering as they grow since the women are constantly engaged in cultivation in the *Orundu*. The wind breaks would ideally be located on the outer edge of the *Orundu*. They can be source of both wood fuel and timber.

d) Kitchen Nurseries

The *Orundu* is ideal for kitchen nurseries because of its close proximity to the house. It can get ample attention and protection. Kitchen nurseries do not have to be large. They can be designed to suit the needs of the family -thus having only a handful of seedlings. Kitchen nurseries can benefit from the use of waste water especially where water is a constraint. Not all waste water from the house is bad. Some of it can be used to water tree nurseries. If women are trained on operating kitchen nurseries in the *Orundu* they can integrate the management of the nursery with their other daily chores thus improving on their time management.

e) Live hedges around the *Orundu*.

Poor fencing and livestock menace have been quoted by members of the group as some of the major constraints to Agroforestry. Live fences can be effectively grown around the *Orundu* to protect it from livestock. Live fences are cost effective compared to other types of fencing. At the same time, they enhance the environment. They can be used as a source of fodder, wood fuel and even timber. Although fencing is predominantly a male activity, fencing the *Orundu* is not an area of conflict between the sexes because the *Orundu* is the woman's domain. She is free to fence it without seeming to threaten the male role. Tree selection for

live fencing in the *Orundu* must be specific so as not to affect other activities adversely

f) Soil Conservation in the *Orundu*

Soil conservation methods can be practiced in the *Orundu* especially because the *Orundu* is cultivated continuously with subsistence crops. This makes the soils of the *Orundu* susceptible to exhaustion and subsequently erosion and reduced productivity. It is important to plant the *Orundu* with crops that improve soil nutrients to allow for its continued productivity. Its close proximity to the house allows it to benefit from manure from chicken, goats and cows easily thus maintaining a good level of fertility.

g) Fodder Banks in the *Orundu*

Despite the small size of the *Orundu*, it can be used as a fodder bank with proper management and planning. The live hedge can be planted with tree/shrub species that are used as fodder for livestock. It can be made deliberately thicker to increase its fodder supply.

6.6 Emerging Issues

- a) The small size of the *Orundu* limits extensive practice of Agroforestry but allows a small manageable level of adoption for the rural women.
- b) The *Orundu* is always intercropped therefore Agroforestry will not be introducing a new land use.
- c) Activities in the *Orundu* focus on providing food for the household. This has not been exploited for optimum production.
- d) The *Orundu* has income generating potentials that have not been exploited.
- e) The rural women have a lot of chores therefore they have very little time left for additional activities. Since their income is also very limited, they are not in a position to employ labour for these extra activities. They must engage their own labour. In the light of the above, their impact can best be seen on a small scale hence the appropriateness of the *Orundu*.
- f) The close proximity of the *Orundu* to the house is an advantage because it allows for the integration of the women's household chores and farming without compromising either.
- g) Although the *Orundu* is small, every home has an *Orundu* therefore the cumulative effect of all the activities in all the *Orundus* is significant.

Opportunities to Exploit in Designing Agroforestry Interventions for the *Orundu*

- a) The *Orundu* is near the house so they can carryout their work more easily.
- b) The *Orundu* is small so it is easier to fence it property to keep away livestock.
- c) The *Orundu* is their garden so there will be no conflicting interest without the men.
- d) The *Orundu* is small so the impact of their activities can be easily appreciated.
This can lead to replication by men on the larger farm.
- e) The *Orundu* is often more fertile because it received organic manure from the household waste, chicken droppings and livestock manure.
- f) The *Orundu* is under cultivation all the year round. Perennial trees and shrubs in agroforestry systems can benefit from this intensive care.

Constraints to Agroforestry practices in the *Orundu*.

- a) The *Orundu* is small so only specific agroforestry interventions can be applied on it. Requires wise selection.
- b) The *Orundu* is close to the house and this again restricts the types of agroforestry interventions that can be applied within it.

Suggestions by the Community on Other Ways through which the *Orundu* can be used.

Table 6.7 - Suggestions by the community on other ways through which *Orundu* can be used.

Suggested activities	%
Planting cash crops e. g cotton, sugarcane etc	5
Planting Nippier grass for animals	17.5
Trees for shade, firewood and timber	5
Applying manure on the <i>Orundu</i> to produce high yields	45
Planting horticultural products e.g. fruit trees, peas	1.3
Planting tuber roots crops such as cassava	3.8
Fencing the garden with cypress trees	13.8
Intercropping / Mixed cropping	5
ICRAF should give assistance on forestry	1.3
Practice bee keeping	1.3
Plant tomatoes and avoid traditional vegetables.	1.3

Source: Field Survey

CHAPTER 7 – SUMMARY OF FINDINGS RECOMMENDATIONS AND CONCLUSION.

7.1 Overview

This chapter gives a summary of the main findings of the study based on the objectives set out at the beginning of the research. On the basis of the findings the chapter explains the implications of women's participation in agroforestry. Finally, conclusions and recommendations are drawn from a synthesis of the findings.

The study set out to examine women's participation in agroforestry in Nyando district, as a land use approach that can contribute to a sustainable rural environment. It examines the role of women in agroforestry on the farm in general and the women's activities in the *Orundu* specifically. The study has several research questions which translate to research objectives as follows:-

Objective 1

To establish an inventory of existing agroforestry practices in Nyando District.

Objective 2

To examine the role of women in planting and managing trees/shrubs in Nyando District.

Objective 3

To establish the potential of the *Orundu* for agro forestry interventions.

Objective 4

To examine the impact of culture and history on women's adoption of agro forestry technologies.

Objective 5

To make policy recommendations and strategies that promotes a sustainable environment through gendered agroforestry.

7.2 Summary of Findings

Objective I

The first objective of the study was to establish an inventory of agroforestry practices in Nyando District. It is against this inventory that women's participation in agroforestry is examined.

The inventory of agroforestry includes the district development priorities in the District Development Plan. Rural afforestation through extension and the establishment of the nurseries are priorities for the Nyando District Development

Committee. There are ongoing projects while new proposal for the 2002-2008 Development plan include promotion of agroforestry and afforestation. These are confirmation that there is an awareness of the need to promote agroforestry in Nyando district.

The inventory includes the various forms of agroforestry that are practiced in the District. The most practiced form of agroforestry is fruit tree growing. 81.9% of the respondents had at least a fruit tree. However, although many people grew fruit trees, the intensity of the fruit tree growing is very low. Most homesteads have a few trees that receive hardly any attention and yield very little of poor quality products. There is no serious economic exploitation of fruit trees in the District.

Other forms of agroforestry that are widely practiced in the District are homestead planting (79%), live fences (78%), homestead gardens (73%) and boundary planting (62%). It is interesting to note that all these forms agroforestry that are widely practiced are indigenous forms of agroforestry, innovations forms of agroforestry such as improved fallows (23%), Pasture improvement (23.8%) and fodder banks (28.6%) are not widely practiced in the district.

Live fencing is a widely practiced form of agroforestry. In North East Nyakach and most parts of the Kano plains the most common tree used for fencing is ("*Eurphorbia Tirucalli (Ojuok)*") *Euphorbia tirucalli* but in the higher regions exotic species such as kei apple and cypress are used. However, in the low lying areas, most of the live fences are destroyed by over harvesting for wood fuel because there is severe inadequacy of wood fuel.

Homestead planting is also very widely practiced form of agroforestry. It is more elaborate in affluent homes and viewed by the poor as luxury. The poor, who are the majority, are too busy trying to supply their basic requirement by working as farm labourers or cultivating their fields for food crops.

The inventory includes the common tree species used for agroforestry in Nyando district and their uses. In the Kano plains, the tree population is less than in the higher areas. The indigenous trees are more dominant than the exotic tree species. The most common exotic tree in the Kano plains is the eucalyptus saligna because it can easily

thrive in poorly drained soils. The most common use of trees are timber, wood fuel, fruits and medicine.

Tree planting constraints include the following:

- 1) Drought or low an erratic rainfall.
- 2) Livestock damage.
- 3) Lack of appropriate tree seeds and seedlings.
- 4) Small land sizes.
- 5) Lack of knowledge on how to manage trees.
- 6) Pests and disease.
- 7) Poor soils
- 8) Poor drainage
- 9) Inadequate knowledge on appropriate tree species.
- 10) Cultural constraints (myths and legends)

Objective II

The second objective of the study was to examine the role of women in planting and managing trees and bushes in Nyando district. The study examined the status of women in Nyando district and found that they are marginalized and have poor access to productive resources such as land. Polygamy is common in the community with about 50% of the married women living in polygamous marriages. Polygamy reduces women's access to land. Most women in Nyando do not attain high educational level. 65% of the female respondents have primary education and below. This reduces their access to formal employment. Income levels for women in Nyando are very low with an average of Kshs. 1667.00 per month. This is well below the U. N. poverty line of one dollar a day. The study confirms that farming is the activity that most rural women are involved in. 41.6% of the female respondents indicated that their occupation was farming.

The current Nyando District Development Plan in their strategies to mainstream gender recommends that adequate financial allocation be made to activities that benefit women directly such as small scale enterprises that promote women's access to productive resources. The study found that culture imposes constraints to women's planting and managing trees. There are trees that the Luo culture discourages women

from growing such as (*Eurphorbia Tirucalli (Ojuok)*) euphorbia tirucalli, tamarind (Chwa or Mukwaju), among others.

There are also some agroforestry practices that the culture discourages women from participating in. For instance, agroforestry practices that involves fencing the homestead or live fencing along property boundary. Boundaries dividing crop fields have no cultural constraints on women rowing trees and shrubs on them.

In the Luo culture, the man is the head of the house and inheritance is through the male. It was found that the men required that the women seek permission if they wish to practice agroforestry. Not seeking permission is seen as challenging the authority of the head of the household. When the women used the right approach to seek permission, they often got it.

The unmarried women who are still living with their parents have no voice in anything therefore; she has no role in agroforestry. Unmarried women who are heads of households are not many because the culture discourages this. Most of them move away from the home area to the urban or perri-urban areas where they are not stigmatized. They are less stigmatized in the settlement schemes where people are from diverse origins than in the former native reservations where kinship is strong. Where they have their own land, they have complete freedom because they do not have to seek permission. Those who can afford to buy their own piece of land are often educated, employed and are innovators. Those who cannot afford to purchase their own land are very disadvantaged because the community is patrilineal and land is bequeathed to sons and not daughters.

Married women in monogamous marriages have better access to land than those in polygamous marriages. They must seek permission from their husbands if they want to plant trees. When they use the accepted protocol, they easily get this permission; therefore, they can effectively participate in agroforestry. Married women in a polygamous marriage who are not first wives are disadvantaged because the cultural practice of seniority requires that they must follow the lead of the first wife. For instance, they cannot cultivate their fields until the first wife has cultivated hers and so on. This puts them at the mercy of the first wife. This dependency is a constraint to development in general.

Widows living within the husbands' parental homestead often have very little access to land and must seek permission. However, if the widow is in her husband's own homestead, she does not need to seek permission, therefore, she has complete freedom to use land and can participate in agroforestry.

Women are most interested in trees that provide them with fuel and food. Men are most interested in trees that provide them with timber. Conflicting interest arise when women cut down trees. As long as they are using branches and products, there is no conflict between the men and women. This boils down to the question of ownership in the cultural context where men "own" means of production but their wives only "use" them as dictated by cultural norms.

Women groups are a common feature in Nyando district. Using the focus group discussion for women only as a random sample it can be argued that all women belong to at least one women group. One of their primary reasons for coming together is to mobilize funds and improve their welfare. However, their monthly contributions are very low 60%. Of the groups contribute Kshs 50.00 and less per month.

It emerged that though the women practice agroforestry at individual level, they do not practice agroforestry as groups. However, they use some agroforestry products such as sisal for producing ropes and for weaving baskets. They also use palm leaves for basket weaving. The women groups can be used for marketing agroforestry products and disseminating information.

The form of agroforestry that most women are involved in is fruit tree growing. 67% of the respondents indicated that they took part in. Other forms of agroforestry that are widely practiced by women in Nyando District are homestead planting (62.8%) and home gardens (58%). Due to cultural constraints only 23% of the respondents participate in live fencing. It is the form of agroforestry that women are least involved in despite the fact that it is a very common practice in the district. Where there are no constraints women tend to adopt indigenous agroforestry practices better than innovative forms of agroforestry.

Agricultural extension workers visit farmers in the district but there does not appear to be a significant impact of their work. The level of awareness of the economic benefits of agroforestry amongst the women is low.

Objective III

The third objective of the study was to establish the potential of the *Orundu* for agroforestry interventions. In order to establish this, the study examines the characteristics of the *Orundu* and the activities of women within it.

The traditional Luo homestead has a specific pattern of land use which is predetermined by cultural norms. This land use pattern caters for the *Orundu*. The *Orundu* is always small and the actual size is determined by the size of the homestead. 45% of the respondents had an *Orundu* measuring between 0.05 ha and 0.1 ha. Where the land size allows, all married women have an *Orundu* for production of subsistence crops for the family. The *Orundu* is always intercropped.

The cultivation of traditional vegetables is the most widely practiced activity in the *Orundu*. 94% of the respondents grew traditional vegetables. Traditional vegetables have a high market demand and fetch relatively high prices. Maize and other grains are next widely practiced form of Agroforestry. However, grains command low market value and the quality produced in the *Orundu* is very little.

Legumes grown in the *Orundu* command a higher market value and contribute to soil fertility because they are nitrogen fixing. The *Orundu* is cultivated all the year round therefore it requires crops which improve soil nutrients.

Fruit trees are widely grown in the *Orundu*. 70% of the respondents indicated that they grew paw paw, 68% for bananas, 61% for mangoes, 54% for lemon/oranges and 53% for avocado. Cultivation of conventional vegetables such as sukuma wiki (kale), onions, tomatoes, etc is also high. 75% of the respondents indicated that they kept poultry in the *Orundu*. All the activities carried out in the *Orundu* by more than 50% of the respondents are activities that can easily be integrated with trees to form an agroforestry system.

Objective IV

The fourth objective of the study was to examine the impact of culture and history on women's adoption of agroforestry technologies. Cultural beliefs constrain women's participation in planting and managing trees in agroforestry systems that involve the

homestead fences and boundaries of property because the land belongs to the men and not women in the cultural context. Culture also controls the order of cultivation of field and planting of crops. The processes must be began by the senior members of the family must begin first before the younger people can proceed. This can hinder progress in the event that the seniors decide to drag their feet. The culture of the people indicates that women ought to seek permission from their husbands on land use.

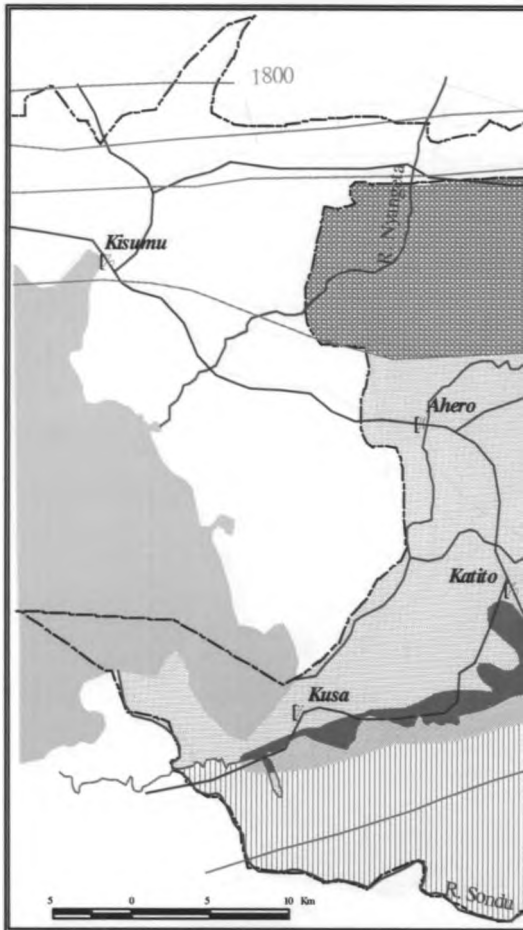
Women therefore, are not the final authority on what land use the household adopts. This constraints their participation in agroforestry. Myths and legends concerning women and trees, also serve as constraints their participation. The Luo culture promotes the existence of extended families. This has made worse the problem of destruction of trees and crops by livestock. It is considered wrong to prosecute kin. By virtue of the extended family most people are kin so if livestock destroy your trees/crops no legal action can be taken. This problem exists in North East Nyakach but not in Koru.

Historical factors have influenced agroforestry in Nyando District. The population of a cash economy in the former white highlands and a subsistence economy in the former native reservations led to a dual economic structure in the region which still exists. The former native reservations still have a traditional economy which is dependant on the cash economy of the settlement schemes. This also affects the adoption of agroforestry in the region. In the subsistence economy, where traditional forms of agriculture are practiced, the traditional forms of agroforestry are practiced. There, agroforestry is not viewed as an economic activity but as a subsistence activity. In the cash economy, modern agriculture is practiced and many forms of agroforestry are seen as economic activities.

The establishment of the settlement schemes which is a historical factor has led to the evolution of a district settlement patterns. In the settlement schemes there is the clustered settlement pattern which was deliberately planned to make service provision easier. This pattern is a constraint to agroforestry because it separates the sugar fields from the human settlements. The sugar fields which cover the larger areas are not for agroforestry. The subsistence plots which are used for agroforestry are small and

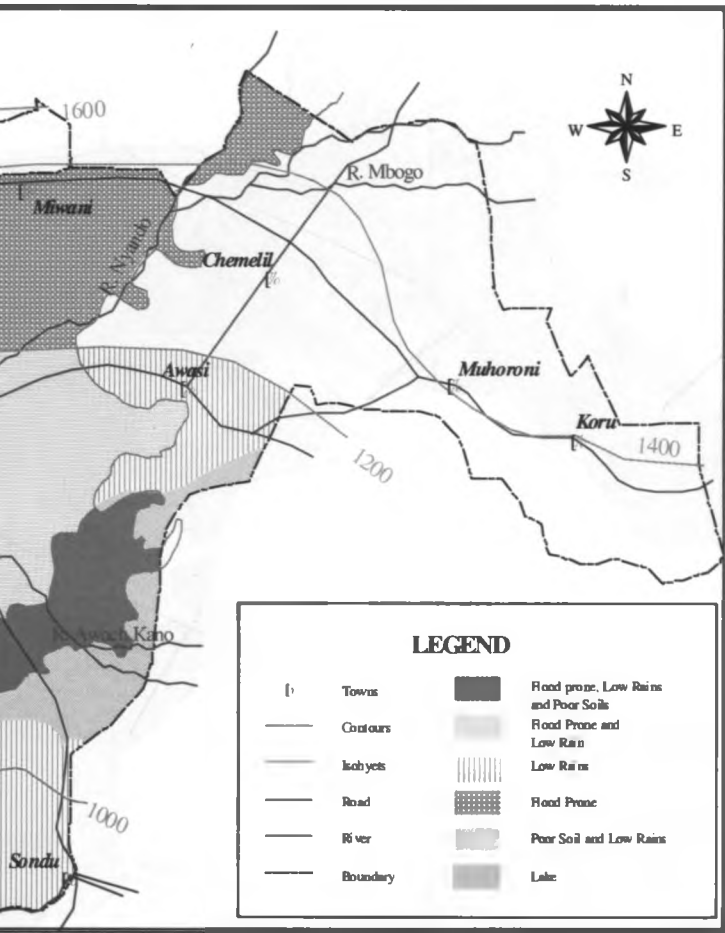
crowded. In the former native reservations, the human settlement pattern is dispersed and all land is used for agroforestry.

The settlement schemes attracted people from a far many parts of the country. The people therefore, do not have close community bonds based on clanism as is found in North East Nyakach. The implication is that cultural practices are less strictly followed. It therefore allows for higher level of adoption of agroforestry innovations.



Source: Field Study

ECOLOGICAL CONSTRAINTS MAP



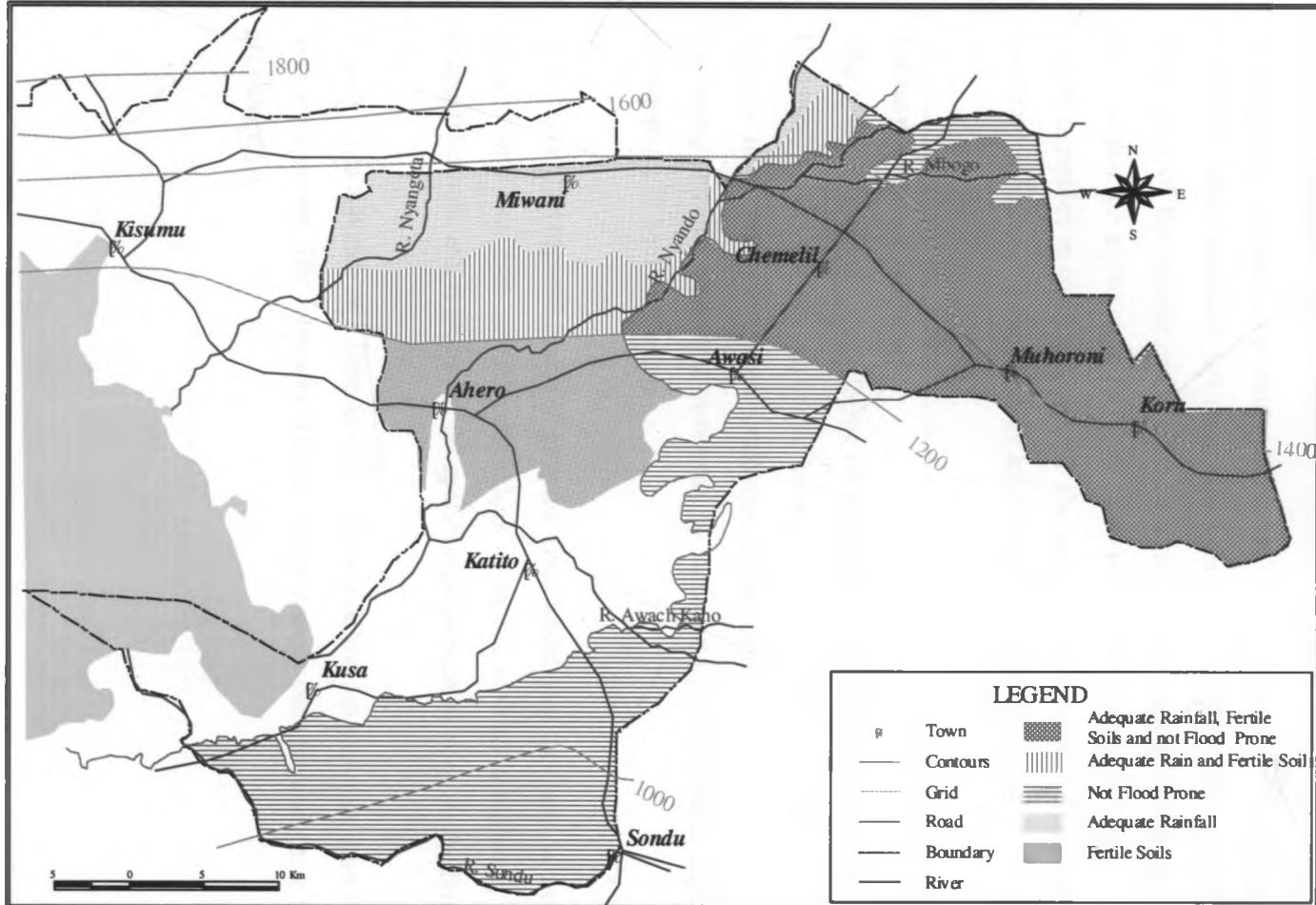
LEGEND

[]	Towns	[Dark Stippled]	Flood prone, Low Rains and Poor Soils
—	Contours	[Light Grey]	Flood Prone and Low Rain
—	Isohyets	[Vertical Lines]	Low Rains
—	Road	[Cross-hatched]	Flood Prone
—	River	[Horizontal Lines]	Poor Soil and Low Rains
—	Boundary	[Dark Grey]	Lake

Prepared by: Onyango L.A

MAP 17

NYANDO DISTRICT - ECOLOGICAL OPPOTUNITY MAP



Source: Field Study

Prepared by: Onyango L. A

7.3 Recommendation

Expanding Agroforestry

As one moves through Nyando District it is evident that a lot of land especially in the low lying Regions is underutilized. Most of it is not cultivated because of poor drainage and flooding as a result of the flat terrain especially in Nyando and Lower Nyakach. Other areas are not cultivated because the rainfall regime does not allow cultivation of the regular crops of the district. There is need to design agroforestry systems that are appropriate for each agro-ecological zone. In this way agroforestry can be expanded to cover more areas. The supply of seedlings can be improved by the use of wildlings and by establishing kitchen nurseries in the *Orundu*.

On farm land use planning

The study found that many forms of agroforestry are practiced in Nyando district. However, there does not appear to be a systematic approach to the arrangement of trees on most farms. Increased production on the same land unit without necessarily increasing the area under tree cover can be achieved by a systematic approach to the arrangement of trees on the farm.

A deliberately prepared plan for growing trees/bushes on the farm is necessary for optimal land use. This can take advantage of niches such as boundaries, road sides, irregular corners, etc. It improves the spatial arrangement of trees on the farm.

Figure 7.1 is a sketch of a farm in Koru where a deliberate plan was drawn before the trees were grown. The farm was original part of a sugar cane farm so there was no tree growing on it.

Time Conserving Agroforestry

Some forms of agroforestry are time consuming. For example improved biomass transfers. The study established that women have very many chores therefore time is a constraint to practicing agroforestry. To make agroforestry more suitable for the little time the women have, there should be developed less time consuming agroforestry practices.

Market Oriented Agroforestry

The study established that although many forms of agroforestry are practiced in the district, the intensity of agroforestry is low. People need an incentive to convince them to intensify agroforestry. Market oriented agroforestry implies that agroforestry is producing for sale and income generation. Since the incidence of poverty in Nyando is high, most people need alternative sources of income. If agroforestry promises to provide an alternative source of income, it becomes more attractive to the farmers and the level of adoption increases.

Sisal

Sisal is one of the plants that is put to commercial use in North East Nyakach. From the study, it is evident that the demand for sisal is high because it is used for rope weaving and basket weaving. It is used as a boundary maker, a source of building poles, wood fuel, source of income, and also for soil conservation. Despite this, the rate at which it is grown is low. There is an urgent need to commercialize the growing of sisal so as to encourage an increase in production.

Plate 4.8 shows an eroded road. The areas plated with sisal are not eroded.

Traditional Vegetables

These are widely cultivated in the *Orundu*. There is an existing market both in the local markets and outside markets. Commercialization of traditional vegetables can contribute to improving the women's access to income.

Wood Lots

The severe scarcity of timber is an indicator that tree products have market. Commercialization of wood lots can improve the income base of rural households as they sell them.

Creation of Awareness

The focus group discussions revealed that although many people have heard about agroforestry as a land use approach there was not enough information on the benefits of Agroforestry. There is need to create awareness at the farm level of the benefits of agroforestry and the range of variable options for each community.

Because of the high poverty levels in the district it is impertinent that the income generation potential of agroforestry be highlighted because this will directly address the people's need for income. It can serve an incentive for adoption of Agroforestry.

Capacity Building and Empowerment

Capacity Building is about skill building and broadening ones knowledge base to enable enhanced productivity. This expands the range of options for the farmers. Empowerment is about the ability to be self-reliant on all needs and aspects of life. The promotion of capacity building and empowerment will lead to less dependency at all levels; economic self sufficiency and the confidence and ability to know and negotiate for rights. Capacity building and empowerment of women in agroforestry can involve the teaching of agroforestry skills.

Intensification of Agroforestry

The study revealed that agroforestry is practiced by many people and in many forms. However, the intensity of agroforestry in the district is low therefore; the benefits of agroforestry are not evident in the lives of the people. Most homesteads have some form of agroforestry but do not pay it much attention. At a result, the returns are low. For agroforestry to be used as a tool for combating poverty there must be intensification of Agroforestry. More time and effort must be put in the agroforestry practices. This requires more efforts from the extension workers in terms of advising and convincing the farmers.

Promote Indigenous Practices and Indigenous trees

The study revealed that agroforestry systems based on indigenous practice were practiced more than innovative forms of Agroforestry. Focus should be put on developing agroforestry systems based on indigenous practices because they have higher chances of being adopted by the community. They are more easily understood. For example the *Orundu* is an indigenous practice that is practiced by most local

people. Agroforestry innovations developed around the *Orundu* have high chances of being adopted by women.

Domestication of indigenous trees should be promoted because they are best suited for the specific ecological zones. Exotic species when introduced into an area need a lot of care for the seedlings to survive. The survival rates are low but indigenous trees grow with minimum care. The farmers will therefore spend less time and money on indigenous trees.

Indigenous trees can be raised from wildlings which cost very little as they are obtained free of cost. Seedlings for exotic species such as *Cyprus* and *Gravillea*, *Robusta*, etc, cost at least KShs. 5.00 each. The cost of seedlings has been quoted as constraint during the focus group discussion.

Community Participation

There are issues in the community that requires more than individual action. In such instances, community action is called for. The study revealed that women groups are not involved in Agroforestry. Women have many chores to handle and little time to spare. As a way of maximizing the use of existing groups they can incorporate marketing and sales of agroforestry products as part of their group activities. When people are sure of a market for their produce, they are bound to increase their production.

The women groups can also be used to grow tree in area such as swamps that are currently underutilized. The community can come together to address conservation issue that affect the whole community such as gulleys at Katuk. These need community action. Issues of free ranging also need community action. Free ranging leads to overgrazing which makes the soils susceptible to soil erosion.

Integrated Policy Legislation and Land Use

Trees are natural protectors of the environment (Wilde and Mattila, 1995). Policy and legislation can be designed in such a manner as to ensure that all land owners care for their land by planting trees on them. For instance, when applying for consent from the Land Control Board to subdivide, transfer or lease land, the granting of the consent can be done subject to evidence that the proprietor has been taking care of his land.

This should be manifested by the number of trees he has planted on his property. In this way, people will be forced to grow trees and in this way, improve the environment and their income and food supply.

Mainstreaming Gender

The study revealed that farming is the occupation most rural women engage in. Since agroforestry has been proved to be an appropriate farming method that can contribute to poverty alleviation, this study recommends designing of agroforestry technologies targeting women. These must consider the limitations posed by the status of women. They should focus on trees that are not of interest to men to avoid conflicting interest. They must also consider cultural constraints such as those discouraging women from growing live fences.

They can take advantage of the fact that women have free access to the *Orundu*. Agroforestry technologies designed for the *Orundu* should involve the use of tree species that can combine with other activities that are carried out in the *Orundu*. Agroforestry technologies designed to target women should address women's needs such as supply of wood fuel, supply of food, and income generation. They should take advantage of activities most practiced by women such as fruit tree growing. Agroforestry will meet the felt needs of the women without compromising the integrity of the environment.

Agroforestry technologies targeting men must focus on men's areas of interest. For instance, the study revealed that men are most interested in timber producing species. The agroforestry targeting men should focus on timber producing agroforestry technologies and tree species. The youth can also be brought aboard on the promotion of agroforestry especially in public places. Agroforestry technologies can be designed suitable for implementation by the youth. Niches that favour this are school compounds, road sides, playing fields, etc.

Gender Mapping

Mapping Gender species will enable researchers and development agents to explore and analyse dominant socio-cultural categories of "women" and "men" and the ways in which gendered use of space conform or contradict such expressions. There are

places, spaces and resources which men and women use. It is important for planning purposes to know what these spaces mean to them. It is also important to know which spaces meet their practical and strategic needs.

Gender Budgeting

Gender Budgeting is about how the budget deals with the question of gender. It is a means of mainstreaming gender in development. The budget should be gender responsive. Expenditure allocations should be made with considerations of the gender distribution of benefits and costs. According to Debbie Bundler a gender responsive budget is not a separate budget for women but an attempt to disaggregate expenditure and revenues according to their different impacts on women and men. "(Kisiero, 2002). This can be implemented through the Poverty Reduction Strategy Paper (PRSP) and the Medium Term Expenditure Framework.

Integrate Agroforestry in the Poverty Reduction Strategy Papers (PRSP)

The PRSP has two objectives; reducing poverty and economic growth. Since agroforestry can lead to the achievement of these two, it makes it possible to integrate agroforestry in the PRSP. The PRSP is pro-poor and pro-growth. It hopes to achieve its goal through Medium Term Expenditure Framework (MTEF).

Live Fencing for Enhanced Agroforestry

Free ranging of livestock has emerged as a constraint to agroforestry. Modern fences of barbed wire are expensive and the people are poor so they can not afford to erect such fences. Live fences are a cost effective method of fencing. They also have multiple benefits. They are a source of timber, wood fuel and biomass. At the same time, they protect crops from being damaged by livestock and enhance the environment. Although the fencing will be best done by the male as dictated by culture and conformed by the study, other forms of agroforestry can be carried out effectively within the protected area. In this way both men and women will gain from the live fence.

7.4 Proposed Agroforestry Plan for Nyando District

Index of Ecological Suitability for Agro forestry (ESAF)

This study has generated an index for classifying agroforestry stability. It has called it ESAF index. Ecological constraints to Agro forestry in Nyando district ranked in Descending of importance order are inadequate rainfall, floods, and poor soils. Ecological opportunities for Agro forestry in Nyando District ranked in Descending order on importance are rainfall, freedom from floods, fertile soil.

To calculate ESAF index the constraint are awarded marks as follow

Inadequate Rainfall -3

Flood Prone -2

Poor soils -1

Opportunities are awarded marks as follows:

Adequate Rainfall +3

Not flood prone +2

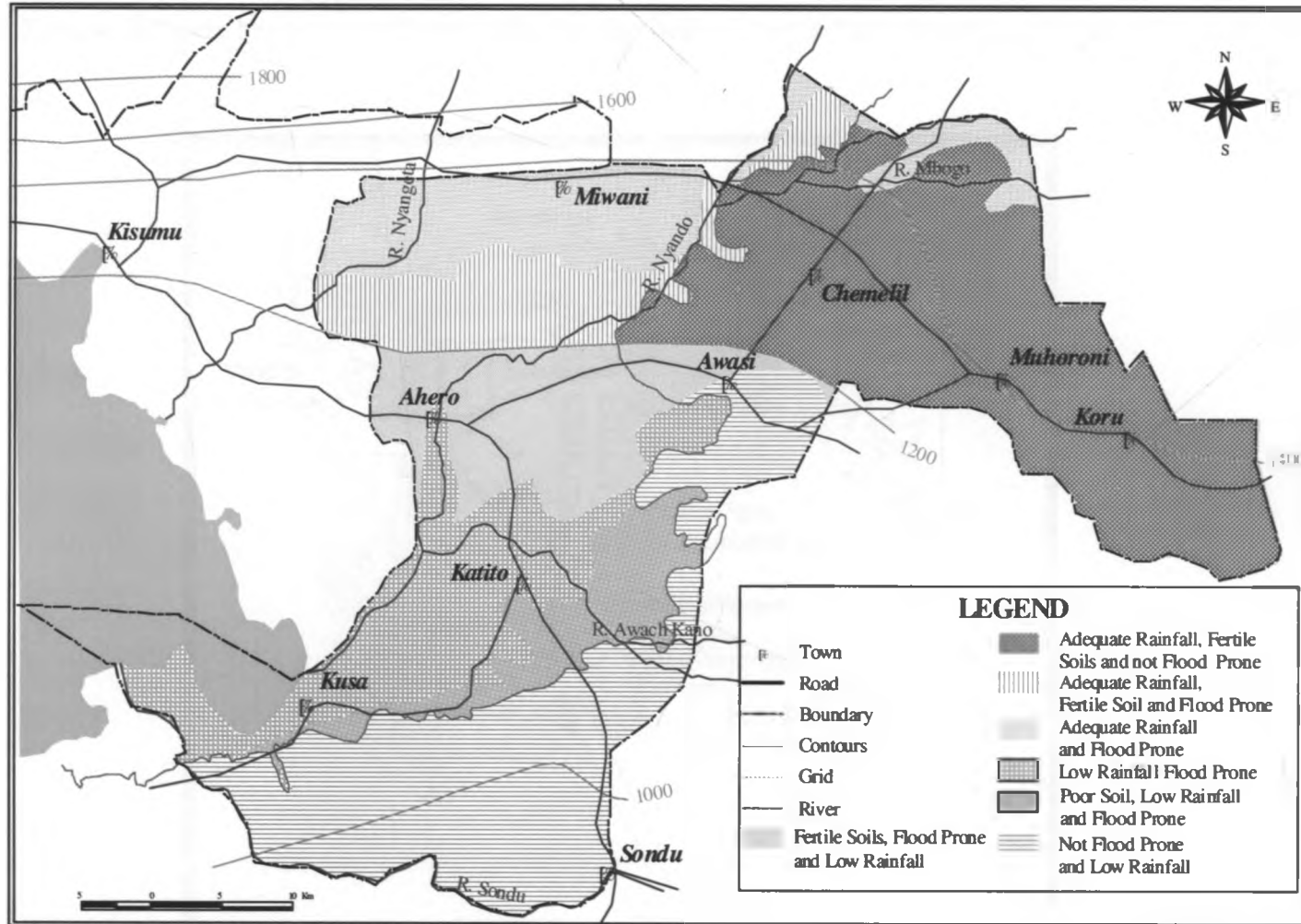
Fertile soils +2

The sum score obtained by each region according to its ecological conditions is considered the ESAF index in this study. The ESAF index is an indicator of how suitable the area is for agro forestry. Below are the proposed agroforestry zones and their ESAF index for all parts of Nyando District. This score can be used for planning appropriate agro forestry practices in various locations of the district.

Table 7.1: Ecological Suitability for Agro forestry (ESAF) Index and Zones

Zone	Characteristics			Index
1	Not flood prone	Adequate rainfall	fertile soils	
2	Flood prone	Adequate Rainfall		
3	Not flood prone	Inadequate rainfall	Fertile soils	
4	Flood prone	Adequate rainfall	Fertile soils	
5	Flood prone	inadequate rainfall	poor soils	
6	Flood prone	inadequate rainfall.		
7	Not flood prone	inadequate rainfall.		

Source: Field Survey



Source: Field Study

Prepared by: Onyango L. A

Pate 7.1

On farm land use planning:

The layout of a farm in Koru where there has been a deliberate effort to plan land use on the farm. It can incorporate gender mapping

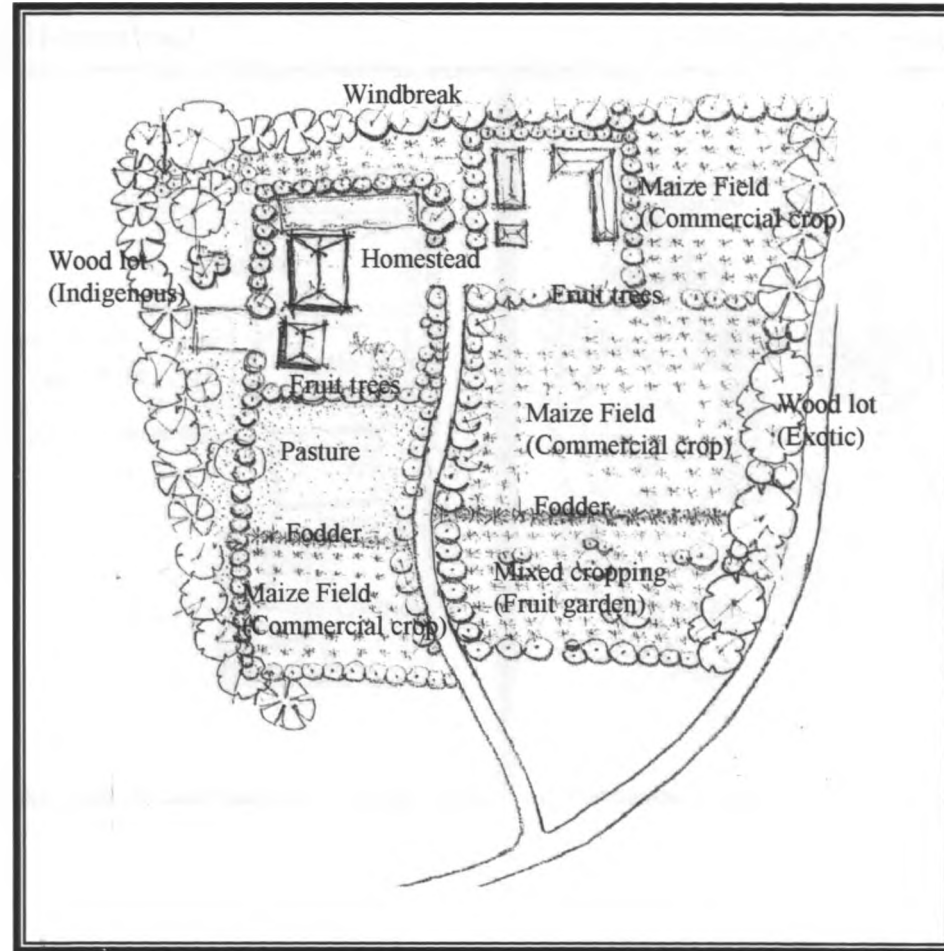
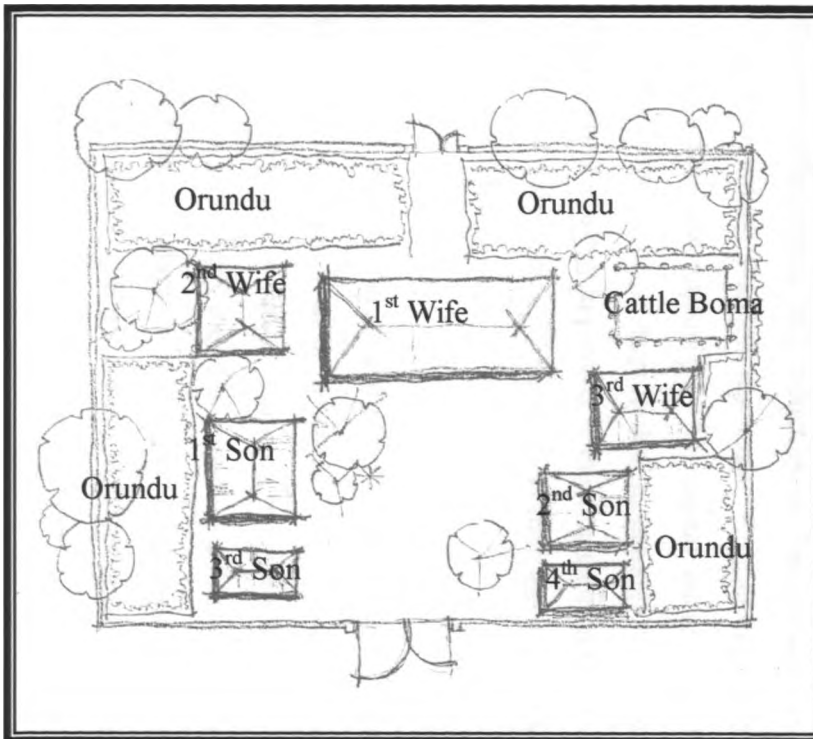


Plate 7.2

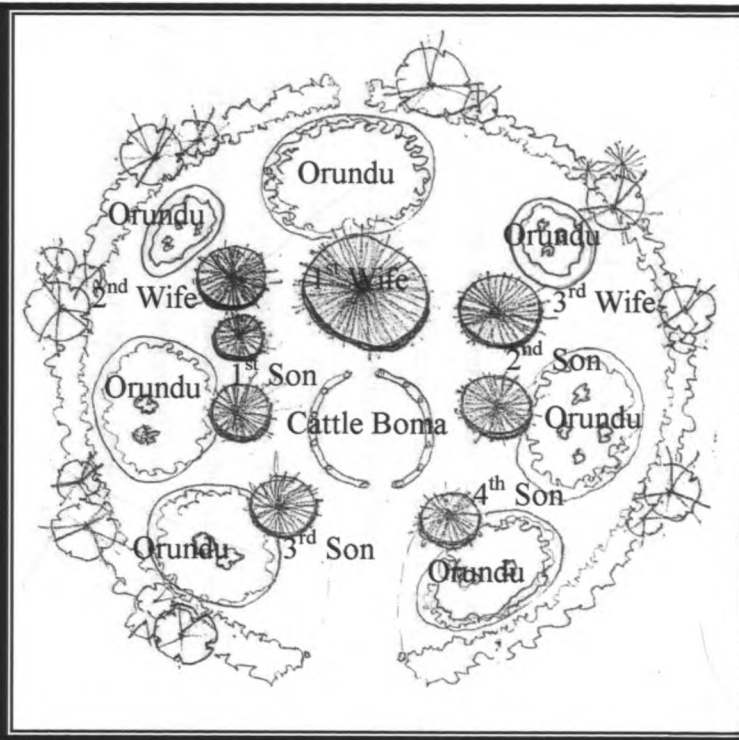
Land use Planning within the homestead

The Layout of a typical Luo homestead which depicts land use planning within the homestead

Modern Homestead



Traditional Homestead



7.5 Conclusions

Agroforestry is widely practiced in Nyando District. Traditional forms of agroforestry are more evident than scientific agroforestry innovations. Little effort is put in the traditional forms of agroforestry and the returns are understandably low. The District development committee has realized the need to promote agroforestry as a land use approach because of its many benefits. As a result agroforestry is included as one of the priority areas of development in the Nyando District Development plan 2002 – 2008.

In spite of the cash economy in the settlement schemes, levels of poverty are increasing. This is because the sugar industry is influenced by external forces as explained in the dependency theories. Cotton and rice which were the other cash crops in the district have also declined. There is therefore, a felt need in the communities for alternative or complimentary farming systems to improve their poverty situation. If agroforestry is promoted at this time when there is a felt need, it can be well received because studies have proved that it can fulfill these needs. Agroforestry can therefore play a significant role in improving the livelihood of the people of Nyando District.

In this era of structural adjustments and reduction in foreign aid, poverty reduction strategies must be designed around available resources. “Cutting the coat according to the cloth”. Agroforestry as a land use approach is not capital intensive and makes use of available resources; therefore, it is an appropriate technology for poverty reduction. Agroforestry is an appropriate strategy to poverty alleviation especially for women because it does not require high literacy levels. Women in Nyando have low literacy levels so agroforestry is appropriate for them.

The most widely practiced form of agroforestry in the district is fruit tree grown. It is extensively practiced by women and even in the *Orundu*. 81.9% of the respondents grow fruit trees, 59% of the women are allowed to plant fruit trees and 66.7% of the women are allowed to sell the products. This study therefore, concludes that it is the most promising agroforestry practice for poverty reduction in Nyando. Fruit trees have untapped income generating potential. Sylvopastoral systems are not well developed yet there is plenty of untapped potential. There are cultural constraints to Agroforestry. These are being outweighed by economic considerations. Economic needs are making people put aside the

cultural beliefs and engaging in agroforestry as long as the economic gains are attainable. The major ecological constraints to agroforestry in Nyando are water-related. At one extreme, too much water during the floods and at the other end, too little water during the drought. Cultural constraints against women planting trees are stronger in connection with some trees than others. For instance, the *Euphorbia* is unilaterally taboo for women to plant. On the other hand fruit trees growing are not so restricted.

The *Orundu* is a traditional practice which is well known and practiced by all communities in Nyando. The implication is that agroforestry technologies designed for the *Orundu* can be practiced by all households. Though the *Orundu* is small the cumulative effect of activities in all the *Orundus* in the district can not be overlooked. For instance, if each household produced 2 fruit trees in their *Orundu*, then there would be fruit trees in Nyando District. Agroforestry practices that are suitable for the *Orundu* include fruit trees medicinal trees, wind breaks, kitchen nurseries, live hedges, soil conservation and fodder banks.

The study concludes by stating that although agroforestry is practiced in Nyando District, it is not fully developed. The participation by both men and women is low. There is plenty of unexploited potential which when developed can contribute to poverty reduction and environmental conservation. The *Orundu* is the only niche that the culture has assigned to women to cultivate freely. Although it is small in size, it is continuously cultivated throughout the year and has a higher per unit production than the rest of the farm. It benefits from its close proximity to the house, has high fertility because domestic, poultry and annual waste is often dumped there and it is often sheltered by the homestead fence. This makes it an appropriate pilot plot for testing agroforestry technologies especially those targeting women. Successful agroforestry practices can be replicated on other parts of the farm.

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APPENDIX
APPENDIX 1

Tree/shrub species	Dholuo name	Uses
<i>Balanites aegyptiaca</i>	Otho	Browse, fuel wood
<i>Boscia angustifolia</i>	Ayier gweng	Medicine, ceremonial gathering
<i>Citrus sinensis</i>	Machungwa	Fruits
<i>Eucalyptus</i>	Ndege (Bao) (Kiswahili name)	Building, timber, fuel wood, cash crop, boundary
<i>Euphorbia</i>	Bondo	A poisonous plant used for baking pots, fixing spearheads
<i>Ficus capensis</i>	Ng'owo (Ngou)	Timber, fruits, indicator of water availability due to deep roots
<i>Grevillea robusta</i>	Mutaragwe	Timber, building houses and boats
<i>Jacaranda mimosifolia</i>	Jacaranda (English name)	Shade, fuel wood
<i>Lantana camara</i>	Nyabenda	Fencing, fuel wood, biomass production and livestock feed
<i>Mangifera indica</i>	Maembe (Kiswahili name)	Fruits, shade
<i>Markhamia lutea</i>	Siala	Building, fuel wood, timber
<i>Melia azedarach</i>	Dwele	Building, fuel wood, medicine
<i>Psidium quajava</i>	Mapera (Kiswahili name)	Fruits, shade, implement handles, fuel wood
<i>Senna siamea</i>		Fuel wood, medicine (roots), building
Sisal	Tworo	Rope making, boundary fencing, building, cash crop, fuel wood
<i>Terminalia brownii</i>	Onera	Building houses and boats, fuel wood, shade, fencing
-	Afwong'o	Medicine
-	Alii	Fuel wood, charcoal
-	Bap-rachar	Timber, fuel wood
-	Madat	Timber, fuel wood
-	Nduga	Building, food
-	Ochwoga	Food, medicine
-	Ojuka	Food, fuel wood
-	Okaka	Medicine, decorating floors
-	Ombulla	Fuel wood
-	Ong'ang	Fuel wood
-	Onjolo	Tooth brushes
-	Pap Obino	Timber, fuel wood, medicine
-	Sac	Fuel wood, timber, shade
-	Tera	Tying on grass-thatched roofs to protect against wind
<i>Acacia abyssinica</i> subsp. <i>Calophylla</i>	Ogongo	Charcoal, fuel wood
<i>Acacia senegal</i>	Otiep	Fuel wood, medicine
<i>Albizia corfaria</i>	Ober	Charcoal, fuel wood, medicine
<i>Caesalpinia decapetala</i>	Matata	Fodder, boundary, fencing
<i>Capparis erythocarpos</i>	Ong'ono	Medicine
<i>Carica papaya</i>	Papaya (English name)	Fruits
<i>Casuarina equisetifolia</i>	Pine (English name)	Timber, fuel wood, poles
<i>Cissus rotundifolia</i>	Minya	Ropes
<i>Coleus kilimandschrica</i>	Okita	Medicine
<i>Combretum molle</i>	Keyo	Fuel wood, timber
<i>Commiphora africana</i>	Aru piny	Medicine
<i>Cordia ovalis</i>	Oseno	Boundary, fuel wood
<i>Cyphostemma orondo</i>	Bwombwe	Medicine

<i>Erythria excelsa</i>	Roko	Medicine, timber, fuel wood
<i>Euphorbia tirucalii</i>	Ojuok	Live fencing, fuel wood
<i>Grevillea robusta</i>	Grevillea (English name)	Timber, fuel wood, shade
<i>Grewia trichocarpa</i>	Powo	Medicine, fuel wood
<i>Harrisonia abyssinia</i>	Pedo	Fuel wood, medicine
<i>Hygrophila auricalata</i>	Onduong'o	Fodder
<i>Indigofera spleata</i>	Olando	Basket making, fuel wood
<i>Ipomora kituiensis</i> var. <i>kituiensis</i>	Obinju	Medicine, fuel wood
<i>Juniperus procera</i>	Obudo	Timber, fuel wood
<i>Kigelia african</i>	Yego	Medicine, timber
<i>Lanea stuhlmannii</i>	Kwogo	Medicine, fuel wood
<i>Leuceana leucocephala</i>	Luccenna (English name)	Fodder, fuel wood
<i>Ocimum basilicum</i>	Okinga	Medicine fuel wood
<i>Ormocarpum trichocarpum</i>	Det	Timber
<i>Persea americana</i>	Avocado (English name)	Food, fuel wood, shade
<i>Rhus natalensis</i>	Sangla	Food, fuel wood
<i>Rytigynia neglecta</i>	Anyuka	Fuel wood, building
<i>Sapium, ellipticum</i>	Achak (Opuge)	Fencing
<i>Securinea virosa</i>	Kagno	Medicine, charcoal
<i>Soanum incanum</i>	Ochok	Medicine
<i>Terminalia brownii</i>	Onera	Shade, timber, fuel wood, charcoal
<i>Terminalia mentalis</i>	Umbrella	Shade
<i>Vernonia amygdalina</i>	Olusia	Medicine, fuel wood, shade
<i>Ziziphus mucronata</i>	Lang'o	Boundaries, fuel wood
	Kaladari	Building, fuel wood, timber, fencing, poles, fish traps
<i>Senna siamea</i>	Obino	Building, medicine, timber, fuel wood
<i>Ocimum basilicum</i>	Okinga	Decorating of pots, medicine
-	Oyieko	Livestock feed, fuel wood
<i>Leonotis spp. (Labiatae)</i>	Nyanyodhi	Medicine, fuel wood
<i>Pavetta crassipes</i> (Rubiaceae)	Rabuor	Fuel wood, livestock feed
-	Milosia	Medicine, fuel wood
-	An'gor (Maswak)	Toothbrush, fire wood
<i>Cassia froribunda</i> (Caesalpinaceae)	Nyayado	Medicine, traditional vegetable, livestock feed
-	Kudho Alaktar	Fuel wood, charcoal, livestock feed, fencing, pins
<i>Syzygium cuminii</i>	Jamna	Fruits, shade
<i>Bothriochloa insculpta</i> (Gramineae)	Apuoyo	Fruits, traditional trumpet, traditional vegetable
-	Abuba	Insect control, fuel wood
<i>Phyllanthus guineensis</i> (Euphorbiaceae)	Kagno	Making fish traps, granaries, medicine
<i>Eucalyptus sligna</i>	Maragoli	Building, timer, fuel wood
<i>Trichodesma zeylanicum</i> (Boraginataceae)	Nyalak Dede	Livestock feed, wood fuel
<i>Terminalia brownii</i>	Onera	Building, timber, boat making, medicine
<i>Acacia lhai</i>	Kuth Ali	Fencing, fuel wood, charcoal, natural pin
-	Fuya Dawa	Medicine for livestock
-	Nyayuora	Traditional vegetable, livestock feed
-	Raywe	Brooms, traditional vegetables, livestock feed
<i>Selerocarya birrea</i> (Anacardiaceae)	Ong'ono	Medicine, fuel wood
<i>Achyranthes aspera</i> (Amaranthaceae)	Ayucha	Medicine, livestock feed, for toilet use

Sonchus Schweinfurthii (Compositae)	Achak	Traditional vegetable, medicine, livestock feed
Sesbania sesban	Asao	Fuel wood, livestock medicine, livestock feed
-	Bap-Nyasore	Timber, shade, fuel wood
Ficus spp. (Moraceae)	Osiir	Fish traps, fuel wood, fencing
Tamarindus indica (Caesalpinaceae)	Chwaa	Fruits, food flavoring, shade
Thevetia peruviana	Achak Achak	Fencing, fire wood
-	Bach Rachar	Building, fire wood
-	Bap Rakwaro	Building, fire wood
-	Kateratera	Medicine
-	Sungarua	Medicine
Albizia zygia (Mimosaceae)	Oturbam	Shade, fuel wood
-	Bongenvilizi	Shade
Delonix regi	Ner Jakaranda	Shade
Citrus auratium (rutaceae)	Ndim	Fruits, fuel wood
-	Gter	Firewood, fish traps
-	Reguo, Regro	Shade
-	Ner Poo	Fish traps
Melia azedrach (Meliaceae)	Owino	Fuel wood
Phragmites maximum (Gramineae)	Owino	Fuel wood
-	Ner Knga	Flowers
Musa spp. (Musaceae)	Rabolo	Fruits
-	Kaladal	Building, fuel wood, medicine
-	Nyakima	Building, fuel wood, medicine
Asparagus racemosus (Liliaceae)	Obudo	Furniture, building, fuel wood
Cissus rotundifolia (Vitaceae)	Minya	Rope, medicine
-	Afit	Medicine, fuel wood
-	KuthKiyombi	Leaves for treating blot in animals
-	Kworo	Building fences
-	Mineke	Appetizer
-	Nyateratera	Dye
-	Obong'o	Seeds used as food
-	Ygo	Medicine
Aberia caffra	Kayaba	Ornamental, fencing
Acacia brevispica	Osiri	Building
Acacia drepanplobium	Odugo	Building, fuel wood
Acacia polycantha	Ogongo	Fuel wood, building, fencing
Acacia spp	Kudho (Alii)	Fence, charcoal, fuel wood, medicine
Acacia senegal	Kuth Otiep	Charcoal, firewood
Acalypha fruticosa	Olando	Medicine for stomach ailments
Albizia coriaria	Ober	Medicine, furniture
Aloe species	Ogaka	Treating poultry diseases, boundaries
Cassia didymoboirya	Owino	Medicine
Cassia siamea	Ndege	Building, furniture, fuel wood, charcoal, treating bulls, leaves for treating colds.
Cassia siamea	Oyieko	Building, fuel wood
Cissus rotundifolia	Minya	Dye
Dadoaea viscosa	Okinga	Medicine
Erlangea cordifolia	Rabuor	Medicine for colds
Teclea nobilis	Madat	Walking sticks, fuel wood
Tithonia diversifolia	Akech	Medicine for stomach ailments
Ficus spp	Bongu	Timber
Gomphocarpus semilunatus	Obwo	Medicine
Maerua edulis	Amoyo	Medicine

<i>Oncoba spinosa</i>	Kuth (Sae)	Charcoal, fuel wood
<i>Ricinus communis</i>	Odagwa	Oil extract
<i>Vernonia auriculifera</i>	Olusia	Medicine, fuel wood
	Ombuto	Fruit
	Gam Mar Othinyo	Firewood, glue
<i>Alphania senegalensis</i>	Ochol	Fuel wood, shade, food, windbreak
<i>Acacia drep.</i>	Adugo	Fuel wood, timber, fodder, medicine
<i>Ochna ovata</i>	Ongang'	Fuel wood, fencing, fodder, food
<i>Acacia spp.</i>	Sai	Medicine
<i>Taveta peruviana</i>		Fuel wood, fencing

Source: Adapted from PRA Reports

APPENDIX 2
HOUSEHOLD QUESTIONNAIRE (GENERAL)

District: _____ Questionnaire Number: _____
 Division: _____ Name of Interviewer: _____
 Location: _____ Date of Interview: _____
 Sub-location: _____
 Village: _____

1. Name of Respondent / Head of Household (optional) _____

2(a) Household details

Serial No.	Relation to head of Household	Marital Status	Age	Sex	No. of Children	Level of Education	Occupation	Income	
								Per month	Per year

N:B For marital status use the code below
 S - Single and never married before
 D - Divorced
 W - Widowed
 F1 - First wife in a polygamous marriage
 F2 - 2nd wife
 F3 - 3rd wife

2(b) When did you come to this area? (Year) _____
 Where did you come from? (Name of District) _____

Why did you come to this area? _____

3. Household Expenditure

Item	Cost per day	Cost per month	Per year
a Food			
b Water			
c Fuel			
d Medical			
e Transport			
f Education			
g Housing			

4. What are your sources of income? (To be Revisited)

Source of Income	How Much?	The Period (e.g. per year, per day)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

5. What do you estimate as your

- a) Monthly income _____
 b) Annual Income _____

7. Explain the Division of labour within the household. (List the duties of each below)

Mother	Father
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

7. Land Issues

Total size of land (in acres)	Size of Homestead (in acres)

8. a) When did you acquire this land? (Indicate the year)

c) How did you acquire it? (Tick the correct answer)

Bought Inherited Allocated by GOK

d) If you bought it, how much did you pay for it? (Per acre / for the whole parcel)
 Kshs _____

9(a) AGRICULTURE (Tick the ones on your farm)

Agricultural activities (Cultivation)
1. Sugar Cane Farming
2. Maize Farming
3. Sorghum Farming
4. Cotton Farming
5. Rice Farming
6. Fruit trees
7. Vegetable Farming

9(b)

Agriculture (Livestock)	Acreage of pastured land
1. Cows	
2. Sheep	
3. Goats	

10. AGROFORESTRY (Tick the ones on your farms)

Agroforestry activities
1. Fruit Trees
2. Live fences
3. Wood lots
4. Boundary Planting
5. Fodder Banks
6. Home Gardens
7. River Bank Stabilization
8. Improved Fallows
9. Homestead Planting
10. Pasture Improvement

11.(a) In which of these activities are women involved? (To be answered by the wife)

Agroforestry Activities	Are the women allowed to plant the trees or shrubs YES/NO	Are the women allowed to sell the tree products YES/NO	Was the woman the initiator of this activity YES/NO
1. Fruit trees			
2. Live fences			
3. Wood lots			
4. Boundary Banks			
5. Fodder Banks			
6. Home Gardens			
7. River Bank Stabilization			
8. Improved Planting			
9. Homestead Planting			
10. Pasture Improvement			

11(b) Do Agricultural extension workers visit your farm? YES / NO

11(c) Who do they deal with ? (tick the correct answer – can be more than one)

The husband [] The wife [] The son []

12. a) Do you know what *Orundu* is? YES/NO
 b) DO you have an *Orundu*? YES/NO
 c) How big is your *Orundu*? (Estimate) Tick the nearest.
 Less than 0.05ha-----
 0.05-0.1(0.25ha) -----
 0.15-0.2ha-----
 More than 0.2ha (0.5) -----
 d). What activities go on within the "*Orundu*"? Tick.
 Traditional vegetables-----
 Cabbages-----
 Sukuma Wiki-----
 Onions-----
 Tomatoes-----

APPENDIX B

HOUSEHOLD QUESTIONNAIRE (CASE EXAMPLES)

District: _____ Questionnaire Number: _____
 Division: _____
 Name of Interviewer: _____
 Location: _____
 Date of Interview: _____
 Sub-location: _____
 Village: _____

1. Name of Respondent / Head of Household (optional) _____

2. AGROFORESTRY

Agroforestry activities	Area covered or No. of trees	Cost per unit	Income per month	Obtained per year	Main reason for practice

N.B Reason for practice – use the letters as follows :-

- E - Soil conservation
- I - Income
- W - Wood fuel
- F - Food
- G - Greening the environment

Choose only one reason the one you consider to be the most important reason behind your decision

3. Areas vulnerable to soil erosion in the rural landscape can be protected by trees cover and other Agroforestry practices.

These areas include :-

1. Watersheds []
2. Steep Slopes []
3. River Banks []
4. Roads / paths []
5. Pastures []
6. Farm Land []
7. The Homestead []

In which of these areas are you practicing Agroforestry ? tick the correct one

4. What does your culture say about women planting trees in each of these areas. Explain. What is the value behind this tradition _____

5. Do you practice what your culture says about planting trees or not planting trees? Explain why you do or do not ? _____

6. Do you think women should be allowed to plant all types of trees? Explain

7. If a single woman wants to plant a tree whom does she ask for permission?

8. If a window wants to plant a tree whom does she need to ask for permission?

9. In your opinion which women have most freedom to use the land in whichever way they choose
- Married women in a monogamous marriage (with living husband) []
 - Windows []
 - Single women (female headed house) []
 - Educated women []
 - Less educated (below 30 years) []
 - Middle aged women (30 – 55 years) []
 - Old women (55 and above years) []
 - Married women wit a living husband who are not first wives but are in a polygamous marriage []
 - Married women with a living husband who are first wives in a polygamous Marriage []

Explain the reasons behind each level of Access

N:B On a scale of 1-4

- 1 - A lot of freedom/access
- 2 - Average freedom/access
- 3 - A small degree of freedom access
- 4 - No access

10. What activities go on within the “Orundu”

Type of activity	Area it covers	Cost per unit	Income		Other benefits
			Per month	Per year	

11. What are the cultural beliefs and values associated with the *Orundu*?

12. How have the cultural beliefs affecting each activity? Explain

13. Where else apart from the *Orundu* on the farm can a woman plant what ever crops she wants without asking for permission from any one?

14. Suggest ways of improving women's participation in Agroforestry.

APPENDIX C

INTERVIEW SCHEDULE FOR THE GOVERNMENT OFFICERS

1. What are the main activities contributing to Rural Development in Nyando District?
How do each of these activities contribute to rural development in terms of
 - (a) *Income generation*
 - (b) *Source of employment*
 - (c) *Food supply*
 - (d) *Housing*
 - (e) *Water supply*
 - (f) *Wood fuel supply*
 - (g) *Provision of community facilities and infrastructure*
 - (h) *Environmental conservation.*

2. To what extent is Agroforestry practiced in the District?
 - (a) Are there any Government initiated or coordinated Agroforestry programmes / projects within Nyando District?
 - (b) Are there any Agroforestry projects by NGO's and C.B.O's within Nyando District?

3. What is the Rural poverty situation in Nyando District?
How is Rural poverty manifested in Nyando?
 - (a) What do you think are the causes of this situation you have described?
 - (b) Is the government doing anything about this situation? Explain.
 - (c) Give suggestions of possible solutions.
 - (d) Is there a role for women? Explain.

4. Is the Rural Environmental deterioration in Nyando District?
 - (a) How is it manifested ?
 - (b) What do you think are the possible cause of the situation you have described?
 - (c) Is the government doing anything about this situation? Explain.
 - (d) Give suggestions of possible solutions or interventions.
 - (e) Is there a role for women? Explain.

5. What is the food situation in Nyando District?
 - (a) What do you think are the possible causes of this food situation?
 - (b) Is the government doing anything about this situation? Explain.
 - (c) Give suggestions or interventions on possible solutions or interventions to this situation.
 - (d) Is there a role for women? Explain

6. What is the Rural wood fuel situation in Nyando District?
 - (a) What do you think are the possible causes of this situation?
 - (b) Is the government doing anything about the situation? Explain.
 - (c) Suggest possible solutions or interventions.
 - (d) Is there a role for Women? Explain.

7. What is the Rural domestic water supply situation in Nyando District?
 - (a) What do you think are the possible causes of this situation?
 - (b) What is the government doing about this situation? Explain.
 - (c) Suggest possible solutions and interventions.
 - (d) Is Agroforestry a possible intervention? Explain
 - (e) Is there a role for women? Explain

8. What is the Rural Housing situation in Nyando District?
 - (a) What do you think are the possible causes of this situation?
 - (b) Is the government doing anything about this situation? Explain.

- (c) Suggest possible solutions or interventions.
 - (d) Is Agroforestry a possible intervention? Explain
 - (e) Is there a role for Women? Explain
9. What is the employment situation in Nyando District?
- (a) What do you think are the possible causes of this situation?
 - (b) Is the government doing anything about this situation? Explain.
 - (c) Suggest possible solutions or interventions.
 - (d) Is Agroforestry a possible intervention? Explain
 - (e) Is there a role for women? Explain
10. What is the income situation in Nyando District?
- (a) What are the sources of income?
 - (b) What are the levels of income?
 - (c) What are the demands on income?
 - (d) What do you think are the possible cause of this situation?
 - (e) Is the government doing anything about this situation? Explain.
 - (f) Give suggestions of possible solutions or interventions.
 - (g) Is Agroforestry a possible intervention? Explain
 - (h) Is there a role for women? Explain
11. Describe the Rural access roads situation in Nyando District?
- (a) Who are the providers?
 - (b) Who maintains them?
 - (c) What are the demands on these facilities?
 - (d) What do you think are the possible cause of this situation?
 - (e) Is the government doing anything about this situation? Explain.
 - (f) Give suggestions of possible solutions or interventions.
 - (g) Is Agroforestry a possible intervention? Explain
 - (h) Is there a role for women? Explain.
12. What comments can you make on the relationship between development and the environment?
- (a) Describe your experience of the above in Nyando district.
 - (b) Give explanations.
 - (c) Give recommendations.
 - (d) How does Agroforestry relate to the above situation? Explain
 - (e) Is there a role for women? Explain.
14. Is development in Nyando District carried out at the expense of the Environment?
- (a) Nyando district is a watershed but has no Gazetted Forest. What is the Government Policy to ensure proper watershed management? I.e. ensure that there are enough trees to sustain the watershed.
 - (b) Is Agroforestry a possible intervention?
 - (c) Is there a role for women?

APPENDIX D**INTERVIEW SCHEDULE FOR NGO'S AND CBO'S**

1. What is the name of your organization
2. When was it formed?
3. How long has it operated in
 - (a) Kenya
 - (b) Nyando District
 - (c) Muhoroni Division/Lower Nyakach
 - (d) Koru Location/North East Nyakach
4. What are your areas of activities?
5. So far what are the activities you are involved in within
 - (a) Kenya
 - (b) Nyando District
 - (c) Muhoroni Division/Lower Nyakach
 - (d) Koru Location/North East Nyakach
6. What has your organization contribution to Rural Development in terms of
 - (a) Income generation
 - (b) Employment
 - (c) Rural Wood /fuel supply
 - (d) Rural food security
 - (e) Rural housing
 - (f) Provision of Rural Community facilities and infrastructure
 - (g) Rural Environmental protection
7. What are the views of your organization towards Agroforestry?
8. Has your organization involved women groups in your activities? Explain.
9. Is there scope within your constitution to incorporate Agroforestry activities which promote Environmental management through women? Explain.

APPENDIX E**FOCUS GROUP DISCUSSION GUIDELINES**

1. Selection of focus group members.
 - (1) The District Officer
 - (2) The Chief
 - (3) The Assistant Chief
 - (4) 2 male opinion leaders
 - One recommended by the D.O.
 - One recommended by the Chief
 - (5) 2 female opinion leaders
 - 1 official representative of a woman's group
 - 1 official representation from an active Non Governmental Organization in the location
 - (6) 2 female adult members of the community picked at random
 - (7) 2 male adult members of the community picked at random
 - (8) 4 male adult members of the community practicing extensive Agroforestry with the location.
 - (9) 4 female adult members of the community practicing extensive Agroforestry within the location

Venue: The D.O.'s Office

Agenda:

- I Meeting to be chaired by the D.O.
- II Introduction of members
- III Guided Questions to the group

APPENDIX F

FOCUS GROUP DISCUSSION GUIDELINES (MIXED)

1. Rural Development.
What is your view on Rural Development in your location?
2. What activities contribute to Rural Development in your location in terms of
 - (a) Income generation
 - (b) Source of employment
 - (c) Food supply
 - (d) Rural Housing
 - (e) Provision of Community facilities and infrastructure
 - (f) Rural water supply
 - (g) Wood supply
 - (h) Environmental Protection
2. What is the Rural Poverty situation in Koru location/North East Nyakach? Describe
 - (a) What do you think are the causes of the above situation?
 - (b) What is the government doing in response to this situation?
 - (c) Give suggestions of possible solutions and interventions.
 - (d) Is Agroforestry a possible intervention?
 - (e) Is there a Role for women? Explain.
3. What are your views on Agroforestry as a form of Agriculture? Explain
 - (a) What Agroforestry activities are practiced in Koru location/North East Nyakach?
 - (b) How do they contribute to Rural Development in terms of
 - Income generation
 - Source of employment
 - Food Supply
 - Housing
 - Water Supply
 - Wood fuel supply
 - Community facilities and infrastructure
 - Environmental protection
 - (c) What are the common trees/plants used for Agroforestry in Koru location? Give the names in English, Kiswahili & mother tongue where possible the botanical name.
 - (d) Which of these trees are of interest to women? Why?
5. What Role do women play in Agroforestry?
 - ❖ Which trees can they plant? Why?
 - ❖ Which trees can they not plant? Why?
 - ❖ Which tree products can they sell? Why?
 - ❖ Why not the others?
6. The Luo culture allows the women considerable freedom with regard to farming around the homestead. This home garden is referred to as "*Orundu*" by some of the Luos.
 - (a) What other names are used in this areas for this garden?
 - (b) What cultural values are related to this practice?
 - (c) What are some of the activities women carry out in the *Orundu*?
 - (d) Of what importance are these activities the women carry out in the *Orundu*?
 - (e) Do they contribute to:
 - Income generation
 - Employment
 - Food supply
 - Water supply
 - Rural Housing
 - Wood fuel supply
 - Provision of community facilities and infrastructure
 - Environmental protection
7. Can the women of your location use the *Orundu* for Agroforestry?
 - (a) What are the advantages?
 - (b) What are the disadvantages?

- (c) What are the limitations?
8. II) Suggest possible Agroforestry activities that the women can carry out in the *Orundu* to enhance rural development and Environmental Management
 9. II) Suggest uses of the *Orundu* different from Agroforestry.
 10. Which alternative (I or II) would lead to reducing Rural poverty? Why?
 11. Which of the two (I & II) would lead to better protection of the environment? Why?
 12. Which one lead to sustainable rural development? I.e. development with environmental protection? Explain

APPENDIX G

FOCUS GROUP DISCUSSION GUIDELINES (WOMEN ONLY)

1. Rural Development.
What is your view on Rural Development in your location?
2. What is the Rural Poverty situation in Koru location/North East Nyakach? Describe
 - (a) What do you think are the causes of the above situation?
 - (b) What is the government doing in response to this situation?
 - (c) Give suggestions of possible solutions and interventions.
 - (d) Is Agroforestry a possible intervention?
 - (e) Is there a Role for women? Explain.
3. What are your views on Agroforestry as a form of Agriculture? Explain
 - (a) What Agroforestry activities are practiced in Koru location/North East Nyakach?
 - (b) How do they contribute to Rural Development in terms of
 - Income generation
 - Source of employment
 - Food Supply
 - Housing
 - Water Supply
 - Wood fuel supply
 - Community facilities and infrastructure
 - Environmental protection
 - (c) What are the common trees/plants used for Agroforestry in Koru location? Give the names in English, Kiswahili & mother tongue where possible the botanical name.
 - (d) Which of these trees are of interest to you as women? Explain why?
 - (e) Do extension workers promote these trees which are of interest to women?
4. What Role do women play in Agroforestry?
 - Which trees can they plant? Why?
 - Which trees can they not plant? Why?
 - Which tree products can they sell? Why?
 - Why not the others?
5. The Luo culture allows the women considerable freedom with regard to farming around the homestead. This home garden is referred to as "*Orundu*" by some of the Luos.
 - (f) What other names are used in this areas for this garden?
 - (g) What cultural values are related to this practice?
 - (h) What are some of the activities women carry out in the *Orundu*?
 - (i) Of what importance are these activities the women carry out in the *Orundu*?
 - (j) Do they contribute to:
 - Income generation
 - Employment
 - Food supply
 - Water supply
 - Rural Housing
 - Wood fuel supply
 - Provision of community facilities and infrastructure
 - Environmental protection
6. Can the women of your location use the *Orundu* for Agroforestry?
 - (d) What are the advantages?
 - (e) What are the disadvantages?
 - (f) What are the limitations?
7. II) Suggest possible Agroforestry activities that the women can carry out in the *Orundu* to enhance rural development and Environmental Management
8. II) Suggest uses of the *Orundu* different from Agroforestry.
9. Which alternative (I or II) would lead to reducing Rural poverty? Why?

10. Which of the two (I & II) would lead to better protection of the environment? Why?
11. Which one lead to sustainable rural development? I.e. development with environmental protection? Explain

TRADITIONAL VEGETATION

(Osuga, Boo, Mitto, Deg Akeyo, Susa, Apoth, e. t. c.)

1. (a) Do you grow any vegetables?

YES [] NO []

(b) If yes, which ones??

- Osuga []
- Boo []
- Deg Akeyo []
- Mitto []
- Susa []
- Apoth []
- Others []

2. DO you use them for domestic only?

YES [] NO []

3. Do you sell any?

YES [] NO []

SISAL QUESTIONNAIRE

1. Do you have any sisal growing on your farm?

YES [] NO []

2. Did your husband plant any sisal on your farm?

YES [] NO []

3. Did you plant any sisal in the farm?

YES [] NO []

Did you find any sisal growing on the land when you bought/inherited it ?

YES [] NO []

- 5 (a), Does your husband use the sisal?

YES [] NO []

(b). If yes, what are the uses?

(a). Do you use the sisal? YES [] NO []

(b). If yes, what do you use it for?

(c). Do you sell the sisal? YES [] NO []

Focus Group Discussion 1 (mixed)

Venue : Chief's Office Koru
 Date : January 18th 2002
 Time : 9.00 – 1.00 p. m

Attendance

1. Leah A. Onyango – Researcher
2. George Agutu – Chief Koru Location
3. Patrick O. Abour – Ass./Chief Nyando Sub-location
4. Pius Dinda – Ass./chief Koru Central
5. Lorna Oganda
6. Pius Otiwa
7. Domnicus Okoko
8. Gilbert Ongala
9. Walter Oloo
10. Allan Otieno
11. Luke Onyango – Divisional Soil Conservation (Muhoroni Division)
12. Alando Owiti – Divisional Crops officer (Muhoroni Division).
13. Wilkister Onjonga
14. Remjus Amimo
15. Jeniffer Wamboga
16. Joshua Benson Odhiambo
17. Elly Nyabondo
18. Beatrice Ayango
19. Jared Odhiambo – Research Assistant
20. Seline Onyango – Research Assistant
21. Henry Odhiambo – Research Assistant
- Walter Nyaranga – LVEMP (Nyando Sub-location)

Focus Group Discussion II (Mixed)

Venue : chief's Office Katito
 Date : January 12th 2002
 Time : 10.00 – 2.00 p.m.

Attendance

1. Leah A. Onyango – Researcher
 2. John Odhiambo Wariga – Ag. Chief – North East Nyakach Location
 3. John Akello – Ass./Chief Agoro West Sub-location.
 4. Japheth Muga – Extension Worker (retired).
 5. Herine Onyisi
 6. Rispr Muhonya
 7. Jacob Abuto
 8. Janet Odhiambo
 9. Peter Onyango
 10. Robert Agola
 11. Wilfrida Okumu
 12. Fredrick Abudha
 13. Anne Dwelle – Research Assistant
 14. Jared Odhiambo – Research Assistant
 15. Timothy Ogola – Research Assistant
- Zakayo Jalango Olwal

Focus Group Discussion III (Women only)

Venue : Chief's Office Katito
 Date : 26th February 2002
 Time : 9.00 a.m. to 2.00 p.m.

Attendance

1. Leah A. Onyango -Researcher
2. -Chief, North East Nyakach Location
4. Phoebe Awino Elizabeth Otieno
5. Jane Okuu
6. Hellen Otieno
7. Pamela Osee
8. Winifried Akumu
9. Abigail Okal
10. Evalyn Otieno
11. Estehr Okelo
12. Jane Okuta
13. Doris Agao
14. Penna Sikot
15. Benter Opiyo
16. Justine Okoth
17. Anne Dwelle – Research Assistant
18. Jared Othiambo – research Assistant
19. –Agriculture Extension Worker.

Focus Group Discussion IV (Women only)

- Venue : Chief's Office Koru
 Date : 19th March 2002
 Time : 9.00 a.m. to 2.00 p.m.

Attendance

1. Leah Onyango – Researcher
2. Willis Oyieno – Ass. Chief Homa Lime
3. Rael Ogada
4. Herina Atieno
5. Jeniffer Wamboga
6. Lorna Ogada
7. Hellen Gaya
8. Teresia Ombe
9. Wilfrida Othundi
10. Hellen Achieng
11. Filgona Onyango
12. March Adhaya
13. Susan Achieng Olango
14. Josephine Mbai