PARTICIPATORY AGROFORESTRY EXTENSION: THE EXPERIENCE WITH SMALL-SCALE FARMERS IN TRANS NZOIA DISTRICT, RIFT VALLEY PROVINCE, KENYA.

BY

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DECLARATION

This is my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

To my parents with a lot of love and gratitude, for instilling basic life's virtues and for their fervent prayers that have seen me this far.

Good extension does not mean: *telling farmers what to do, forcing change on farmers, that you [extension agent] know more than others [farmers], and that modern methods are always better than traditional ones.*

It does [however] mean: *talking with the farmers, working with farmers, learning from farmers, [and] suggesting new approaches to farmers.*

(Quoted in Chilufya and Tengnäs, 1996)

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ABSTRACT

This study was conducted in Trans Nzoia District and it pursued the concept of farmer participation in agroforestry extension with particular reference to small-scale farmers. The study identified extension methods and the extent to which extension agencies have involved the farmers in extension services. Emphasis was laid on factors that inhibit farmers' participation both at the agency and farmer levels. The study further examined the existing local potential among farmers and within their environment that could be harnessed to promote sustainable agroforestry practices.

In carrying out the study, a questionnaire, an interview schedule and a guide, and an observation record sheet were used to collect data. Data collected were collated, coded and analysed using SPSS 6.1 version. Data were analysed descriptively using multi-response cross-tabulations and contingency tables that generated frequencies and percentages. Additional descriptive analytical tools, such as, SWOT analysis and content analysis were used to treat descriptive data generated by focus group interviews with small-scale farmers and interviews with the extension fraternity. Statistical significance testing was also employed using the Chi-square at 0.05 alpha level to test differences, relationships and associations between variables.

The study identified six principal methods in agroforestry extension. There was however, a variation between the methods used across institutions although a shift towards group approach by majority of the institutions was revealed. Additionally, farmers were involved in the initial stages of planning, decision making and implementation. In the other levels of participation, i.e. monitoring and evaluation, farmers' inputs were conspicuously absent. The study further revealed that farmers who had participated in extension programmes were better adopters of agroforestry than those who had not.

The study established constraints at the agency and farmer levels inhibiting the implementation of participatory extension programmes. Constraints at the agency level included staffing inadequacies with regard to number, training and motivation, paucity of support resources in transport and back-up literature, and poor inter-agency co-ordination. These problems implied poor preparation in implementing participatory methods in extension. Farmer-centred problems included poor funding of groups, poor attendance of meetings, passiveness of group members, and conflicts among farmers.

Finally, the study revealed a wealth of indigenous knowledge in seedling production and tree management. Farmers also exhibited a deep grasp of knowledge on tree uses reflected in their preference for particular tree species. The study further found out that the existing local potential among farmers has been less utilised in the planning and implementation of extension programmes. From the study's findings, many options exist for future extension contact, among them the local groups hitherto overlooked in extension delivery.

Based on the research findings therefore, the study recommends the provision of an enabling environment by extension agencies to facilitate the effective implementation of farmer involvement in extension programmes. This demands the review of policies and restructuring of the institutional framework within which agroforestry extension takes place to overcome the major constraints faced by the institutions in this respect. Hence support and commitment is needed in the areas of physical and human resource development to overcome constraints of staffing and support resources. This should also include inter-agency co-ordination, the building of an effective monitoring and evaluation mechanism, and exploring other options to enhance the role of farmers in extension programmes to galvanise the existing extension efforts. The research concludes by proffering recommendations for areas of further research that are necessary if the concept of farmer participation is to be fully realised.

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LIST OF ACRONYMS AND ABBREVIATIONS

CARE: Co-operative for American Relief Every Where

DA: Department of Agriculture

DANIDA: Danish International Development Agency

FAO: Food and Agricultural Organisation of the United Nations

FD: Forest Department

FESD: Forestry Extension Service Division

FINIDA: Finish International Development Agency

ICRAF: International Centre for Research in Agroforestry

IUCN: The World Conservation Union

KARI: Kenya Agricultural Research Institute

KEFRI: Kenya Forestry Research Institute

KENGO: Kenya Energy Non-governmental Organisation

KWAP: Kenya Woodfuel and Agroforestry Programme

KWDP: Kenya Woodfuel Development Programme

LLP: Local Level Planning

NGO: Non-governmental Organisation

ODA: Overseas Development Agency

PAME: Participatory Assessment, Monitoring and Evaluation

PRA: Participatory Rural Appraisal

RAES: Rural Afforestation and Extension Service

RELMA: Regional Land Management Unit

RSCU: Regional Soil Conservation Unit

SIDA: Swedish International Development Agency

SWCP: Soil and Water Conservation Programme

USAID: United States Agency for International Development.

VIAP: VI Agroforestry Project

WB: World Bank

CHAPTER ONE

INTRODUCTION

1.1 Background to the Problem

The concept of peoples' participation has entered the core of global development and environmental agenda. Among agroforestry researchers and policy makers, people's participation is now widely acknowledged as an integral component in development, dissemination, adoption and enhancement of agroforestry technologies and sustainable agroforestry practices.

Participatory Rural Appraisal (PRA), an expanding group of techniques and approaches, has been advanced to enhance the involvement of the local people in identifying their problems and needs, ranking them, collecting relevant data, proposing and deciding a plan of action, and in the implementation of the selected plan (Kilewe, *et al.* 1988). It is a recognition that local people and their knowledge, are the basis of the solution to their problems and needs (Chambers and Guijt, 1995). This is a field that falls within the realm of extension.

In the context of rural development, the term *extension* refers to the work of 'change agents' to catalyse awareness, organisation, information and technology among farmers and other land users (Scherr, 1990). Agroforestry extension is therefore charged with the responsibility of bringing the message of agroforestry to rural communities. According to Vergara *et al.* (1989), the message should emphasise sustainability of the environment and optimising farmers' income.

Extension is further expounded by Tengnäs (1994) as ideally embodying the integration of indigenous knowledge and derived knowledge, attitudes, and skills to determine what is needed, how it can be done, and what additional assistance is available to overcome particular obstacles. This however, can not be achieved if local people are not actively involved. Participatory approaches ensure that local people are involved in extension.

A major strength of participatory approaches is that they take their direction and emphasis on farmers' existing situation. They are therefore, according to Scherr (1990), less likely to promote commodities or technologies that meet the external objectives but are not adopted because they do not meet the local demands or production conditions. Thus, participatory extension approaches can address highly heterogeneous needs of farmers better than centrally programmed approaches that are a characteristic of top-down extension strategies.

This is supported by the fact that whereas institutions can give directives and financial support, the actual managers are the farmers (Budd, *et al.* 1990). Surveys in some humid, high potential areas of Kenya show that over half of the farmers engage in some form of rural tree planting (Wamugunda, 1988). This trend needs to be promoted given the fact that only about 2.3 percent of the total land area in the country is under gazetted forest cover (Wass, 1995).

A particular concern, however, should be the small-scale farmers striving to improve their production systems, their socio-economic status and contribution to environmental management (Ngoda, 1988), with limited capital for production

(Khurana and Khosla, 1993) and shrinking land holdings coupled with inadequate technical assistance (Government of Kenya, 1994c). Decentralisation of decision-making through farmers' involvement in extension is one way in which farmers' needs and abilities can best be understood. This, in turn, can help re-orient external support and establish workable partnerships that can lead to sustainable agroforestry.

In retrospect, agroforestry extension has undergone marked changes, shifting from a 'physical' to a 'people' focused approach. It is now widely acknowledged that agroforestry possibilities are determined by socio-cultural and socio-economic conditions (Emerton *in* Mugah, 1996). This humanistic approach revolutionises previous extension strategies that were based on top-down approaches. The major purpose being to improve peoples' welfare and livelihood, and enhance environmental quality.

On the ground, however, extension agencies meet challenges such as poorly co-ordinated activities leading to duplication of roles and often conflicting messages and limited resource capacities both physical and human (Government of Kenya, 1994b; Government of Kenya, 1988 and Iyamabo, 1990). Objections have also been raised about biases in extension where particular groups such as the rural elite (those less poor and more influential), males, users of services and adopters of practices are favoured (Abel, *et al.* 1988 and Kerkhoff, 1990). Overcoming these challenges is a prerequisite in agroforestry development in the country. Embedded in participatory agroforestry extension, is the call for concerted efforts from all actors in agroforestry. Contribution(s) from each actor, however meagre, can synergistically promote sustainable agroforestry.

Embracing participatory agroforestry extension by extension agencies should nevertheless raise a lot of expectation and be viewed as the ultimate solution to sustainable agroforestry. With it come associated problems. Some of these problems have been broadly categorised by Cook and Bonitabus (1997) into three categories, namely: rural-centred problems, extension workers' problems and extension managers' problems. Rural-centred problems include *inter alia* farmers' incorrect adoption of advice, gender bias and difficulty working in-groups. Extension workers' problems are given as poor reporting, incompetence and low morale. Lastly, problems of extension managers comprise unrealistic targets and management inadequacies. These problems pose challenges to the realisation of participatory agroforestry and may even negate the achievement of sustainable agroforestry hence the need to redress them.

Based on this background, the present study aimed at investigating the delivery of agroforestry extension services among small-scale farmers in Trans Nzoia District. It was in recognition of the diverse benefits offered by agroforestry to often resource-constrained farmers hence the choice of small-scale farmers. In addition, the potential offered by participatory extension amidst failures of top-down approaches in extension laid a good foundation for this study.

1.2 Statement of the Problem

Participatory agroforestry extension has been widely advocated as the key to sustainable agroforestry. In view of the failures of top-down agroforestry extension strategies and the need to focus extension on farmers' existing situation (their needs, problems and potential), extension agencies in Trans Nzoia District are integrating more participatory strategies in their frameworks.

The extent to which participatory strategies in agroforestry extension have been implemented, however, is still scantly documented. This notwithstanding, the overriding concern is that little is known of the problems that are being faced. Thus, this study sought to address itself to the problems inhibiting effective implementation of participatory extension programmes. The purpose of the study, therefore, was to identify problems and suggest possible ameliorative measures. One among other ameliorative measures, but within the precincts of participatory agroforestry extension so far not yet documented, is the harnessing of local potential by agroforestry agencies. Thus the study was aimed at providing a broad benchmark through which future interventions in agroforestry could be achieved.

1.3 Research Questions

This study sought to answer the following questions:

a) how and in what areas do extension agencies involve farmers in the delivery of extension services?

b) what problems do extension agencies and farmers face in carrying out participatory agroforestry extension?

c) what local potential in the form of material, indigenous knowledge and opportunity for contact is available that is pertinent to agroforestry extension programmes?

1.4 Research Objectives

The broad objective of the study was to examine the status of agroforestry extension services with regard to farmer participation in Trans Nzoia District of the Rift Valley Province.

The Specific objectives were to:

(a) identify the methods and establish the extent to which agroforestry extension agencies involve the farmer in the delivery of their services,

(b) identify the problems that hinder farmer participation in agroforestry extension both at the agency and farmer levels,

(c) examine the existing local potential inherent among farmers in the form of material, indigenous knowledge and opportunity for contact that is pertinent to agroforestry extension programmes.

1.5 Research Hypotheses

The research hypotheses were:

(1) there are differences in delivery of extension services and in the adoption of agroforestry between contact and non-contact farmers.

(2) there is an association between the manner in which farmer-centred problems manifest themselves and the contact institution the farmers are affiliated to.

(3) There are gender disparities in opportunities for extension contact through local groups as avenues for optimising local potential use in agroforestry.

1.6 The Study Area

1.6.1 The Geographical Location

Trans Nzoia District is situated in the Western part of Kenya. The republic of Uganda, Bungoma and Kakamega Districts border it to the West, Pokot District to the East and Marakwet and Uasin Gishu to the Southeast (see Fig.1.1). The District lies at approximately latitude 0^{o} 5^{1} and 1^{o} 18^{1} North of the equator and longitudes 34^{o} 38^{1} and 35^{o} 23^{1} East of the green meridian. With an area of 2468 square kilometres, it covers 0.42 percent of the whole republic and 1.4 percent of the Rift valley Province (Government of Kenya, 1994c).

1.6.2 Main Physical and Agricultural Characteristics

Trans Nzoia forms a continuation of the fertile Uasin Gishu plateau beyond ('trans') the Nzoia River. Its topography is generally flat with gentle undulation rising steadily to Mt. Elgon (4,313m) in the Northwest and Cherengani hills (3,371 m) in the East. Most of the District has an elevation of 1800 m and 1900 m. The altitude however, decreases to 1400 m above sea level in the North, along the border with West Pokot (Jaetzold and Schmidt 1983; Government of Kenya, 1989 and Agtsiva, 1985).

The District has a highland equatorial type of climate, with a fairly well distributed average annual precipitation of 1,120 mm and an average temperature of 18.6 ^{0}c (Government of Kenya, 1996). The rainfall peaks between April-May and July-August. There is only one dry period starting mid-November and ending mid-March (Jaezold and schmidt, 1983).

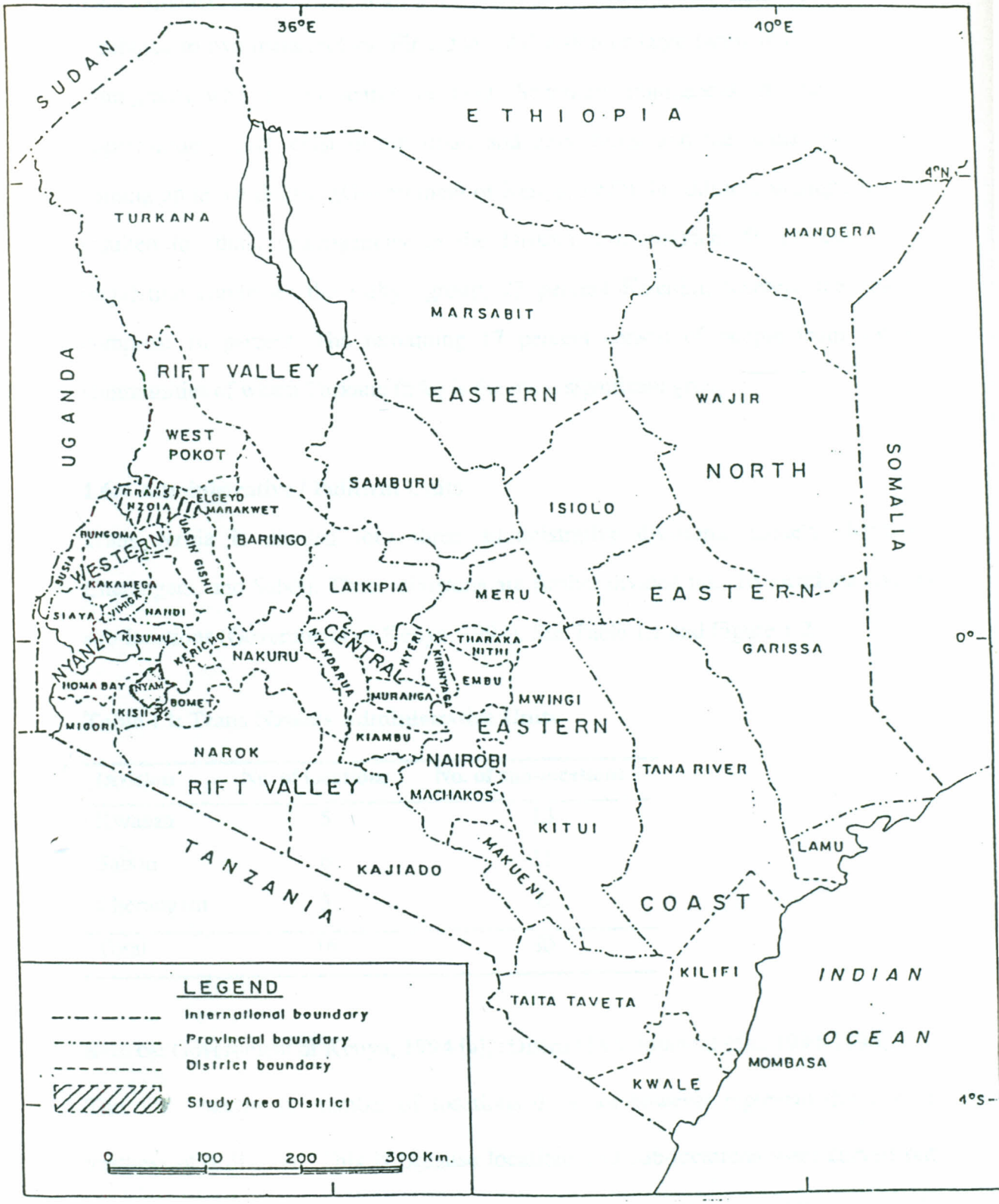
The central part of the District consists of well-drained, very deep, red to dark soils (mainly *ferralsols).* These soils have moderate to low fertility. The lower slopes of Mt. Elgon are covered with red and brown clays, derived from volcanic ash, which have a high fertility. The hills and steep slopes of Mt. Elgon, Cherangani and the North boundary zone have rather stony soils, with variable fertility (Jaezold and scmidt, 1983; Government of Kenya, 1989, and; Agatsiva, 1985).

Overall, the topography, rainfall distribution, temperature and the soil characteristics make the District suitable for maize growing and dairy farming. Besides maize, other important crops cultivated in the District are beans, wheat, sunflower, coffee and tea.

1.6.3 Population

According to the Government of Kenya (1998) Economic Survey, the District's population was estimated at 462,748. Population growth has been quite fast during the last few decades. For instance, between 1969 and 1979, the average annual growth was not less than 7.7 percent (Livingstone, 1986), making Trans Nzoia the fastest growing District in the country. Although the population increase during the following decade slowed down to an average of 4.2 percent per year, it is still above the national average. Similarly, population density increased accordingly from 50 inhabitants per square kilometre in 1969 to 160 in 1989 (Foeken and Tellegen, 1994). Locally, however, there are marked differences regarding density; high in settlement schemes or otherwise subdivided farms and low in areas where large farms have remained intact.

Fig. 1.1 The Position of Trans Nzoia District in Kenya



Source :Kenya, 1994-96

There has also been a steady flow of immigrants into the District in the last 30 years. This explains the persistent high population growth rate of the District. This can be attributed to two main factors. First, the subdivision of large farms that has attracted immigrants who are in search of land. Secondly, immigrants in search of job opportunities which exist in the small and large farms and the industries that are coming up in the District (Government of Kenya, 1997). In addition, immigration has resulted to ethnic heterogeneity in the District. For instance, 50 percent of the population comprises the Luhya group, 23 percent Kalenjin, whereas the Kikuyu comprise 10 percent. The remaining 17 percent consist of people from various communities of which Turkana (5%) is the most significant group.

1.6.4 Administrative / Political Units

Trans Nzoia is divided into three administrative divisions, namely; Kwanza, Cherangani, and Saboti. These divisions are further divided into 16 locations and 30 sub-locations (Government of Kenya, 1994). See Table 1.1 and Figure 1.2.

Table 1.1: Trans Nzoia's Administrative Units

Division	No. of locations	No. of sub-locations
Kwanza	5	13
Saboti	6	11
Cherangani	5	6
Total	16	30

Source: Government of Kenya, 1994 [a], (District Development Plan 1994-1996).

The difference in the number of locations does not however represent the size or vastness of a division. This is because locations and sub-locations were curved out according to the farming settlement pattern (Government of Kenya, 1997).

1.6.5 Small Farm Sector

The small farm sector supports the largest number of farm families. In total there are 50,666 families engaged in crop production on small-scale basis on approximately 106,621 hectares. These families participate in the production of most crops grown in the District. The distribution of the small farm sector is shown in Table 1.2 below.

Table 1.2: Distribution of Small-scale Farm Sector in Trans Nzoia District

Division	Farm area (Ha)	No. of H/holds	H.H per sq. Km
Cherangani	38,589	14,760	38
Kwanza	36,010	21,986	61
Saboti	32,920	13,920	43
Total	106,621	50,666	—

Source: Government of Kenya, 1994 [a], (District Development Plan, 1994-1996).

Most small-scale farmers are engaged in subsistence farming. Although official records do not exist, it is clear that most of the land is now in the hands of subsistent-oriented small holders with parcels ranging between 5 and 30 acres (Kamugisha, *et al.* 1997).

1.6.6 Forestry and Agroforestry

The District's forests cover an area of 50,292.4 hectares of which 48,068.1 is demarcated and gazetted, whereas, 2,224.3 is approved demarcated but not gazetted. Natural high forests occupy about half of the total area (47.3%) under forest. Man-made forests account for 28.5 percent of the forests in the District, whilst the rest of the area is woodland.

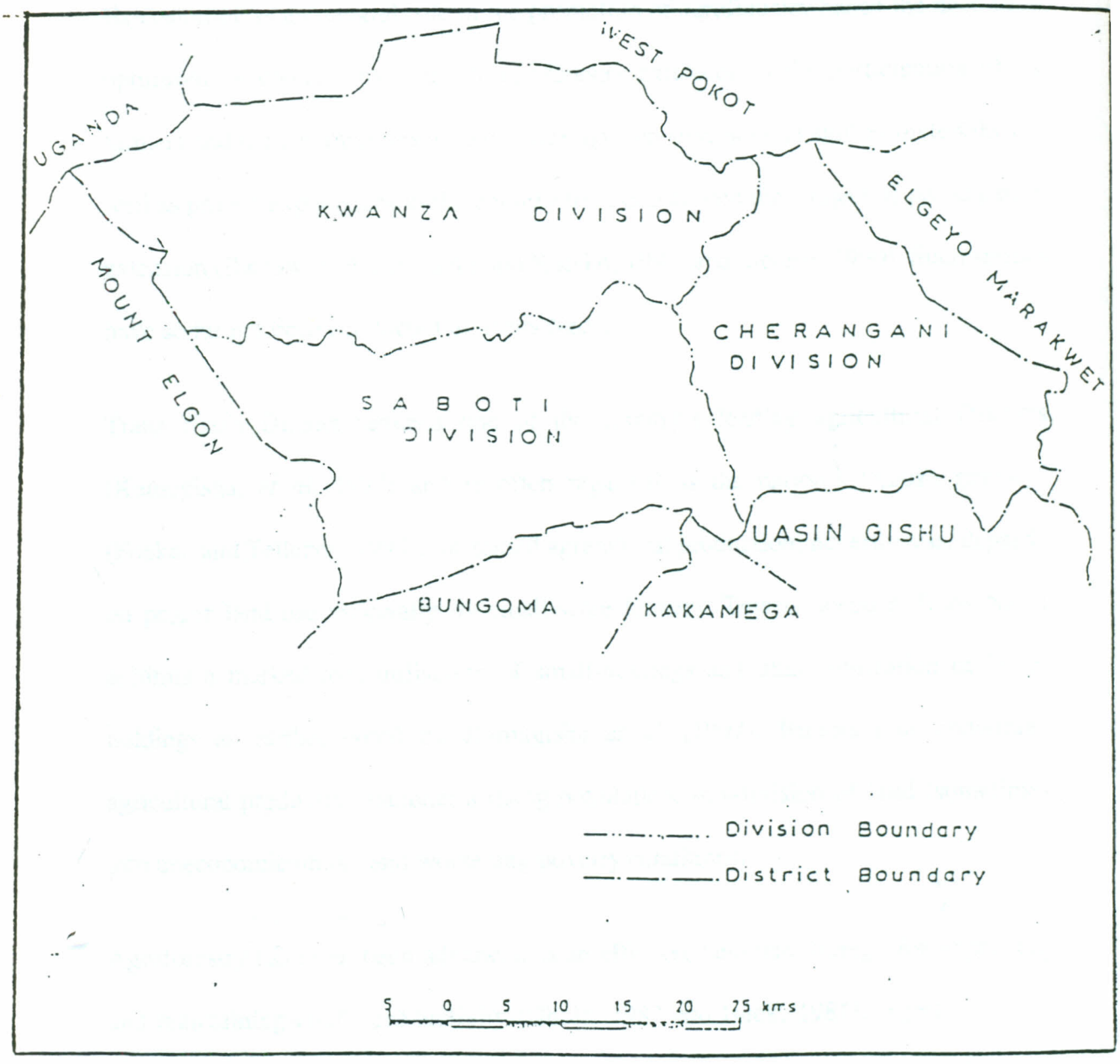
The forests are clustered all over the District. There are four major forests, namely; Sosio in Kwanza Division, Kapolet in Cherangani Division, and Saboti and Kitarare in Saboti Division. These forests are an important source of timber for construction, furniture, wood fuel, raw materials for paper, pulp, tanning, dying, and match industries.

The main threats to forests in the District are sawn timber and pulpwood industries which have steadily increased the exploitation of forests over the recent years (Government of Kenya, 1997), immigration and settlement (Mureithi, 1997) and domestic fuel consumption. The current consumption of fuel wood in the District is about 700,000 m^3 annually.

The mentioned threats to forests are being combated by incorporation of trees and shrubs into farming systems (Mureithi, 1997). For instance by 1994, 530 people were involved in production of seedlings and agroforestry related activities with the assistance of NGO's and the government. However, the poor survival rate of seedlings has been the main impediment to these efforts. Consequently, only 30 percent of seedlings planted then survived to maturity (Government of Kenya, 1997).

Among the benefits that have accrued to farmers as a result of the adoption of agroforestry are regular supplies of fuel wood and income from the sale of tree seedlings particularly to women and youth groups as well as to individual farmers. Agroforestry has also helped control soil erosion and increased soil fertility for improved crop yields.

Fig. 1.2: The Map of Trans Nzoia District Showing Administrative Boundaries



Source : Kenya (a), 1994

1.7 Justification of the Study

Extension plays an integral role in the promotion of agroforestry hence the need to be optimised. A contentious issue in agroforestry extension is the participation of the farmers and the communities who practice agroforestry. Several studies undertaken as well as project experiences in the country have delved into the subject of participatory extension (Barrow, 1996; Holding and Kareko, 1997; and, Scherr, 1990). Such studies have so far not been conducted in Trans Nzoia.

Trans Nzoia District remains one of the country's leading agricultural Districts (Kamugisha, *et al.* 1997) and is often regarded as the nation's "maize granary" (Foeken and Tellegen, 1994). Sustained agricultural production, nevertheless, depends on proper land use especially by small-scale farmers. This is because Trans Nzoia exhibits a marked over-utilisation of small-holdings and under-utilisation of large-holdings as further noted by Kamugisha *et al.* (1997). Factors that undermine agricultural production include; a rising population, sub-division of land (sometimes into uneconomic units), and worsening poverty conditions.

Agroforestry has often been advanced as an effective land use strategy for improving and maintaining land's productivity (Gholz, 1987 and Buck, 1981). Agroforestry in the District is being promoted by the Department of Agriculture, the Forestry Department and the VI Agroforestry Project as well as self-help groups (Chavangi *et al.* 1996). Agroforestry extension serves as a link between the farmer and these external support institutions. Information on how these links take place and how they can be optimised is lacking.

The study, therefore, draws rationale from and gives weight to the role of the farmer in shaping agroforestry extension. In view of this, this study pursued the concept of farmers' participation in extension in the light of their problems and opportunities available.

1.8 Significance of the Study

The study will broadly contribute to the existing pool of knowledge in agroforestry extension particularly the scantly researched area of participatory agroforestry extension. The findings of the study and recommendations are expected to; first, augment the rationale and the impetus behind the national call for the farmer and community involvement in agroforestry extension. Second, serve as a blue print for future agroforestry extension efforts. Exposing the shortcomings of present extension efforts would enable extension agencies review their policies and strategies making these focussed on farmers' needs and potential through their active participation. In addition, this study will inform extension workers of the need to better understand and appreciate farmers' needs values, priorities and potential.

Lastly, the study will benefit farmers through improved contact with extension workers and external support in agroforestry that addresses farmers' prevailing conditions. This is in turn important to extension workers and managers who are concerned with promoting a tree growing culture given the current policy provisions in agroforestry extension. This would ultimately translate into sustainable agroforestry practices among small-scale farmers.

1.9 Scope and Limits of the Study

The principal focus of the study was small-scale farmers with land holdings not exceeding 5 acres. This is because it is within this range that a majority of farmers were most likely to have low capital inputs for production and tend to over-utilise their land – problems that can be addressed by agroforestry. Ideally this should be the prime target of agroforestry extension efforts.

Owing to the vastness of the District, only two Divisions were covered given the resource constraints of time, finances and logistical problems such as transport difficulties. Sampling two Divisions out of three Divisions may not have produced results that are quite representative of the entire District. Nevertheless, interviewing central projects' staff and Departmental heads managing extension, whose coverage included the whole District, provided a cursory view of the broad theme of participatory agroforestry extension.

Additionally, the study focused on women and youth groups and not all grass-root institutions, although they are also important avenues of optimising agroforestry. The reason for the choice of women groups relates to the important role women play in environmental management, agricultural production and as custodians of natural resources (Khasiani, 1992). Youth groups, on the other hand, were not gender agglomerated and present future land users (Wamugunda, 1988). Important information may have, however, been lost since these institutions are not uniformly distributed in the District.

Finally, the study was restricted to areas of indigenous knowledge on tree growing (sowing, raising and other management operations) and not the broad theme of indigenous knowledge in (agro) forestry.

1.10 Definition of Terms

Extension: Transfer of ideas and technologies through media or dialogue. Extension generally implies a one way transfer of knowledge, from outsider to insider. But in a participatory approach, extension is defined as a two-way communication of knowledge.

Two-way communication: Interaction between two people that allows both parties to contribute equally.

Active involvement (participation): Entails involving people in the entire decision making process and implementation of an agroforestry project or programme including monitoring of progress and evaluation of its success.

Passive participation: Where people participate in a project or programme without being actively involved but by being told what has been decided or has already happened.

Actors: Institutions, communities and individuals who have interest in, promote or practice agroforestry. Also used synonymously with the term **Stakeholders.**

Extension agency: Institutions that provide extension services.

Agroforestry: A collective term for land use systems and practices in which woody perennials are integrated with crops and / or animals on the same land management unit. The integration can either be in spatial or temporal sequence.

Agroforestry practices: Denotes a specific management operation of an agroforestry nature on a farm or any other management unit. Commonly, a practice includes arrangement in space and time *vis a vis* the management or functions of the tree component.

Sustainable agroforestry: Agroforestry that meets the needs of the present generation without compromising those of future generation.

Small-scale Farmer: A farmer undertaking farming on a small farm. In this study, refers to a farmer with a land holding measuring between 1 and 5 acres.

Top-down: Description of research and development strategy in which the researchers, planners and developers make decisions without the participation or contribution of individuals at other levels, particularly the target population. The opposite is **Bottom-up**.

Programme / Project: The organisation of material resources, people and labour for specific and stated purposes. A programme or project can be created and controlled by insiders, or insiders and outsiders working together as the case is with a participatory approach.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews some of the relevant literature that contextualized the research theme. The review is an attempt to appreciate studies done on extension and to evaluate the concept and rationale of farmer-involvement in agroforestry extension programmes. This, in turn, provides a good benchmark for the study. The review is presented at seven different levels, which comprise trends in agroforestry, trends in agroforestry extension, participation in agroforestry extension, methods and limitations of participation in agroforestry extension, the role and limitations of institutions in agroforestry institutions, the role of local potential in agroforestry extension, and the conceptual framework.

2.2 Trends in Agroforestry

Trees, crops and animals have been raised together on small farms throughout the world for at least 1,300 years (Brookfield and Padoch, 1994). Agroforestry is therefore an old age practice. However, agroforestry was brought from the realm of indigenous knowledge into the fore front of agricultural research about two decades ago. It has been promoted as a sustainability enhancing practice that combines the best attributes of forestry and agriculture (Bene, *et al.* 1977). Agroforestry is now a popular concept among agricultural development and environmental specialists, and is often invoked by scientists as a solution to rural development needs (Rocheleau, 1988).

Most developing countries are currently confronted by the urgent need to halt or reverse land degradation and introduce sustainable agricultural production (Juma and Ojwang, 1996). The pressure to expand the area under cultivation has resulted in more utilisation of marginal land. Cultivation on steep hill sides and increasing rates of deforestation in the tropics have led to soil degradation, declines in productivity and desertification (Tolba, 1992). No where else is the picture more grim than sub-Saharan Africa.

In Kenya, the increasing population expected to be 35 million by the year 2000, and the fact that less than 20 percent of the area is arable, have jeopardised food security, increased malnutrition and famine (Government of Kenya, 1994c). In addition, population pressure and land scarcity in the high potential areas have led to an influx of farming communities into fragile ecosystems of the Arid and Semi-arid Lands (ASALs). Darkoh (1990) partly attributes this trend to the dwindling environmental quality status in the ASALs.

It is against this background that agroforestry with its myriad benefits can make an immense contribution to agricultural production in an environmentally sustainable manner. In Kenya, agroforestry faces the challenge of promoting agricultural intensification in the high potential areas to prevent population overspills to ASALs. Rooling (1990) contends that agroforestry allows the land to support a much higher population than traditional agriculture. This is in agreement with a study conducted by Bradley (1988) in Western Kenya, which found out that the proportion of land under trees increases with population density.

Giving the rationale for agroforestry, Rocheleau (1988) notes that trees and shrubs integrated with crops and / or livestock provide both ecological and economic benefits. Gholz (1987) further enlists agroforestry practices and technologies with potential applicability to maintain soil's fertility and production. The National Environmental Action Plan (NEAP) further calls for intensified agroforestry extension to support sustainable agriculture, reduce land degradation and provide wood products (Government of Kenya, 1994c).

Trans Nzoia, a high potential District, exhibits progressive build-up of land pressure (Kamugisha, *et al.* 1997), against a background of fast growing population (Foeken and Tellegen 1994). In order to forestall threats to environment and enhance agricultural productivity and human health, agroforestry is recommended among other possible interventions (Chavangi, *et al.* 1996 and Mureithi, 1997).

In Kenya, traditional agroforestry has been carried out through selective clearing of forested areas. The trees grow naturally but occasionally some are planted, for instance, *Markhamia lutea* in alternate fields in association with any crop (Bradley, 1988). Traditional agroforestry practices include; boundary planting or windbreaks, mixed cropping, and enriched fallows and home gardens. New trends have introduced fodder production systems, organic farming and alley cropping (Amare and Scott, 1989). These practices are a common feature on small farms in high potential areas. In Trans Nzoia District, trees are planted around the homestead for shade, and as a protective hedge around the compound. Boundary planting mainly of *Grevillea robusta* is also a common practice (Chavangi, *et al.* 1996). This is by far consistent with general national trends of agroforestry practices.

On the whole, agroforestry has found relevance in agricultural production systems since time immemorial on small farms and will continue addressing the needs of the present small-scale farmer. Ozowa (1997) notes that a small-scale farmer depends on his efficiency in the utilisation of available basic production resources. In concurrence with Ozowa's observation, Sinclair (1995) argues that agroforestry can improve this level of efficiency given limited land and capital resources by farmers.

Thus, with the realisation that agroforestry provides a low cost alternative for production as well as environmental protection, forest and agricultural departments of many countries are integrating agroforestry with conventional silviculture and crop production programmes. Similarly, many National Agricultural Research Systems (NARS) are increasingly developing programmes for agroforestry research, training and education (Tewari, 1995). This reality added weight to this study, which sought to investigate how agroforestry is being promoted through agroforestry extension among small-scale farmers and the available local potential that can support agroforestry.

2.3 Trends in Agroforestry Extension

Since the early 1970's, increased attention to poor people in development and foreign aid has led to a major turn in extension approaches. This is clearly reflected by the emergence of a two-way communication model, a model that includes a more critical view of extension message. This meant a shift from adopters' categories to target categories (Hillbur, 1998). Consequently, instead of a focus on *when* people adopt, it was now crucial to identify groups of people as targets for intervention. Inevitably, the use of target categories became a move from influencing adoption of a certain phenomenon, to designing extension to make *any* significant impact.

Thus, the wind of change towards farmer or community involvement that has currently characterised agroforestry is a break away from the traditional model in the execution of agroforestry extension. The traditional approach has invariably been

faced with massive failures even where external support has been superfluous. For instance, Feber and Slade (1984) and Baxter (1984) give examples of some traditional approaches in agricultural extension such as the Training and Visit (T&V) approach that failed to live up to the expectations in many countries. Broadly, the reason given for this by Chitere and Mutiso (1991) is lack of emphasis in people as a resource in situations where development projects are proposed and introduced with little or no consultation with the people they are intended to benefit. Various examples of forestry programme or project failures in Africa and Asia have been cited in Curtis *et al.* (1985), Kerkhoff (1990), Arnold (1992), Krishnaswamy (1995), Hobley (1996) and Barrow (1996). All these studies exhort the need for peoples' involvement in development programmes or projects. In the arena of forestry-related development endeavours, particularly farm forestry or agroforestry, supporting these endeavours with farmer responsive extension is a prerequisite (Holding and Kareko, 1997).

Support to farm forestry through the agriculture and forest Departments of East African governments started in the late 1970's, and early 1980's (Holding and Omondi, 1998). Previously, nurseries that had been established to supply seedlings for state plantations also gave free seedlings to neighbouring farmers. However, central nurseries were few and far between, and their stock was based entirely on species required for state plantations (*i.e.*, Pine, Cypress and Eucalyptus species). Though these species matched the demand of settlers then, this was not the case after independence where small-scale farmers favoured a multi-purpose species mix.

With the advent of forestry extension services, there was a shift to decentralised nurseries and attempts to provide species which farmers requested. However, transport and matching demand continued to be problems. Throughout the 1980's, seedlings were sold at a subsidised price, in the belief that this would encourage tree planting. But as tree planting became common in many households, this policy of

subsidised pricing undercut local initiatives and competed unfavourably with small-scale entrepreneurs establishing tree nurseries. East African countries have now adopted the concept of facilitation to enable farmers to grow their own tree seedlings (Holding and Omondi, 1998).

In Kenya, forest extension activities geared towards individual farmers, first came on the agenda of the Forest Department in 1971 when the Rural Afforestation Extension Service Scheme (RAES) was incepted (Tengnäs, 1993). This scheme entailed massive production of seedlings of useful trees to be distributed among rural population. The scheme, however, performed dismally owing to low survival rates of tree seedlings.

In view of the failure of these initial efforts, RAES gradually underwent several changes and evolved into what is now known as the Forest Extension Service Division (FESD), still within the Forest Department. In this new scheme, less emphasis is placed on producing seedlings for farmers and more emphasis put on activities that can support seedling production and tree growing by farmers themselves (Wamugunda, 1988). This commitment is reiterated in the current Forest Master Plan which aims, through forestry extension, to reach potential farmers and development partners by supporting them with advice and material aid where necessary (Government of Kenya, 1994b). Here, the extension service providers (NGOs and the government) supply seeds and technical advice in nursery management and maintenance. In this approach, the underlying principle is to place the knowledge to grow trees in the farmers' hands. This has increased the number of farmers growing their own trees. Nevertheless, not all farmers wish or are able to grow trees on their farms due to resource constraints (*i.e.*, labour and water, among

others). As a result, the system currently promoted by government and other extension services is a combination of home nurseries and private commercial nurseries to supply to those willing to grow trees but unable to grow seedlings.

Future trends however, are expected to lay more emphasis on pluralistic partnerships (communities, private sector, NGOs and government departments) through commercialisation of agroforestry and collaboration with other agencies (Holding and Omondi, 1998). This is occurring within a climate of reduced resource availability that is likely to continue in the discernible future (Holding and Kareko, 1997; Government of Kenya, 1998). In a nutshell, peoples' participation has come into focus and FESD now aims at playing a facilitator role rather than executor role. Training and extension are now the main tools that have replaced the intensive work done on tree nurseries.

Another experience worth noting in the development of agroforestry extension is drawn from the SIDA-supported National Soil Conservation Project implemented by the Ministry of Agriculture. This programme first started with seedling production in 1977 (Tengnäs, 1993). Initially the focus was on tree nurseries mainly of fruit trees where farmers could easily do grafting and budding themselves. Since 1988 however, a shift towards a more holistic and supportive role has taken place, paving way for participatory strategies. Farmers are now recognised as the main actors, with more efforts devoted to training and extension.

Yet another important and perhaps the greatest contribution in the evolutionary process of agroforestry extension in Kenya was the introduction of Participatory Rural Appraisal (PRA) by the National Environment Secretariat (NES) in 1986 (Lelo, *et al.* 1995). Early trials of PRA's by NES showed that it had a relative advantage over

previous top-down approaches in the management of natural resources particularly in decision making. Over time, PRA has increasingly been embraced by other governmental and non-governmental institutions. For instance, PRA has been introduced as a tool for planning soil conservation activities in the Ministry of Agriculture using the catchment approach. Moreover, training in PRA techniques has been offered since 1989.

All these developments point to the need for a multi-displinary and participatory planning system at the local level that would lay the foundation of harmonising extension work carried out by different Ministries, Non-governmental organisations, local institutions and farmers. This is particularly important given the intricate nature of agroforestry extension and the many actors involved. Holding and Kareko (1997) argue in favour of Local Level Planning (LLP) as a means of integrating various extension efforts by different stakeholders in agroforestry. LLP is a participatory planning tool or process in which various extension agencies working in a given area, consult with stakeholders and farmers in an analysis of farmers' problems, needs, priorities and aspirations, and an extension basket of solutions for that specific agro-ecological zone developed. The package is implemented, monitored and evaluated by both farmers and officers.

2.4 Participation in Agroforestry Extension

Participation of people involved in development programmes is often seen as away to make those programmes more successful, especially for solving problems of poor people (Van den Ban and Hawkins, 1996 and Chambers, 1983). Participation is, however, highly context-specific and its effects range from coercion to full local control (Hobley, 1996); thus, participation can be voluntary or involuntary or by means of incentives. Lelo *et al.* (1995) further conceive the term participation as a

means and an *end*. If participation is used as a *means*, the aim of such participation is often only to persuade the intended beneficiaries to take part in activities from which outsiders have already decided the basic contents. Participation as an *end* has its goal in the 'empowerment' of the intended beneficiaries in exerting greater control over their resources and their lives. Participatory extension emphasises on the latter meaning of participation, which is in deed consistent with the requirement that farmers be largely self-supporting. The study adopted this latter meaning of participation.

In the context of extension, Kilewe *et al.* (1988) further note that participation implies shared involvement and responsibility for information generation and use of project's or programme's major actors (extension agents and researchers), but must include the farmers as key land use decision makers. FAO in Gift (1996) further prescribes that extension serve as a two-way link between (forestry) research institutions and administrators, who are the sources and organisers of much of new technology, and the farmers who, by their active participation, can contribute to the realism and effectiveness of research programmes. The First Kenya Agroforestry Conference recommended research efforts to be focused on key agroforestry technologies in terms of developing a decision-support system package (Mugah, 1996). Through participation, extension should strengthen the local capacity for agroforestry technology innovation, testing adoption and diffusion.

According to Barrow (1996), extension implies more than imparting knowledge. It aims at creating awareness that is conducive to action to improve natural resource management and facilitate change. He further identifies the following key issues as integral components of participation in extension: gender balance, equity, enhancement of local decision making capacities and an effective means of

harnessing indigenous knowledge. Participation is, therefore, a process designed to develop and strengthen the local capacities of rural people to gain responsibility for and authority over local resources, and effectively contribute to all decisions on how these resources are used. FINNIDA (1991) identifies participation as beginning with the perception of the farmer and his problems based, to a great extent, on particular relationships of power when both persons or peoples' capacity determines their future. These arguments indicate the need integrate different stakeholders and understand community dynamics in the process of participation.

In their contribution to the subject of participatory extension, Van den Ban and Hawkins (1996) list six dimensions of the term participation with regard to farmers or their representatives' involvement in extension programmes. These include:

i) Co-operation of farmers in the execution of extension programmes by attending meetings, demonstrating new methods and asking their extension agents questions.

ii) Organisation of the implementation of extension activities by farmers' groups, such as meetings where the extension agent gives a lecture, organising courses and publishing a farm paper.

iii) Providing information that is necessary for planning an effective extension programme.

iv) Farmers or their representatives participating in the organisation of extension service, in the decision making of goals, target groups, messages and methods in evaluation of activities.

v) Farmers or their organisations paying all or part of the cost of extension service.

vi) Supervision of extension agents by board members of farmers' organisations which employ these agents.

The first four dimensions of farmer participation in extension programmes have been adopted in this study since they seem to represent the totality of how participation is conceived and implemented in the country.

Ideally, participation begins by identifying a problem, planning how to solve it, implementation, and ends with monitoring and evaluating the completed activity (Kerkhoff, 1990 and Tengnäs, 1993). Barrow (1996) cites a case in Francophone Africa where participation by local people has been extensively used to define problems and identify solutions right from the beginning of the programme. Technical packages are based on improving the local knowledge with low level external inputs. This has resulted in villages accepting and implementing new techniques rapidly. Thus, peoples' participation is central to the success of agroforestry projects. Such participation should cut-across the project cycle (Holding and Kareko, 1997).

Chambers and Guijt (1995) confirm that through participation, the responsibility and ownership of the project is promoted, contributing to its success and sustainability. In his contributions to rural development, Chambers (1983) discusses the futility of not targeting research and development support to clients' needs particularly the poor strata of society. Clients' needs in this regard, can only be clearly discerned if they are involved in the conception of projects or programmes and their participation sustained to subsequent phases of planning, decision making, implementation, monitoring and evaluation. Underlying this requirement as argued by Vergara *et al.* (1989) is that local people are more perceptive of their needs than outsiders.

Mixed results have been met in implementing farmers' participation in agroforestry extension programmes and projects. In Kenya, for instance, a survey on the effectiveness of agroforestry extension carried out on 108 projects revealed that only

45 percent were involved in impact evaluation. A majority of these projects were evaluating simple variables such as number of trees planted and area under agroforestry rather than indicators of socio-economic or environmental impact (Scherr, 1990). This means that farmers have been participating only on the initial stages of executing agroforestry programmes. Nevertheless, Participatory assessment monitoring and Evaluation (PAME) is now widely advocated to achieve full participation and as a better 'yard stick' to gauge success of agroforestry projects (Case, 1990). Underlying PAME's requirement, is that farmers being the beneficiaries of extension programmes, need also to be involved in the monitoring and evaluation phases over and above their involvement in the planning and implementation of these programmes. The local people, therefore, constitute the basic 'measuring rod' for the success of any programme (Van den Ban and Hawkins, 1996 and Kerkhoff, 1990).

Studies done by CARE-International in Western Kenya (Scherr, 1990), Turkana District (Barrow, 1996) and Nyandarua District (Holding and Kareko, 1997) have delved into the subject of participatory extension. These studies underscore the value of 'tailoring' extension services to local circumstances, the need for community and / or farmer participation and the concept of an extension worker as a catalyst and information broker for farmers. This calls for a re-examination of traditional extension methods, which according to Barrow (1996) have tended to favour those who are receptive, guided by predetermined needs and rigid to changes. Such studies are yet to be conducted in Trans Nzoia District. This study therefore, sought to investigate the status of farmer participation in extension programmes and aimed at providing options for improvement.

2.5 Methods and Limitations of Participation in Agroforestry Extension

According to Scherr (1990) a participatory extension approach can be used with any extension model. A variety of extension methods have been identified by Kerkhoff (1990), Budd *et al.* (1990), and Tengnäs (1994), which comprise: individual extension, group extension, school-based extension, mass media, model farms and demonstration plots, field days and farmers' excursions. In Scherr's (1990) postulation all these methods fit in a participatory framework.

Scherr (1990) further classifies extension methods into five basic categories. First, media-based extension to increase awareness of the need for tree growing or new species or services. Second, commodity-based extension usually to increase supplies of commercially important tree products by improving access to external inputs, technical and / or markets. Third, the training and visit model which focuses on delivery of specific agroforestry extension messages defined by a public agency, often as a broad effort to improve land husbandry. Fourth, farming systems research and extension by which extension agents and farmers work with researchers to generate or adopt and then introduce new technologies for a specific farming system. Lastly, community-based extension focussing on community action to meet local needs often through local innovations. This classification covers the entire spectrum of methods used in extension.

In facilitating farmers' participation in extension, PRA methods are preferred because they are flexible, encourage innovation, improvisation and interaction. Most of the methods used are visual, making them accessible to a larger number of people and

analysis is based on the group and not the individual (Chambers and Guijt, 1995). In addition the methods help break the barriers between external facilitators such as researchers and extension agents and the people. Here, Vlaenderene, (1996) recommend that external facilitators listen and not lecture thereby discouraging dependency and encouraging sustainability of the project. Thus, PRA is a radical departure from the traditional approaches for information gathering which only helped the outsiders make decisions.

Participation through PRA has, however its drawbacks. Chambers and Guijt note the following two limitations. First, as a methodology in fashion and politically correct, people not well trained in the techniques are forced to utilise them. Second, it is assumed that PRA is a rapid method of getting information when in fact, it is a slow process which emphasises taking time to listen to people and allow them to carry out the exercise and discuss issues. Lelo *et al.* (1995) observe that there is a tendency among PRA practitioners and trainers to "push" the concept and its implementation beyond reasonable time boundaries. Besides, Kumar (1993) further observes that discussions may be domineered by influential people such as community leaders, hence not being quite representative of all people participating. Similarly, gender biases against women may also be introduced. Even in the absence of the mentioned problems, Holding and Kareko (1997) warn against PRA's which are conducted just as another step in the extension workers' or managers' work plan. In such cases, extension services revert to the same old centrally planned activities once the PRA is completed.

Generally, the criterion for choice of any agroforestry extension method should take cognisance of resource constraints such as time and finances while ensuring maximum coverage of farmers. This perhaps explains why extension agencies are increasingly adopting group-based and mass media extension methods. The ultimate determinant, however, rests on the existing constraints in agroforestry especially those that relate to farmers' needs and problems (Scherr, 1990).

On the whole, different extension methods and approaches have been employed by institutions to reach out to and promote the concept of farmer involvement in extension programmes. There are however areas in which extension agencies require to streamline if participation of farmers in extension programmes is to be optimised. This, according to Cook and Bonitatibus (1997), demands urgent redress of those factors that act as stumbling blocks towards this worthy course. The present study covered the problems of participation experienced in Trans Nzoia District.

2.6 The Role and Limitations of Institutions in Agroforestry Extension

Broadly, three categories of institutions in agroforestry extension can be distinguished: donor, research organisations, and extension agencies (Budd, *et al.* 1990, Van den Ban, *et al.* 1996 and Mugah, 1996). Donor organisations provide financial support to research institutions and extension agencies. The donor organisations fund most of the activities by research organisations and extension agencies to complement government funding or support specific programmes or projects by these institutions. Research institutions on their part are charged with the responsibility of developing research packages that reach farmers for adoption through the work of extension agencies. Concepts such as participatory Action

Research (PAR) have been introduced to optimise links between research institutions, extension agencies and the farming communities (Chitere and Mutiso, 1991; and Chambers, 1983). Here, research institutions work together with the extension agents and the farmers to develop technologies based on on-farm experimentation. The three categories of institutions are therefore inter-linked and mutually supporting each other. Wangati and Makau (1989) recommend co-operation and collaboration among scientists, government institutions and other organisations involved in the activity of institutionalisation if success in research and extension programmes is to be realised.

In Kenya, three principal research institutions in agroforestry development include; ICRAF, KARI and KEFRI. The three have benefited from funding provided by international donors such as, SIDA, USAID, DANIDA, FAO, CARE International and The World Bank, among others. These organisations collaborate in generation of technologies related to trees, crops and livestock interactions.

On agroforestry extension, Forest Departments in many countries have been used to promote rural tree planting (Kerkhoff, 1990). However, training among staff and infrastructure required to mount a major agroforestry extension programme is lacking in most Forest Departments. In such cases, there are arguments favouring agricultural extension agencies to promote agroforestry. Either way there is a strong case for broadening this responsibility to include agriculturists, foresters and other disciplines instead of relying entirely on one Department or discipline – a requirement that demands good inter-agency co-ordination between institutions concerned. This present study captured the aspect of inter-agency co-ordination between institutions in agroforestry development in the study area.

Citing the example of Kenya, the Ministry of Energy, and the Ministry of Agriculture and Livestock Development with the assistance of donor organisations have participated in agroforestry, all being efforts outside the forest sector (Budd, *et al.* 1990). Some of the projects which were implemented with an extension component right from inception include: FINIDA and WB funded Bura Fuelwood and Agroforestry Extension Project, and the Marigat Fuelwood and Afforestation and Extension Project under the auspices of FAO and Australian government. The Ministry of Agriculture and Livestock Development supported by SIDA established the National Soil and Water Conservation Programme to arrest land degradation, increase fodder and browse species and grow fruit trees.

Government institutions are, nevertheless, weak and require donor support (Amare and Scott, 1989). They also suffer poor co-ordination leading to overlapping and conflicting roles. The latter problem as observed by Wamugunda (1988) is also experienced by Non-governmental organisations. This is partly attributed to sectoral policies and the large number of disciplines involved in agroforestry. This notwithstanding, government institutions have taken time to shade the cocoon of bureaucracy and rigidness in institutional or organisational set up (Chitere and Mutiso, 1991). For instance, Aloo and Rodger (1996) note that in countries where foresters are seen as policemen owing to the coercive mode in extension, this presents a major barrier to winning the trust of local people.

Unlike government-based institutions, Non-governmental initiated efforts are more flexible and reach out to the communities effectively (Kerkhoff, 1990). These institutions play an increasingly important role in rural development and extension education is one of their policy instruments. They often use a participatory approach

in their extension programmes and offer farmers an opportunity to participate in the planning of extension programmes (Van den Ban *et al.*, 1996). However, because of their tendency to operate on a small scale, doubts have been raised about their ability to implement nation-wide programmes as their methodology may not be replicated to other parts of the country. Other disadvantages include: lack of staff competency in production technology; their solutions to farmers problems are sometimes based more on ideology than on research findings; insistence on short-term rather than long-term results to attract more funding often owing to donor's system of funding, and; the high expense caused by employing expatriates (Caroll, 1992).

In terms of their success rate however, Kerkhoff (1990) notes no distinct disparities between programmes managed by government extension agencies and those co-ordinated by non-governmental agencies, either locally based or international. He further notes that some of the best results have emerged from projects where there has been collaboration between NGO's and government agencies. Neither is there any correlation between the success of programmes and projects with the amount of money spent on them. This may be because some of these programmes or projects have tended to invest heavily in offices, staff housing, vehicles and other items with a corresponding lack of emphasis on the practical aspects of achieving results in the field.

In the process of institulization of agroforestry in Kenya, organisations are undergoing changes which when fully realised will lead to sustainable agroforestry and production (Mugah, 1996). This fact is strengthened by the proliferation of self-help groups interested and active in tree planting (Wamugunda, 1988). Budd *et al.* (1990) further observe that Kenyan farmers, especially women and youth hold a special role

in agroforestry development. Their collective efforts, however, as noted by Barrow (1996) are consistently underestimated in rural development and natural resource management. He advances that there may be a wide range of institutions for a variety of issues concerning control and responsibility within a community. Some of these groups are more social in function, but they are more likely to be multi-functional. Utilisation of these groups or institutions in agroforestry extension can help foster faster development of agroforestry. Thus, it is not only non-governmental and governmental institutions that are important in agroforestry development but also the local institutions.

2.7 The Role of Local Potential in Agroforestry Extension

Rural people have a great deal of useful knowledge to contribute in their role as consumers of agroforestry messages and technologies. In his model for agroforestry planning and implementation process of extension programmes, Tengnäs (1993) shows the need to harmonise indigenous or local knowledge and the expert knowledge in agroforestry. This is in agreement with an observation made by Walker *et al.* (1995) that one of the richest but not utilised sources of knowledge is the indigenous knowledge of farmers who practice agroforestry.

Participation in agroforestry extension is based on understanding that farmers' knowledge base is different from the experts' base and that the two pools of knowledge are mutually reinforcing. Holding and Kareko (1997) present a two half-cup measures analogy of the two sets of knowledge where if the two cups are combined, an overflowing cup of knowledge is derived. In other words, both the farmer and the expert have something to learn from each other. Vlaenderene (1996)

and Tengnäs (1994) have noted this educative effect. On the need to promote indigenous knowledge, Buckers (1995) attributes the loss of indigenous tree species to the disappearance of knowledge on the affected trees. Bucker's observation is just one aspect that represents the dire consequences following failure to tap indigenous knowledge of trees.

Gift (1996) further observes that, even if rural people are not familiar with production ecology of a particular plant or groups of plants, information about local preferences and uses of plant products can help agroforestry workers identify the most appropriate species for introduction into an area, or the most important qualities to seek through planting. Not only, therefore, can peoples' past experience and traditional knowledge help to guide the development of new agroforestry systems, but their judgement and skill in their own right can make a significant contribution. Local people can use their experience in innovation and evaluation to identify and develop useful new practices and their full involvement can also inspire wide adoption of new practices. Consequently, active local participation is important for improving and adopting traditional agroforestry practices and for fitting trees into new situations such as settlements, cropping systems or rangelands (Rocheleau, 1988).

Unlocking the storehouse of rural peoples' knowledge and finding ways of integrating with modern scientific ideas is the key to tackling agroforestry needs and problems. This is because local knowledge of the environment is unsurpassed and any outside plan or modern or scientific techniques introduced, will inevitably have to face the rigours and idiosyncrasies of a given environment (Chambers, 1983). Kerkhoff (1990) in Zimbabwe cites a case where a seedling production programme depended on local propagation of useful trees through cuttings, stumps, wildings and direct sowing and

use of locally available materials. These methods were found easier than standard nursery techniques. Banda *et al.* (1997) underscore the need to analyse the local situation making use of indigenous knowledge in formulating and planning extension programmes. However, there is a limit to what the community can offer in terms of knowledge and support hence the need to incorporate other actors in agroforestry development.

2.8 Conceptual Framework

The conceptual model (Fig.2.1) is founded on premises presented below that relate to participatory agroforestry extension. First, sustainable agroforestry is a function of concerted efforts by all actors in agroforestry, namely: researchers, donor organisations, extension agencies and farmers or farming communities. The research however confined itself to the two principal actors in extension, the farmers and extension agencies. Here, the model borrows heavily from Bosch's communication theories (Van den Ban and Hawkins, 1996) and diffusion theories (Hillbur, 1998), which emphasise two-way communication links between the extension agent and the farmer and the mutual learning environment provided which enables diffusion of both expert and local knowledge. This, according to Vergara *et al.* (1989), is an antithesis of directive or one-way communication mode in a top-down approach to extension.

The second premise, also related to the first one, emphasises the need for farmers or farming communities to explore avenues to self-support agroforestry activities. In support of this requirement, Kerkhoff (1990) advocates making agroforestry profitable in economic sense as a precondition that promotes movement towards autonomy. The Government of Kenya (1998) further notes the dwindling external support in forestry sectors. Thus, whereas external support in form of material,

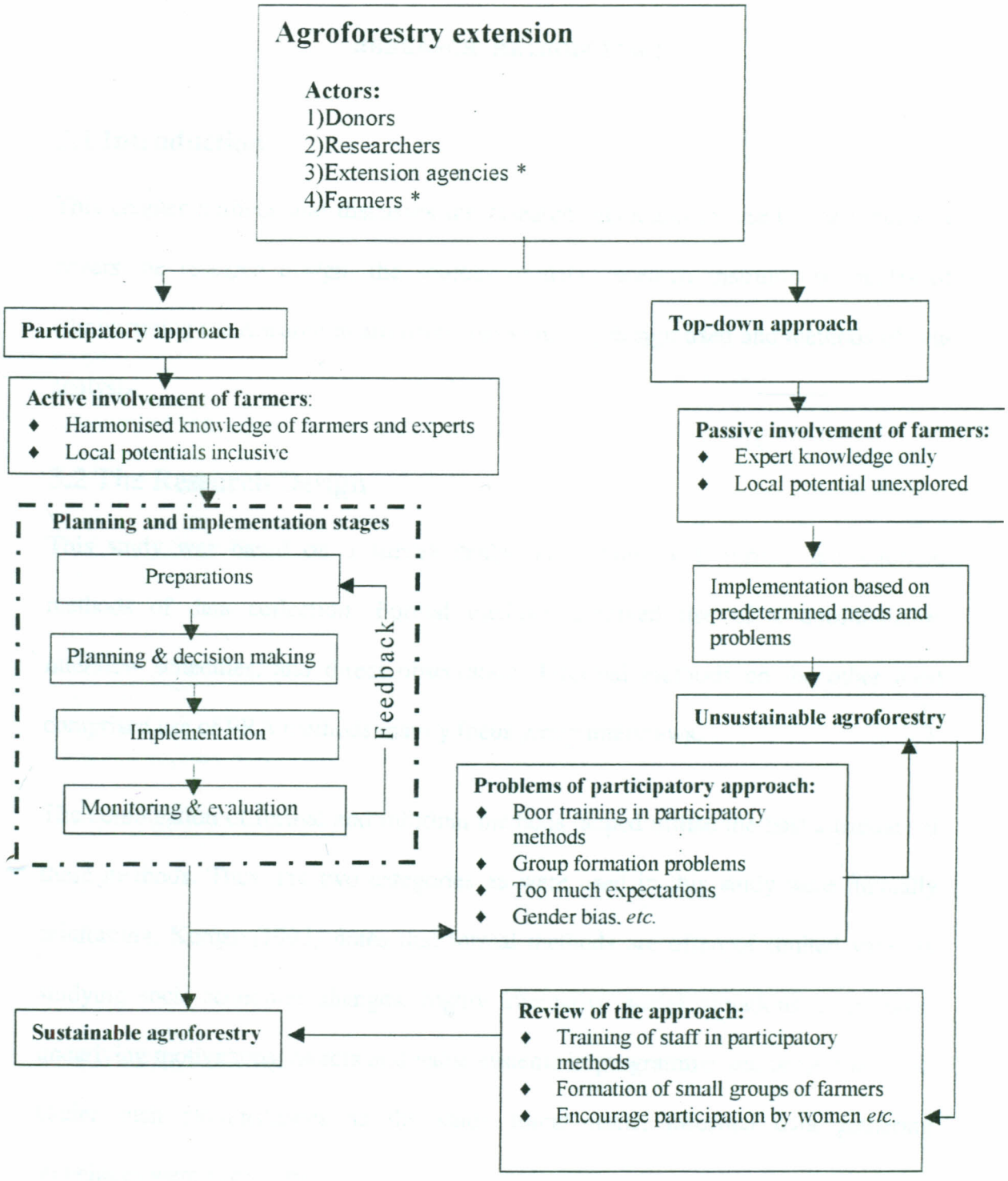
financial, or logistical support is necessary, there is need for extension programmes to emphasise incremental change to permit self-financing, short-term and intermittent benefits from practising agroforestry (ICRAF, 1997) to be achieved through harnessing the local potential in agroforestry. This is expected to set an environment conducive to optimise local potential use in agroforestry.

The third premise relates to the entire process of farmers' participation in extension programmes. The ideal set up demands that farmers are involved right from the conception, planning, and implementation through monitoring and evaluation phases of extension programmes or projects (Van den Ban and Hawkins,. 1996; Kerkhoff, 1990, and; Holding and Kareko, 1997). Consequently, participation is a continuous process complete with a feedback mechanism (Tengnäs, 1993).

The last premise advances the argument that poor execution of a participatory agroforestry extension programme in itself can lead to unsustainable agroforestry. Problems related to the implementation of participatory agroforestry extension can jeopardise its success however well intended the purposes or objectives were. These problems hinge on expectation, attitude and training, among others. Redressing these problems is therefore imperative.

On the whole, the conceptual framework supports active involvement of farmers in extension programmes where this has been non-existent and the re-examination of strategies in situations where participation has been problematic. Only then, can agroforestry extension be optimised and focused on the farmers' existing situations.

Fig. 2.1 A Schematic Presentation of Agroforestry Extension Based on Top-down and Participatory approaches



* Actors considered in the study

Source: Modified from Tengnäs' (1993) model of agroforestry extension planning and implementation

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines and discusses the research methodology used in the study. It covers the research design, the sources of data, research instruments, modes of administering the research instruments, the sampling design used and methods of data analysis.

3.2 The Research Design

This study was based on a survey design employing both formal and informal methods of data collection. Formal methods involved use of a questionnaire, interview schedules, and direct observation. Informal methods on the other hand comprised use of PRA methods mainly focus group interviews.

The combination of formal and informal methods helped utilise the best attributes of these methods. Thus, the two categories as were used in this study were mutually reinforcing. Kumar (1993) notes that formal methods are often of limited value in studying socio-economic changes, highly interactive social situations or peoples' underlying motivations, beliefs and value systems in programme and project settings. Under such circumstances as the study found itself, informal data gathering techniques were necessary.

The formal methods as advanced by Emerton (1996) generated quantitative data that were statistically analysed to draw conclusions. Further, random selection was used in the selection of sample areas. This allowed the study to meet the requirements for

statistical significance testing of variables as stipulated by Kuper and Kuper (1996) and Andersen (1980) on the use of survey models in research. On their part, informal methods gave an in depth analysis of the phenomenon investigated (*i.e.*, participatory agroforestry extension) but not of its extent or pervasiveness.

3.3 Nature and Sources of Data

Data used in this study were from primary and secondary sources. Primary data were obtained through the field work exercise. Information here was generated from questionnaires, individual and focus group interviews and through observation, all targeted at answering the research questions that guided the study. The secondary sources on the other hand, entailed an explorative review of relevant literature on agroforestry and extension. This helped unveil previous research efforts that were pertinent to the study.

3.4 Research Instruments

The research instruments in the study were a questionnaire, an interview schedule, a guide to focus group interviews and an observation record sheet. (See appendix 1 a, b, c, d and e).

3.5 Methods of Data Collection

Several methods were used in collecting data from both primary and secondary sources. This process entailed administration of questionnaires, recording observation made, conducting interview schedules and guides, and review of documented information as discussed below.

3.5.1 Questionnaire Administration

The questionnaire was administered to small-scale farmers. Both open-ended and closed questions were asked. The questionnaire was used to identify extension methods, the extent of farmer participation in extension programmes and problems or constraints faced by farmers in extension. The questionnaire was further used in identifying the local potential among farmers or within their farming environment that could be tapped by extension agencies to promote sustainable agroforestry. Additional information on the size of the land, family sizes, and level of education, age, and gender of the household head, were also sought in the questionnaire.

3.5.2 The Observation Record Sheet

Alongside questionnaire administration was direct observation. A checklist of trees on farm, agroforestry practices, and tree management and seedling production techniques served as a guideline for observation and recording of the findings. Sometimes this was followed by relevant probe questions and the answers recorded in a notebook designated for this purpose.

3.5.3. Interview Schedules / Guides

Interview schedules were used to interview extension managers and extension workers whereas interview guides were used for focus group discussions. The interview schedule to extension managers of the various extension agencies elicited information on topical themes in agroforestry extension, *inter alia* the management of agroforestry extension services, farmer involvement in agroforestry extension, and the status of local potential in agroforestry.

The interview schedule to extension workers was used to give a better insight into the situation (agroforestry and extension) on the ground. Interviewing extension workers is supported by Barrow (1996) in studies on agroforestry extension. Additionally, interviewing the extension workers procured information on problems encountered when working with the farmers.

The interview guide, basically an outline of topics, elicited information from focus group interviews *cum* discussions with women and youth groups. The discussions centred on specific topics such as activities of the group, their roles in agroforestry, extension contact, problems encountered in the course of undertaking their activities and possibilities of harnessing local potential in agroforestry. The purpose of these discussions was to validate and give an in-depth coverage of some the information collected from the small-scale farmers about groups they were affiliated to. This provided a good frame for comparison between groups involved in tree planting activities and those that were not.

3.5.4 Review of Documented Information Related to the Study

To put the research into context, identify research gaps and enable comparison of the study's findings with similar studies elsewhere, a review of literature was necessary. This involved reading various books, journals, theses and manuals on agroforestry extension and other themes of germane reference to the study. This exercise was also guided by the research questions the study sought to answer. Consequently, information on extension methods, extent of farmer participation in agroforestry projects or programmes and indigenous knowledge in agroforestry was reviewed.

3.6 The Pilot Survey

A pilot study was undertaken before the main survey. The purpose of the pilot survey was to pre-test the questionnaire, make acquaintance with relevant authorities (*i.e.*, the local administrators and the extension managers) and have a general reconnaissance of the study area. Twenty farmers in the District were randomly selected for this purpose. These farmers were not part of the sample in the main survey. Pre-testing the questionnaire was necessary to make it more relevant and explicit.

3.7 Sampling Design

Multistage cluster sampling criteria was used. In this method which according to Peter (1994) is appropriate for sampling large areas, the primary unit (*i.e.*, the District) was divided into systematic sub-areas along the administrative boundaries. The Division was the secondary unit while the location was the tertiary unit as given by Mulusu (1990) and Kothari (1985). Two Divisions were randomly selected, namely: Cherangani and Saboti. Using the same criterion, two locations were selected from each Division making a total of four locations. Similarly, two sub-locations were selected from the chosen locations making a total of eight sub-locations.

In order to capture the aspect of farmer participation in agroforestry programmes, two categories of respondents were established: contact farmers and non-contact farmers. This was found necessary to forestall the risk of interviewing farmers who may not have participated in extension programmes.

Contact farmers, who in the study refer to those farmers who had participated in extension programmes, were identified in the Soil and Water conservation Programme (SWCP) of the Department of Agriculture and the VI Agroforestry Project (VIAP). A list of contact farmers in the two institutions was prepared with assistance from VIAP's Zonal offices and Divisional offices of SWCP of all sampled

sub-locations. For non-contact farmers, a list of those with land holdings within the range of one to five acres was prepared with the assistance of local administrators (*i.e.*, the Sub- chiefs and Village Elders). These farmers also fell within the sampled sub-locations. The latter list (non-contact) included contact farmers but the two categories were separated using the list of contact farmers.

The respondents within a sub-location were chosen using systematic sampling. This was considered appropriate because the sample was being drawn from a large population. A systematic sample consists of the selection of each n^{th} term from a list (Best, 1970). During the survey, each tenth farmer from the two lists of contact and non-contact farmers was selected for interviewing. In total 40 contact and 40 non-contact farmers were sampled. The identification of the sampled farmers was assisted by the area extension workers (from the Department of Agriculture or VIAP) and occasionally the Village Elders.

A total of 80 farmers were sampled, 40 from each Division. This was deemed sufficient as other similar studies based on the same research design have used an equivalent or a small sample size and produced reliable and valid results. (Chavangi *et al.*, 1996; Karembu, 1992; and, Ombaba, 1998). Additionally, the rather homogeneous tendencies of the small-scale farmer *vis a vis* production activities allowed the study to use the sample size to extrapolate the findings from the sampled sites for the District.

All agroforestry extension agencies were visited. Relevant source persons who mainly constituted heads of extension departments in the government sector and project managers or co-ordinators in the NGO sector were contacted following an introduction and a rapport-building session. In the field purposive sampling and snow balling were used to identify extension workers in the sampled areas. Here, an

extension worker working for a particular agency was most likely to know his counterparts representing other agencies in the sampled area. The choice of the extension worker to interview among extension workers in any given agency was at the discretion of the investigator. Though these modes of sampling (snowballing and purposive sampling) are known to introduce biases (Peter, 1994 and Deaton, 1997), the information generated was of qualitative nature without pressure to generalise. In total 19 extension workers were interviewed, eight from VIAP, six (Department of Agriculture), four (Forest Department) and one (WWF).

To identify women and youth groups engaged in tree planting activities for the purpose of focus group interviews, a list of these groups was obtained from the Social Services Department (see appendix 4). A total of 155 groups engaged in tree planting activities were identified. Women groups comprised 48 percent, 33 percent youth groups while the rest fell outside these two categories. Groups falling within the sampled sub-locations were selected purposively where at least one group in the two categories was selected per location. In total, eight focus group interviews were conducted, four with youth groups and four women groups.

3.8 Data Analysis

At the end of data collection in the field, data was collated and analysed. This process involved coding of all responses, which were then fed into a computer and analysed using the Standard Statistical Package for Social Sciences (SPSS) 6.1 version. Both descriptive and inferential statistics were used. Descriptive statistics involved the use of multi-response cross-tabulations and contingency tables that generated frequencies and percentages. This was found appropriate because most of the data were nominal (Coats and Parkin, 1977; Siegel and Castellar, 1988).

Inferential statistics, on the other hand, entailed the use the Chi-square. For instance, contingency tables were further treated to Pearson Chi-square (χ^2) test (Siegel and Castellar, 1988) to find out the statistical significance of the relationships and associations between variables (Gupta, 1992). The chosen level of significance to reject or accept a H_o hypothesis was 0.05 α level.), which is the recommended level for social sciences (Coolican, 1994).

Additional descriptive analytical tools, such as SWOT analysis and content analysis were used to treat the descriptive data generated by focus group interviews and interviews with the extension fraternity. In some cases, however, responses were presented *verbatim*. These analytical tools provided an in-depth cover of the variables considered in the study.

SWOT analysis was used to analyse data generated in the focus group interviews as prescribed by Holding (1995). SWOT analysis provides decision makers (extension agencies) with information that form the basis for making decisions and actions aimed at achieving set objectives (Boseman and Phatak, 1989; Thompson and Strickland, 1993). Most of this analysis was with group members interviewed, a task which started in the field. Here, group members among whom focus interviews were conducted were expected to rank the various strengths, weaknesses, opportunities and threats of items considered in the interviews (see appendix 3). This exercise according to Dyson (1990) allows the decision maker(s) to exploit opportunities while combating threats. In other words, results of the SWOT analysis provide pointers towards change in objectives, policies, strategies or institutional arrangements based on existing or latent strengths and opportunities while critically evaluating weaknesses and threats.

During SWOT sessions with the chosen groups, notes were taken for purposes of recording information generated during the interviews by a secretary who was more often than not the investigator. In addition, the investigator played the role of facilitator to guide the direction of the interviews. This avoided much digression from the subject of discussion. Finally, the information recorded from all groups interviewed was cross-tabulated to show general trends in the discussions between the groups.

Additionally, content analysis was used to analyse results from focus group interviews and interviews with the extension fraternity. Here, data were classified to facilitate the search for patterns and themes within the discussions and across the discussions as recommended by Patton (1990).

3.9 Research Constraints

The following constraints were faced in the course of the research:

1) Difficulty in mobilising women and youth group members to conduct focus group interviews. Either the request notice was too short or members were burdened with individual responsibilities at home or otherwise.

2) Transport problems especially where road network was poor. Some farmers who formed part of the sample were located in remote areas with a difficult terrain.

3) Organising interviews with extension workers was, in some cases, not easy. This was attributed to lack of proper work schedules by extension workers thus making it difficult to trace them in the field, a problem aggravated by the high mobility of extension workers.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

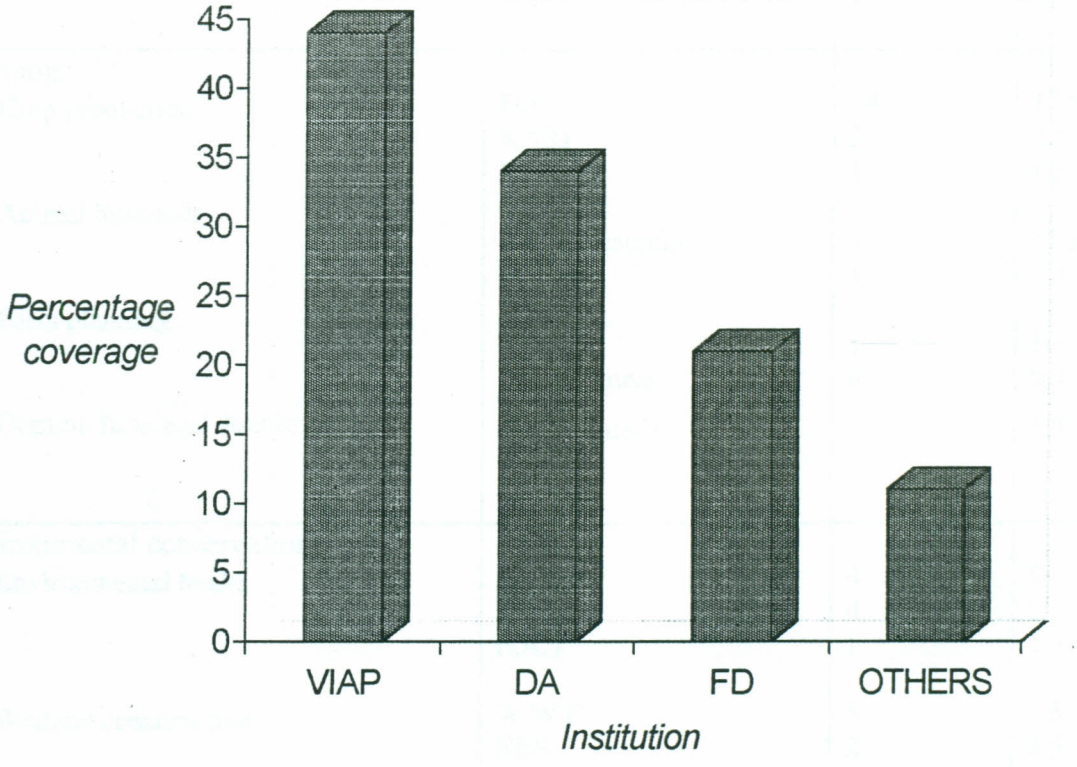
This chapter presents the study findings and discusses emerging issues. It is divided into three sections each handling a core objective of the study. The first section begins by identifying the various extension methods used to reach out to farmers. The section further covers the component of farmer participation in extension programmes. In the second section, problems experienced in participatory extension both at agency and farmer levels are discussed. The last section explores the status of local potentialities that are pertinent to future extension strategies.

4.2 General Extension Contact

Different institutions and individuals have taken part in the delivery of extension services in the study area. The study revealed that a majority of farmers (*i.e.*, 90 percent) had been reached by an institution with agroforestry extension messages. However, only 14 percent of the farmers reached had been visited by a neighbour as part of farmer-to-farmer extension delivery.

The three institutions on the forefront of agroforestry extension delivery were V1 Agroforestry Project (VIAP) which had reached 44 percent, Department of Agriculture (DA) with 34 percent and the Forest Department (FD) which had contacted 21 percent of the farmers (Figure 4.1). Combined, the rest of the organisations represented in extension delivery shared 11 percent of the total number of farmers reached (see appendix 5 for the list of organisations in extension delivery).

Fig. 4.1: Agroforestry Extension Coverage by Different Institutions in Trans Nzoia District



The study found out that apart from VIAP, which concentrated almost exclusively on agroforestry extension, the rest of the organisations were preoccupied with other activities besides promotion of agroforestry extension messages and products (Table 4.1). This is because VIAP as an institution is committed only to the promotion of agroforestry as stipulated by its goals and objectives.

Table 4.1: Farmers' Responses on Non-agroforestry Extension Messages by Institution

Message	Source	Frequency	Percentage
Soil and water conservation	DA (SWCP)	18	22.5
	Local administration	7	8.75
	NES	1	1.3
Farming:			
• Crop production	DA	14	17.5
	KARI	2	2.5
	KTDA	1	1.3
• Animal husbandry	DA (Livestock)	9	11.3
	Moronjo	1	1.3
• Farm planning	DA	1	1.3
	Manor house	5	6.3
• Organic farming / double digging	C.P.K church	1	1.3
Environmental conservation:			
• Environmental health	MoH	4	5
	I.A.S	4	5
	E.A.T	1	1.3
• Wetland conservation	W.W.F	3	3.8
	NES	2	2.5
• Forest conservation	FD	1	1.3
• Spring protection	Northsud	1	1.3
• Energy conservation	Green belt	2	2.5
	DA (Home Economics)	4	5
Community participation in development projects	Local administration	4	5
	DA (SWCP)	6	6.3
Security	Local administration	8	10
Leadership training	S.S.D	1	1.3

* Acronyms defined in appendix 5

Source: Field Survey, 1999

Cumulative messages on soil and water conservation (33.8%), crop farming (17.5%) and animal husbandry (11.3%) dominated extension packages by the Department of Agriculture (DA). This could be attributed to the fact that the department is charged with the mandate of enhancing food production through soil fertility, crop and livestock improvement (Admassie, 1992). In soil and water conservation for instance, trees are incorporated as a measure to achieve the fore-mentioned commitment. In crop and livestock farming, trees seem to serve a subsidiary function as long as they do not jeopardise the dominant farming system of either crop or livestock production. This is perhaps why tree growing may not have received much attention from the crop and livestock arms of extension in the Department of Agriculture.

On the other hand, Forest Department (FD) had general forest conservation (1.3%) as an extension package. The low percentage may be partly explained by the previous approach that emphasised on forest plantation as opposed to on-farm planting. Of the remaining sources (institutions), W.W.F, N.E.S, Greenbelt and local administration were involved in one way or another in the promotion of tree planting activities. The Ministry of Health through the Public Health Department, International Aid Sweden (I.A.S), North Sud, Manor House, Environmental Action Team (E.A.T) and the Social Services Department (SSD) promoted, *inter alia* activities outlined in Table 4.1 but did not either promote tree planting or agroforestry. They have, however, recently (beginning in 1995) taken part in the joint planning of rural development activities together with agroforestry extension delivery institutions.

4.3 Extension Methods and the Extent of Farmers' Participation in Extension Programmes

The first objective of the study was to identify the extension methods and examine the extent to which farmers have been involved in agroforestry extension programmes. This objective tackled the general extension methods, how these methods are executed and how well they promote the ideals of a participatory approach. The part on the extent of farmers involvement extension considered the stages in the execution of extension programmes (*levels* of participation) and situations or how (*form* of participation) farmers participate in the same.

4.3.1 Extension Methods

In order to elicit information on the various methods used in extension, farmers were asked to specify institutions and places (forums) where information was received. Interviews with extension managers, subject matter specialists (SMS's) and frontline staff also provided vital information about methods used by extension agencies to reach out to the farmers.

The survey identified six extension methods in use namely: individual visits, group approach, public meetings (*barazas*), seminars and workshops, field days and tours. Different institutions favoured different methods that depended on resource availability (*i.e.,* both financial and physical), manpower, target groups and overall guiding principles of an institution. Each method employed is discussed below.

4.3.1.1 Farm / Individual Visits

In this method the extension worker visited a farmer on the farm for a one-to-one discussion. The farmer fell within the extension workers' target area (TA). This method was identified by the extension workers as a good strategy of solving unique problems of the farmer. Moreover, individual visits were crucial in monitoring the progress of the farmer upon adoption of agroforestry messages or utilisation of extension products such as seeds or seedlings as an institutional requirement to judge the impact of the programme. Monitoring at the farm level was also important in gauging the progress of farmers who might have agroforestry messages disseminated, or products supplied using other extension methods as a basis for comparison with other methods used. Table 4.2 shows the proportion of farm visits by institutions.

Table 4.2: Number of Farmers Reporting Ever Having Been Visited by Institutions

Institution	Frequency	Percentage
VIAP	32	40
DA	21	26.3
FD	9	11.3
Local administration	5	6.3

Source: Field Survey, 1999

VIAP made the most number of farm visits constituting almost half of the farmers reached. This can be attributed to intensified efforts in agroforestry extension by the institution beginning 1995, coupled with the availability of support resources that have allowed more deployment of frontline staff (extension workers) and catered for mobility requirements in targeted areas.

Though in operation for a longer period, the Forest Department (FD), Department of Agriculture (DA) and the Local administration were reported to have slightly lower numbers of visits. One possible reason for this was that VIAP targeted only the poor within the category of small-scale farmers whereas, the scope of DA and FD was not delimited thus even covering the large-scale farmers. Other reasons for the low numbers of visits as drawn from the interviews with extension managers were dwindling resource capacities both physical and human to effectively support extension – a fact accentuated by the governments' failure to deploy more extension workers to both institutions owing to ministerial financial cutbacks.

Return visits showed a similar trend with VIAP having 35 percent and the Department of Agriculture (11.3%) while there were no recorded return visits by the Forest Department. Since VIAP has set specific targets for its extension workers, the extension worker is obliged to show performance upon which judgement for supervision is based. This explains why VIAP's extension workers may be so much concerned with the farmers' progress. In addition, the VIAP's extension workers are provided with bicycles to facilitate mobility from one place to another in the course of their extension duties.

4.3.1.2 Group Approach

Results from interviews with extension managers and workers indicate that group approach is a recent phenomenon in Trans Nzoia District. A similar observation has been made by Chavangi *et al.* (1996). Table 4.3 below summarises extension contact *via* group approach.

Table 4.3: Farmers' Responses on Group Extension Contact by Institution

Institution	Frequency	Percentage
VIAP	10	12.5
DA (SWCP)	5	6.3
FD	2	2.5
Green Belt Movement	1	1.3
WWF	1	1.3

Source: Field Survey, 1999

VIAP had reached the most number of farmers in the survey through the group approach. Started in 1995, the group contact by VIAP has so far reached 12.5 percent of the farmers. The Department of Agriculture had reached 6.3 percent whereas the Forest Department Green Belt Movement and WWF had contacted 2.5 percent, 1.3 percent and 1.3 percent of the farmers respectively.

The survey further revealed disparities on how the concept of group approach was embraced and executed by extension agencies. Three notable distinctions in the manner of understanding and implementing group approaches were drawn from the experiences of VIAP, the Soil and Water Conservation Programme of the Department of Agriculture, and the Forest Department.

The VIAP approaches this extension method by the formation of neighbourhood groups of about 10-15 farmers. The groups serve as avenues to impart and exchange knowledge in agroforestry. On average extension workers interviewed had five of these groups, two of which were active. The process involves holding meetings between extension workers and group members where various issues in agroforestry are deliberated. Meetings are held on a rotational basis among group members.

Discussions revolve around farmers' agroforestry needs and problems, how to establish home nurseries, direct sowing/seeding, tree management and general agroforestry practices. Apart from free supply of seeds of selected tree species, the role of the extension worker and that of the project is entirely technical or advisory. This method has been successfully implemented in Uganda as part of a pilot scheme in four counties, namely; Tororo, Bushenyi, Iganga and Kabalore. In this scheme, each group comprises 12 – 15 members who meet two times a month. However, the method varies with the one used by VIAP as each group has a chairperson who is a contact farmer and that each extension worker is required to include informal groups such as women and youth groups (Kaboggaza, 1999). The success of the group approach as implemented by VIAP project never the less rests on time.

Unlike VIAP, the Soil and Water Conservation Programme tends to handle large groups of farmers, whose size will vary depending on the population of farmers in a catchment designated for rehabilitation. The groups sampled in the survey ranged between 100 and 200 farmers in a catchment. For this reason, most of the groups' activities are deliberated and executed through farmers' representatives. The process begins by the Divisional Planning Team (D.P.T) liasing with the local administration to call a public meeting (*baraza*). This serves as a sensitisation campaign and as a forum to elect or appoint the local Soil Conservation Committees. In addition this arrangement provides an enabling environment to articulate the programmes' objectives including the need to plant trees as soil and water conservation measures. After the appointment or election of Soil Conservation Committee members, these members together with D.P.T and local administrators (*i.e*, chief, sub-chief and village elders), planning and mobilisation of farmers for implementation of activities

decided upon then takes place. The approach adopted in the study area to plan soil conservation activities and to mobilise farmers has been used with mixed results in Embu and Nandi Districts as reported in Admassie (1992).

The Forest Department on its part uses already established groups mainly women and youth groups as avenues for extension delivery. Forest Department Officials interviewed contended that if properly utilised the method is both a cheap and effective means of reaching out to the farmers. The main concern of the Department is to assist the groups attain self-sufficiency in tree production and management. However, the method leaves out a majority of farmers who are not organised in groups. Adopting a similar approach, the Green Belt Movement also reaches the farming community through Women groups. The objective of the Green Belt Movement as revealed by the survey, was to facilitate and enhance women's role in agroforestry, improve their livelihood and that of their families. The WWF on the other hand, uses Women and Youth Groups in articulating and implementing its objective of conserving the Saiwa catchment on which Saiwa Swamp National Park depends.

4.3.1.3 Public Meetings (*Barazas)*

Farmers and other survey respondents identified public meetings *(barazas)* as one avenue for disseminating agroforestry messages in the study area. Nonetheless, public meetings were never specifically held for one purpose, this is, to promote agroforestry. Referring to Table 4.1 above, the call for community participation in development projects (5 %) and security (10 %) saliently featured as some of non-agroforestry messages delivered during *barazas*.

Normally, public meetings were organised by the local administrators, either by the area District Officers (5%), the chief (23.8%) or the Sub-chief (5%). It was only in one case where a farmer mentioned the Agricultural Officer as having organised the meeting. The presence of the local administrators was necessary for security reasons and to instil trust among farmers especially during the introduction of new projects.

The survey revealed that during public meetings, various governmental and non-governmental officers (*i.e.* Subject Matter Specialists-SMS's) were invited to deliver speeches in their areas of profession. Tree themes were mainly delivered by Subject Matter Specialists from VIAP, Department of Agriculture, Forest Department and National Environment Secretariat (NES) – see Table 4.4.

Table 4.4: Number of Farmers Who Had Attended Public Meetings Covering Tree-planting Themes

Institution holding meeting	Frequency	Percentage
Department of Agriculture	19	23.8
Forest Department	11	13.8
VIAP	10	12.5
Local Admin.	7	8.8
NES	3	3.8
No response	30	37.5
TOTAL	80	100

Source: Field Survey, 1999

As shown in the table, government sectors, namely: Department of Agriculture, Forest Department, Local administration and National Environment Secretariat were the greatest users of public meetings as an extension strategy. The Department of Agriculture had used this method more than the rest of the institutions probably because it utilises public *barazas* as a means of sensitising farmers about soil and water conservation.

4.3.1.4 Farmers' Seminars and Workshops

Seminars and workshops revolving around different topics in agroforestry have been held as methods of information dissemination and training. The underlying philosophy behind seminars was to train a small number of farmers who would, in turn through spill-over effect, benefit more farmers. The study results found out that in most cases, leadership of community groups was the criterion for invitation to the seminars / workshops. In other words, it is the leaders of local groupings or institutions who were selected to attend the seminars or workshops. For instance, the Soil and Water Conservation Programme (SWCP) invited local Soil Conservation Committee Members, whereas the Green Belt and VIAP considered women group leaders (Table 4.5).

Table 4.5: Number of Farmers Attending Seminars / Workshops by Host Organisation

Host Agency	Frequency	Percentage
DA	5	6.3
Green Belt	4	3.5
VIAP	1	1.3

Source: Field Survey, 1999

The Forest Department did not record any contact through seminars or workshops from the farmers interviewed. The District Forest Officer however mentioned that three workshops had at the time of the study been conducted in Cherangani Division as part of the groundwork to implement the newly incepted World Bank funded Lake Victoria Environmental Management Programme (LVEMP). Invited farmers included members of women, youth and self-help projects involved in tree planting activities. These groups have been singled out as possible producers of seedlings to re-afforestate the Nzoia river catchment. The project intends to support these groups by providing tools, tubes, as well as buying seedlings that will be earmarked for rehabilitating communal or public lands on the Nzoia catchment.

The study revealed that there were variations in topics covered in the seminars and / or workshops that depended on the host agency. For instance, the Department of agriculture (SWCP) covered topics in agroforestry, soil conservation, crop farming and community participation. The Green Belt advanced themes in general environmental conservation, energy conservation and leadership dynamics. VIAP, on its part, dwelt on subjects in agroforestry particularly seed collection. The project encourages seed collection through women groups. These groups contribute the greatest portion of seeds bought by the project. It is noteworthy, however, that the topics covered in seminars or workshops were not exclusively the task of members of the host agency. In that case, the host agency would normally invite Subject Matter Specialists from other professions in the workshops or seminars to assist in training of the farmers / community leaders. This approach provides for a multi-disciplinary exchange of knowledge and / or experience, which serves to buttress knowledge available in any single profession.

The survey further found out that for purposes of convenience and economy, most workshops or seminars were held at a venue in proximity to the invited farmers usually at a more central location within the division. Besides, the duration of the courses was short ranging between 1 to 3 days. All these factors favourably combined to cut down on the travel costs of farmers, expenses of hosting them and time spent on the course.

4.3.1.5 Field Days

According to survey findings, field days were either held on individual farms or an institutional demonstration farm. For the former, model farmers were preferred for hosting demonstrations (Table 4.6). Overall, the Department of Agriculture conducted the most number of field days (8.8 percent), VIAP (3.8 percent) and Forest Department (1.3 percent). The dwindling resources in the Department of Agriculture

and lack of new products to promote (*e.g.* fertilisers) have, however, reduced the use of field days as an extension strategy. Field days in the FD were conducted during national tree planting days. Field days by VIAP were normally organised by Zonal Managers together with extension workers. The field days took place either at Olof Palme centre or ADCs usually at the discretion of the Zonal Manager who, when deemed necessary, organised transport to the demonstration site.

Table 4.6: Farmers Participating in Field Days, Venue and Facilitating Agency

Facilitating agency	Venue	Frequency	Percentage
Department of Agri.	Farm	7	8.8
VIAP	• Farm	1	1.3
	• Olof Palme Centre	1	1.3
	• A.D.C	1	1.3
FD	Tree planting day	1	1.3
No response	-	60	75
TOTAL		80	100

Source: Field Survey, 1999

All field days by Department of Agriculture were held on a model farm. The VIAP on the other hand had more options, namely: on the farm (5%), Olof Palme centre (1.3%) and Area Demonstration Centres – ADCs (2.5%). The Olof Palme Centre, located in Kitale, is a central agroforestry demonstration centre. Located on a 10 acre piece of land, half of which exhibits most agrosilvipastoral practices, the centre is a major attraction to groups of visiting farmers, school children, tertiary institutions and others for educational purposes. In addition, each extension zone (or area of concentration) has an area demonstration centre (ADC) which is more accessible to farmers.

Among lessons learnt during field days were: Agroforestry techniques (11.3%) general farm management (10%), management of a specific crop (1.3%), soil conservation (6.3%), animal husbandry (1.3%) organic farming / double digging (1.3%) and nursery management (1.3%). Table 4.7 below shows the distribution of messages covered in field days across institutions.

Table 4.7: Distribution of the Type of Messages Covered in Field Days by Institution

Institution	Message delivered in field days	Frequency	Percentage
VIAP	• Agroforestry techniques	9	11.3
	• Organic farming/double digging	1	1.3
Department of Agri.	• General farm management	8	10
	• Soil conservation	5	6.3
	• Management of a specific crop	1	1.3
Forest Department	Management of a nursery	1	1.3

Source: Field Survey, 1999

From the field days survey respondents identified three common messages. Agroforestry messages were, however, minimal despite the large proportion of messages represented in the field days by the institution. VIAP, on the other hand, has tried to diversify agroforestry messages to include other production-enhancing techniques that are easily accessible to the farmers. In fact the concept of Area Demonstration Centres (ADCs) as conceptualised by the management has been prompted by the desire to offer agroforestry options to the small-scale farmer in a manner affordable to and easily replicable by them. This is important particularly in forestalling the risk of farmers perceiving the techniques demonstrated as alien to them, too complicated and expensive – all being factors that can discourage adoption of practices learnt. Such was the folly taken according to Kerkhoff (1990), when introducing the RAP Project in Rwanda where about 100 model farms were

established. These model farms were created to feature a full package of trees, crops, livestock-keeping and soil conservation techniques but ended up in low adoption by local farmers, not even the immediate neighbours, adopted the techniques on display.

4.3.1.6 Farmers' Tours / Excursions

From the study's findings, VIAP dominated in the use of farmers' excursions as an extension strategy. VIAP had reached 5 percent of farmers using this method. The Department of Agriculture had taken 2.5 percent of the farmers to excursions while Forest Department did not record any of these (Table 4.8).

Table 4.8: Farmers Responses on Their Participation in Excursions by venue and Institution

Institution	Frequency	Percentage	Place taken (venue)
VIAP	4	5	Outside the division
Department of Agriculture	2	2.5	Within the division

Source: Field Survey, 1999

VIAP's extension workers interviewed regarded farmers' excursions as an incentive for farmers to adopt agroforestry and embrace the neighbourhood (group) concept. This perhaps explains why all farmers who had participated in the farmers' excursions were active members of a VIAP-initiated group. Since VIAP has readily available transport, use of excursions by the project does not pose a major problem, an element that also supports the higher proportion (5%) in terms of utility of this method by the project compared to other institutions.

Farmers interviewed had been taken to Kolongolo in Kwanza division or Olof Palme centre which is apparently a success story in the implementation of the projects activities particularly in the area of intercropping trees with crops, hedge row planting and trees dispersed on farms. Visiting farmers were thus expected to learn from the farmers' excursions, gain motivation and subsequently emulate what they had seen. The 2.5 percent represented by Department of Agriculture were members of a Soil

and Water Conservation Committee taken to a successful catchment (mostly Kananachi). The Committee members were in turn expected to draw from the experiences of the successful catchment to be later replicated in their own catchment.

Since most of the farmers in the survey were taken for an excursion within the District, it was expected that the experiences they were exposed to be relevant locally. This is an important aspect in determining the success of the method. A case in point is Koro Project in Mali, which after 3-4 years succeeding an excursion, farmers were unable to replicate Majjia Valley Project's windbreaks in Niger despite the impression created by the windbreaks. To all participants, extension staff, administrators and farmers, windbreaks were seen as the solution to sand dune encroachment back at home. However, the windbreaks were not locally appropriate (Hagen, 1986). This experience underscores the need to look for more locally appropriate examples to learn from in farmers' excursion s as opposed to distant and expensive examples.

The foregoing discussion has identified six methods used by extension agencies in the delivery of extension services, namely: individual visits, group approaches, public meetings, seminars and workshops, field days and tours. There were however differences in terms of the methods preferred or commonly used by agroforestry extension institutions (Table 4.9).

Table 4.9: A Comparison Between Institutions Delivering Extension Services by the Method Used

Institution	Farm visit		Group		*Baraza*		Seminar		Field day		Tours	
	Freq.	%	Freq.	%	Freq.	%	Freq	%	Freq	%	Freq	%
VIAP	32	40	10	12.5	11	12.5	1	1.3	3	3.8	4	5
DA	21	26.3	5	6.3	19	23.8	5	6.3	7	8.8	2	2.5
FD	9	11.3	2	2.5	11	13.8	-	-	1	1.3	-	-
Green Belt	-	-	1	1.3	-	-	4	5	-	-	-	-
Local adm.	5	6.3	-	-	7	8.8	-	-	-	-	-	-
NES	-	-	-	-	3	3.8	-	-	-	-	-	-
WWF	-	-	1	1.3	-	-	-	-	-	-	-	-

Source: Field Survey, 1999

Individual visits, as are evident, dominate in extension contact. According to the survey results, VIAP had reached the greatest number of farmers using this method followed closely by the Department of Agriculture. This could be attributed to the fact that individual visits have a long history in Kenya (Tengnäs, 1993) owing to the Training and Visit strategy (T&V) that has been used which is as old as extension itself (Lelo *et al.,* 1995). The cumulative percentages between the NGO's and the government institutions in the use of the method showed that government institutions had more strength with 43.8 percent, against 40 percentage represented in the NGO sector. This is attested by the great number of institutions involved in extension delivery using this method in the government sector. These institutions include the Department of Agriculture, the Forest Department and the Provincial / Local Administration. There also existed variations in the time farmers were contacted with governmental institutions having reached farmers earlier than non-governmental institutions. On the other hand, Non-governmental organisations have operated for a short time but have in the recent past achieved higher proportions of the farmers reached. This owes to intensified extension efforts and the enabling environment in terms of human and physical resources in the non-governmental sector already discussed in section 4.3.1.1.

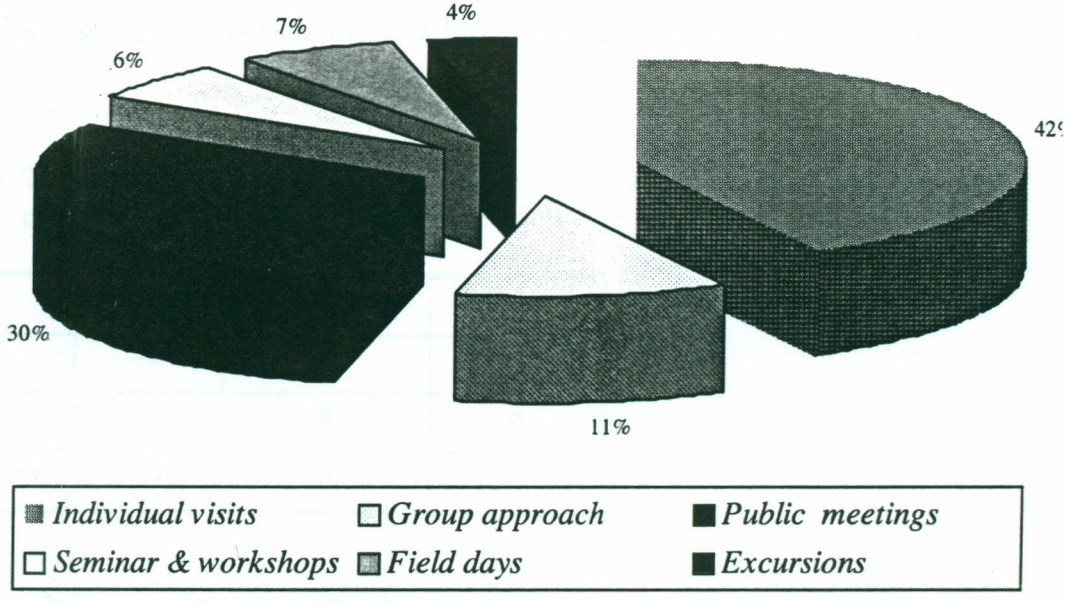
Increasingly however, in terms of usage and preference, were *barazas* and the group-based approaches. Ranking highest in the survey were public meetings followed by the group approach (*i.e.,* neighbourhood groups, soil conservation committees and women groups). *Barazas* were preferred most by the governmental institutions with a cumulative percentage of 50.2 percentage recorded by DA, FD, NES and the Local administration against 12.5 percentage of the NGO's represented by VIAP of the total farmers' responses on this method.

The group approach was preferred and commonly used by the NGO's. VIAP, Green Belt Movement and WWF had a cumulative percentage of 15.1 percent against 8.8 percent reported by DA and FD. Combined, the *barazas* and the group approach were reported to achieve considerable economies of scale considering the demands of individual visits in terms of time, manpower and support resources required. This finding is consistent with Tengnäs (1994) and Kerkhoff (1990) findings on the use of group-based approaches in extension. This in itself is a pointer to the continued usage of the methods in future, considering the dwindling resource capacity among extension agencies.

The rest of the methods were generally less utilised in extension delivery in the study area. Considering the proportions in terms of the use of the methods, however, field days ranked highest followed by seminars / workshops and farmers' excursions in that order. According to survey results, the greatest proportion of field days were recorded in the governmental sector where the Department of Agriculture dominated in the use of the method. For seminars and workshops, there were no marked differences in the use of the method between NGO's and governmental institutions. The slight difference may be attributed to bias for the method by governmental institutions. Given the scarce resource status in governmental institutions, expending less on training a few numbers of farmers so as to benefit the rest through the spill-over effect, seems plausible.

On the other hand, the NGO institutions used the excursion method more than did government institutions. On the whole, seminars / workshops, field days and excursions were good forums for training particular issues in agroforestry and served to exemplify to (small-scale) farmers the practicability of integrating forestry into their existing farming systems. Figure 4.2 summarises extension coverage by the method used.

Fig.4.2: Variations in the Use of Extension Methods



The figure clearly depicts that individual visits were the most utilised, followed by public meetings, group approach, field days, seminar and workshops, and excursions in a descending order. In a nutshell, different institutions favoured different extension methods, which depended on resource availability of the institution, policy provisions and basic ideologies governing the management and operations of the institution.

The study further sought to establish whether there were differences in terms of the farmers reached along the two categories, contact farmers and non-contact farmers. The frequency distribution between the variables, "contact" and "reached" is given in Table 4.10.

Table 4.10: The Frequency Distribution Between Contact Farmers and Non-contact Farmers Reached by Extension Agencies

Reached	**Contact**	**Non-contact**	***Row total***
Yes	40	32	72
No	0	8	8
Column total	40	40	80

Computed (χ^2) value	Degree of freedom	Critical value
8.455	1	3.84

Source: Field Survey, 1999

Results of the Chi-square (χ^2) indicate that the differences were significant at α 0.05 level. This implies that contact farmers have been recipients of extension messages and products more than non-contact farmers suggesting extension bias for contact farmers. This can be partly explained by the fact that individual visits dominated as an extension method where extension workers are required to visit the farmer in his farm. Here, it might be prudent that the extension worker visit farmers who are more co-

operative and hospitable, among other reasons. This point is supported by the vast majority of the extension workers who perceived their efforts being frustrated by hostile or unco-operative farmers. This finding agrees with similar findings by Kerkhoff (1990) and Budd *et al.* (1990) about extension biases.

4.3.2 The Extent of Farmer Participation in Extension Programmes

Farmer participation in extension programmes is a key determinant to the success of these programmes (Van den Ban *et al.* 1996). This being the case, this study investigated the inputs of farmer in the entire cycle within which extension programmes are executed, namely: planning, decision making, implementation, monitoring and evaluation. It further sought the various *forms* of participation in the course of implementing extension programmes. Data were obtained through interviews with extension managers, subject matter specialists and extension workers. Some of the data collected were verified in the field *via* questionnaires and the focus group interviews.

4.3.2.1 Planning and Decision Making

Planning begins by knowing the farmers' needs, problems and potential. The survey revealed three distinct strategies employed by extension agencies in an attempt to identify farmers' needs and potential. First, the Soil and Water Conservation Programme involves farmers indirectly through their elected or appointed representatives who are members of the Soil and Water Conservation Committee. The Soil and Water Conservation Committee members together with the assistance of local administrators make most planning activities and decisions, which are then set for implementation. This approach nevertheless, underplays the role of farmers in identifying their needs as the selection of a catchment is the preserve of Divisional

Planning Teams (D.P.T's). This is because the requirement for rehabilitation is not determined by the farmers but by outsiders. Besides, the approach gives much leeway to domineering role by the local administrators and the Soil Conservation Committee members whose overt influence may be counter productive.

The VIAP on the other hand approaches planning through Participatory Rural Appraisals (PRA's). A full-fledged P.R.A Department has been in operation since 1997. PRA's have allowed farmers to identify and rank their needs, problems and potential. The P.R.A exercise culminates in a community work plan stipulating what farmers will do and what external support is required. The P.R.As are broad and cover a wide spectrum of community / farmers' needs. Consequently, the project only intervenes within the provisions of its goals and objectives.

The survey revealed that planning and decision-making on the ground was achieved a long various extension methods. The study therefore seems to concur with Scherr's (1990) postulation that farmers' participation can be achieved using any extension model. For instance, communication between the extension worker and the farmer during a farm visit was considered cordial by 48.8 percent of the farmers. Although the farmers' role in planning and decision making could not be clearly established, all farmers who found communication not cordial (7.5 percent) and those who were indifferent (10 percent), were antagonistic towards extension services offered. This is evident by the low rating of the method as presented in Table 4.11 below. One farmer who argued against the poor status of communication with the extension worker posed the question:

> *Why should I be told not to cut trees that I planted of my own volition? Why was the extension worker not here before I planted them?*

Table 4.11: The Frequency Responses of Farmers' Feelings on Communication *versus* the Rating of Individual Visit Extension Method

Communication	Rating of Individual Visit (Frequency)			Total	
	V. Important	Important	Irrelevant	Frequency	Percentage
Cordial	18	21	0	39	48.8
Not cordial	0	0	6	6	7.5
Indifferent	4	11	8	23	28.8
Missing cases	-	-	-	12	15

Source: Field Survey, 1999

Results on farmers-extension worker communication lead to the presupposition that where cordial relations exist, mutual discussions between a farmer and an extension agent thrives and indeed yields better results in extension as indicated by the high rating of the method. Such is a typical example of a two-way communication system which demands the extension agent to be a good listener and perceptive of farmers' feelings, needs and problems. This is supported by similar findings by Mwangi (1998) and KWAP in Western Kenya (Kerkhoff, 1990) on the need for extension agents to be equipped with good communication skills.

Yet, another example can be drawn from the group approach. Dealing with small groups of neighbours as the case is with VIAP, the extension worker directly interacts with, plans and assists farmers make decisions. For instance, focus group discussions revolving around themes such as, establishment of a home or on-farm nursery, direct seeding, and intercropping of trees with crops dominated activities by VIAP groups. This differs with the approach by the SWCP discussed above. The SWCP indirectly makes planning decisions through SCC's leaders who are farmers' representatives.

Overall, the survey distinguished two dimensions of farmer participation in the planning and decision making of extension programmes. First, involvement of farmers indirectly (*e.g.* catchment approach) where planning decisions were made through farmers' representatives, in this case, the Soil Conservation Committee. Second, beginning with the farmers, directly planning with them, and making decisions together as the case is with the neighbourhood concept and PRA by VIAP.

4.3.2.2 Implementation

Implementation followed the planning and decision making stages in the cycle within which farmers participated in the extension programmes. In the study area, implementation entailed pulling together of resources that were externally provided by extension agencies or locally available among farmers to adopt planned activities. This, according to the study, constituted the *forms* of participation. For instance, farmer participation in the SWCP involved provision of labour to rehabilitate public and communal degraded areas such as hillsides and roadsides. The programme on its part provided materials for laying soil conservation structures (*i.e.*, spirit level, *jembes*, wheel barrow and spades) as well as technical support to enable this to be done. In some cases the programme facilitated provision of tree seedlings. On individual farms, the contribution of the programme was entirely technical. The farmer on his part provided labour.

Adopting a more or less similar approach, the VIAP provides seeds and advice to farmers. Previously before instituting a full-fledged extension scheme in 1995, however, the project provided seedlings raised in village nurseries to be distributed to farmers throughout the District (Chavangi *et al*, 1996). In the current approach the farmer provides the rest of the resources necessary to establish a nursery or for direct

seeding after receiving free seeds. Such resources include, water, tubes, fertilisers or manure, and tools as well as labour.

In addition, farmers who were members of women groups affiliated to the Green Belt Movement identified the Institution as a source of material support. The nature of support included provision of planting tubes and buying of seedlings from the women groups. Women group members on the other hand, were expected to provide labour to establish and manage the nursery, and provide a site for the tree nursery. Table 4.12 below summarises the farmers' contributions and the support they received from institutions delivering extension services.

Table 4.12: Frequency of Farmers' Responses on Institutional Sources of Support and Their Contributions in Extension Programmes

Institution	**External Support**	Freq.	%	**Farmers' Contribution**	Freq.	%
Department of Agriculture (SWCP)	Tools (*jembes*, spirit level, spades *e.t.c.*)	4	5	Labour • Digging terraces • Planting trees	 5 3	 6.3 3.8
Green Belt movement	Tubes Seedlings	1 3	1.3 3.8	Labour Nursery site	4 1	5 1.3
VIAP	Seedlings Seeds	30 17	37.5 21.3	Labour Water Fertiliser/manure Used containers/ tubes	40 21 3 1	50 26.8 3.8 1.3

Source: Field Survey, 1999

As shown in the table, labour was the greatest contribution by farmers in extension programmes. Other *forms* of participation included use of resources that could be expended at the discretion of the farmer to plant and manage trees, for example, use of fertiliser or manuring, and the choice to use containers or tubes in on-farm seedling

production. On the other hand, seedlings have been the most common material support given by extension agencies. But with the change of focus away from seedling production, provision of seeds to farmers is becoming common. According to the results of the interviews with farmers, the Forest Department had not provided any material support to farmers probably because of the fact that seeds from the central nurseries were sold (though at a subsidised cost) to the farmers and thus not considered as support from the institution.

On implementation, the survey established that adoption of agroforestry extension packages was the prerogative of the farmer. This is supported by the fact that all respondents in the survey viewed their participation in extension as voluntary and not coerced. In total, 68.8 percent of farmers had adopted (*i.e.,* utilised extension messages or products) while 16.4 percent had not. Farmers who had implemented agroforestry had done so by: planting trees distributed from the village nurseries (VIAP) or central nurseries (Forest Department) which were among the institutional sources of seedlings, attempting direct seeding, and experimenting with the promoted tree management techniques. Table 4.13 Provides evidence of the adoption of agroforestry messages and products.

Table 4.13: Farmers' Frequency of Responses on the Adoption of Agroforestry Messages and Utilisation of Products

Adoption Type	Adoption Practices / Techniques	Frequency	Percentage
Planting trees	• Boundary planting/hedge	34	42.5
	• Home garden/compound	43	53.8
	• Woodlot	9	11.3
	• Intercropping	3	3.8
	• Trees dispersed on the farm	21	26.5
	• Trees on conservation structures	6	7.5
Direct seeding	• Broad casting	2	2.5
	• Line planting	8	10
	• Scattered	4	5
On-farm nursery	• In containers/ tubes	5	6.3
	• Bareroot	14	17.5
Tree management	• Coppicing	11	13.8
	• Pollarding	4	5
	• Side pruning	28	35
	• Root pruning	1	1.3

Source: Field Survey, 1999

Tree planting was the most common adoption type and essentially involved the integration of the tree component into the crop and livestock systems described in section 1.7.2 above. The survey provided evidence for this by looking at the common agroforestry practices on farmers' fields. The survey identified the following six agroforestry practices: boundary planting (42.5 %) adoption rate, compound planting (53.8 %), woodlots (1.3%), tree-crop intercropping (3.8%), trees dispersed on farms (26.5%) and trees on conservation structures (7.5%).

Most trees were located on the compound and along the boundary or hedge. For the two forms of tree configuration, *Grevillea robusta, Cupressus lusitanica, Sesbania sesban, Eucalyptus spp. Casuarina equisetifolia, Melia azedarach* and *Acacia mearnsii* were among the common exotic tree species planted in that order. Indigenous species included *Markhamia lutea, Croton megalocarpus,* and *Croton macrostachyus.*

On the other tree planting configurations, trees dispersed on the farms were an assortment of different tree species such as *Grevillea robusta, Sesbania sesban, Croton spp.* and *Acacia spp.* In this category *Acacia spps.* with the exception of *Acacia mearnsii* formed part of the original vegetation and it was thus difficult to ascertain whether they had been planted. *Eucalyptus spp.* was the most common in woodlots followed by *Acacia mearnsii, Grevelia robusta and Pinus spp.* respectively. Three common tree species on conservation structures were *Grevelia robusta, Sesbania sesban and syzygium cuminii.* Lastly, *Sesbania sesban* and *Markhamia lutea* were the tree species used for tree-crop intercropping in the study area. Similar findings where most trees are planted in homesteads and field boundaries with a few trees on cropland have been reported by Teklay (1996) in Feleghe-Hiwoi locality in the Eastern part of Tigray, Ethopia.

The second most adoption type was tree management manifested through side pruning (35%), coppicing (13.8 %), pollarding (5 %), and root pruning (1.3 %). Side pruning was done on *Cupressus lusitanica, Grevillea robusta* and *Croton megalocarpus* to mainly improve the tree trunk for quality timber and as away of harvesting firewood from prunings. Pollarding had been done on, *Grevillea robusta* and *Croton megalocarpus* mainly to reduce the shade effect on crops. Coppicing was

mainly done on *Eucalyptus spp.* and in one case each on *Croton macrostachyus* and *Markhamia lutea.* Coppicing was performed as a harvesting technique for small tree trunks but only confined to trees that had proven ability to resprout. One farmer who got advice from the Agricultural Officer had also done root pruning on *Eucalyptus spp.* to reduce competition for nutrients and water between the crops and trees.

The third most common adoption type was the establishment of an on-farm nursery. The study found out that more farmers preferred raising tree seedlings bareroot (17.5%) as opposed to the more demanding option of having to plant them in containers or tubes (6.3 %). The reason given for this bias was that the former technique was both cheap and less labour intensive. However, most nurseries were not well protected from damage by livestock (refer to table 4.14 below).

Finally, farmers have attempted direct seeding as an adoption type. The survey identified three techniques employed in direct seeding. First, seeds were planted in a line (10%) preferably on a boundary, a hedge or an alley. This was the most common form of direct seeding. *Sesbania sesban, Croton megalocarpus, and Calliandra calothyrsus* species had been planted in lines. The second technique involved sowing seeds in single holes (5%). This had been attempted using *Croton megalocarpus, Markhamia lutea, and Melia azedarach.* Lastly, seeds were broadcasted (2.5%) on the planting site as the case with *Acacia mearnsii* and *Sesbania sesban.* The general reasons given for direct seeding were that it was a good method for establishing many trees on the farm and that less labour was required. Yet another reason was that if seeding was done on an agricultural field or on the boundary, this ensured that as the crop is weeded the saplings were also weeded.

The study also considered factors that have hindered effective adoption of agroforestry extension messages and utility of products (Table 4.14).

Table 4.14: Adopters' Responses on Problems That Hinder the Effective Adoption of Agroforestry

Factors	Frequency	Percentage
(a) Seedlings		
• Livestock damage	25	31.3
• Fire	13	16.3
• Water scarcity	37	46.3
• Theft	2	2.5
• Boundary conflicts	1	1.3
• Transport difficulties	6	7.5
• Pests	3	3.8
(b) Seeds		
• Poor germination	16	20
• Unavailability of seeds	9	11.3

N = 80

Source: Field Survey, 1999

There were three major factors that farmers thought hindered effective integration of the tree component into the existing farming systems, hence, considered as constraints to tree growing in the study area. These factors were: water scarcity (46.3%), livestock damage (31.3%) and fire (16.3%). These factors may have contributed significantly to low survival rates of seedlings / saplings in the study area. Other constraints, but of lesser magnitude, were transport difficulties (7.5 %), tree pests (3.8 %) particularly termites and the Cypress aphid in the early 1990's, seedling theft (2.5 %) and boundary conflicts (1.3 %). These figures compare well with the findings of Chavangi *et al* (1996), on the constraints in tree establishment in Trans Nzoia District. Their study did not, however, cover the constraints stemming from the use of seeds in tree establishment.

The farmers who had used seeds for tree establishment indicated two factors that hinder the effective use of this method. First, poor germination of seeds was reported by 20 percent of the farmers suggesting low viability of seeds distributed especially of *Grevillea robusta* and *Calliandra calothyrsus*. This could be attributed to the fact that most seeds particularly those distributed by VIAP were locally collected from farmers without stringent seed provenance requirements and quality control standards. Holding and Omondi (1998) have explained this fact as emanating from seedlings bought hurriedly and without proper planning by VIAP resulting into poor quality seeds. Low viability of seeds does not, however, rule out other determinants of poor germination of seeds such as water scarcity or management operations, among others. But the fact that seeds of other tree species such as *Markhamia lutea* have performed fairly well in terms of germination makes the argument plausible and a pointer to the need for the project to investigate the underlying causes for poor germination of seeds of the affected species.

Second, was the unavailability of seeds particularly of preferred species. Most farmers (11.3 %) felt that the seeds distributed did not regard their preferences. The VIAP which is the principle seed provider in the District, for instance, promotes only selected tree species with a bias for intercropping species (*Sesbania sesban, Calliandra calothyrsus*), fruit trees (*Pasiflora edulis, Psidium guajava*) and indigenous species (*Ndomdea rotundifolia, Cordia africana and Prunus africanus*) among other species.

The survey also dealt with factors related to non-adoption of agroforestry messages or utility of extension products. Several reasons were given by farmers for failure to implement agroforestry extension packages (Table 4.15).

Table 4.15: Farmers' Responses on Reasons for Non-Adoption of Extension Packages and Products

Reason	Frequency	Percentage
Poor contact with extension worker	6	7.5
Farm too small	4	5
Lack of adequate information	5	6.3
Negative tree crop interactions	3	3.8
Leased land	1	1.3

Source: Field Survey, 1999

Poor extension contact between the farmer and the extension worker (7.5%), lack of adequate information (6.3%) and the farm too small to integrate crops (5%) were the three principal reasons for non-adoption of agroforestry extension packages. These reasons suggest the likelihood of extension deficiencies that have negatively influenced farmers' attitude towards adoption of agroforestry. For instance, farmers who felt that the farm was too small showed ignorance on the potential role of agroforestry in meeting their diverse needs. This also applies to a minority who could not adopt agroforestry owing to the perception that all tree species have negative interactions with the crops. One farmer though felt that he could not adopt agroforestry because he had leased the piece of land he was cultivating and therefore not concerned with long-term investments like tree growing. This perception in itself emphasises the need for security of tenure of land to tree planting or investment in agroforestry.

It was also necessary for the study to find out whether there was any variation in terms of adoption of agroforestry between contact farmers and non-contact farmers. The existing relationship between variables "adoption" and "contact" were tested using the Chi-square (χ^2) test. The contingency tabulation is presented in Table 4.16.

Table 4.16: Frequency Distribution of Responses on the of Adoption Agroforestry Extension Services Between Contact and Non-contact Farmers

	Adoption of Agroforestry		
Category	Adopted	Not adopted	*Row total*
Contact	34	3	37
Non-contact	21	10	31
Column total	55	13	68

Missing value = 12

Computed (χ^2) value	Degrees of freedom	Critical value
6.634	1	3.84

Source: Field Survey, 1999

The results were significant at α 0.05 level, which means that contact farmers were better adopters than non-contact farmers. This finding agrees with the Chi-square results earlier discussed in section 4.3.1, which revealed that contact farmers had an edge over non-contact in receiving extension messages and products. On the whole, this revelation differs with Teklay's (1996) findings that found extension not a factor in explaining the variations in adoption of agroforestry in Eastern Tigray region in Ethiopia.

4.3.2.3 Monitoring and Evaluation

Monitoring is the systematic recording and periodic analysis of information. Evaluation is a measure of progress to determine whether the original objectives have been achieved and if they are still relevant (Case, 1990). These are activities that also require farmers' inputs (Van den Ban *et al*, 1996). A general consensus established during the survey was that farmers were apportioned no role in monitoring and evaluation of extension programmes or activities by the extension agencies. Monitoring was basically used to achieve two objectives. First, monitoring was used as a tool by extension managers to supervise frontline extension staff. This entailed checking the field progress of the frontline extension staff, and the collection and perusal of field monthly reports. Second, and as an objective previously met by VIAP, was the assembling of data on the numbers and species of seedlings produced in the village nurseries, the number of farmers who received the seedlings and survival check up of the seedlings distributed. For instance Chavangi *et al.* (1996) and Government of Kenya (1997) have used these results which showed that only 30 percent of seedlings distributed from the village nurseries had survived to maturity.

Such methods of monitoring as the ones used by VIAP, however, have been known to obtain information of little value. For instance, they are slow, expensive and errors may creep in when farmers have other sources of seedlings. But more important, they lack a feedback mechanism where the farmer can articulate his problems (Kerkhoff, 1990). Survey findings showed that monitoring has failed to unearth the underlying reasons to explain the low survival rates of tree seedlings. Moreover, the project did not seem to have effective data collection and processing capability. The monitoring Department has only one computer at its disposal, which might not be sufficient to perform administrative tasks as well as process monitoring data from the field. The

other institutions did not have a discernible monitoring criterion for their activities nor was it clear, during the study, about the monitoring or progress indicators used by any of the institution contacted.

Giving the rationale of instituting monitoring based on effective feedback machinery, an aspect that lacked in the study area, Kerkhoff (1990) cites the experiences of two projects. On the one hand, is RAP project in Zimbabwe whose results compare favourably with the study findings on the monitoring experience in Trans Nzoia District. The RAP Project concentrated effort towards keeping records of farmers receiving seedlings and the survival rates of seedlings distributed, an exercise that was largely futile in promoting rural tree planting. On the other hand, for Gituza project in Rwanda, a participatory method was used with a rigorous staff-training component in monitoring techniques whose results yielded more and valuable information. Farmers were also involved in the monitoring exercise hence the project was able to show the difficulties farmers faced in the implementation of agroforestry.

The survey also found out that evaluation had been used more often in donor-funded programmes, such as, VIAP and SIDA's Soil and Water Conservation Programme to gauge their impact (*i.e.* whether programme goals and objectives are being met and how this is done). However, this was done by external researchers and not the project staff and thus tended to be treated by the extension managers and workers as a separate exercise. Consequently, the extension staff takes little interest in the results.

The foregoing scenario in the study area may be partly explained by the fact that farmers' participation is a concept newly introduced in the District and still at the initial stages of implementation. Much of the work is concentrated on conducting PRA's and awareness creation. However, no framework has hitherto been instituted to

integrate farmers in monitoring and evaluation of extension programmes. The trend towards institutionalising monitoring in extension programmes, as is the case with the VIAP, is nonetheless commendable. Similar results have been reported by Kiristos (1998) where farmers participation in monitosring and evaluation is partial or non-existent have been reported in Degua Tembien area in Tigray, Ethopia which has been one of the major hindrances to the full realisation of local people's participation in reforestation.

4.4 Problems of Participatory Agroforestry Extension

The second objective of the study was to expose problems that impede the full realisation of participatory agroforestry extension in the study area. The problems were tackled at two levels: first, problems existing at the agency level. Here, data were obtained from interviews with extension managers, subject matter specialists and frontline extension staff. The second level which involved a set of questions administered to the farmers, were to expose problems which hinder or make it difficult for farmers to participate in extension programmes. Some of the data were also obtained from interviews with extension workers and focus group interviews.

4.4.1 Problems at the Agency Level

Broadly, problems of participatory agroforestry extension at the agency level hinged on the general problems that relate to the overall extension organisation of the institutions concerned. Thus, in trying to expose problems of participatory extension, issues relating to the management, goals / objectives and policies were considered. Survey findings revealed several factors affecting the full realisation of participatory agroforestry extension in the study area, namely: staffing, support resources and inter agency co-ordination.

4.4.1.1 Staffing

The survey sought to establish the size of staff *vis a vis* extension coverage, staff's competency, supervision and motivation. All these factors, as given by McCaslin and Mwangi (1994), act in juxtaposition to determine the quality of extension service delivered.

(a) Staff Size

The survey revealed that there was understaffing particularly among frontline staff. Differences also existed between extension agencies on the size of frontline staff (Table 4.17).

Table 4.17: Size of Extension Staff by Institution / Agency

	Staffing			
Agency	**Managers**	**SMS**	**FLS**	**Total**
DA				
• Crop and livestock	3	60	130	193
• SWCP	1	4	–	6
VIAP	3	14	90	117
WWF	1	1	7	9
FD	1	4	*	*

* No official records available.

Source: Field Survey, 1999

The Department of Agriculture had more strength in extension considering the staff size *per se*. However, the staff was distributed among other departments such as the Home Economics, livestock and crop arms of extension within the Department to carry out special extension services. The Soil and Water Conservation Department did not have frontline extension workers. This compartmentalisation of the 130 frontline

staff means that an extension worker had wide extension coverage (target area). Besides, some of these extension workers within which a designated Soil and Water Conservation Catchment fell, particularly crop extension, were overburdened when called upon to assist in the soil and water conservation activities. Overall, according to official records, the extension agent to farmer ratio is 1: 400 (field survey, 1999). This ratio is far much great for the effective delivery of extension services as noted by Kerkhoff (1990) who recommends an average of about 100 farmers per annum.

The Forest Department did not have a definite number of frontline staff (no official records existed at the time of survey) but the District Forest Extension Officer (D.F.E.O) mentioned that on average, every location has a forest extension worker. He further indicated that some locations lacked extension workers. The reason given for this was failure to replace those who retired through the "Golden Handshake" early retirement scheme and the fact that the government does not deploy more extension workers. The latter reason was also cited in the Department of Agriculture.

In the NGO sector, VIAP had considerable strength with regard to staff size in agroforestry extension. The extension workers, though, felt overburdened by activities they were required to undertake because of the great number of farmers ($\cong$ 200) targeted per annum. For instance, managing neighbourhood groups ($\geq$ 13) of 10-15 farmers and individually attend to 200 farmers in a year including monitoring individual farmer's progress was considered quite difficult by project's staff. This is partly the implicit demand of the policy of neighbourhood groups now widely advocated by the project. WWF on the other hand has its activities concentrated on the Saiwa catchment with the object of conserving Saiwa Swamp National Park. Since the project is still young in the area the full demands of the activities on the extension workers are yet to come. In addition, current use of the few existing Women and Youth groups in catchment for conservation by the project is in itself no arduous task and a possible reason for the small number of frontline staff.

(b) Staff Competency

On competency, the survey considered the kind of training extension workers had received. Of the 19 extension workers interviewed, 11 or 57.9 percent were certificate holders from an agricultural or forestry college. A good number (4 or 21.1 %) were form four leavers. In 2 (10.5 of the) cases were extension workers of a lower level of education than form four. All ten extension workers working for the government institutions (DA and FD) had been formally trained. The nine extension workers who had not received formal training were represented in the NGO institutions (VIAP and WWF). Though the NGO sector may have a considerable number of extension workers that have not been formally trained, on-the-job training has been a source of knowledge to extension workers.

The Subject Matter Specialists (SMSs) were mostly Diploma or Bachelors holders in an Agriculture or Forestry College. For instance, of the nine SMSs interviewed five were Diploma holders, three Bachelors holders and one with a Postgraduate degree. Moreover, most extension staff had received on-the-job training organised by the VIAP, or through monthly workshops in the Department of Agriculture.

Training in participatory techniques was however sketchy. Study results indicated that VIAP staffs were at least aware of the importance of such techniques, for example, P.R.A techniques but only three out of the eight interviewed had been trained. But a grimmer picture was depicted in the governmental sector that appeared generally less concerned about training or merely lacked opportunities to train. Communication skills were also lacking among extension workers. Few extension workers had received this kind of training at the time of survey, if at all.

Realising the importance of training in participatory techniques, VIAP has instituted a training Department to serve its frontline staff. Various topics such as seed collection, use of P.R.A. techniques, and Lepsa (Learner Centred, Problem Posing, Self-

discovery, Action-oriented) method, among others, have featured in the training provided by the project. Lepsa is a training tool for reaching out to adult learners who may not have a good grasp of technical issues in agroforestry. As applied in extension, the method entails use of drama, comedy or a song and then posing to the audience (farmers) the following five key questions based on a particular agroforestry theme:

i) *What did you hear or see happening?*

ii) *Does it happen to our everyday life?*

iii) *What are its causes?*

iv) *What are its effects?*

v) *What are the possible solutions we can offer?*

The survey's educational level rating revealed that a majority (42.5%) of farmers had primary education, while 7.5 percent had received no formal education while the mean age of the respondents was 39 years. The extension workers interviewed felt that the method was useful in reaching out to this category of adult learners. An objection raised on training was that it did not consider peak periods such as between March and June and September and October when extension workers were busy with farmers. These are periods of tree planting or seedling production.

(c) Supervision

Supervision, which is an important factor in staffing, was also considered. As used in this study, supervision is the process of giving the agents (extension workers) instruction, guidance and discipline they require to fulfil their extension duties and responsibilities. Two main problems were identified. The first, was lack of resources for supervision. Field workers work in distant and remote areas. This requires mobility on the part of supervisors. However, fuelling and poor maintenance of vehicles especially in the government sector was a constraint to supervision.

The second problem was the attitude of extension workers who viewed supervision as a "policing" tool by the administration and as such, most resented supervision. McCaslin and Mwangi (1994) point out that for supervision to succeed, it requires mutual trust between the supervisor and the agent. This seemed to be lacking in the study area and a possible influence of motivation discussed in section 4.4.1.1 (d). Even in the absence of the fore stated problems, extension managers considered supervision difficult without proper work schedules by the field extension workers. This made supervision in the field quite difficult in a situation where the supervisor did not know which farmer the extension worker had visited at the date of supervision.

(d) Motivation

The study found out that motivation of extension workers was affected by several factors, namely: work incentives, remuneration, work location, supervision, promotion and training. Work incentives included provision of housing, hospital insurance, food and transport allowances. Remuneration entailed a good pay including pay for overtime work done. On supervision, extension workers felt that the atmosphere for supervision should be made friendlier. They were of the opinion that staff performance be assessed based on standards that employees perceive as fair, achievable and equal for all. Extension workers also preferred to be deployed in relatively accessible areas with security and other amenities such as a good school, health centre and water. On promotion and training, a majority of the extension workers felt that promotion should be given on merit (qualification and job performance) rather than amount of years worked. A minority of the extension workers particularly the elderly, however, differed with this view. To them, the number of years worked and not just academic qualification merited promotion. One extension worker did not spare harsh sentiments about this issue, as quoted below:

> *I have worked for the... for over 15 years now and have seen boys and girls fresh from college promoted to higher ranks...if my performance was not good enough, I would have already been sacked like many of my work mates who did not prove their worth!*

The motivation determinants discussed above compare favourably with the findings of McCaslin and Mwangi (1994) on the factors that affect motivation among extension agents in Rift Valley province. Their study enlisted eight factors that affect extension workers' motivation, namely: Evaluation, dependable supervisors, work incentives, pay, praise and work location, housing and transport, job security and administration and supervision.

4.4.1.2 Support Resources

The study results indicated constraints in support resources to facilitate effective delivery of extension services. Two areas in which these constraints were manifested were transport and back-up literature.

(a) Transport

Transport constraints were attributed to the vast geographical area covered by extension, terrain of the area, poor road network coupled with lack of means to overcome some of these obstacles. For instance, extension workers in the Forest Department and the Department of agriculture had no means of transport to conduct their daily extension duties. The VIAP on the other hand had provided a bicycle to each extension worker. However, there were areas especially the hilly and mountainous ones, such as, Elgon and Cherengani regions where bicycles were of little use given the rugged terrain of the area. Even in areas where bicycles were handy, the monthly allowance of Ksh. 100 apportioned by the project to maintain a bicycle was deemed too little. This has resulted into some of the bicycles being grounded owing to poor maintenance.

At the administrative level, the Forest Department had three vehicles but only one was functional. The rest were grounded because of lack of funds to maintain them. The only functional vehicle was mostly used by the District Forest Officer. The entire extension division did not have a vehicle for overseeing extension activities hence making supervision of field activities difficult. The Department of agriculture had one vehicle attached to the extension division but lack of fuel and maintenance problems had undermined its effective utilisation. The Soil and Water Conservation Programme had three motorcycles used by the Soil and Water Conservation Officer and his Divisional assistants. One assistant was at the time of the survey still waiting to be allocated a motorcycle from the headquarters in Nairobi.

The VIAP did not have much transport problems at the administrative level. At least one vehicle was attached to each of the main project's departments, namely: Monitoring, P.R.A and Training. Each of the five Zonal Heads has a motor cycle. The high maintenance cost of vehicles was, nevertheless, given as one of the greatest operational costs of the project. This is partly attributed to poor conditions of roads (Government of Kenya, 1997).

(b) Back-up Literature

Back-up literature such as field guides and manuals, pamphlets and other relevant literature in extension, were almost non-existent among frontline extension workers. These were, however, available to extension managers and SMS's. Back-up literature is important in augmenting an extension worker's knowledge in new methods, research and field experiences in extension. Lack of this consigns the extension workers to reliance on outdated methods and denies them opportunities for learning

from other project experiences. This may stifle the tempo for creativity among extension workers. Further, lack of knowledge in participatory methods leads to poor handling of farmers. Also lacking was documentation of field experiences making it hard to learn from and share experience – a scenario that leads to loss of "institutional memory".

4.4.1.3 Inter-agency Co-ordination

Weak institutional links existed between extension agencies and other stakeholders in agroforestry. Collaboration and co-operation as observed by Wangati and Makau (1989), is necessary given the many actors in agroforestry. The situation in the field seems to indicate that each agency pursued its goals with minimal consultation with other agencies. This scenario often led to duplication of resources and efforts. Moreover, it does not augur well with the concept of participatory extension that requires identification of all stakeholders and the subsequent harmonising of efforts and resources to achieve desired goals, in this case, agroforestry development.

A recent development in 1997 worth noting in the promotion of participatory extension, is the holding of joint PRA's where different stakeholders in community development are brought together. Here, stakeholders deliberate and intervene where possible on various communities' needs and problems. In addition, such P.R.A's should be able to involve most stakeholders in planning, decision making, implementation, monitoring and evaluation of agroforestry programmes and projects. Furthermore, P.R.A's could help in mitigating against possible role or content conflicts in agroforestry messages delivered to farmers in order to come up with a common ground or terms of reference.

4.4.2 Problems at farmer level

Problems at farmer level, also referred in this study as Farmer-centred problems, in the context of the survey were those problems common among farmers, which acted as a stumbling block to their participation in extension programmes. The study considered those farmers who had prior experience of participation in extension programmes. Information was therefore drawn from the contact farmers in VIAP and the Department of Agriculture, Soil and Water Conservation Programme. Results revealed the following problems as the main hindrances to farmer participation in extension programmes: lack of funds, poor attendance of meetings, passive members, mobilisation difficulties, individual and / or ethnic prejudice, gender imbalance and attitude (Table 4.18).

Table 4.18: Frequency of Occurrence of Farmer-centred Problems

Problem	Frequency	Percentage
Lack of funds	17	42.5
Poor attendance of meetings	12	30
Passive members	10	25
Mobilisation difficulties	11	27.5
Individual/ethnic prejudice	7	17.5
Gender imbalance	9	22.5
Attitude	8	20

N= 40

Source: Field survey, 1999

Lack of funds (42.5%) was the main impediment to farmer participation in extension programmes. This can be explained by the fact that most of the contact farmers interviewed were affiliated to groups engaged in other activities besides agroforestry, a majority of which were income-generating projects (refer to section 4.3.1). Some of the farmers belonging to groups engaged in agroforestry activities had commercial

nurseries for the same reason (*i.e.*, income). Yet another reason that perhaps explains why the problem of funding featured prominently is hinged on the problem of attitude (20%). The extension staff interviewed expressed concern over high expectations with regard to material support from farmers. There was the tendency among farmers to view their participation as a conduit for material or financial support from institutions. This attitude has been entrenched by the orientation given by previous efforts in agroforestry that supplied free or subsidised seedlings to farmers in the study area as noted by Chavangi *et al.* (1996).

Poor attendance of meetings (30%) and passive members (25%) were related problems that stifle the spirit of participation particularly in the use of group approach. The reason given was that farmers were overburdened by individual tasks and were generally too busy elsewhere. Since most small-scale farmers are casual labourers in Agricultural Development Co-operation farms and adjoining large-scale farms (Foeken and Tellegen, 1994), the reason given for the above mentioned problems stands. These problems are particularly acute during peak labour season of planting, weeding and harvesting, *i.e.*, between March and June, and between October and December. This is about the same time when tree planting activities demand attention from the farmer. Additionally, two farmers or 5 percent of the farmers singled out introversion among group members as a manifestation of passiveness. This means that some group members may not have been free to contribute in the discussions or participate in the organisation of the activities of the group hence leaving the vocal ones to contribute. This finding is similar to that of KWDP on the factors that limit the use of groups for extension. The only deviation from the study's finding is that whereas farmers in Western Kenya (*i.e.*, Kisii and Kakamega Districts)

have cultural reasons such as attending burials and other local events (Chavangi, 1984), in Trans Nzoia, economic reasons seem to prevail where underlying poverty condition is the main culprit.

The problem of mobilisation (27.5%) which in the context of this research means bringing together farmers towards a worthy cause, mainly affected the Soil and Water Conservation Programme. This was attributed to interference by the local administrators and discontent over SCC's leadership. This compares favourably with similar results from rehabilitation efforts of Kigumo catchment in Runyenjes Division, Embu District selected as unsuccessful catchment in the District (Adamassie, 1992) where mobilisation of farmers has led to the failure of conservation efforts. Also identified as a problem and indirectly impinging on mobilisation was the attitude of the farmers regarding the need for soil and water conservation. For instance, the Soil and Water Conservation Officer was of the general opinion that farmers in Trans Nzoia do not perceive soil erosion as a problem of great magnitude which he attributed to the difficulty in mobilising farmers for soil and water conservation activities. The problem of mobilisation emanating from attitude regarding the magnitude soil erosion has also been reported in Koyo catchment in Aldai Division, Nandi District (Adamassie, 1992) and a factor leading to the delay in rehabilitation of the catchment.

The survey further showed that individual / ethnic prejudice (17.5%) and gender imbalance (22.5%) led to disharmony in the composition of group, often resulting to gender or ethnic polarisation. For instance, most women were more available than men when group meetings were called. This may partly explain the great number of women groups engaged in agroforestry related activities. Additionally, farmers found

it difficult to interact and work with neighbours they had differed with or were suspicious of. This problem has been profound following ethnic clashes in Saboti and Kwanza divisions. As a result, most active groups tended to be homogenous in terms of ethnic representation.

The study further sought to find out whether there was any association between the presence of farmer-centred problems and the contact institution the farmers were identified with, considering variables 'problem' and 'institution' in a contingency table (Table 4.19). In other words it was important to establish whether the was any relationship in the manner in which farmer-centred problems manifested a long the two contact institutions. The Chi-square results were not significant at α 0.05 level of significance.

Table 4.19: Frequency Distribution of Farmer-centred Problems across Contact Institutions

	Contact Institution		
Problem	VIAP	DA	*Row total*
Lack of funds	12	5	17
Poor attendance of meetings	9	3	12
Passive members	10	0	10
Mobilisation	3	8	11
Individual prejudice	6	1	7
Gender imbalance	9	0	9
Attitude	5	3	8
Column total	54	20	74

Chi-square (χ^2) value	Degrees of freedom	Critical value
18.976	12	21.028

Source: Field Survey, 1999

It is therefore likely that contact institutions may not have been responsible in the way farmer-centred problems manifested, but possibly owing to reasons intrinsic among the farmers themselves. These finding disagree with the survey results by Cook and Bonitatibus (1997), who found out a relationship between an extension agency and the farmer problems based on the particular method or strategy used. Although different strategies have been used to achieve farmers' participation in the study area, their results are not consistent with the present findings because their survey was restricted to issues related to formation and sustenance of groups involved in agroforestry with particular reference to focus group discussions. The present study, however, covered the broad-spectrum of strategies and problems affecting farmer participation in extension programmes.

4.5 Status of Local Potential

The third objective of the study was to explore the status of local potential among small-scale farmers. For the purpose of analysis, three broad categories of local potential were identified, namely: indigenous knowledge possessed by farmers, the locally available resources that they could utilise to support agroforestry and opportunities available for extension contact. These three were considered as channels through which the diverse agroforestry needs and problems of small-scale farmers could be met. And, ultimately serve as integral entry points as future agroforestry intervention measures. Several factors the study considered were:

(a) The farmers knowledge on tree growing (*i.e.*, seedling production and management) preferences and uses of trees.

(b) The resources farmers have that can support or sustain a tree growing culture.

(c) Other avenues that are available to harness local potential and to provide necessary external support to farmers.

4.5.1. Indigenous Knowledge in Tree Growing and Uses

The survey revealed that farmers exhibited diverse knowledge in tree growing and various uses of trees. This is perhaps because the District has different ethnic communities, each with a different tree culture (Table 4.20). The culture in turn influences the choice of tree growing techniques and management practices.

Table 4.20: Ethnic Representation in the Survey

Ethnic Specification	Frequency	Percentage
Luyha	45	56.3
Kalenjin	19	23.8
Kikuyu	10	12.5
Teso	2	2.5
Turkana	2	2.5
Kamba	1	1.3
*Sebei	1	1.3
TOTAL	80	100

*Respondent's origin outside the country

Source: Field Survey, 1999

The Luyha community is over-represented compared to the District's statistics (Government of Kenya, 1997). This is because in the survey sample, more Luyha respondents were classified as small-scale farmers using the survey's criterion. When the survey's respondents were asked about the origin of knowledge on tree growing and uses, 8.8 percent of the respondents owned to their respective communities as sources of knowledge on tree growing and use, 6.3 percent from another community, whereas, 13.8 percent considered this knowledge as self-acquired. The rest did not

identify with any of these categories. The comparative high percentage of the origin of knowledge as self may suggest that the knowledge on tree growing and use may not be entirely adopted by farmers the way it is. Consequently, there may be modification through cross-cultural exchanges and individual experimentation, issues well articulated by Nielsen (1998) and a process that may require the recognition of the farmers' efforts. For instance, Mwangi (1998) reports a case where a farmer felt disgruntled by an extension worker working in Bahati area of Nakuru District who shared his diverse knowledge about growing passion fruits but was never acknowledged by the worker.

4.5.1.1 Local Knowledge on Tree Growing

The survey confined itself to two main areas in tree growing (*i.e.,* seedling production and tree management). Conventional or modern methods, scientifically proven were thus not considered as local methods thus excluding institutional sources of knowledge. Results indicate that at least 25 percent of the farmers possessed and had utilised a form of local knowledge in seedling production and 18.8 percent in tree management (Tables 4.21 and 4.23).

(a) Knowledge in Seedling Production

Study results showed that farmers have devised different techniques for producing seedlings besides those procured from village nurseries (VIAP) or central nurseries (FD) among other seedling sources, based on indigenous knowledge (Table 4.21).

Table 4.21: Farmers' Local Uses of Knowledge in Seedling Production

Knowledge Type	Seedling Production Technique	Frequency	Percentage
Mode of propagation	• Wildings (transplanted)	6	7.5
	• Wildings (retained)	11	13.8
	• Cuttings	4	5
	• Direct seeding	2	2.5
Nursery management	• Spraying wood ash	5	6.3
	• Using kitchen water	3	3.8
Seed pre-treatment	• Feeding seeds to goats	1	1.3
	• Fermentation	2	2.5

Source: Field Survey, 1999

Among local techniques for seedling propagation in the study area were; use of wildings (transplanted) or retention of wildings, cuttings and direct seeding. Transplanted wildings were mainly those of species, such as *Eucalyptus spp. Podocarpus milanjianus* and *Cupressus lusitanica*. Trees retained were those of indigenous species, such as, *Acacia spp.* and *Croton spps*. The reason given for retaining these species was that, their seeds were easily dispersed and that raising the species using other methods was difficult. The same reason was also extended to transplanted wildings in situations where young seedlings were available under trees particularly in forest plantations after harvesting mature stands. Additionally, where wildings occurred in a woodlot, they were transplanted to other areas deemed fit by the farmer sometimes as a management operation through thinning.

Study results indicate that 7.5 percent of the farmers had used transplanted wildings as a means of propagating seedlings either procured within the farm, or from external sources such as a friend, roadside or a nearby forest. Another 13.8 percent relied on retaining wildings as a means of raising seedlings. However, farmers indicated the

problems related to seedling production through wildings as withering during transplanting or damage by livestock or during cultivation and that not many tree species produced wildings. Retained wildings were most affected by fire since burning of maize stalks before cultivation is a common practice in the District. Overall, wildings were the most common local technique for raising seedlings.

Other local methods used by farmers for plant propagation were use of cuttings (5%) and direct seeding (2.5%). Cuttings were mainly of *Tithonia diversifolia* and *Lantana camara* used in the study area as a hedge around the homestead to serve both protective and aesthetic functions. Farmers indicated ease in establishing a hedge using this method. Direct seeding had been tried with *Acacia mearnsii* (black wattle) *and Dovyalis caffra* (Kei apple). Remarkably, direct seeding through broadcasting of *Acacia mearnsii* seeds was followed with burning of the field. By doing so farmers interviewed indicated that burning would achieve faster and high germination rates.

Farmers also exhibited a grasp of seed pre-treatment requirements. For instance, two farmers revealed that fermentation of *Dovyalis caffra* seeds by dipping them in a container with water for three to four days promotes the seeds viability when planted. Fetching approximately Ksh. 10 per seedling in the market, most commercial and group nurseries are increasingly raising this species. Another example among the local techniques in seed pre-treatment was the feeding of goats with the seeds of *Terminalia brownii* reported in one case. According to Banda *et al.* (1997) the seeds of *Terminalia brownii* are classified as recalcitrant and would therefore not germinate without nicking owing to hardness of the coat. In the study area, a farmer had however, discovered that feeding the pods of *Terminalia brownii*, a relish to goats, softened the coat to allow easy germination.

With the concept of on-farm nurseries taking root, farmers have devised methods of reducing pests attacks on nurseries. Pest control as part of nursery management measures can be expensive especially if synthetic chemicals have to be used. To cut down on expenses, farmers had used local methods such as dusting the nursery with ash (6.3%) or spraying it with kitchen water (3.8%). These were found effective in keeping away termites. Yet another rationale for using kitchen water was the need to maximise the use of the scarce water resource, and by so doing, reduce labour requirement for watering during the dry spells.

One farmer who exhibited a high understanding of moisture demand and retention on the nursery, had strategically located the nursery in a banana groove that acted as a buffer from vagaries of weather, such as excessive sunlight, rain and hailstorms. The farmer further noted that this siting of the nursery served other protective functions such as prevention from livestock damage.

The study, however, revealed that despite the enormous local knowledge in seedling production, farmers in the study area have continued to rely on external sources of seedlings. Table 4.22 below presents a comparison between external and on-farm sources of seedlings and / or seeds.

Table 4.22: Comparison between Frequencies of Occurrence of On-Farm and Off-Farm Sources of Seedlings and Seeds

Off-farm Sources			On-farm Sources		
Source and product	Frequency	Percentage	**Source and technique**	Frequency	Percentage
Seedlings:			**Wildings:**		
DA	6	7.5	• Woodlot	2	2.5
FD	11	13.8			
VIAP	33	41.3	• Dispersed trees	11	13.8
Group nursery	4	5			
Neighbour	1	1.3			
Road side	2	2.5			
Commercial nursery	3	3.8			
Wildings:			**Nursery / seedlings:**		
Forest	2	2.5	• Compound	17	21.3
Friend	1	1.3	• Along the river	2	2.5
Roadside	2	2.5			
Seeds:			**Seeds:**		
VIAP	19	23.8	• Collected from trees on farm	2	2.5
Forest	3	3.8			
Friend	2	2.5			

Source: Field Survey, 1999

Off-farm sources of seedlings dominated with the VIAP being the greatest institutional source of agroforestry products, such as, seedlings and seeds. The Department of Agriculture and Forest Department participated only to a small extent in the provision of seedlings or seeds. The Department of Agriculture, for instance, specialised in production of fruit seedlings and tree crops, such as, coffee and tea. The Forest Department on its part had in the central nurseries produced seedlings of *Eucalyptus ssp. Cupressus lusitanica* and *Pinus patula.* There is, however, recent emphasis towards promotion of indigenous species. Besides institutional sources of seedlings, other sources included; group and commercial nurseries, friends and the

roadside. The last two sources were also mentioned to have provided wildings and seeds. Certainly, as the institutional sources of seedlings decline, there is a strong basis for strengthening on-farm sources by extension agencies by supplementing the existing local knowledge in seedling production. In Zimbabwe, for instance, extension packages have been developed based on local knowledge with encouraging results (Banda, *et al.* 1997).

(b) Knowledge in Tree Management

The study enlisted some of the local knowledge in tree management among the farmers. The results are presented in table 4.23 below.

Table 4.23: Local Uses of Knowledge in Tree Management

Knowledge Type	Tree Management Technique	Frequency	Percentage
Pest control	• Spraying wood ash	7	8.8
	• Spraying with *omo* + paraffin	2	2.5
	• Spraying with a concoction of Mexican marigold + paraffin	1	1.3
Improve tree- crop interactions	• Root pruning	2	2.5
	• Pollarding	3	3.8
Weeding	• Minimal weeding	1	1.3
	• Timely weeding	3	3.8
Planting	• Manuring	1	1.3
	• Late transplanting	1	1.3
Reversing tree sex	• Driving a nail on the trunk	1	1.3
	• Partial cutting of the stem.	1	1.3

Source: Field Survey, 1999

Pest control was the most common knowledge type in tree management. This involved use of cheap and local options, such as, detergent *omo* and paraffin to eradicate Cypress aphids (2.5%), wood ash (*kumunyu* in Luhya) for termite control (8.8%) and a concoction made of paraffin and pounded leaves of *Tagetes minuta* (Mexican marigold) (1.3%), for general pest control. These are either applied on

young or mature stands. A mixture of *omo* and paraffin was, for instance, widely experimented by farmers to combat the aphid menace on the Cypress species prevalent in the early 1990's.

The second most common knowledge type in tree management was in the area of tree-crop interactions. Farmers reported pollarding (3.8%) and root pruning (2.5%) as techniques to minimise negative tree-crop interactions. Pollarding was done to reduce the shading effect on crops by partial or selective cutting of the tree's crown. Finally, farmers with *Eucalyptus spp.* have managed lateral roots of the trees to avoid unfavourable competition for resources with crops. Normally, a trench is dug between the interface of the cropland and the trees. The lateral roots are cut with a sharp 'panga' thus minimising the competition for water and other resources with the crops.

The use of manure to grow trees was reported as one way to promote faster growth of trees as part of farmers' knowledge in tree planting. Farmers particularly identified *Kumusiola* in Luhya or *Markhamia lutea* as a tree that requires manuring. Additionally, the ground under it is not to be disturbed by subsequent weeding. This may explain why the species thrives in cattle *bomas*.

The survey also reported other peculiar tree management techniques, such as, late transplanting and reversing of tree sex. One farmer, for example, mentioned that transplanting wildings of *Croton megalocarpus* when they had reached a height of about 2 metres promoted faster growth. The farmer, however, indicated that for better results a wide hole measuring approximately 2 feet square and 2 feet in depth planted at an isolated site. Leaves and the crown have also to be trimmed before transplanting to curtail excessive loss of water through transpiration. This technique was suitable in establishing qualities for a good shade tree.

Change of tree sex to improve fruit production of *Carica papaya* (pawpaw) and *Persea americana* (avocado) was reported in two cases. Male pawpaw and avocado trees produce fewer and smaller sized fruits than female trees. It is however difficult to differentiate the sexes when the trees are young. When mature, the farmer mentioned that it was possible to change the males into females by driving a long nail through the stem or cutting the tree slightly below the crown. This process is locally referred to as giving it a 'shock' or *kushitua* in Swahili. One farmer gave his experience as quoted below:

> *I bought 22 pawpaw seedlings from a commercial nursery. I took good care of them to maturity with 18 of them surviving to this stage. When the first fruiting season came, I noted that the fruits were smaller and fewer than I had anticipated. However, little did I know that all of them were male? A friend told me that these were the characteristics of male pawpaw. I could nevertheless, reverse them to females by driving a large sized nail into their trunks and expect to improve my production. I experimented this on 15 trees and 9 are now able to produce a bumper harvest and large sized fruits.*

On the whole, the field performance of indigenous uses of practices that have been mentioned above in tree growing, was rated as excellent by 2.5 percent by the farmers interviewed, good (18.8%) and fair (12.5%). This points to the fact that the presence and use of local knowledge has immense potential in tree growing that should be tapped by extension agencies. Integrating modern science technologies can enhance the effectiveness of these practices.

4.5.1.2 Farmer's Knowledge on Tree / Shrub Uses

According to Kiage (1998) and Evans *in* Kiriro and Juma (1991), the choice of tree species to plant and manage depends largely on their uses to the farmer. In order to capture knowledge on tree uses, farmers were asked to identify and rank tree species preferred most (Table 4.24) and to give reasons for their preferences (Table 4.25).

Those who identified trees with special functions were further asked to specify the functions (Table 4.26).

Table 4.24: Trees Preferred Most With Total Scores as Ranked by the Farmers

Species Name	Species Type	Rank	Total Preference Scores
Grevillea robusta	Exotic	1	168
Eucalyptus spp.	Exotic	2	99
Cupressus lusitanica	Exotic	3	68
Sesbania sesban	Indigenous	4	58
Persea americana	Exotic	5	30
Melia azederach	Exotic	6	29
Acacia mearnsii	Exotic	7	28
Markhamia lutea	Indigenous	8	26
Dovyalis caffra	Exotic	9	23
Croton macrostachyus	Indigenous	9	23
Calliandra calorthysus	Exotic	11	20
Citrus spp.	Exotic	11	20
Acacia spp.	Indigenous	13	12
Syzygium cuminii	Exotic	13	12
Croton megalocarpus	Indigenous	15	9
Erythrina abyssinica	Indigenous	16	5
Ficus natalensis	Indigenous	17	3

Source: Field Survey, 1999

From the table above, seven of the top ten preferred species were exotic. Besides, the mean total preference scores between exotic (51.2) and indigenous (13.4) species showed that the former was rated higher. Here, farmers had been asked to rank the first five tree species in order of preference and placed in the two categories, exotic and indigenous. The ranks were then given weights, five for rank one and one for rank five, for analysis. The difference in preference rating may be attributed to previous extension strategies, which promoted exotic species such as *Grevillea robusta, Cupressus lusitinica* and *Eucalyptus ssp.*, among others, which has over time made

farmers discard indigenous species. A similar observation has been made by Ombaba (1998) in the promotion of indigenous species in Kisii District. Conversely, other factors that have directly undermined preference of indigenous species are slow growth (Wass, 1995) lack of seeds (Nakiganda *in* Holding and Omondi, 1998) and delayed economic returns (Walker, *et al.* 1995).

Differences also existed in the reasons farmers gave for their preference of a species whether indigenous or exotic that were hinged on the various uses of the particular tree species (Table 4.25).

Table 4.25: Frequencies of Farmers' Responses on Uses of Different Tree Species

Species	Income	Timber	Wood Fuel	B/Poles	Food	Fodder	M/purpose	Aesthe-tics	Others
Grevillea	8	16	11	3	-	-	22	8	-
Eucalyptus spp.	15	'2	-	20	-	-	# 6	-	❖ 1
Cupressus lusitanica	8	8	9	*8	-	-	-	11	➲ 1
Sesbania sesban	1	-	18	-	-	4	16	-	-
Persea americana	6	-	-	-	10	-	3	1	-
Citrus spp.	4	-	-	-	8	-	1	-	2
Acacia mearnsii	7	-	10	*6	-	-	-	-	-
Calliandra calothyrsus	5	-	2	-	-	3	2	1	-
Dovyalis caffra	3	-	-	-	-	-	-	8	-
Markhamia lutea	-	2	4	6	-	-	4	-	-
Croton Macro.	-	-	3	-	-	-	6	-	❖ 2
Croton mega.	-	-	4	-	-	-	-	5	-
Acacia spp.	1	-	3	4	-	1	-	-	-
Ficus natalensis	-	-	-	-	1	-	1	-	♣ , 2
Syzygium cuminii	-	-	-	-	1	-	3	-	-
Erythrina abyssinica.	-	-	-	-	-	-	1	-	♣3
Melia azedarach	-	-	-	-	-	-	-	-	❖ 6

KEY:

* Represents withes used in construction.
\# Ability to coppice (species not promoted for agroforestry purposes)
❖ Medicine
♣ Cultural
◆ Hedge
■ Boundary markers
➲ Tomato staking

Source: Field Survey, 1999

Different tree species had different uses as given by the farmers. These uses, in turn, greatly influenced the choice or preference of a particular tree species. Cross referencing with Table 4.24 above on preference ranking of tree species, *Grevillea robusta,* ranked first, was preferred mainly because of the following uses: Multi-purpose qualities (27.8%), timber (20%), wood fuel (13.8%), income (10%) and as a boundary maker (10%). On the other hand, *Eucalyptus spp.* was preferred mainly because of its use for building poles (18.8%) and generation of income (25%). Farmers further indicated its ability to coppice, and that it was faster in maturing. Another reason given by the farmers was that harvesting of the species could also be done at any stage of maturity. *Cupressus lusitanica,* ranked third, was reported to have uses such as hedge (13.8%), woodfuel (11.3%), income (10%) and timber (10%). *Persea americana* was ranked fourth and its uses included food (10%), multi-purpose qualities (3.8%) and shade (1.3%). Lastly, medicinal use was the principal use for *Melia azedarach,* a tree species that often was confused with *Azadirachta indica* or the Neem tree but nonetheless believed to have similar medicinal properties. These five tree species were the most preferred among the exotic species by the farmers in the study area.

Among three most preferred indigenous species were; *Sesbania sesban, Markhamia lutea, Croton macrostachyus* and *Syzygium cuminii* ranked in that order. *Sesbania sesban,* which was ranked first, had fuelwood use dominating with (22.5%) closely followed by its multi-purposeness (20%) and minimal use as fodder (5%). Farmers gave building poles (6.3%), fuelwood (5%), multi-purpose qualities (5%) and timber (2.5%) as the uses *Markhamia lutea* was put into. *Croton macrostachyus* uses, on the other hand, were given as agroforestry qualities (7.5%), woodfuel (3.8%) and medicinal use (2.5%). Lastly, *Syzygium cuminii* uses included agroforestry qualities (3.8%) especially in riverine stretches of the farm for soil and water conservation, and food (1.3%).

The rest of the tree species were ranked basically owing to their peculiarity with regard to uses that the farmer felt they met. For instance, for *Acacia mearnsii,* preference was based on its uses as a wood fuel (mainly charcoal) provider and supplier of quality withes all being attributes that made it a good source of income. Uses of *Calliandra calothyrsus* and *Citrus spp.* were listed in the fodder and food categories respectively. Additional uses for the two species included hedge (*Calliandra calothyrsus)* and medicine (*Citrus spp).* For *Dovyalis caffra,* its aesthetic uses as hedge and an income generator from sale of its seedlings was the criterion used for its selection. Apart from *Acacia spp.* (building / fencing poles, charcoal, and fodder) and *Croton megalocarpus* (fuelwood, and hedge) the remaining indigenous species namely, *Erythrina abyssinica* and *Ficus natalensis* were listed mainly in the category of cultural value.

Inspite of low rating on preference, indigenous species were heavily represented in the special function category. Three categories of special functions of tree species identified in the survey were; human medicine, livestock medicine and cultural functions.

Table 4.26: Trees with Special Functions

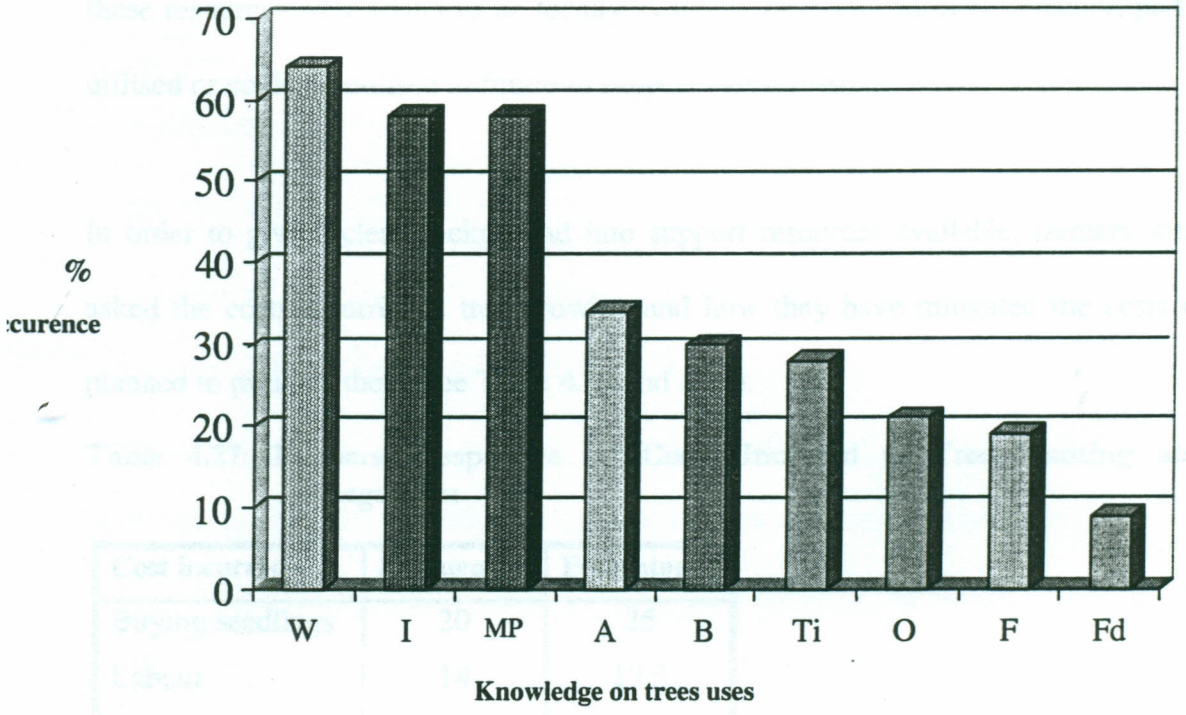
Function	Tree/Shrub / Herb Species	Frequency	Percentage
Human medicine	**Castor spps, Croton macro, Eucalyptus spp., *Dodonea v,* and * **Senna s*	14	17.5
Livestock medicine	#Tithonia d, Castor spp. *Senna* s. *&Melia a.*	4	5
Cultural	*Erythrina a* and *Ficus n*	5	6.3

Life form:
* Shrub
# Herb
Source: Field Survey, 1999

Melia azedarach and *Senna spectabilis* were used for treatment of malaria in humans. They were also used to treat fever in animals. Castor oil plant (*Ricinus communis)* and *Dodonea viscosa* were used to treat stomach problems, constipation and aches

respectively. Sap drawn from the bark of *Croton macrostachyus* was used to treat cuts particularly to stop bleeding. A concoction of pounded leaves of *Tithonia diversifolia* mixed with grilled pepper was reported to prevent *coccidiosis* in poultry. Boiled *Eucalyptus spp.* leaves was also reported to possess medicinal properties that treat common cold in humans. *Erythrina abyssinica* or 'kumurembe' in Luhya was traditionally used as a site for oath. For this purpose, the community preserves the tree. The process involves going round the tree species seven times. It is believed that an individual denying an offence would drop dead after the exercise. Fig 4. 3 below summarises overall local knowledge on tree uses.

Fig. 4.3: Local Knowledge on Tree Uses



KEY:

I	Income	Ti	Timber
W	Wood fuel	B	Building poles
F	Food	Fd	Fodder
MP	Multi-purpose		
A	Aesthetics		
O	Others		

Judging from the first three uses of trees which constitute to slightly more than half all the tree uses, the overriding concern in the choice of tree species were trees which provided woodfuel (firewood or charcoal), economic returns and those that offered minimal damage or supportive role to crops. This therefore indicates the need by extension agencies to promote tree species that reconcile these three overriding concerns.

4.5.2 Local Support Resources

Besides knowledge in agroforestry, the survey looked into the local support resources which farmers can utilise to support agroforestry. During the course of the survey, these resources were found to be locally available or within farmers' vicinity, partly utilised or could be utilised in future to support agroforestry.

In order to give a clear background into support resources available, farmers were asked the costs incurred in tree growing and how they have mitigated the costs or planned to mitigate them (see Table 4.27 and 4.28).

Table 4.27: Farmers' Responses on Costs Incurred in Tree Planting and Management

Cost incurred	Frequency	Percentage
Buying seedlings	20	25
Labour	14	17.5
Fencing	4	5
Buying tubes	2	2.5
Transport	2	2.5
Spraying	1	1.3

Source: Field Survey, 1999

Buying seedlings (25%) and labour (17.5%) were the two major costs incurred by the farmers in the survey. Other costs given by the farmers included, fencing (5%), buying tubes (2.5%), transport of seedlings from the source (2.5%) and spraying (1.3%). In mitigating the costs above, farmers gave the following strategies given in Table 4.28.

Table 4.28: Farmers' Responses on Mitigation Measures to Reduce Costs Incurred in Tree Planting and Management

Mitigate measure	Frequency	Percentage
• Establish nursery	20	25
• Use of local materials in nursery establishment	2	2.5
• Local methods for pest control	1	1.3
• Local fencing materials	1	1.3
• Proper scheduling of tasks	6	7.5

Source: Field Survey, 1999

A majority of the farmers (25 %) gave establishing an on-farm nursery as a means of achieving self-sufficiency in seedling production and to off-set transport costs of procuring seedlings from external sources. Another 2.5 percent of the farmers indicated use of local materials in seedling production. This related to the input side of establishing a home nursery or a commercial nursery. For example, one farmer having a commercial nursery had improvised tubes by cutting polythene sheets or papers into sleeves and joining them together using a hot metal rod or by beating them together to form cylindrical tubes. These were further cut into recommended sizes to be filled with soil to raise seedlings. Two other farmers used waste containers (*i.e.*, broken pots, milk packets, cooking oil containers *e.t.c.*) to raise seedlings. This, according to the farmers, cut down on the costs of having to buy expensive tubes and

facilitated easier handling of the seedlings because of their portable nature. Similar findings where local materials were widely used in seedling production have been reported in Tanzania by Kerkhoff, (1990) and in Zimbabwe by (Banda *et al*, 1997).

One farmer also indicated use of cheap fencing materials to protect seedlings by use of rafters and withes to establish a fence. Another farmer also indicated future use of biological control measures to cut down on costs of buying expensive chemicals for spraying his citrus fruit trees by crashing and boiling seeds of *Azadirachta indica* (Neem tree) and then spraying the mixture on the tree-crops (oranges).

Farmers in the survey indicated that proper scheduling of tree planting and management practices could reduce labour costs. These farmers (7.5 %) considered this as a solution to their labour predicament. The farmers contended that labour was cheaper during the off crop planting, weeding and harvesting season. Proper scheduling of tree planting and management operations would avoid a situation where trees are neglected in favour of crops.

One among the most important potential support resource in agroforestry considered by the study was income from trees and their products. The results indicated that 23.8 percent of the farmers had ever earned income at least from the sale of a tree or a tree product (Table 4.29).

Table 4.29: Percentage of Farmers Obtaining Income from the Sale of Trees and their Various Products

Species	Product	Frequency	Percentage
Eucalyptus ssp.	• Poles	6	7.5
	• Rafters	3	3.8
	• Timber	1	1.3
Cupressus lusitanica	• Timber	5	6.3
	• Withes	2	2.5
Acacia mearnsii	• Charcoal	3	3.8
	• Withes	4	5
Calliandra calothyrsus	• Seeds	2	2.5
Citrus spp.	• Fruits	2	2.5
Acacia abyssinica	• Poles	1	1.3
Dovyalis caffra	• Seedlings	1	1.3
Grevillea robusta	• Firewood	1	1.3

Source: Field Survey, 1999

Among the most important income source from trees were poles (8.8%), timber (7.5%) and withes (7.5%). Other sources included; rafters (3.8%), charcoal (3.8%) fruits (2.5%), seedlings (1.3%) and firewood (1.3%). Different species provided different products with *Eucalypus spp.* supplying poles (7.5%) and rafters (3.8%), *Cupressus lusitanica* supplied mainly timber (6.3%) whereas *Acacia mearnsii* supplied withes (5%) and charcoal (3.8%).

Further rating of income, however, showed that the proceeds were adequate for 2.5 percent, inadequate for 3.8 percent, and negligible for 17.5 percent. The situation is however set to improve given that most tree species are still young as observed by

Forssblad and Spångberg (1995). The survey did not however authenticate that increase in income would raise investments or income ploughed back to agroforestry. Nevertheless, such commitment is expected as findings by Banard and Foley (1984) and Sinclair (1994) contend that adoption of agroforestry first means putting money into the farmer's pockets. It, therefore, follows that farmers would be enticed to invest where they are certain of reaping benefits – a situation that may avert the tendency by small-scale farmers to rely on crops or livestock as exclusive income sources.

4.5.3 Future Options for Extension Contact

The survey further sought possible options for future contact within the framework of farmer participation in extension. Many local institutions and groups exist in Trans Nzoia District. These groups have been formed to meet different aims and have different membership (Table 4.30).

Table 4.30: Farmers' Responses on Group Affiliation and Activities Undertaken by the Groups

Group Affiliation	AF Activities			Non- AF Activities		
	Activity	Freq.	%	Activity	*Freq.	%
Merry-go-round	-	-	-	Revolving fund	8	10
Welfare	-	-	-	• Burial arrangements • School fees committees	3	3.8
Women	Nursery Improved *jikos*	2	2.5	• Poultry rearing • Dairy farming • Rental houses	7	8.8
Youth	Nursery	1	1.3	Vegetable farming	3	3.8
Church	Nursery	1	1.3	Fellowship	5	6.3

* Represents total frequency for all activities in that category

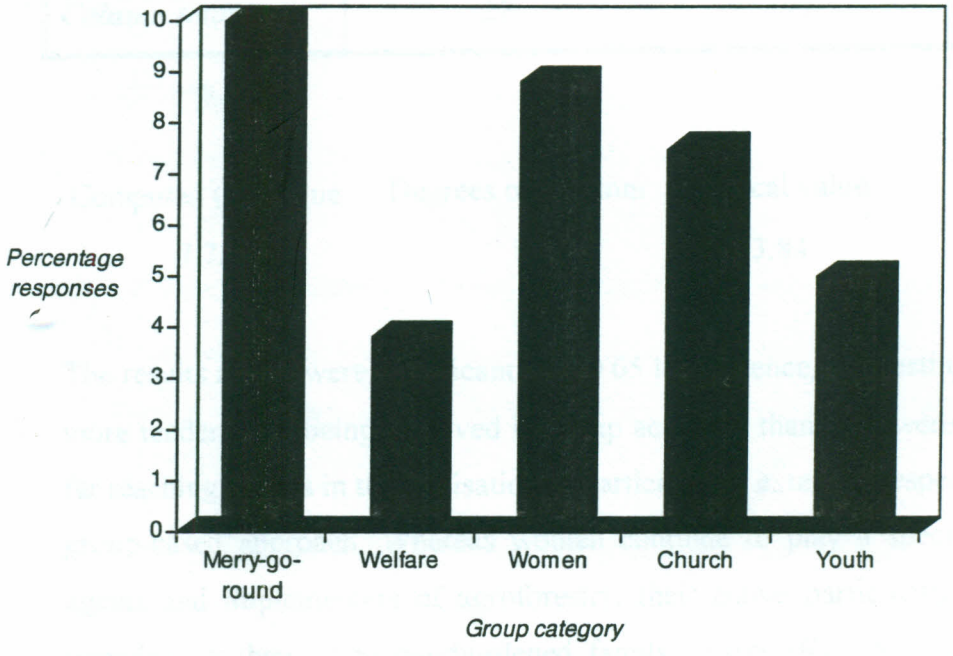
Source: Field Survey, 1999

Majority of farmers who belonged to local groups were not engaged in agroforestry activities, save for, women groups (2.5 %), youth groups (1.3 %) and the church groups (1.3 %). Thus, non-agroforestry activities dominated the activities undertaken by these groups suggesting that these groups have been under-utilised as forums to disseminate extension packages.

Among non-agroforestry activities performed by these groups were, a revolving fund for house keeping (10%), burial arrangements and school fees *harambees* (3.8%), poultry rearing, dairy farming and rental houses (8.8%), vegetable farming (3.8%) and fellowship (6.3%). Figure 4.4 below summarises the overall group affiliation of farmers interviewed in the survey.

Yet another category also under-utilised in extension contact were self-initiated

Fig. 4.4: Local Groups that Farmers in the Survey were Affiliated



groups involved in tree planting activities. In the study, this category included women and youth groups operating group or commercial nurseries. These nurseries, as

reported by the group members, had a dual purpose of meeting members seedling needs and generating income from the sale of the seedlings. However, the market for seedlings was expressed as not favourable.

The study further went further to investigate whether there were any gender disparities in the composition of groups. The variables group 'affiliation' and 'gender' were treated to Chi-square (χ^2) test in a contingency table (Table 4.31).

Table 4.31: The Frequency Distribution of Farmers' Responses on Group Affiliation Across Gender

	Group Affiliation		
Gender	In groups	Not in groups	***Row total***
Women	18	9	27
Men	9	44	53
Column total	27	53	80

Computed (χ^2) value	Degrees of freedom	Critical value
7.73	1	3.84

The results above were significant at α 0.05 level, hence, suggesting that women had more tendency of being involved in group activities than men were. This finding has far reaching effects in the realisation of participatory extension especially in the use of group-based approach. Whereas women continue to play a special role as change agents and implementers of agroforestry, their active participation is bound to be impeded by their often overburdened family chores (Khasiani, 1992) and cultural inhibitions in tree planting (Bradley, 1988). This demands more involvement of men in local initiates in agroforestry. The challenge for extension agencies therefore remains in effectively targeting and encouraging participation by men to ensure gender parity and effectively realise the latent local potential in executing a participatory framework.

On the whole, use of local institutions and groups as evident in the study, could ease extension efforts in the distinct in three ways. First, local institutions could be used to harness local potential in agroforestry. This, in essence, would relief the burden of extension institutions in a situation where the agency provides almost everything for the farmer from technical advice to material support. In a study on the role of local institutions in extension among the Turkana people, Barrow (1996) notes that the local groups serve as important channels of tapping indigenous potential. A similar observation has also been made by Kiage (1998) on the role of women groups in revegetation of degraded sites in Chepereria divison of West Pokot District. Moreover, the use of local institutions can mitigate the problems related to formation of groups specifically intended for agroforestry purposes such as the requirement by VIAP's neighbourhood groups.

Second, local institutions and groups could be used to channel available external support to farmers. Support required by farmers in the survey included training (30%), provision of seedlings (17.5%), and seeds (25%), and offering marketing possibilities for their tree products (2.5%). All these requirements may not be within the capacity of any extension agency to meet particularly owing to donor fatigue in funding projects. However, by bringing all stakeholders in play, the essence of participatory extension, most expectations of both farmers and extension agencies can be realised.

Finally, as forums for awareness creation they can help demystify some of the reasons that farmers in the survey gave for not implementing agroforestry as discussed in section 4.3.2.2 above. This is particularly pertinent given that majority of the farmers (86%) in the survey were willing to continue planting trees on their farms. The minority (13.8%) of the farmers would not continue planting trees on their farms since they were conspicuously ignorant about the productive potential offered by agroforestry.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of research findings, conclusion and recommendations. The chapter begins by highlighting all the salient findings of the study from which conclusions are drawn. In highlighting the findings, each objective is tackled separately. The chapter ends by suggesting recommendations to policy makers, extension agencies and future researchers.

5.2 Summary of Findings

The first objective of the study was to identify extension methods and the extent of farmer participation in agroforestry extension. The study identified six principal methods in extension namely: individual visits, (neighbourhood) groups, public meetings, seminars and workshops, field days and excursions (farmers' tour). Individual visit was the most utilised extension method suggesting a longer period of use, which is supported by the fact that extension in Kenya has since time immemorial been based on the Training and Visit (T&V) strategy. However, a shift towards use of group-based approaches was revealed. Among reasons given for this, were that they were more participatory, cheap and had a wide coverage of farmers relative to time. Further statistical analysis using the Chi-square test revealed that there were significant differences in favour of contact farmers in extension delivery that might be attributed to the biases imposed by the individual approach in extension.

On the extent of farmers' participation in extension programmes, farmers were involved in the initial stages of planning, decision making and implementation. The other levels of participation *i.e.,* monitoring and evaluation, farmers' inputs were conspicuously absent. *Forms* of participation mainly included provision of labour but mainly confined to the Soil and Water conservation Programme. These findings seem to negate the premise that participation is a continuous process from the beginning to the end of the programme and that farmers have a great deal to contribute in form of knowledge and material support in the movement towards sustainable agroforestry. Chi-square results further indicated differences between contact farmers and non-contact farmers in the adoption of agroforestry with contact farmers adopting agroforestry (*i.e.,* utilising extension packages) better than non-contact farmers.

The second objective sought to investigate problems that hindered farmer participation in agroforestry extension programmes. The study identified two broad categories in which these problems manifested themselves. In the first category, were those problems experienced at the agency level. Problems here included staffing inadequacies with regard to staff size, training and motivation; paucity of support resources in transport and back-up literature and poor inter-agency co-ordination. These problems implied poor preparation in implementing participatory methods in extension.

In the second category, farmer-centred problems included poor funding of groups, poor attendance of meetings, passiveness of members, and conflicts among farmers. These were problems identified by farmers as obstacles to their participation in extension programmes. This fact was confirmed by the Chi-square results that showed that farmer-centred problems occurred independently and had no association with contact institutions farmers belonged to.

The third objective of the study was to find out the status of local potential that is pertinent to extension programmes. The study revealed indigenous knowledge in tree growing and uses among farmers in the study area. On tree growing, farmers have used different local methods to plant and manage trees to maturity. Farmers exhibited vast knowledge in seedling production namely, mode of tree propagation, pest control in on-farm nurseries and in seed pre-treatment. Knowledge in tree management in the study manifested in the areas of minimising negative tree-crop interactions, pest control and performing field operations such as weeding, transplanting and manuring.

Additionally, small-scale farmers had different preferences for tree species that were hinged on tree uses or special functions of these species. A majority of the farmers in the study showed preference towards growing of exotic species. Nevertheless, indigenous species are fast picking up, for example, *Croton macrostachyus Sesbania sesban and Markhamia lutea* had remarkably high proportion in the category of indegenous species which may in future bridge the gap between the presence of exotic and indigenous species in farmers' fields. Among the main uses of exotic trees were woodfuel providers, possession of multiple uses and capability to generate income. Indigenous species on the other hand, were mainly preferred because of their special functions that included provision of medicine for both livestock and humans and their cultural value.

The study also found out that the existing local potential among farmers has been put into little use notwithstanding the general consensus of its importance as expressed by most extension managers and SMS's. As a possibility of harnessing this potential, the study disclosed a growing spirit of group-formation that comprised women and youth

groups, church groups, welfare associations and merry-go-rounds. However, these local institutions or groups have, hitherto, not been seriously considered as avenues for extension contact.

5.3 Conclusion

The study revealed a shift of emphasis towards use of group-based approaches in agroforestry extension. These are considered participatory owing to their great sense of economy of scale (time and finances). This should, however, not suggest riddance of methods previously used and largely based on the traditional (top-down) model such as the farm visits. What is required is to revitalise methods based on top-down model to provide an enabling environment for farmer participation.

The six methods used in extension contact in Trans Nzoia District are, therefore, still relevant in participatory agroforestry extension. Each method needs to be considered as playing a complementary role. For instance, individual visits can be retained to attend to unique problems of farmers that cannot be addressed using group-based approaches such as the neighbourhood groups. The public meetings are important vehicles for awareness creation particularly in introducing new products, messages or projects. The seminars and workshops could be used to train local leaders in various subjects in participatory agroforestry extension. Lastly, field days and excursions could be used to demonstrate the practicability of adopting new technologies in agroforestry. However, reconciling the use of these methods would entirely depend on the availability of resources to the extension agencies. This means that such a requirement should be based on constraints imposed by their budgets or institutional frameworks.

In addition, notwithstanding the method used in extension, farmers should be more involved in monitoring and evaluating extension programmes. This is the only way problems in the course of implementing extension packages would be redressed and the success or true impact of extension programmes judged.

Central, however, to realising participatory agroforestry extension, are optimising farmers' inputs. This poses two challenges to agroforestry extension agencies and other stakeholders. First, it involves removing the obstacles that hinder farmer participation in extension programmes. This demands the strengthening of physical and human resources in support of participatory extension. In this regard, more support resources, training and collaboration of stakeholders are prerequisites. With this in place, even farmer-centred problems would be redressed.

The second challenge is the need to utilise the local potential in agroforestry. Local institutions and groups are suggested as other alternative forums for harnessing the local potential. This should help re-orient future extension efforts by making them more focussed on the farmer *vis a vis* his needs, problems and potential. The manner in which this is done should ensure gender parity where participation of men should be encouraged. This requirement is considered timely given general resource inadequacies among extension agencies expressed in the study.

In a nutshell, extension agencies have made commendable efforts in agroforestry extension but have still a long way to go in empowering the farmer as an important participant in agroforestry extension programmes.

5.4 Recommendations

5.4.1 Recommendation to Policy Makers and Extension Agencies

Based on the research findings the following recommendations are suggested to policy makers and extension agencies:

i) A clear cut and integrative policy that embraces the myriad contributions from different actors in agroforestry extension is needed to avoid piecemeal approaches in order to foster concerted development of agroforestry by having a common ground or point of reference.

ii) There is need to strengthen co-ordination and networking among extension agencies and between all stakeholders in extension particularly with grass-root organisations or groups. The grass-root or local institutions should be in the mainstream of agroforestry extension planning and development.

iii) A need for more financial, technical and logistical support to the governmental arm of extension to facilitate effective delivery of extension services to redress institutional inadequacies both in physical and human resource abilities.

iv) There is need to use other extension methods and target groups to reach the farmers, for example the school going children. Use of audio-visuals is also recommended to complement the existing methods.

v) Provide more training to extension staff in subject content (technical skills) and in participatory methods particularly in group dynamics and communication skills. This training should include both on-job training (refresher courses) and formal training. In the latter case, training in participatory methods needs to be integrated in the curricula of training institutions where such training is not offered.

vi) Concentrate extension efforts in few areas as opposed to blanket coverage. The focal area development approach used in other areas with success is suggested. This should allow the extension institutions or projects learn from pilot experiences before instituting a large-scale programme or replicating such a programme to other areas. Such targeted efforts can address specific issues relating to cultural, gender and socio-economic barriers in adopting a participatory strategy.

vii) Pursue the concept of farmer-to-farmer extension *via* the neighbourhood groups to galvanise extension agencies' efforts. This is particularly important in changing farmers' attitudes regarding agroforestry and synergistically realises the spill-over effects of technology and knowledge transfer. Correspondingly, it can overcome resource inadequacies a rising from donor fatigue in supporting forestry projects.

viii) Introduce techniques such as participatory assessment, monitoring and evaluation (PAME) as a tool to involve farmers in the entire cycle of extension programmes. This should, however, be supported with staff training in monitoring and evaluation techniques as well as developing effective mechanism and framework for data collection and processing.

ix) Extension agencies should design mechanisms for harnessing the local potential among farmers to support agroforestry. This should involve promotion of locally preferred species, augmenting farmers' knowledge on tree uses, identification and awareness creation of indigenous species that compete favourably with exotic species in terms of agroforestry qualities and economic returns.

5.4.2 Recommendations for Further Research

i) The scope of the research was limited to the small-scale farmers with land sizes between 1 and 5 acres. This may have blurred the true picture of farmers' involvement in extension programmes as it excluded the views of many farmers with land holding exceeding 5 acres, but nonetheless among the target groups for agroforestry extension. There is need, therefore, for future research to consider views of this group.

ii) A comparative study of successful and unsuccessful target areas (areas of concentration) needs to be carried out in order to broaden and deepen the understanding of intricacies involved in implementing participatory agroforestry extension. Such research would be able to answer the question as to why certain target communities or areas succeed or fail to embrace participatory extension. Such comparison could also be extended to cover other Districts with homogenous ethnic characteristics.

iii) A detailed and explorative inventory of indigenous knowledge in the use and management of native trees and shrubs and their conservation should be done. The present study concentrated on tree growing and uses and within the confine of agroforestry extension.

iv) A research on efficiency and proper management of resources at the agency level would be worthy carrying out. Such a research should be able to recommend on how resources can be sparingly utilised for maximum output in the provision of extension services given the general dwindling resource capacities of extension agencies expressed in this study.

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APPENDICES

APPENDIX 1 (a)

A QUESTIONNAIRE SCHEDULE TO SMALL-SCALE FARMERS

Questionnaire No._____

Date:_____

Name of respondent (optional):_____

Division:_____

Location:_____

Sub-location:_____

Area/Village:_____

Section A: Socio-economic Information

1) Age (Household head) _____

2) Gender

01) Male [ ]

02) Female [ ]

3) Highest level of education attained

O1) Primary [ ]

02) Secondary [ ]

03) Post-secondary [ ]

04) Non-formal [ ]

4) Size of the family

01) Boys [ ]

02) Girls [ ]

5) Size of the land holding (acres)

_____

6) Security of tenure

01) Title deed [ ]

02) No Title deed [ ]

7) Mode of acquisition

01) Inherited [ ]

02) Purchased [ ]

03) Leased [ ]

04) Others *(specify)* _____

8 (i) For how long have you been living in this area?_____

(ii) Where did you originally come from?_____

Section B: Participation in Agroforestry Extension

9) Have you so far been reached by any institutions or individual(s) with information on agroforestry?

01 Yes [ ]

02) No [ ]

10) If yes for 9 above, specify the source of information

01) Department of Agriculture [ ]

02) Forest Department [ ]

03) VI Agroforestry Project [ ]

04) A neighbour [ ]

05) Local Administration [ ]

06) Others *(specify)*_____

11) Where did you receive this information?

01) On the farm (Individual visit) [ ]

02) Group of farmers [ ]

03) Public meeting (*Baraza*) [ ]

04) Seminar/Workshop [ ]

05) Field day [ ]

06) Farmers tour/Excursion [ ]

12) Specify the institution involved and the forum where this information was received for questions 10 and 11 above?

FORUM / INSTITUTION	I	G	P	S/W	F	T
DA						
FD						
VI AP						
LA						
Others *(specify)*						

KEY:

DA	- Department of Agriculture	G	-Group of farmers
FD	- Forest Department	P	- Public meetings
VI AP	- VI Agroforestry Project	S/W	- Seminar / Workshop
LA	- Local administration	F	- Field day
I	- Individual visit	T	- Farmers tours/excursion

13) A part from information on agroforestry, are there any other messages which you received?

01) Yes [ ]

02) No [ ]

14) If yes for 13 above, which information / message and by which institution?

Message	Source / Institution
i)	
ii)	
iii)	

15) How beneficial was the information you received on tree planting? (Rate along the three columns provided)

Info. category	Very beneficial	Beneficial	Irrelevant
Individual visit			
Group			
Public meeting			
Seminar / Workshop			
Field day			
Farmers' tour			

16. (i) Did you make use of the information?

0 1) Yes [ ]

02) No [ ]

(ii) Explain the answer given. _____

_____

_____

17 (i) In the case of an individual visit, were return visits ever made?

01) Yes [ ]

02) No [ ]

18) If yes, for 17 above, how often?

01) Regularly [ ]

02) Once after a very long time [ ]

03) Once [ ]

19) Rate the contact between you and the expert (extension worker).

01) Friendly [ ]

02) Indifferent [ ]

03) Unfriendly [ ]

20) i) In the case of a public meeting (*Baraza),* who organised the meeting ?

_____

ii) Who covered tree-planting themes? _____

21) i) In the case of seminar / workshop, where was it held? _____

_____

ii) What was the duration of the course? _____

iii) Who invited you for the course?_____

iv) How many participants were you?_____

v) Which topic(s) was/were discussed?_____

_____

_____

22. (i) In the case of a farmers' tour, where were you taken?

_____

(ii) What did you learn?

_____

23) Do you belong to any of the following groups or association *[Indicate by ticking the adjacent box the one(s) that apply]*

01) VIAP groups	[ ]
02) Soil Conservation Committee	[ ]
03) Church-based groups	[ ]
04) Women groups	[ ]
05) Youth	[ ]
06) Non of the above	[ ]
07) Merry go round *(Sindikiza)*	[ ]
08) Welfare groups	[ ]
07) Others *(specify)*_____	

24) Is/are the group(s) you belong to in 23 above engaged in any agroforestry (tree planting) activities?

01) Yes [ ]

02) No [ ]

25) i) If yes for question 24, whose initiative was it? _____

ii) How many members are there?_____

iii) What activities do you undertake?

Agroforestry	Others
i)	
ii)	
iii)	

iv) (a) Do you receive any external support material or otherwise?

01) Yes [ ]

02) No [ ]

(b) If yes, specify the nature of support and source.

Support	Source
i)	
ii)	
iii)	
iv)	

(c) What contributions does the institution expect of you?

_____

_____

_____

v) What problems do you encounter?

_____

_____

_____

vi) How do/can you tackle these problems?

_____

_____

_____

Section C: Status of Local Potential

26) Which mode of tree propagation do you use?

01) Seedlings [ ]

02) Wildings [ ]

03) Direct Sowing [ ]

04) Others *(specify)*_____

27) Where do you get the tree seedlings, wildings or seeds for direct sowing? (*state whether on farm or off-(outside the) farm).*

Mode of Tree Propagation	**On-farm**	**Off-farm**
01) Seedlings		
02) Wildings		
03) Direct seeding/sowing		
04) Seeds		
05) Others *(specify)*		

28) If on-farm, which problems do you face with the method you use?

_____

_____

_____

29) i) If outside the farm, specify the species and the source?

Species	**Source**
i)	
ii)	
iii)	
iv)	

i) What problems do you encounter with:

Seedlings	**Seeds**
i)	
ii)	
iii)	
iv)	

iii) What costs do you incur in the mode of tree propagation you use and thereafter in raising the trees?

_____

_____

_____

_____

iv) What measures have you in place to reduce these costs?

_____

_____

30) Do you have any experiences (practical experiments) or knowledge on agroforestry that does not include expert knowledge or advice in the following areas?

Seedling Production	**Tree Management**
i)	
ii)	
iii)	
iv)	

31) i) For each of the above, specify the species involved?

Species	**Seedling Production**	**Tree Management**
i)		
ii)		
iii)		
iv)		

ii) How successful are these experiences?

_____

32) Is this knowledge and / or practice common to the rest of community members?

01) Yes [ ]

02) No [ ]

33) If no for 32 above specify whether,

01) Self Initiative _____

02) From another community (specify)_____

34) i) Are there tree species you prefer most?

01) Yes [ ]

02) No [ ]

ii) If yes, rank the species in order of preference and state the reason for each.

Tree Species	Reason(s) for Preference
(a) Exotic spp.	
1)	
2)	
3)	
4)	
5)	
(b) Indigenous spp.	
1)	
2)	
3)	
4)	
5)	

35) Are there tree species or shrubs, which have a special function to you, your livestock or crops?*(indicate the species and function?)*

Tree Species	Function
i)	
ii)	
iii)	
iv)	

36) i) Do you earn any income from the sale of trees or their products?

01) Yes [ ]

02) No [ ]

ii) If yes indicate the species and rate the amount received.

Species	Products	Adequate	Inadequate	Negligible
i)				
ii)				
iii)				
iv)				

38) If yes for 37 above, give the reason (s)

39. i) Will you continue planting trees?

01) Yes[ ]

02) No [ ]

ii) If yes for 37 above, what kind of external support do you think is necessary?

_____

_____

_____

_____

THANK YOU

APPENDIX 1 (b)

AN INTERVIEW SCHEDULE TO EXTENSION WORKERS

Name of extension worker:_____

Area operation:_____

Location:_____

Sublocation:_____

1) Age:_____
2) Gender: 01) Male [ ] 02) [ ]
3) Highest level of education attained:_____
4) Which organisation/institution do you work for?
5) What are the activities of your organisation in this area?
6) (a) What kind of training do you have on extension? (*indicate whether formal or on-the-job training/refresher courses).*

   (b) How relevant/beneficial is the training when working in the field particularly in the promotion of agroforestry?

   (c) How do you reach out to the farmers and what are the problems faced?
7) (a) Do you involve farmers in the following areas in the delivery of extension services? *(Choose the ones applicable).*

   - [ ] Needs assessment and problem identification
   - [ ] Planning
   - [ ] Decision making
   - [ ] Monitoring and evaluation of completed activity(ies).

   (b) How do you ensure that farmers are actively involved in any of the areas above?

   (c) What are the benefits of actively involving the farmers, if at all they are involved?

   (d) What are the challenges of actively involving the farmers?

   (e) How do you ensure that farmers accept and adopt your advice?
9) (a) What factors in your opinion and/or experience do you think affect your individual motivation or performance in extension?

   (b) Suggest how these factors can be addressed.

APPENDIX 1(c)

AN INTERVIEW SCHEDULE TO EXTENSION MANAGERS

Name of institution:_____

Name of officer interviewed:_____

Position of the officer in the institution:_____

1) What are the objectives of your institution with regard to agroforestry extension?

2) How are extension services organised and managed?

3) What agroforestry extension activities do you have and how effective has been their implementation? *(Mention target areas, groups or communities).*

4) (a) What (agro)forestry extension methods do you use?

(b) Why are the methods preferred?

(c) Are there plans to introduce other extension methods? *(which ones and why).*

5) (a) What are the problems or constraints encountered in the delivery of extension services?

(b) How are you currently addressing or planning to address these problems or constraints?

(c) Which other organisations groups or individuals (partners) does your organisation work in liaison with? *(state the areas of co-operation).*

6) Do you have measures in place to ensure active participation of farmers in agroforestry extension? If yes, state:

(a) what these measures are,

(b) When and why they were instituted,

(c) Problems and constraints being faced, and

(d) How these problems or constraints are being / can be reddressed.

7) Ideal participation begins with *planning* with the farmers, *deciding* with them of an appropriate course of action, together overseeing the *implementation* of the preferred plan(s) of action, and ends with *monitoring* and *evaluation* of the completed activity. How far has your organisation recognised these levels of participation?

8) What is the place of indigenous knowledge in meeting the fore stated objectives of this Institution?

9) (a) Given your opinion and / or experience, can farmers sustain agroforestry practices without external material support? *(Briefly give reasons for your answer).*

(b) What are the extension implications for this?

10) Give your opinion on how agroforestry extension can be made more responsive to farmers' needs, aspirations, problems and potential.

APPENDIX 1 (e)

AN OBSERVATION RECORD SHEET

The checklist given below guided the process of observation to provide evidence of agroforestry.

Date:_____

Name of the farmer:_____

1) Trees on Farm

Indigenous Tree Species	Exotic Species
i)	
ii)	
iii)	
iv)	

2) Agroforestry Practices

Practice		Species
i)	Boundary planting	
ii)	Home garden / orchard	
iii)	Woodlot	
iv)	Dispersed trees on farms	
v)	Others	

3) Tree Management Techniques

Technique		Species
i)	Coppicing	
ii)	Pollarding	
iii)	Side pruning	
iv)	Root pruning	

4) Seedling Production and / Nursery Management Techniques

Traditional / Local		Conventional	
i)	Wildlings	i)	Direct sowing
ii)	Tree / shrubs retained	ii)	Bare roots
iii)	Banana stalks / used times tins and containers	iii)	Polyethylene bags
iv)	Others *(specify)*	iv)	Others *(specify)*

APPENDIX 2

A MASTER LIST OF CODES AND NAMES OF TREE / SHRUB SPECIES IDENTIFIED IN THE STUDY AREA

Species Code	Botanical Name	Trade / Common Name
(01)	*Grevillea robusta*	Silky oak
(02)	*Cupressus lusitanica*	Mexican cypress
(03)	*Eucalyptus spp.*	Blue gum
(04)	*Sesbania sesban*	# Chisubasubi
(05)	*Markhamia lutea*	# Kumusiola
(06)	*Acacia mearnsii*	Black wattle
(07)	*Croton macrostachyus*	Croton *Mutundu
(08)	*Croton megalocarpus*	Croton *Mukinduri
(09)	*Calliandra calothyrsus*	Calliandra
(10)	*Parsiflora edulis*	Passion fruit
(11)	*Citrus limon*	Lemon
(12)	*Citrus sinensis*	Sweet orange
(13)	*Persea americana*	Avocado
(14)	*Mangifera indica*	Mango
(15)	*Annona senegalensis*	Castard apple
(16)	*Psidium quajava*	Quava
(17)	*Eriobotrya japonica*	Loquats
(18)	*Ricinus communis*	Castor oil plant
(19)	*Sycigiun cuminii*	Java plum
(20)	*Acacia abyssinica*	* Mugaa
(21)	*Acacia hockii*	* Mukunga
(22)	*Dovyalis caffra*	Kei apple
(23)	*Lantana camara*	Lantana
(24)	*Cordia africana*	East African cordia / ✱Mugunguret
(25)	*Prunus africanus*	Red stinkwood
(26)	*Erythrina abyssinica*	Red-hot-poker tree / # Murembe
(27)	*Entada abyssinica*	Kumusembe
(28)	*Juniperus procera*	Pencil cedar / ✱Torokio / *Mutarakwa
(29)	*Podocarpus milanjianus*	Podo

(30)	*Casuarina equisetifolia*	Horsetail tree
(31)	*Pinus patula*	Mexican weeping pine
(32)	*Spathodea campanulata*	Nandi flame
(33)	*Callistemon citrinus*	Bottle brush
(34)	*Albizia gummifera*	Peacock flower
(35)	*Warburgia ugandensis*	East Africa greenheart / # Kumusikhu
(36)	*Ndombeya rotundifolia*	White ndombeya
(37)	*Melia Azederach*	Persian lilac
(37)	*Terminalia mantaly*	Umbrella tree
(38)	*Carica papaya*	Paw paw
(39)	*Ficus natalensis*	Fig tree
(40)	*Caesalpinia decapetala*	Mauritius thorn
(41)	*Jacaranda mimosifolia*	Jacaranda
(42)	*Senna spectabelis*	-
(43)	*Olea welwitschii*	Elgon teak / # Mutukuyu
(44)	*Cyphomandra betacea*	Tomato fruit
(45)	*Azadirachta indica*	Neem tree
(46)	*Kigelia africana*	Sausage tree / *Muratina
(47)	*Leucaena leucocephala*	♦ Lusina
(48)	*Dodonea viscosa*	-
(49)	*Terminalia brownii*	❖Koloswa

KEY:

❖ Pokot

Luyha (Bukusu sub-community)

* Kikuyu

✱ Sebei / Sabaot

♦ Swahili

N/B: Trade names without symbols are in English

APPENDIX 3

A sample SWOT analysis sheet of (wesakulile Women Group)

Issue	Strength	Weakness	Opportunities	Threats
1) The role of agroforestry as a land use system	♦ Firewood ♦ Fertility improvement ♦ Construction poles ♦ Food ♦ Beauty ♦ Soil erosion control ♦ Fodder	♦ Competition with the crops ♦ Attracting birds and pests (worms) ♦ Border conflicts with neighbours	♦ Increased income ♦ Improved nutrition ♦ Reduced time in search of firewood ♦ Self-sufficiency in wood production	♦ Limited tree species for planting ♦ Limited availability of seeds ♦ Lack of funds for buying tools
2) The need to form groups	♦ Work is made easier ♦ Negotiations for external support more possible ♦ Learn from each other	♦ Passive members ♦ Leadership wrangles ♦ Member-to-member conflicts ♦ Funds to accomplish non- agroforestry activities Conflicts of interest	♦ Able to easily mobilise efforts towards group's goals.	♦ Poor co-operation among members ♦ Ethnicity ♦ Lack of tree knowledge
3) The role of external support institutions	♦ Offer technical advice ♦ Provide funding ♦ Provide material support	♦ Over-dependency on outsiders ♦ Misunderstandings on use of support	♦ More knowledge on tree growing ♦ Ease of seedling production	♦ Few extension officers ♦ Embezzlement of funds by group leaders
4)The local resources that can be used to support agroforestry	♦ Reduce dependency on outside help ♦ Ensure self-sufficiency in seedling production	♦ Resources unavailable ♦ Attitude	♦ More seedlings ♦ More trees and associated benefits ♦ More money for other needs	♦ Reduce prospects of donor assistance

APPENDIX 4

A LIST OF WOMEN AND YOUTH GROUPS ENGAGED IN AGROFORESTRY ACTIVITIES IN SAMPLED AREAS

Name of Group	Catchment Area	Division
1) Msamaria Mwema	Saiwa Swamp	Cherengani
2) Umoja Youth Group	Kimini	Saboti
3) Mazingira Action Women Group	Kitale Municipality	Saboti
4) Sinyerere Youth Group	Sinyerere	Cherengani
5) Kipsaina Wetland Youth Group	Kipsaina	Cherengani
6) Sibanga Women Group	Sango Village	Cherengani
7) Fairelare Conservation Youth Grp.	Sinoko	Cherengani
8) Pendekesha Women Group	Kapretwa	Saboti
9) Lurende Women Group	Kimondo	Saboti
10) K.A.G Youth Group	Sitatunga	Cherengani
11) Milima Women Group	Kipsaina	Cherengani
12) Mwiri Women Group	Kipsaina	Cherengani
13) Sosuet Youth Tree Nursery	Waitaluk	Saboti
14) Legio Maria Women Group	Kimondo	Saboti
15) Wesakulile Women Group	Kaplamai	Cherengani
16) Milimani Women Group	Saiwa Swamp	Cherengani
17) Ndalala Women Group	Kinyoro	Saboti
18) Birunda Youth Tree Nursery	Birunda	Saboti

N/B: The shaded background in the list represents the groups focus group interviews were conducted.

APPENDIX 5

A LIST OF INSTITUTIONS WITH GENERAL EXTENSION CONTACT IN THE STUDY AREA

1) Department of Agriculture (DA)
   a) Soil and Water Conservation section
   b) Home Economics section
   c) Livestock section
   d) Crop section
2) Kenya Agricultural Research Institute (KARI)
3) VI Agroforestry Project
4) Moronjo Vertinary Services
5) Manor House Agricultural Centre
6) Church Province of Kenya (C.P. K).
7) Minisrty of Health (MoH)
8) International Aid Sweden (I.A.S)
9) Environment Action Team (E.A.T)
10) World Wide Fund for Nature (W.W.F)
11) National Environment Secretariat (N.E.S)
12) Forest Department (FD)
13) Northsud
14) Green Belt Movement
15) Local (Provincial) Administration (L.A)
16) Social Services Department (S.S.D)
17) Kenya Tea Development Authority (KTDA)