POSSIBILITY OF SUSTAINABLE TREE-GROWING BY FARMERS IN MARGINAL AREAS: A CASE STUDY IN KWAVONZA, KENYA

BY

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A thesis submitted in fulfilment of
the requirements for the degree of
Master of Forest Science.

7 July, 1995

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ABSTRACT

This thesis examines the possibility of sustainable tree-growing by the farmers of the marginal rainfall areas of Kenya. Kwavonza, a village where the Government of Kenya and the Government of Japan have jointly conducted a pilot forestry extension program, was selected for this case study. Kwavonza, like most other villages in marginal areas, was settled by farmers from higher rainfall areas due to rapid population growth in these decades. Although some recent studies indicate that some farmers have overcome land degradation problems in high rainfall areas, it is still not clear that the farmers of marginal areas are in the position to do so under harsher natural and socio-economic conditions.

This study reviews and analyses the tenurial arrangements of land and trees, identifies social units suitable for forest resource management, examines their potential and limitations, and accommodates these issues along with farmers' perspectives. It was revealed that individual households and farmers' groups are capable of managing resources, both of them with certain advantages and disadvantages. Groups are effective in the use of labour, the lack of which is the single most serious constraint in tree-growing by individual households. However, groups do not automatically assure the access of individuals to trees planted in the long-term. Individuals should be convinced, regardless of management options, that they have ownership of or rights to access trees, and the problems of labour shortage should be addressed to enhance tree-growing practices by farmers in marginal areas.

ACKNOWLEDGMENTS

I would like to thank my supervisor Professor Ian Ferguson for his guidance throughout my studies towards this thesis. I appreciate his broad experience and practical knowledge covering a wide range of disciplines. I would also like to thank the course coordinator, Mr. John Perkins, and other faculty staff for providing me an opportunity to come and study in the University of Melbourne and assisting me in various ways.

Thanks are due to Mr. Katsura Watanabe, the former Chief Adviser of the Kenya/Japan Social Forestry Training Project, who invited me to work in Kenya, Dr. Shigeru Iida who led the series of socio-economic surveys carried out by the Project, and other Kenyan and Japanese colleagues who have collected a substantial amount of field data.

Finally I would like to express my gratitude to the Japan International Cooperation Agency, which enabled me to study in Melbourne for two years and conduct this study by giving me a scholarship.

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CHAPTER 1

INTRODUCTION

In most developing countries, forests are an important part of rural life. They provide fuel, food, construction materials and other commodities, and also various services like shade, windbreaks, grazing land, and soil and water protection. In the past, the growth rates of forests exceeded the needs of people using traditional methods and knowledge.

However, growing population pressure has made it extremely difficult to maintain sufficient production by traditional methods from the available land area (Adeyoju, 1978). The population explosion in recent years has forced Kenyan people to clear forests to expand the arable lands in order to meet their increasing daily needs. Farm sizes have shrunk rapidly, due to subdivision, as it is impossible to find unoccupied arable land (Tiffen *et al*, 1994). To tackle this problem, the Forest Department of the Government of Kenya established a forestry extension service in 1971. However, tree-growing outside forest reserves has had only a marginal impact (Kenya Forestry Research Institute, 1990). Many people face difficulties due to a shortage of woody biomass and a reduction in soil productivity. These people increasingly rely on resources collected illegally or bought commercially.

Kenya has one of the highest population growth rates in the world. It is nearly 4 per cent per year (see Table 1-1). Forests, which cover only 2.7 per cent of the total area of Kenya, are under severe pressure (Burley, 1982). Population density is unevenly distributed. In some high rainfall areas the population density exceeds 900 person/km^2. These high rainfall areas support the majority of the population, but cover less than 15 per cent of the total land area of Kenya (Warner, 1993). As a result, arid and semi-arid lands have increasingly become important as areas of new settlement (Dewees, undated) forming so-called *marginal areas,* indicating their marginal rainfall and agricultural productivity.

Table 1-1: Population Growth and Projection in Kenya.

Item	Period		
	1965-73	1973-83	1980-2000
Annual growth rate (%)	3.7	4.0	3.9
Population (million) at the end of each period	19	25	36

Source: Adapted from World Bank (1986).

Agricultural production on marginal areas is usually not large nor reliable enough to support a large population. It is easy to destroy the fragile natural vegetation of these areas but difficult to restore it. Unlike the pastoralists living in much drier areas, people's life styles and production systems may not be well adapted to the harsh conditions of marginal areas. People in marginal areas rely on depleting resources rather than trying to manage them sustainably.

Besides being marginal in agricultural productivity, marginal areas have largely been neglected in social and political terms (Brokensha and Riley as cited in Fortmann and Bruce, 1988). Despite their increasing importance, marginal areas have received little attention from the government due to the comparatively sparse population. The government has grappled with problems in more populated areas, where it must look for political support (Westoby, 1975). Of the more than 60 projects operating under the category of social forestry in Kenya few have been located in marginal areas (Kenya/Japan Social Forestry Training Project, 1987). Forestry extension services of the government and non-governmental organisations (NGOs) are out of reach of most dwellers in marginal areas.

The Japan International Cooperation Agency and the Kenya Forestry Research Institute have been carrying out an intensive social forestry program in the Kitui District since 1986 as a part of the Kenya/Japan Social Forestry Training Project. The main project site (model extension area), Kwavonza (see Figure 1-1), is typical of marginal areas. People began settling in this area in 1967 because of population pressure in adjacent areas. Since then, forests have been cleared for farming and trees cut down both for daily use and for sale. The degradation of forest has become a critical problem.

Some recent studies (e.g., Tiffen *et al.*, 1994; Dewees, undated), however, suggest that tree coverage has increased in some areas despite the higher population pressure. Given that the analysis of the nearby Machakos District by Tiffen *et al.* suggests that the problems of land degradation were transitory and not permanent, it is appropriate to ask why should Kwavonza be different. The reasons are several.

First, most areas studied by Tiffen *et al.* (1994) have higher rainfall, hence higher productivity in both crop and tree-growing, by comparison with Kwavonza, which is a marginal rainfall area. This has implications for the relative levels of income and risk involved.

Second, although not stated by Tiffen *et al.* (1994), many farmers in the high rainfall areas of Machakos, because they have higher cash incomes than those in Kwavonza, purchase charcoal and firewood brought from surrounding marginal rainfall areas, putting additional pressures on those lands. To accentuate this problem, trees are more often grown for commercial production of fruits or timber in high rainfall areas, rather than fuelwood.

Thirdly, even if the problems of land degradation in Machakos were only transitory, they resulted in potentially avoidable losses of productivity over a substantial period of time, as well as downstream siltation and deterioration of water quality. A social cost-benefit analysis at the beginning of the transition may therefore have yielded a very different answer to that implied after it by Tiffen *et al.* (1994).

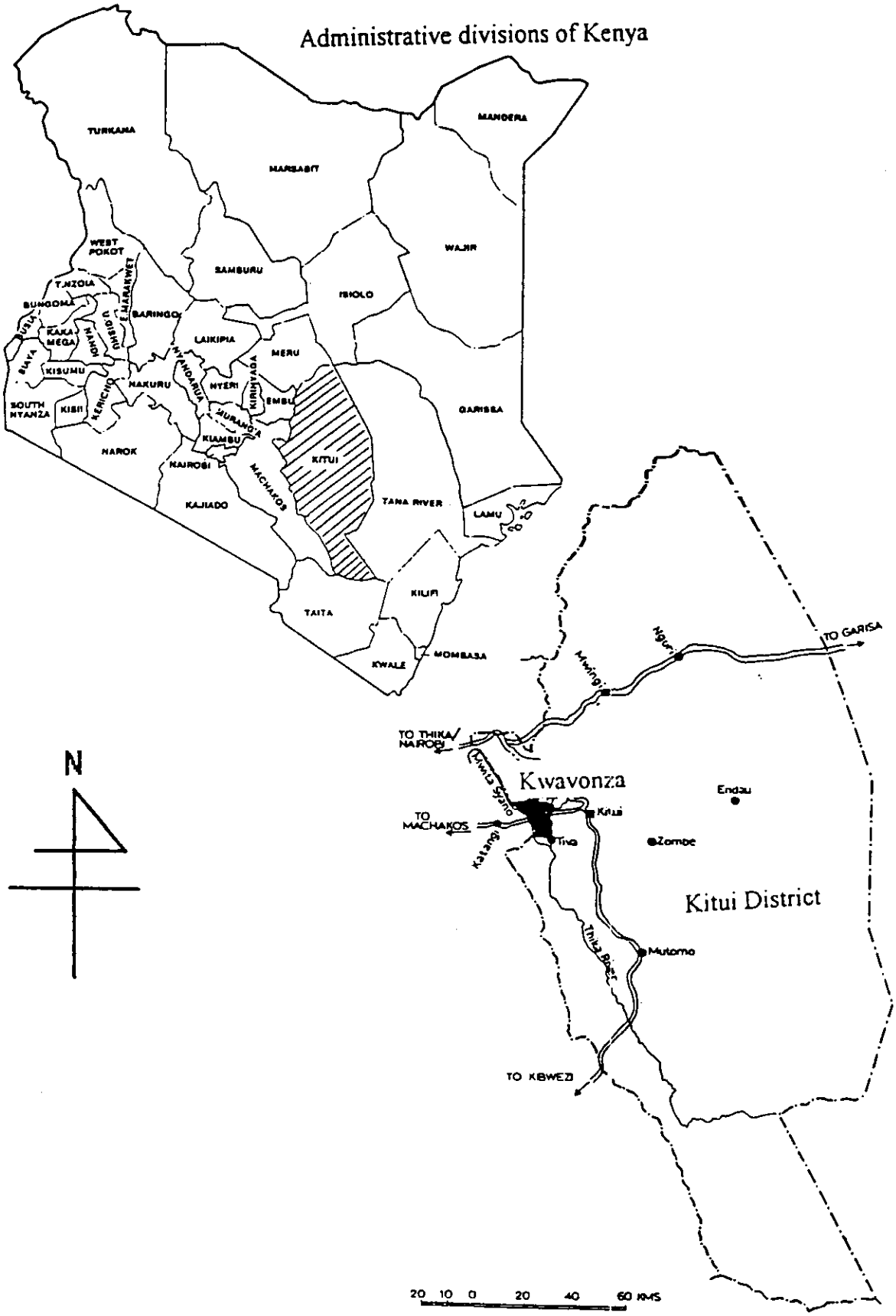
Finally, as some of the preceding points illustrate, there are problems in generalising from one area to another. One may well accept the conclusion of Tiffen *et al.* (1994) that some communities can react to and correct over time serious problems of vegetation loss and land degradation. However, it is by no means clear that the generally poorer farmers of Kwavonza or other marginal areas are in a position to do so without institutional and other changes or assistance.

Tree-growing and extension in a marginal area of the Kitui District like Kwavonza was a new experience, at the practical level, for both Kenyan officials and Japanese foresters. The goal of the project was set as "the realisation of sustainable tree-growing by local farmers." Unfortunately the Kenya/Japan Social Forestry Training Project was devoted to purely technical developments and was thus unable to realise this goal. A common drawback of cooperation programs, including the Kenya/Japan Social Forestry Training Project, is often their strong technical orientation.

Rural development must build on what is present and what the local people actually do. The failure of many development plans necessitates consideration of the complex and diverse local realities, before any decision on action (Riley and Brokensha, 1988). Bromley and Cernea (1989) criticised the absence of sociological analysis in many social forestry projects. Advanced silvicultural techniques cannot always solve underlying problems such as the lack of land and inequitable share of profits. The most important task of social forestry programs is to identify and establish successful management practices and to extend proven refinements (Arnould, 1990). This inevitably involves sociological issues.

The objectives of this study are to review critically the possibility of sustainable tree-growing by the farmers of Kwavonza and to make recommendations to achieve this goal, as a case study for marginal areas of Kenya. Emphasis will be placed upon the socio-economic issues rather than silvicultural issues. Following Budowski (1984), the socio-economic restraints will be approached on the basis of sympathy towards rural farmers, and what they perceive and practise.

Figure 1-1: Location of Study Area in Kenya.



CHAPTER 2

STUDY AREA

2.1 Agroclimatic zones in Kenya

It is important to note that there are many differences between districts, villages, ethnic groups and other units. These differences include, for example, climatic conditions, cultural backgrounds and social structures, and greatly affect tree-growing practices. The uses and perceived value of trees vary from one place to another according to the ethno-botanical knowledge of a particular group; for instance, settled farmers generally have more tree uses than pastoralists (Burley, 1982). Also the frequency and quantity of the trees used for particular purposes varies depending on agro-climatic regions, cultures and the economic conditions of individual households. Tree-growing on farms may be readily accepted by farmers in some areas while the same approach may be rejected by farmers in other areas (Salem and Nao, 1981).

In practice, it is important to understand the principal factors affecting the types of agricultural production (e.g., farming and grazing) systems in an area. In Kenya, cultures and agricultural production systems seem to be primarily related to, or defined by, clearly distinguishable agroclimatic zones.

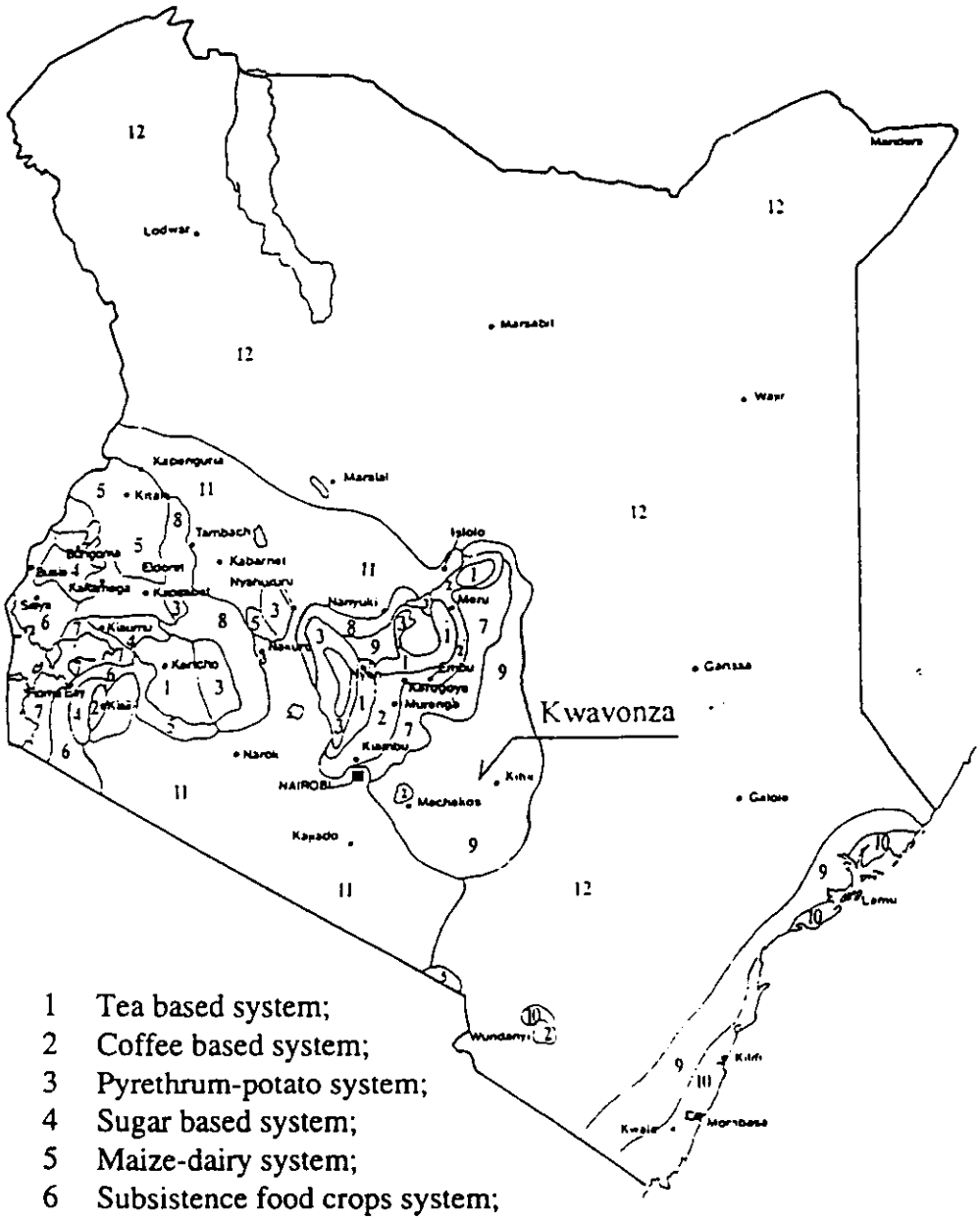
The climate of Kenya is diverse. Mean annual rainfall is less than 200 mm in the semi-desert areas of northern regions but is over 1,500 mm in the central highlands. Temperature also varies largely in relation to altitude from sea level (the coastline of the Indian Ocean) to over 5,100 m (the summit of Mt. Kenya). The productivity of an area roughly correlates to the rainfall rather than the temperature. Low temperature hence unproductive zones are confined to uninhabited alpine areas.

Agroclimatic zones in Kenya can be classified by climatic factors, particularly the combination of annual rainfall and evaporation, as Table 2-1 shows.

2.2 Land-use systems and agroclimatic zones

Minae *et al.* (1989) identified 12 major land-use systems in Kenya delineated by biophysical and socio-economic factors. They are shown in Figure 2-1.

Figure 2-1: Land-use Systems in Kenya.



1 Tea based system;
2 Coffee based system;
3 Pyrethrum-potato system;
4 Sugar based system;
5 Maize-dairy system;
6 Subsistence food crops system;
7 Cereal-grain legumes system;
8 Wheat-dairy system;
9 Livestock-cereal system;
10 Cashew nut-coconut system;
11 Group ranching system; and
12 Communal pastoralism system.

Source: Minae *et al.* (1989).

These 12 land-use systems are largely condensed into three distinct zones. These zones are largely defined by rainfall and thus the agricultural productivity: They are (a) high rainfall areas, (b) marginal (rainfall) areas and (c) pastoral (low rainfall) areas. High rainfall areas roughly correspond to Zones I, II and III in Table 2-1 and the land-use systems (1)-(8), (10). Marginal areas correspond to Zones IV and V in Table 2-1 and land-use system (9). Pastoral areas correspond to Zones V, VI and VII in Table 2-1 and land-use systems (11) and (12) respectively.

Table 2-1: Agroclimatic Zones in Kenya.

Zone	Average annual rainfall r (mm)	Average annual potential evaporation E (mm)	r/E (%)	Classification	Typical vegetation
I	1,100-1,700	1,200-2,000	80	humid	moist forest
II	1,000-1,600	1,300-2,100	65-80	sub-humid	moist to dry forest
III	800-1,400	1,450-2,200	50-65	semi-humid	dry forest and moist woodland
IV	600-1,100	1,550-2,200	49-50	semi-humid to semi-arid	dry woodland and bushland
V	450-900	1,650-2,300	25-40	semi-arid	bushland
VI	300-550	1,900-2,400	15-25	arid	bushland and scrubland
VII	150-300	2,100-2,500	15	very arid	desert scrub

Source: Adapted from Teel (1984).

Marginal areas and pastoral areas are often combined (e.g., Burley, 1982; Owino, 1982; Fries and Heermans, 1992) as arid and semi-arid lands. However, marginal areas and pastoral areas should be clearly distinguished from each other. Although natural conditions are somewhat similar in these two zones, they have fostered entirely different cultures and production systems.

2.3 Characteristics of marginal areas

Marginal areas are at the extensive ranges of rainfed agriculture. These areas are prone to drought. Crops often return no yield in drought years and good crops are only expected in years of exceptional rainfall (Teel, 1984). Farmers cultivate maize, pigeon peas, cowpeas, sorghum and millet, mostly for subsistence. Cultivation of marketable fruits is almost impossible. Marginal areas carry the most economically retarded peasant societies in Kenya (Trier, 1978).

Cattle (mainly drought-tolerant East African zebu varieties) are kept for draught power and milk production for domestic consumption. Goats are probably more common than cattle and are often hold as a form of savings rather than meat. Relatively rich people have donkeys to fetch water from distant water sources (Iida *et al.*, 1989). Livestock is grazed in bushlands, along roadsides and wherever fodder grasses or trees are available.

Farmers in marginal areas are often settlers from high rainfall areas, driven out by the growing population pressure (Burley, 1982), or former pastoral people adopting sedentary agriculture (Warner, 1993). Recently marginal areas have experienced the most rapid population growth in Kenya. Lusigi (1986) stated that the population in marginal areas has doubled in the last 25 years and predicted that it would double again within 10 years. In the Machakos District, only 9 % of the total population of the District lived in marginal areas in 1932 but the figure increased to 35 % by 1979 (Tiffen *et al.*, 1994). This rapid population growth has also been accompanied by an increase in crop lands and livestock numbers, exerting high pressure on a vulnerable environment and a severely limited resource base.

Natural vegetation is low density deciduous forest (woodland) or bushland (so-called wooded savanna), characterised by thorny *Acacia* and *Commiphora* species. Other important or predominant species include *Balanites aegyptiaca*, *Dalbergia melanoxylon*, *Melia volkensii* and *Terminalia brownii*. Vegetation found in the semi-arid areas of Africa is, to an unknown extent, the result of the planned and unplanned impact of grazing and browsing animals (Shepherd, 1993). Forests or bushlands in marginal areas have been used as sources of wood materials and as grazing lands. As a result of poor management, depletion of wood resources and soil erosion has become serious.

Apart from unpredictable drought there are many directly visible or tangible problems in marginal areas. According to a survey carried out in semi-arid areas

of the Eastern Province (Yamashita and Noda, 1990), farmers had encountered problems, or anticipated problems such as:

(a) soil erosion on farm lands;
(b) degradation of farm productivity;
(c) shortage of firewood; and
(d) shortage of fodder or grazing lands.

Riley and Brokensha (1988) also found a shortage of construction timber and Raintree (1987) reported soil erosion on common lands and watershed areas due to overgrazing. In Kwavonza, most of these problems also exist. It should be noted that all of these problems are related to the loss or degradation of woody vegetation. In marginal areas, agricultural crops, livestock and forests are closely integrated.

Farmers have planted small numbers of trees as hedgerows, for fruits, medicines and ornamental purposes. However, tree-growing for other purposes is virtually non-existent. Commercial tree-growing has either not been practised or failed.

2.4 Location and topography of Kwavonza

The study area, Kwavonza (formerly called Yatta B2), is a Location (a government administrative unit) in the Kitui District, Eastern Province, about 160 km east from Nairobi and 20 km west from Kitui town, the district centre. The total area of Kwavonza is about 80,000 ha. Public land, owned by the District Council, occupies about 75,000 ha. The remaining 5,000 ha is privately owned and is divided into six Blocks, I to VI, for administrative purposes. This privately owned land is the village area. Some parts of public lands adjacent to the village area have been illegally but intensively utilised by villagers.

Kwavonza occurs on the gently undulating Yatta Plateau, a large ancient lava flow. The altitude of the area is about 1,000-1,100 m above sea level with a few isolated rocky hills (the highest point is 1,280 m). The base rock is gneiss, which

is exposed on hill tops. There are two main seasonal rivers; the Tiva and Mwitasyano. Many small seasonal streams also dissect the plateau.

2.5 Climate, soil and vegetation of Kwavonza

The climate is typical of semi-arid areas. Rainfall is bimodal; there are two short rainy seasons around April and November each year. Mean annual rainfall is said to be 500-700 mm, though the rainfall record in the 1987-1993 period (Table 2-2) shows slightly higher figures (long-term meteorological records do not exist[1]). Rainfall is extremely unpredictable and unreliable. Due to a high evaporation rate (about 2,000 mm) and high temperatures (mean annual temperature is over 20°C) the climate is barely adequate for dryland agriculture such as livestock-millet systems.

Table 2-2: Rainfall Record in Kwavonza.

Month	Rainfall (mm) in year							Average (1988-1993)
	1987	1988	1989	1990	1991	1992	1993	
Jan.	-	33.5	106.5	21.0	80.0	11.0	205.5	76.3
Feb.	-	0.5	0.0	44.0	0.0	0.0	45.0	14.9
Mar.	-	165.5	21.0	212.0	37.0	5.0	5.0	74.3
Apr.	-	143.5	270.5	266.5	122.0	53.5	10.8	144.5
May	-	3.0	65.5	36.5	52.5	10.0	31.5	33.2
June	-	0.0	3.5	0.0	0.0	0.5	7.0	1.8
July	-	0.0	0.5	3.0	6.0	0.0	0.0	1.6
Aug.	-	6.0	0.0	0.0	20.5	0.0	0.5	4.5
Sep.	-	22.0	0.0	22.5	1.0	0.0	0.0	7.6
Oct.	3.0	48.0	193.0	50.0	22.5	38.0	35.5	64.5
Nov.	209.0	247.0	285.0	248.5	286.3	151.0	209.5	237.9
Dec.	25.5	201.0	67.0	216.5	97.0	176.0	111.0	144.8
Total	-	870.0	1,013.5	1,120.5	724.8	445.0	661.3	805.9

Source: Data from the Tiva nursery operated by the Kenya/Japan Social Forestry Training Project.

In 1980 a nationwide government soil survey (Sombroek *et al.*, 1982) identified soil types by combining the landforms, geology and the FAO-UNESCO soil classification system. According to this survey, two types of soils on

[1] A study of the long-term meteorogical records of the Machakos District (Mutiso, *et al.*, 1991) suggests that a cycle in rainfall pattern is more than nine years. Therefore, the records during the 1987-1993 period are insufficient to estimate the average figure and distribution.

undifferentiated basement system rocks (predominantly gneisses) can be identified in Kwavonza:

(a) Lower middle-level uplands

Well drained, moderately deep to deep, dark reddish brown to dark yellowish brown, friable to firm, sandy clay to clay; in many places with a topsoil of loamy sand to sandy loam (ferralo-chromic/orthic/ferric ACRISOLS; with LUVISOLS and FERRALSOLS)

(b) Hills and minor scarps

Complex of excessively drained to well drained, shallow, dark red to brown, friable, sandy clay loam to clay; in many places rocky, bouldery and stony and in places with an acid humic topsoil (dystric REGOSOLS, lithic phase; with LITHOSOLS, humic CAMBISOLS, lithic phase and rock outcrops)

Type (a) is the common soil in Kwavonza and most production activities are carried out on this soil. Type (b) is generally confined to on or near hills, but when it occurs as isolated patches, they are often left as grazing lands. Apart from these two types, VERTISOLS (known as black-cotton soil) also can be found (Yagi, 1992) but its distribution is limited.

According to Hayashi (1992) the natural vegetation of Kwavonza is a drought-deciduous woodland. Dominant species include *Commiphora africana*, *Acacia tortilis*, *A. nilotica*, *A. senegal* and *A. mellifera*. This vegetation type is known as *Acacia-Commiphora* Bushland. Nearly all species are drought-deciduous and their foliar development is closely linked to the variable rainfall (Agnew and Waterman, 1989). Other important species are *Melia volkensii*, *Terminalia brownii*, *Balanites aegyptiaca* and *Dalbergia melanoxylon*, though their numbers are currently small. *C. africana* is predominant because this species is useless as firewood or timber; other trees having been cut by villagers for timber and charcoal production.

Due to a high grazing pressure, the soil surface often does not have grass or shrub coverage. The emergence of a dense shrub layer in the observation plot

where livestock had been excluded for 1 year shows the potential of natural vegetation to recover (Hayashi, 1992).

2.6 Population of Kwavonza

Kamba people (a Bantu-speaking tribe) settled in the area currently covering the Kitui District and the adjacent Machakos District before the colonisation. Kamba men used to be hunters, herders and long distance traders, while women farmed millet. They have turned increasingly to sedentary farming as population densities have increased (van Duijl as cited in Shepherd, 1993). The territory of Kamba people used to be called *ukambani*, means Kamba land in Swahili and related languages. Kwavonza was a part of ukambani and all villagers are Kambas. However, Kwavonza had only been used for occasional hunting and herding until illegal cultivation and settlement started in the early 1960s. The 1960s and 1970s are the period when many small-scale farmers in older settled areas moved to new settlements nationwide (Matingu as cited in Tiffen *et al.*, 1994). Settlement in Kwavonza was officially permitted in 1967. Since then, the population has grown constantly.

The Kenya/Japan Social Forestry Training Project carried out a socio-economic survey in Kwavonza early in 1988 (Iida, 1988; Iida *et al.*, 1989). There were 473 households[2] in total and 150 households were taken as samples. The estimated population of Kwavonza was about 3,800. The population density on privately owned land was about 76 person/km^2. According to Warner (1993) the population density of arid and semi-arid areas in Kenya ranges from less than 1 person/km^2 to more than 50 person/km^2. Thus the population density of Kwavonza is relatively high for a semi-arid area. The average household size was 8.5 persons (for the distribution, see Table 2-4). Table 2-3 shows the distribution of age groups. The proportion of the younger generation is quite high; children

[2] A household refers to people who share a home, food and wealth, and is not same as a family (Rocheleau *et al.*, 1988). In Kwavonza, especially in the cases of polygamy, financial independence from other wife (or wives) was considered as forming a household.

and adolescents under 20-years old representing more than 50 % of the population. This indicates that the population is still growing rapidly.

Table 2-3: Structure of Population in Kwavonza in 1988.

Item	Age (years)							
	0-9	10-19	20-29	30-39	40-49	50-59	60 & over	Total
Men	654	486	312	192	132	93	126	1,995
Women	576	426	327	153	141	72	153	1,848
Total	1,230	912	639	345	273	165	279	3,843
Distribution (%)	32.0	23.7	16.6	9.0	7.1	4.3	7.3	100

Source: Adapted from Iida *et al.* (1989) and modified.

In some countries like Kenya, where the traditional structure is changing, women are *de facto* heads of households and agricultural decision makers (Murphy, 1990). Female household heads occur in 26.7 per cent of the households sampled (see Table 2-4). This figure was higher than expected since the traditional form of land inheritance is patrilineal. As male household heads are often absent working in towns, women's control over their farms has become stronger. In Kamba tradition, while the male head is absent, the 'acting' household head used to be the next most senior close male relative (Hill, 1991). However, as a characteristic of a new settlement, kinship is not strong in Kwavonza and women's power has increased. Equality between two sexes in Kamba society (relative to other African societies), Christianity, and western education also raised the status of women (Tiffen *et al.*, 1994).

Table 2-4: Household Size and Sex of Household Heads.

Size of household (person)	Number of households	Number of male household heads	Number of female household heads
14 or more	10	8	2
13	6	6	0
12	3	2	1
11	18	16	2
10	18	12	6
9	15	13	2
8	22	19	3
7	21	13	8
6	15	5	10
5	11	7	4
4	5	4	1
3 or less	6	5	1
Total	150	110	40

Source: Adapted from Iida *et al.* (1989).

Table 2-5 shows the occupations of villagers in 1988. Although 'farmer' accounts for only 11.3 per cent, most of the other people may be considered as part-time farmers. As the case of Mbeere society reported by Riley and Brokensha (1988), it was rare to find a household that depended solely on on-farm income. Most housewives are virtually full-time farmers. Women described themselves as housewives since there was no culturally prescribed alternative status open for an adult woman other than to be a wife (Chaiken, 1990). Considering that only 21.6 per cent of men are full-time farmers, women are possibly the main work force and decision makers on farms. In Africa, in general, where subsistence farming is predominant, research results indicate that nearly all tasks associated with subsistence food production are performed by women (Todaro, 1992).

Table 2-5: Occupation of People over 15-years old in Kwavonza.

Occupation	Men		Women		Total	
	person	%	person	%	person	%
Farmer	77	21.6	1	0.3	78	11.3
Housewife	n/a	n/a	213	64.2	213	31.0
Civil servant	36	10.1	7	2.1	43	6.3
Other wage earner	88	24.7	12	3.6	100	14.5
Student	71	19.9	50	15.1	121	17.6
No occupation	52	14.6	24	7.2	76	11.0
Retired [a]	5	1.4	18	5.4	23	3.3
Others	27	7.6	7	2.1	34	4.9
Total	356	100	332	100	688	100

Source: Adapted from Iida *et al.* (1989). [a] Kamba people traditionally 'retire' from productive work at a certain age (Hill, 1991).

In the 1988 socio-economic survey, illiteracy was defined as the lack of any formal education. Table 2-6 shows the illiteracy rate in each age class over 16-years and gender. Generally illiteracy rates among women are higher than ones among men in most of the age classes. There is, however, a drastic difference between people above and below 30-years old. This coincides with the history of settlement of Kwavonza in 1960s (or possibly the independence of the state in 1963). People growing up in Kwavonza have a higher educational level than earlier generations. Also the difference between men and women has diminished in younger generations, at least at the primary education level.

Table 2-6: Illiteracy Rate of People over 15-years old in Kwavonza.

Item		Men			Women			Total		
		No. of sample	No. of illiterate persons	Illiteracy rate (%)	No. of sample	No. of illiterate persons	Illiteracy rate (%)	No. of sample	No. of illiterate persons	Illiteracy rate (%)
Age class	16-19	71	2	2.8	50	2	4.0	121	4	3.3
	20-29	104	4	3.8	109	4	3.7	213	8	3.8
	30-39	64	8	12.5	51	26	51.0	115	34	29.6
	40-49	44	13	29.5	47	40	85.1	91	53	58.2
	50-59	31	13	41.9	24	24	100.0	55	37	67.3
	60 -	42	36	85.7	51	49	96.1	93	85	91.4
Total		356	76	21.3	332	145	43.7	688	221	32.1
Household head		110	51	46.4	40	36	90.0	150	87	58.0

Source: Adapted from Iida *et al.* (1989).

2.7 Land holding

There are no landless people in Kwavonza as this is a relatively young settlement. The subdivision of lands, the excess of which often causes people to become landless, is still to occur. In 1988, all 150 sample households had their own lands. As their lands have never been surveyed, figures given by farmers were rough estimates given in acres and converted to hectares. All the figures shown in Table 2-7 are of the lands actually managed by farmers (not necessarily the lands owned). The average land size is 7.9 ha, varying from 0.8 ha (2 acres) to over 80 ha (200 acres). The majority (about 70%) of households have less than 8 ha. The average size of 7.9 ha is significantly larger than the national average of 1.25 ha (Owino, 1982). Most of the households in this area still have enough lands to produce food crops but only in years of good rainfall.

Table 2-7: Land Size and Land-use Pattern in Kwavonza in 1988.

Land size (ha)	Number of sample household	Ratio (%)	Area managed		Cultivated land			Grazing land		
			Total (ha)	Average (ha)	Total (ha)	Average (ha)	Ratio (%)	Total (ha)	Average (ha)	Ratio (%)
under 4	44	30	107.9	2.5	69.2	1.6	64	38.3	0.9	35
4-8	60	40	317.4	5.3	157.7	2.6	50	154.0	2.6	49
8-12	29	19	268.0	9.2	111.3	3.8	42	156.7	5.4	58
12-16	7	5	90.7	13.0	35.2	5.0	39	55.5	7.9	61
16-20	2	1	37.2	18.6	8.3	4.1	22	28.9	14.5	78
over 20	8	5	367.9	46.0	60.7	7.6	17	306.1	38.3	83
Total	150	100	1,189.1	7.9	442.5	3.0	37	739.5	4.9	62

Source: Adapted from Iida *et al.* (1989) and modified.

In 1988, six small-scale farmers rented some land (total 6 ha), for which only four farmers payed nominal rent. Two farmers leased their lands (total 5 ha) to others free of charge. Why the rent was free or nominal is not clear. Local people may have time preference functions and planning horizons that cannot be explained in Western economic terms (Goodland *et al.*, 1989). For example, farmers often look after the goats owned by groups without any payment or compensation. The owners of hand-grinding mills usually allow neighbours to use their mills without any payment.

However, it seems more likely that people think the opportunity cost of under-utilised lands, which are leased, is low. Uncultivated lands do not produce any crop and farmers usually do not have the resources (money or labour) to cultivate more. According to Shepherd (1993), it was the investment of labour which created ownership of land in the traditional tenure arrangement. For the farmers, therefore, the opportunity cost of these yet-to-be-cleared lands may still be considered very low.

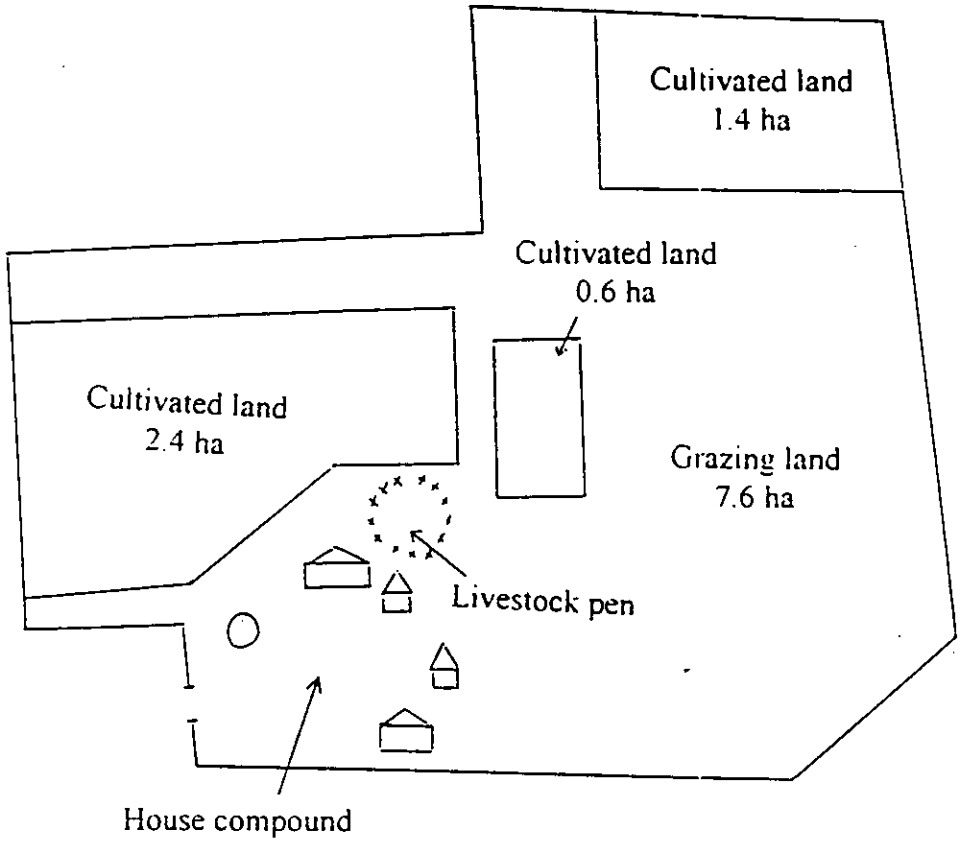
During the 1988-1990 period, six households in the sample bought land and two households sold part of their land (Edazawa, 1990). Although the number of these cases was limited, farmers with large areas exceeding their current capacity and needs may be selling their under-utilised lands to small landholders who may be wealthier in other resources as Shipton (1988) suggests. Small-scale farmers want to buy land in order to utilise fully their labour.

2.8 Land use

Land can be classified into two categories; cultivated land and grazing land. Figure 2-2 shows the land-use of a contact farmer in Kwavonza. Virtually all the households have cultivated land and more than 90 per cent of households had grazing land in 1988. Grazing land, despite its name, usually includes waste land, fallow land and bushes. Grazing land is used for firewood collection and other purposes in addition to grazing animals. The proportion of cultivated land tends to decrease with increasing total land size (see Table 2-7). This may be due to the

comparatively higher costs (labour and cash inputs) and higher risks (crop failure in drought years) incurred in crop production in a semi-arid environment (Iida *et al.*, 1989). Grazing land usually does not require any additional inputs and is simply set aside.

Figure 2-2: Land-use of a Contact Farmer.



Source: Iida (1988). Not in scale.

Crop cultivation

Crops grown in Kwavonza are primarily for subsistence consumption with a small quantity of cash crops. Sorghum and millet used to be the main crops. Maize became a staple food and gradually replaced sorghum and millet in most parts of Kenya (Tiffen *et al.*, 1994). Some quick growing maize varieties (such as Katumani Composite B) have been developed, though as Heyer (1971) suggested, their impact was not substantial. Legumes (e.g., beans, cowpeas and pigeon peas) are an important source of protein intake as livestock are rarely consumed domestically, except on special occasions such as Christmas. Pigeon pea is

particularly important. This drought-tolerant species is perennial, thus requiring less soil disturbance. It also provides fodder and fuel (Finan, 1988). Some farmers in Kwavonza have tried to grow other cash crops, such as tobacco, cotton, potato and castor oil. However, yields were discouraging and their role in household economy is not significant (Iida, 1988).

Since mixed-cropping is commonly practised in Kwavonza, it is nearly impossible to estimate the production per hectare accurately. Table 2-8 shows crop production in 1987 based on the results of the 1988 socio-economic survey. According to villagers, production of maize, beans, cowpeas and pigeon peas in a good year is about 1,100 kg, 670 kg, 450 kg and 450 kg per hectare respectively. Since a record taken in the nearby Machakos District shows that the maize yield varying from 360 kg to 1,260 kg per hectare during the 1970-1988 period (Mbogoh, 1991), the figures given by villagers may be fairly reliable.

Table 2-8: Crop Production in Kwavonza in 1987.

Administration Block	Crop yields (kg)				
	Maize	Beans	Cowpeas	Pigeon peas	Other grains [a]
I	6,095	2,173	773	1,779	246
II	3,095	1,522	629	761	360
III	965	511	311	444	36
IV	4,660	1,190	1,060	585	252
V	7,895	1,640	2,305	1,098	0
VI	1,980	1,640	773	576	234
Total	25,455	7,328	5,851	5,243	1,128
Production per capita	20	6	5	4	1
Minimum requirement [b]	90	45	22.5	22.5	-

Source: Adapted from Iida *et al.* (1989) and modified. [a] Includes various types of sorghum and millet. [b] Local extension staff estimates of annual per capita requirements.

The availability of water is crucial. Farms that always manage to produce some yield are almost always located along watercourses or in depressed areas. Farms on exposed ridges did not produce anything in 1987 (Iida, 1988). This observation also indicates that if water harvesting methods or the water-holding capacity of the soil are improved, higher yields could be expected.

In 1987, only 50.7 per cent of households could harvest maize from their farms (Table 2-9). According to extension staff employed locally, the minimum

requirement of maize is 90 kg per capita per annum (see Table 2-8). The average production of 20 kg per capita in 1987 was far below the minimum requirement. Only 2 per cent recorded surplus for sale. Other important crops (mostly legumes) were even worse. The result of the crop failure appeared as an average expenditure of KShs 5,667 (US$ 340) per household for food (see Table 2-15).

Table 2-9: Crop Failure in Kwavonza in 1987.

Item	Crop types				
	Maize	Beans	Cow peas	Pigeon peas	Other grains [a]
Households attempting to grow	150	150	149	148	39
Household harvesting	76	60	73	52	12
Household selling	3	4	2	4	1

Source: Adapted from Iida *et al.* (1989) and modified. [a] Includes various types of sorghum and millet.

Livestock husbandry

Livestock have various functions in Kwavonza. Animal breeding is an important enterprise, which is considered less susceptible to drought than cropping. Especially high reproduction rates and multiple births of small stocks (goats and sheep) enable their populations to recover rapidly after periods of high mortality caused by drought (Butterworth and Lanbourne, 1986). Animals also represent a form of savings, sold to pay for various economic needs such as school fees, medical costs or food during famine. Livestock are readily convertible to cash resources, representing another form of available capital and wealth (Meyers, 1982). Livestock also have social value as marriage payments, ritual payments, gifts and meat for social occasions (Hill, 1991). Animals are also an important source of protein as milk.

A survey on livestock in Kwavonza was carried out in 1991 (Cheboiwo and Iida, 1991). Seventy-four households were selected from the sample households previously interviewed in the 1988 socio-economic survey, and data from both surveys were compared. The most significant change during the 1988-1991 period was the increased number of cattle and cattle owners (Table 2-10). Possible reasons are that 1986 and 1987 were consecutive drought years and many animals were sold or died; 1989 and 1990 were exceptionally wet years with more than

1,000 mm of annual rainfall (see Table 2-2). Therefore crop yields were high (a farmer reported threefold maize yield increase compared to an average year) and there was no need to sell cattle to buy food. Then farmers could save money (an average household spent KShs. 5,667 for food in 1987); and the exceptional rainfall helped the grass recover, hence improving the health and reproduction of cattle (many farmers experienced cattle death in 1987).

On the other hand, the numbers of goats and sheep slightly declined. Farmers might shift from goats and sheep to the more valuable cattle during exceptionally wet years. In the Machakos District, the numbers of small stocks in relation to cattle are highest in those Locations with most emphasis on livestock, and least in those where agriculture is more intensive (Ackello-Ogutu, 1991).

Table 2-10: Livestock Owners and Number of Livestock.

Year	Number of livestock owners (% of total)				Number of livestock (average number per owner)			
	Cattle	Goat	Sheep	Donkey	Cattle	Goat	Sheep	Donkey
1988	54 (73 %)	65 (88 %)	34 (46 %)	59 (80 %)	402 (7.4)	999 (15.4)	188 (5.5)	95 (1.6)
1991	60 (81 %)	62 (84 %)	31 (42 %)	-	457 (7.6)	989 (16.0)	157 (5.1)	-

Source: Adapted from Cheboiwo and Iida (1991) and modified.

Animal prices rose significantly during the 1987-1990 period (Table 2-11). Considering the inflation rate (about 10 per cent per year in 1987 and higher in later years), however, it is difficult to attribute the price rise only to the drought in 1987 and the high rainfall in 1990.

Table 2-11: Average Price of Livestock in Kwavonza.

Year	Average price (KShs. per head)		
	Cattle	Goat	Sheep
1987	1,820	200	117
1990	3,000	354	185

Source: Adapted from Cheboiwo and Iida (1991) and modified.

Data from the Ministry of Livestock (Table 2-12) shows that the price rise was not linear. It occurred between 1988 and 1989. The year 1988 was also a drought year following 1987 but 1989 was an exceptionally good year. It is also interesting to find only the price of donkeys had fallen. Donkeys are kept specifically for

fetching water, therefore, they are more valuable in drought years when the nearby water sources dry up.

Table 2-12: Livestock Trade in Central Division, Kitui District.

Year	Average prices (KShs./head)				Numbers sold			
	Beef cattle	Goats	Sheep	Donkeys	Beef cattle	Goats	Sheep	Donkeys
1988	1,800	160	130	1,500	2,765	4,670	644	3
1989	3,500	450	340	1,200	5,628	15,042	203	188

Source: Adapted from Ministry of livestock (1990). Until 1990, Kwavonza was a part of the Central Division (now it is in newly established Kwavonza Division).

Also note in Table 2-12 that; (a) the number of cattle and goats sold in the market was higher in a good year (1989) than a bad year (1988), and (b) despite the higher numbers sold in 1989, the prices of cattle and goats had risen significantly. Although the sample size was small, the same tendency was observed in Kwavonza. In contrast to the common belief that more animals are sold in drought years resulting in plummeting prices, a considerably larger number of animals were traded in good years for higher prices. This may indicate that the demand is significantly higher in wet years, and the lower demand in drought years is a cause of oversupply (hence lower prices) in the livestock market. A survey on charcoal producers (Iida, 1989) showed that some people in Kwavonza purchased livestock in 1989 (see Table 3-4), suggesting farmers' attempts to increase their livestock numbers in good years. This strategy to build up herds to a maximum size during good years in order to survive through worse years is common among pastoralists (Lusigi, 1986).

Farmers consider cattle a 'multipurpose animal' and rank them above other animals (Table 2-13). To plough hard soil in dry periods, two powerful oxen are usually necessary. Goats and sheep are often considered as savings. Sheep are the cheapest animal but not as versatile compared to cattle and goats. People tend to shift from sheep to other animals if they can afford it.

Table 2-13: Objective of Livestock Husbandry.

Use of livestock	Number of household (ratio)		
	Cattle	Goats	Sheep
Draught power	57 (95 %)	0 (0 %)	0 (0 %)
Sale	53 (88 %)	60 (97 %)	31 (100 %)
Milk	55 (92 %)	55 (92 %)	0 (0 %)
Other [a]	16 (27 %)	31 (50 %)	13 (42 %)
Number of owners	60	62	31

Source: Adapted from Cheboiwo and Iida (1991) and modified. Plural answers were obtained. [a] Bridal gift (all animals), domestic meat consumption (goats and sheep), manure production (mainly cattle), etc.

The person responsible for livestock rearing is usually the wife (67 per cent), followed by the husband (16 per cent), children (10 per cent) and others (20 per cent) such as hired labourer (Cheboiwo and Iida, 1991). Young boys were responsible for herding livestock in Kamba tradition. However, as most children attend the school these days, much of their work has devolved upon women (Hill, 1991; Tiffen *et al.*, 1994).

2.9 Farming tools

The 150 samples of the 1988 socio-economic survey and the 158 samples[3] of a follow-up survey in 1990 (Edazawa, 1990) showed that all households have basic farming tools such as hoes (Table 2-14). The ratio of hand-grinding mill owners was lower because of its high price. A hand-grinding mill cost KShs. 1,200-1,500 (US$ 60-75) in Kitui town in 1988. Hand-grinding mills are also often borrowed from neighbours. The low ratio of cart owners is partly attributable to the bad road conditions in Kwavonza. Privately owned tractors are still non-existent.

A plough is a critical capital element in farming practices (Tiffen *et al.*, 1994). Ploughs save time, and are generally cheaper and more effective than using hired labour. Farmers who do not have one or hire one, often fail to have the ploughing done at the end of the planting season, jeopardising their crops (Riley and Brokensha, 1988). Table 2-14 shows that about 25 per cent of people in Kwavonza did not own ploughs. This is partly due to price. The price of a plough

[3] This includes the 146 sample households in the 1988 survey to note any change.

was about KShs. 850 (US$ 45) in 1988. Another reason is that a plough needs two trained bulls or oxen to draw. Therefore, it is pointless to purchase ploughs without having cattle. The ratio of plough owners (73 per cent in 1988) corresponds to the ratio of cattle owners (71 per cent in 1988).

Table 2-14: Ownership of Production Tools.

Year	Type of farming tools				
	Plough	Tractor	Animal cart	*Jembe* (hoe)	Hand grinding mill
1988 [a]	73 %	0 %	3 %	100 %	49 %
1990 [b]	75 %	0 %	3 %	100 %	49%

Note. [a] Adapted from Iida *et al.* (1989). [b] Adapted from Edazawa (1990).

2.10 Household economy

The year 1987 was a 'moderate' drought year (Tiffen *et al.*, 1994). The data on household income and expenditure in the 1988 socio-economic survey (Table 2-15) do not represent the situations expected in average or 'ordinary' years. However, it clearly shows the adverse conditions that farmers in this area often face. Income from crop sales in 1987 accounted for only 0.4 per cent of the total income, which was almost negligible. On the contrary, the expenditure for food accounted for almost half of total expenditure.

It also became clear that many farmers in this area were already heavily relying on non-farm income. Having some family members in a non-farm activity to insure against risks became a common strategy in Kenya (Tiffen *et al.*, 1994). In Kwavonza, non-farm income (mostly salary and remittance from family members under employment) was the highest (87 per cent). For those who have no opportunities of employment, drought is a matter of life or death. Meyers (1982) pointed out the importance of off-farm income for the economic livelihood of farmers in semi-arid areas. Off-farm income is particularly important in enabling farmers to survive poor crop seasons. One poor woman farmer, with many small children, but no family member with employment, begged money from the survey team to buy food (Iida, 1988).

Even in a drought year, people spent about 12 per cent of income for education. This may be one of their investment strategies; people know that the

households with some members having a good job are well off even in drought years. Collier and Lal (1980) argued that urban based non-farm incomes are significantly correlated with education levels. Secondary school education, which is not free, is frequently a requirement for obtaining employment in the labour market in Kenya (Meyers, 1982).

Table 2-15: Household Income and Expenditure in 1987.

Block	No. of sample[a]	Average income (KShs.)			Average expenditure (KShs.)					Total (KShs.)		Balance (KShs.)
		Crop sale	Livestock sale	non-farm income	Food	Education	Clothing	Housing	Other	Income	Expenditure	
I	29	133	1,776	12,885	6,070	2,163	1,388	3,476	633	14,794	13,749	1,045
II	24	118	1,202	9,008	5,577	1,571	1,565	3,563	580	10,328	12,855	-2,528
III	17	1	1,174	18,726	5,323	1,116	1,544	2,941	415	19,902[b]	11,339	8,563
IV	18	31	1,836	12,000	5,917	1,574	1,275	5,430	1,087	13,867	15,284	-1,417
V	24	9	1,836	7,758	5,271	1,065	115	1,163	2,640	9,604	10,253	-649
VI	23	1	2,052	10,358	5,723	955	796	1,743	581	12,411	9,798	2,613
Total	135	56	1,664	11,471	5,667	1,446	1,097	2,978	1,009	13,191	12,197	994
Ratio (%)		0.4	12.6	87.0	46.5	11.9	9.0	24.4	8.3			

Source: Adopted from Iida *et al.* (1989). US$ 1 was about KShs. 17 in 1987.
[a] Out of 150 samples, 15 answers were rejected for insufficiency. [b] In Block III, there was a household whose five members are salary earners. They had earned an exceptionally large amount of KShs. 138,000, hence lifting up the average figure. If this household is excluded, the average total income becomes KShs. 12,521.

It should be noted that the average income may not necessarily be higher in good years. In good years, many farmers can produce a crop surplus for sale. Hence, farmers did not need to sell their livestock, produce charcoal for sale, borrow money from or ask remittance to family members in cities to buy food.

2.11 Housing

In rural areas of Zimbabwe, Dewees (1992) observed that villagers often considered the transition from a traditional house to a brick house as a modernisation. In Kwavonza, materials used for house construction change along with the improvement of the economic condition of households: starting from traditional pole and mud huts, houses of adobe (unburnt bricks) and finally houses of bricks, stones or concrete blocks. Riley and Brokensha (1988) observed the same tendency in Mbeere society in the nearby Embu District. It also should be noted that the construction of brick houses may place great pressures on tree resources since brick-burning needs substantial amounts of fuelwood.

During the 1988-1990 period, the materials for walls had not dramatically changed. Table 2-16 shows the materials used for the main living quarters. However, many households had improved their roofs from tin (flattened large tin cans) or grass to iron sheets. In many parts of the Third World, one of the first and most noticeable changes in material culture with increased economic prosperity is the use of iron for roofs (Riley and Brokensha, 1988)[4]. It was also observed that the number of food stores and toilets had increased (Edazawa, 1990).

Table 2-16: Housing Materials.

Year	Wall materials				Thatching materials		
	Stone	Brick	Adobe	Mud	Iron	Tin	Grass
1988 [a]	3 %	32 %	57 %	8 %	54 %	12 %	34 %
1990 [b]	3 %	34 %	55 %	8 %	70 %	3 %	27 %

Source: Adapted from Edazawa (1990). [a] Based on 150 samples out of 473 households. [b] Based on 158 samples out of 474 households. To note any change, 146 sample households of 1988 were included in the samples of 1990.

Many areas of East Africa lack nucleated villages and villages are a dispersed collection of homesteads (Riley and Brokensha, 1988). Kwavonza is no exception. Houses are almost always constructed on the highest point of the land regardless of other conditions. This also means the locations of the houses are far from water sources and farmers suffer from strong wind due to the exposure caused by land clearing. The reason for this habit is unknown, though, it might be due to the necessity in the past to protect their land from invasion by wild animals and hostile tribes. Riley and Brokensha (1988) recorded the oral history of Mbeere society, in which conflicts between tribes are narrated. Some villagers of Kwavonza told similar episodes of repeated Masai raids. Before settlement, there had been abundant wildlife, such as elephants and lions in Kwavonza. According to a villager, the last hyena was sighted in 1986.

[4] Riley and Brokensha (1988) also pointed out that iron-roofing drastically reduces the labour requirement in maintenance compared to grass-thatching which requires periodical repairs.

2.12 Water consumption

As water is a year-round necessity for people, its availability influences the nature and extent of human settlement. Increased population pressure has forced people to settle in the areas where the labour costs of obtaining water in the dry season are high (Tiffen *et al.*, 1994). Table 2-17 shows the results of the 1988 socio-economic survey on average water consumption, average distance to water sources and other related information for each administrative Block of Kwavonza. Block III has no major river and the distance from a water source is significantly further (7.3 km) than in other Blocks (1.1-3.5 km). However, households in Block III consumed more water (139 litre) than households in any other Block (97-121 litre). The key was the number of donkeys. Households in Block III have more donkeys than households in any other Block on average.

Table 2-17: Water Consumption, Distance to Water Sources and Number of Donkeys in each Block.

Block	Number of sample household	Average water consumption (litre/day/household)	Average distance to water sources in dry season (km)	Average number of donkeys (head/household)	Ratio of donkey owners (%)
I	37	121	2.6	1.3	84
II	27	106	3.5	1.3	81
III	17	139	7.3	1.7	94
IV	20	109	2.4	1.3	90
V	26	100	2.2	0.8	62
VI	23	97	1.1	1.0	57
Total	150	111	3.0	1.2	77

Source: Adapted from Iida *et al.* (1989) and modified.

Table 2-18 shows a significant increase in water consumption along with the increase in the number of donkeys. A woman stated that, in Kwavonza, the first question a woman ought to ask a man who proposes marriage to her was "Do you have a donkey?" There was also a tendency for higher income earners to consume more water than low income groups. However, this also may relate to the number of donkeys. Obviously richer people can more easily afford to buy donkeys.

Table 2-18: Water Consumption and Number of Donkeys.

Number of donkeys per household	0	1	2	3	4	Average
Average water consumption (litre/day/household)	54	101	135	200	220	109

Source: Adapted from Iida *et al.* (1989). Based on 149 samples out of 473 households in 1988. Another household used an oxen-drawn cart and consumed 480 litre per day.

In forestry projects, donkeys have been ignored, unlike other livestock, which usually outnumber donkeys. However, donkeys are equally important, considering that much of a woman's time and labour is spent fetching water instead of caring for trees.

CHAPTER 3

FARMERS AND TREES IN KWAVONZA

The traditional relationship of rural communities with forests and trees is largely based on the variety of goods and services that forests and trees provide (Eighth World Forestry Congress, 1978). Trees and forests are used by farmers in Kwavonza for a variety of purposes which can be categorised broadly into consumptive uses, protective uses and other uses. These are reviewed critically to provide a background to survey results on farmer perceptions of tree-growing needs and an examination of the disincentives and incentives to tree-growing.

3.1 Consumptive uses

Forests, trees and other forest products are essential elements of daily life in marginal areas. First of all, various sorts of food are obtained by cultivating trees, and hunting or gathering in the forests. Trees are an important source of medicine since modern health care facilities are still not within the reach. Livestock husbandry relies on the availability of natural vegetation. Woody biomass provides virtually only the source for most of household energy use. In addition, trees and other forest products are indispensable materials to house construction and traditional handicrafts.

3.1.1 Food

Food from forests

In rural areas of developing countries, forests are often a very important source of food. In the case of north-east Thailand about 60 per cent of all food comes from the forests (Hoskins, 1990). This includes wild animals, vegetables, fruits, nuts, fungi and others. In Kenya, the availability of food from forests seems lower in quantity compared to the humid tropics. However, forests are still important for food collection and production.

Poulsen (1982) pointed out that the importance of the food derived from the African forests is not as significant in quantity as in variety. Rural people may suffer from the symptoms of malnutrition even if they have been fed with a sufficient quantity of staple food such as maize and cassava. The foods from forests are rich in proteins, vitamins and minerals and are an important supplement to the staple foods, which are often high in energy but poor in nutrients or protein.

People in Kwavonza often hunt wild animals, such as small antelopes (*Madoqua* spp.) and porcupines (*Hystrix cristata*), despite the total ban on the hunting mammals by the government. Some tribal groups in Kenya also eat termites (mainly *Macrotermes* spp.) when the young kings and queens leave their termite mounds to search for mates at the beginning of every rainy season. These particular termites contain high levels of protein, fat and other nutrients.

Hoskins (1990) also pointed out the important role of trees in food security. In marginal areas, where the risk of crop destruction is high, or there is a strong seasonality in food supply due to the climate or other factors, forest products often supplement the traditional foods. There is something to eat in African forests or savannas in most periods of the year (Sène, 1985).

Apiculture

Apiculture is probably the most popular form of food production practised in the forests throughout rural Kenya. Traditional log-hives hanging on acacia trees are common in rural Kenya. Many farmers produce honey for domestic consumption as well as for commercial purposes. According to a survey conducted in the semi-arid areas of the Eastern Province in 1988 (Yamashita and Noda, 1990), among 53 farmers interviewed, 25 farmers had beehives. Eleven farmers consumed honey domestically while 14 farmers sold at least some portion. The highest income from honey sales during the last 12 months was over KShs. 6,000.

Riley and Brokensha (1988) reported a decline in recent honey production in Mbeere societies in the Embu District, compared to 1970s. Riley and Brokensha

attributed the decline to the privatisation of common lands, which may have limited the access of honey-hunters to trees. In Mbeere societies, apiculture was traditionally practised mainly by professional honey-hunters. In Kamba societies, however, bee-keeping has never been monopolised. Many farmers practised and are still practising bee-keeping on their own lands, on state-owned lands or even on the lands of others with permission. The owners of beehives used to have the traditionally recognised right that their bees not be disturbed (Penwill as cited in Fortmann, 1985).

According to the results of the 1988 socio-economic survey, about 44 per cent of households in Kwavonza practised apiculture (Iida *et al.*, 1989). The average household practising apiculture had about 10 beehives. Most of the hives were traditional loghives. However, there was a tendency to shift towards modern hives made from sawn timber. This shift was partly due to the higher productivity of modern type hives but also possibly due to the decrease in trees large enough to make loghives (1 m long by 30 cm diameter logs are required). Villagers stated that the production of honey had been declining. This could be attributable to the loss of flowering trees, especially *Acacia* spp. (cut for charcoal production in particular).

In Kwavonza, apiculture is also an important enterprise practised by farmers' cooperative groups. A survey on farmers' groups in Kwavonza was conducted in 1989 (Iida, 1989). Among 26 groups surveyed, 10 groups practised apiculture (see Table 5-8). The objective of bee-keeping was the sale of honey rather than domestic consumption. In 1989, however, these 10 groups recorded a deficit of over KShs. 3,000 in total in apiculture due to the investment to modern bee-hives.

3.1.2 Medicinal use

Apart from food security, forests are also an important source of traditional medicines. Hundreds of drugs derived from plants in the forests have been recorded in Africa, although their effectiveness varies greatly. An example is *Acacia nilotica*, which contains tannin and is widely used in arid and semi-arid

areas to cure diarrhoea and dysentery (Livingstone and Zamora, 1983). Some native species such as *Maytenus* sp., a shrub of the savannas in Kenya, are also attracting the interest of medical scientists in cancer research (Poulsen, 1982). Among exotic species, *Azadirachta indica* is commonly found throughout the drier regions of Africa. Leaves and twigs of this drought-tolerant species are nematode repellent. Leaves contain a natural de-wormer. In Asia, a tea made from its leaves is used to relieve malaria (Teel, 1984). In Kwavonza, leaves of this species are used to cure a fever. Although *Azadirachta indica* is a 'true multiple use tree' (Teel, 1984), uses of this species other than medicinal are not common in Kwavonza.

Kamba people have a reputation as experts in medicinal plants as well as poison and sorcery (Riley and Brokensha, 1988). In the 1970s, traditional herbal medicines were widely used among Kamba people of the Kitui District, particularly for minor physiological or psychological complains (Hill, 1991). The existence of a witch doctor or local medicine man in Kwavonza indicates that their traditional role and knowledge of plants are still alive.

3.1.3 Fodder

In sub-Saharan Africa, it is not relevant to distinguish between forest and rangeland (Birgegård, 1993). Forests are commonly used for grazing especially in semi-arid areas. Farmers also often keep unproductive areas of their farms for grazing animals and fuelwood collection (Iida *et al.*, 1989). Small-scale farmers without such areas sometimes pay for access to grazing lands owned by their neighbours. Government or local council lands are other commonly used grazing lands. Local grazing cooperatives often use these public lands under a contract.

There are two types of forest feed: tree fodder and herbaceous fodder obtained from the ground vegetation. Tree fodder is particularly important in areas with long dry spells (Poulsen, 1982). Some indigenous trees offer good fodder; *Faidherbia albida* is the best fodder tree as this species grows its leaves and pods, which contain a high level of protein, in dry seasons when grasses are scarce.

Barrow (1988) reported that Turkana people protect *F. albida*, *Hyphaena coriacea*, *Cordia sinensis*, *Zizyphus mauritiana*, *Dobera glabra*, *Acacia tortilis* and some other fodder species. In other areas, goats are commonly seen browsing ever-green *Acacia* species in dry seasons.

In Kwavonza, most farmers have livestock such as goats and cattle (see Table 2-10). Small-scale farmers often have no alternative but to allow animals to graze along roadsides[5] or on Council lands. In Council lands many bare patches and gullies can be observed, with important implications for water quality in catchments.

The livestock unit (LU) is often used to measure stocking rate. In Kenya, 1 LU is defined as 440 kg live weight. The livestock units used for major animals are: 1 cow = 1 bull = 4 calves = 1 donkey = 0.7 LU and 10 goats = 10 sheep = 0.75 LU (Cheboiwo and Iida, 1991). Table 3-1 shows the density of livestock in Kwavonza based on 74 sample households.

Table 3-1: Livestock Density in Kwavonza in 1991.

Type of livestock	Number (head)	Livestock Unit (LU)	Average LU/ha (grazing land [a])
Cows and bulls	353	247.1	0.68
Calves	104	18.2	0.05
Donkeys	95	66.5	0.18
Goats	989	74.2	0.20
Sheep	157	11.8	0.03
Total	-	417.8	1.15

Source: Adapted from Cheboiwo and Iida (1991) and modified. [a] Average size of grazing land per household was 4.8 ha in 1991.

According to the Goats and Sheep Project of the Kitui District, 1 LU needs 4 to 6 ha in average, 2 to 3 ha in good years and more than 6 ha in drought years. The average stocking rate of Kwavonza in 1991 was 1.15 LU/ha, an extremely high livestock population density, even considering the two consecutive good years of 1989 and 1990. More than 80 per cent of sample households (livestock holders)

[5] Depressions on the both sides of a road in dry areas are low lying and generally have better grass cover (Gupta, 1986).

answered there was a shortage in fodder supply or grazing land. One household had 43 cattle when interviewed in 1991, but only had 6.8 ha of its own grazing land. This household experienced the death of 15 cattle in 1987. Although the economic optimum (maximum profit) stocking rate is almost always lower than the biological optimum (maximum sustained yield), people tend to think they should maintain their income by running more animals (Workman and Fowler, 1986).

Most of the households in 1991 fed maize and pigeon pea stalks to their livestock but only 23 per cent of the livestock holders could stock this as hay. Eighty one per cent of the livestock holders carried out so-called 'free grazing,' grazing their animals, often unattended, on Council lands, in project site and along the roads. Only 13 per cent had planted a few lines of Napier grass and 21 per cent had planted trees for fodder. Seventy eight per cent of farmers experienced livestock damage to their planted trees in 1991 (see Table 5-5). The control of livestock is critical for successful tree growing in this area.

3.1.4 Fuelwood

Trees are cut for fuel throughout all the agro-ecological zones of Africa. As long as the cutting of trees does not exceed natural regeneration and net growth, fuelwood use should not greatly affect the surrounding environment. However, rapid population growth in Africa has led to overcutting and over-exploitation of bushlands. Shortages of fuelwood have even occurred in the humid areas (Kio, 1982).

Wood fuels (firewood and charcoal) account for more than 90 per cent of the wood consumption in Africa (Kio, 1982). In Kenya, 75 per cent of national energy use is being met by wood (Gathaara, 1988). Nearly all of the households in rural Kenya use wood as fuel. Alternative energy sources such as electricity, paraffin, solar energy and gases are not accessible, either physically or financially, for most rural people. Even in cities, poor people, who may account for the majority of the population, rely on charcoal or firewood transported from rural areas.

The primary importance of fuelwood is as an energy source to prepare food. In some countries, the paucity of fuelwood has forced people to eat uncooked foods (Worou and Nao, 1982). Deforestation has forced rural people (especially women and children) to work longer to collect scarce fuelwood and fodder. Farmers are forced to burn dried cow dung and crop residues, which could be otherwise applied to their farms as organic fertilisers (Kio, 1982). In Benin, the yields of rice, yams and groundnuts have fallen almost to half that of their potential yields due to this reason alone (Worou and Nao, 1982). Fuelwood is also important for heating rooms especially in winter in high altitude areas. Riley and Brokensha (1988) also point out the use of the fire in traditional African lifestyles to: keep predatory animals (such as lions and hyenas) away; deter intruders (possibly of hostile tribes); and provide a focal point for communication between village elders as well as between generations.

Firewood

In developing countries, domestic energy requirements vary with climate, family size and cooking habits. Firewood consumption ranges from 0.5 m^3 (cooking food on an open-fire stove in the warm lowland tropics) to well over 2 m^3 (cooking and heating in cold upland areas) of air-dry fuelwood per capita per year (Arnold, 1978). In Kwavonza, the annual consumption of firewood per capita was estimated as 0.52 m^3 in 1988, assuming that one head-load of firewood weighs about 20 kg (Iida *et al.*, 1989). This figure shows that firewood consumption in Kwavonza is relatively low.

The shortage of firewood is becoming serious in Kwavonza. In 1988, 35 per cent of sample households answered that their main sources of firewood were not their own lands (Table 3-2). Many farmers had to collect wood illegally from public lands and some of them resort to buying firewood from neighbours. Some large scale farmers could supply their own wood needs from their own lands. However, they will face difficulties in the near future because of the growing population and traditional inheritance practices.

Table 3-2 clearly shows a substantial increase in the reliance of farmers upon land other than their own during the 1988-1990 period. The increase in the 'project site' figure, however, is mainly due to the agreement between the Government of Kenya and farmers' groups participating in tree-growing programs. The agreement allows the collection of firewood in the plantation sites allocated to each group. As transport to and from plantation sites was provided, many participants could carry firewood to their distant homes with ease.

Although fuelwood used to be considered almost as a free good (requiring labour only), collected largely for domestic use (Burley, 1982), it has recently become a commercial commodity even within rural areas. In some parts of Kenya, the privatisation of land has restricted access to fuelwood sources and, as a result, the commercialisation of fuelwood has accelerated (Riley and Brokensha, 1988). A slight increase (2 to 4 per cent) in the proportion of households which bought firewood during the 1988-1990 period (Table 3-2) suggests the same tendency in Kwavonza. As mentioned, 10 out of 150 households (6.7 per cent) sold firewood earning average KShs. 500 in 1987. However, it is likely that this relatively large amount of firewood was sold, either directly or through middlemen, to Kitui town where small-scale industries (e.g., brick-makers and potters) exist rather than traded within Kwavonza.

Table 3-2: Sources of Firewood in Kwavonza.

Year	Source of firewood				
	Own lands	Neighbours' lands	Council lands	Project site	Bought
1988 [a]	82 % (65 %)	27 % (21 %)	7 % (6 %)	8 % (6 %)	2 % (2 %)
1990 [b]	80 %	37 %	32 %	41 %	4 %

Source: [a] Adapted from Iida *et al.* (1989). [b] Adapted from Edazawa (1990) and modified. [a] Figures in parentheses indicate the most important sources that farmers rely on. [ab] Plural answers were obtained except figures in parenthesis.

Charcoal

Although rural people make charcoal for domestic use, charcoal has already become a highly commercialised commodity in Kenya (Kinyanjui, 1987). In the cities and towns, charcoal is the most important household energy source. Gas,

electricity and the cooking and heating apparatus for these energies are still too expensive for most urban dwellers.

Charcoal enterprises in Kenya are mostly small scale using traditional earth mound kilns. Commercial charcoal production has expanded from high rainfall areas toward arid and semi-arid areas. However, sustainable charcoal production involving reforestation (using mainly *Acacia mearnsii* and *Eucalyptus saligna*) is currently possible only in high rainfall areas (Kinyanjui, 1987). In drier areas, people make charcoal occasionally to meet their cash needs by cutting naturally growing trees on their properties or by illegally cutting trees on government lands. In marginal areas, this is a typical case of a short-term gain at the risk of a devastating long-term deterioration of forests (Riley and Brokensha, 1988).

Charcoal is not commonly used in Kwavonza. Table 3-3 shows that only about 20 per cent of people use charcoal occasionally (both in 1988 and 1990) for particular purposes such as grilling goat meat. The temperature is relatively high throughout the year and heating is rarely required. Rainy seasons are short and, unlike high rainfall areas, it is not necessary to use charcoal in the place of wet firewood[6]. As mentioned earlier, farmers in this area do not have trees large enough to produce charcoal on their lands. Most of the households have to buy charcoal if they wish to use it.

Table 3-3: Proportion of Charcoal-users in Kwavonza.

Year	Frequency		
	Frequently	Occasionally	Never
1988 [a]	4 %	18 %	78 %
1990 [b]	1 %	22 %	77 %

Source: [a] Adapted from Iida *et al.* (1989). [b] Adapted from Edazawa (1990).

There are, however, charcoal producers in this area. A survey on charcoal producers was carried out in 1989 (Iida, 1989). The top nine charcoal producers among the sample households of the 1988 socio-economic survey were

[6] If firewood contains 30 per cent moisture, energy value decreases about 30 per cent compared to ovendry wood. If it contains 60 per cent moisture, energy loss becomes about 60 per cent (Moslemi, 1982).

interviewed. Table 3-4 shows the economic conditions of interviewees from September 1988 to August 1989. Compared to the average cultivated land in Kwavonza, these charcoal producers are neither small nor large scale farmers. Considering the proximity of these households to wood sources (Council lands), a short distance to the source rather than farm size, could be the main factor relating to the feasibility of charcoal making.

In Table 3-4, figures for two years are compared; 1987 was a drought year and 1989 was an above-average year. In 1987 none of sample households could earn from sale of crops. In 1989 crop yield increased almost four-fold and food expenditure decreased to less than half. Six households managed to sell crops. Charcoal production also decreased from an average of 44 bags to 7 bags (one bag contains about 50 kg of charcoal), providing evidence that charcoal production is an enterprise carried out when necessity arises. In Mbeere society, nearly all of charcoal producers entered the business to get money to fulfil two basic needs; to buy food or to pay school fees (Riley and Brokensha, 1988). It is also noted that livestock sales figures show the same tendency in the cases of these charcoal producers.

Only one household (No. 8) increased its charcoal production, insisting that charcoal production had become an important source of income even in good years. This household has 2.4 ha of grazing land, which is an insufficient area to produce 45 bags of charcoal (more than 2 tons) a year. Although the farmer did not specify the source of the wood, it was presumed to have been collected from the nearby riparian forest belonging to the District Council.

Table 3-4: Household Economy of Charcoal Producers.

Household No.	Cultivated area (ha)	Charcoal production (bags)		Charcoal sale (KShs.)		Livestock sale (KShs.)		Crop yield [a] (kg)		Crop sale (KShs.)		Expenditure for food (KShs.)	
		1987	1989	1987	1989	1987	1989	1987	1989	1987	1989	1987	1989
1	3.2	10	6	300	192	4,000	1,320	810	1,269	0	0	2,100	1,800
2	3.2	80	0	2,400	0	1,400	1,590	756	1,547	0	0	1,200	1,500
3	2.6	100	4	3,120	128	9,500	-750	792	900	0	119	1,150	4,200
4	4.0	10	10	300	320	1,210	4,970	180	1,140	0	0	2,700	70
5	7.6	15	0	375	0	4,100	-2,175	490	3,204	0	810	8,000	6,000
6	4.8	50	0	1,500	0	1,240	0	720	1,800	0	540	3,200	0
7	4.4	16	0	400	0	140	60	342	3,645	0	1,454	1,800	500
8	2.4	24	45	720	1,430	0	0	306	2,160	0	25	4,800	0
9	2.4	94	0	2,820	0	100	-250	189	2,087	0	1,125	7,200	0
Total	34.6	399	65	9,115	2,070	21,690	4,765	4,585	17,752	0	4,073	32,150	14,070
Average	3.8	44	7	1,013	230	2,410	529	509	1,972	0	453	3,572	1,563

Source: Adapted from Iida (1989) and modified. Figures with minus signs indicate a purchase. [a] Total yield of maize, beans, cow peas, pigeon peas, millet and sorghum.

Charcoal making is usually carried out during dry seasons. According to Iida (1988), the production of charcoal takes four days. On day one, trees are felled. On the second day, trees are cut into one-meter long logs. On the third day, logs are covered with soil and a fire started. Carbonisation takes one day. The last day is spent packing and transporting the charcoal to market places. Usually two bags of charcoal can be produced in one cycle. The price for one bag was about KShs. 35 in 1990, equivalent to a day's wages.

Brick making

In rural areas of Zimbabwe, Dewees (1992) observed that the transition from a traditional house to a brick house was often considered by villagers as modernisation and the construction of brick houses had placed great pressures on tree resources. Iida *et al.* (1989) made a similar observation. In Kwavonza, the materials used for house construction change along with the improvement of the economic condition of households: starting from traditional poles and mud huts, houses of adobe (unburnt bricks) and finally houses of burnt bricks or stones. Riley and Brokensha (1988) reported a similar finding in Mbeere society.

In Kwavonza, the increase in the number of brick houses was slower (from 32 to 34 per cent) compared to the increase in iron roof (from 54 to 70 per cent) during the 1988-1990 period (see Table 2-16). Farmers usually produce bricks by

themselves rather than purchase and it usually takes more than 200 days to prepare enough bricks for one house (Iida *et al.*, 1989). However, since 70 per cent of households have already achieved iron roof, the next stage of improvement will likely be the shift to brick houses. Five farmers' groups out of 26 interviewed in 1989 made bricks as a group activity (see Table 5-8) to improve members' houses one by one.

Brick making may not be considered a forest-based enterprise but it is one of the large consumers of firewood. According to Dewees (1992), in Zimbabwe, around 1 kg of wood is needed to produce one brick and 1 m^3 of fuelwood is consumed to make 185-660 bricks in Tanzania (Mnzava, 1981). As this trend of modernisation is continuing, further studies on brick making and its impact on forest resources (and its potential as a small-scale enterprise for income generation) are necessary.

3.1.5 Construction and handicraft materials

Trees as construction materials

Trees have been the most important material for house construction in the rural areas of Kenya. Main structural parts of a traditional house, such as posts, frames and beams, are all made from timber collected by farmers.

Only a limited number of species which exhibit durability, straightness and termite resistance, can be used as construction timber. Due to this specificity in type and quality, there are few substitutes or alternatives to these timber species (Dewees, 1992). As a result, rural people often find greater difficulty in obtaining construction timber than fuelwood. Brokensha and Riley (cited in Fortmann and Bruce, 1988) reported that good timber species (e.g., *Melia volkensii*) had been privately owned in Mbeere societies while fuelwood species had still been collected freely. Although Council lands in Kwavonza are still the main source of construction timber, there are few large trees left. Forests on Council lands have been heavily exploited since the beginning of settlement in this area.

If conditions allow, trees can be good cash crops for farmers. Such schemes are reported from India (e.g., Hedge, 1987; Rorison, 1988) and many other countries often under the name of *farm forestry*. In Kenya farmers produce construction poles and timber by planting introduced species such as *Eucalyptus saligna* and *Grevillea robusta*. Demands on these poles and timber have increased. Riley and Brokensha (1988) observed a shift in construction material from locally collected timber to commercially grown and sawn timber, along with a change in housing style from traditional round house to modern square one. However, tree plantations owned by farmers are currently confined to high rainfall areas. Tree crops, like any other cash crops grown on farms, require a suitable climate to grow and a market for the particular products (Seif el Dim, 1982). Only high rainfall areas can currently fulfil these conditions (Owino, 1982).

Tree seedlings can be another cash commodity where the demand exceeds the supply. In the high rainfall areas of Kenya, seedlings of *Grevillea robusta* are highly valued and many privately owned commercial nurseries exist. In Kakamega District *Eucalyptus saligna* grows quickly and its tall straight poles are in great demand for house construction. A number of farmers, therefore, specialise in raising and selling seedlings (Engelhard *et al.*, 1986). In marginal areas, however, the marketability of tree seedlings other than fruit species may be limited, as few suitable species for these areas occur (Evans, 1990).

Handicrafts

The materials collected in forests are commonly used for handicrafts throughout Kenya. These are important for domestic use and commercial products. Fibres obtained from the forests (palm species and other woody vines) are used in many African communities for weaving baskets, mats, ropes, making furniture and constructing houses. Some high quality fibres even find a market overseas (Poulsen, 1982).

In East Africa, wood carving is a traditional practice among some tribes (e.g., Kamba of Kenya and Makonde of Tanzania). African ebony (*Dalbergia*

melanoxylon) is the most high-valued wood for carving but some *Acacia* species are commonly used as readily obtainable and cheaper alternatives. Wood carvings are sold to international tourists as souvenirs as well as exported as traditional African arts. Wamunyu, 20 km west from Kwavonza, is famous for Kamba wood carvings and a cooperative carving workshop has been in operation since 1917 (Tiffen *et al.*, 1994).

Many of household commodities are also made from wood or other forest produces both for internal use and for sale. In 1974, Riley and Brokensha (1988) recorded that such commodities like walking-sticks, knife and tool handles, bows, arrows, ropes, winnowing trays, spatulas, spoons, ladles, stirrers, stools, brooms and gourds were sold in markets in the Embu District. Although factory-made products have substituted in large cities, most of these products are still sold at open markets in Kitui town. In Kwavonza, every household has a set of locally made mortar and pounder to process grains.

3.2 Protective uses

Farmers have tried to protect or improve their living environment and production systems by maintaining natural vegetation or planting trees. This includes trees planted in the house compound for shade and ornament, trees along the boundaries for fencing and windbreaks, trees applied in various on-farm forms as an organic fertiliser and to avoid soil erosion. Although these trees do not produce any directly usable products, their roles are important and farmers tend to give higher priority to these trees than to trees that produce some products.

3.2.1 Shelter and amenity

Farmers are keen to keep their house compounds clean and comfortable. Ornamental and shade trees are essential for this purpose and most farmers plant trees or take care of natural trees left around their houses. In Kwavonza, shade and ornamental trees are often retained rather than being used as a fuel (Iida *et al.*, 1989).

According to the 1988 socio-economic survey the first priority of farmers was for the shade and ornamental trees around the houses (see Table 5-2). This does not necessarily mean that farmers are only interested in aesthetics as these trees fulfil a need. As already mentioned, the homestead is usually located on the owner's highest ground. Trees can alleviate the hot winds and their shade keeps the house compounds cooler, providing a resting place for both humans and animals. Ongw'eya and Ishibashi (1992) estimated that, in 1991, about 42 per cent of seedlings produced by farmers' groups were planted in house compounds mainly for shade and ornamental purposes (see Table 5-3).

3.2.2 Fence and windbreaks

Traditionally fencing has been crucial in Kenya both for pastoralists and settled farmers. Pastoralists such as the Masai, Samburu and Turkana surround their villages with the branches of a thorny bush: the fence known as a *boma*. These people also make temporary livestock sheds using the same method. Boma provides protection for both people and their livestock from the attack of lions, hyenas and other predators. Unlike settled farmers, fencing is very important even now for pastoralists in the savannas since they coexist with wild animals. Western and Dunne (1979) reported that the presence or absence of vegetation is an essential element for Masai people when selecting settlement sites.

It has been observed that the use of thorny bush is also common among settled farmers, though they often consider this practice as an alternative until hedgerows grow up. *Devyalis caffra* is the species preferred for hedgerows in high rainfall areas (Teel, 1984) while *Euphorbia tirucalli* is widely used in drier areas (Rocheleau *et al.*, 1988). In the settled farming areas, fencing is used to mark the boundaries between properties and to keep the domestic animals away from crops. In high rainfall areas, tall timber species such as *Grevillea robusta* and *Cupressus lusitanica* are also used. The hedgerows of these taller trees may also function as windbreaks. In Kwavonza in 1991, about 25 per cent of seedlings

produced by farmers' groups were planted as fence (see Table 5-3) indicating relative importance.

Strong wind has sometimes caused soil erosion and accelerated drought conditions on farms. Whirlwinds can be commonly observed during dry periods on the exposed plains of Kwavonza. In Niger, windbreaks improved crop production by at least 30 per cent (Hoskins, 1984). In the semi-arid areas of India, an experiment showed that windbreak boosted the yield of ground nuts, pigeon peas and millet up to 43 per cent, 47 per cent and 64 per cent respectively (Reddi *et al.*, 1981). However, Tiffen *et al.* (1994) reported that, in the nearby Machakos District, soil erosion caused by winds is insignificant compared to water-related erosion.

3.2.3 Soil nutrition

Trees are the major source of soil nutrient inputs used by rural farmers (Dewees, 1992). There are three ways to incorporate trees in the nutrient cycling of farming systems. The first is to have trees on cultivated farms as an agroforestry system. Use of naturally growing or planted *Faidherbia albida* is a well-known example of integrating trees into the crop lands to increase soil fertility (Vandenbeldt, 1991; Jama and Getahun, 1991). The second way is the direct application of tree leaves as green manure or compost. However, this form of application is not common in the semi-arid areas of the Eastern Province (Yamashita and Noda, 1990). The most common approach is the third one; the use of cow or goat manure as 'processed' tree leaves. According to research in Zimbabwe, the quantity of nitrogen contained in a ton of manure is equivalent to 17.4 kg of ammonium nitrate fertiliser (Dewees, 1992). For many of the farmers of Kwavonza, this is the only option currently available or affordable.

The farmers of the Eastern Province have reported declining productivity on their farms (Yamashita and Noda, 1990), possibly due to soil erosion and loss of the most nutrient rich surface soil. A study done in the Machakos District (Mbuvi, 1991) confirms this fact: Areas under long term continuous cultivation or

intensive grazing pressure had a low supply of plant nutrients due to the loss of top horizon. However, the effect of degradation has not been very discernible as the amount of rainfall seems to influence far more. Keating *et al.* (cited in Tiffen *et al.*, 1994) found that their simulation model of maize production worked better under water constraint than under nitrogen constraint or any other constraints. In Sudan, rainfall was highly correlated with millet and sorghum yields over a period of more than 20 years, suggesting that rainfall, rather than the decline in soil fertility, was the major factor in falling crop yields (Ahlcrona as cited in Toulmin *et al.*, 1992).

3.2.4 Soil conservation

In a semi-arid environment, soil erosion is caused by heavy downpours occurring over short periods, with most of the rain lost as surface run-off due to the poor infiltration capacity of soil (Wairagu, 1991). In Kwavonza, development of gullies can be observed along roads, on grazing lands and even on some farms.

In Kenya, soil conservation works started in colonial era (Gichuki, 1991; Tiffen *et al.*, 1994). After independence, the Ministry of Agriculture has strongly promoted soil conservation practices on farms (Riley and Brokensha, 1988). As a result, many farmers have adopted approaches such as terracing on farms on slopes. Good terracing can prevent soil moving more than a short distance (Thomas *et al.*, 1981).

However, the use of trees for soil conservation is still unfamiliar to farmers. According to a survey conducted by the Kenya/Japan Social Forestry Training Project (1987) in the Western, Nyanza, Coast, Central and Rift Valley Provinces, no farmer mentioned soil conservation as one of the priorities for tree species selection. Similarly in another survey in the Eastern Province (Yamashita and Noda, 1990), only a few farmers interviewed had planted trees for soil conservation or mentioned soil conservation as an objective of tree-growing in the future. In Kwavonza, tree-growing for soil conservation had never been practised before the Kenya/Japan Social Forestry Training Project started.

In watershed areas, the loss of trees has been the main cause of soil erosion, in particular gully formation and surface erosion. This is especially true in high rainfall areas. Under semi-arid conditions, it is not the initial deforestation, but the continual overgrazing that is primarily responsible for soil erosion. According to a research in Kalama Location, Machakos District, annual soil loss in degraded grazing lands (less than 15-20 per cent grass basal cover) was 53.3 ton/ha while in good grazing lands it was only 1.1 ton/ha (Thomas *et al.*, 1981). According to Zöbisch (cited in Tiffen *et al.*, 1994), soil loss in grazing lands was closely correlated with ground cover and an increase in cover from 20 to 40 per cent led to a major reduction in soil loss.

In the vegetation observation plot protected from grazing animals in Kwavonza, natural vegetation (grasses and shrubs such as *Aspilina mossambicensis* and *Solanum incanum*) covered the once bare soil surface within a year despite the dry climate (Hayashi, 1992). Visible soil erosion had also completely stopped. Ottley *et al.* (cited in Farah, 1991) admitted that lands degraded by grazing in the semi-arid areas of the Machakos District took only 2 years to regain the productivity. Tree-growing for soil conservation may therefore not be essential in watershed management in semi-arid areas; effective grazing control to maintain ground vegetation may be more critical. However, overgrazing is almost inevitable when several seasons of below average rainfall follow in succession (Thomas *et al.*, 1981), which is not rare in marginal areas (Tiffen *et al.*, 1994).

3.3 Other uses

3.3.1 Savings against risks and contingencies

People who live under a harsh environment exhibit risk aversion to cope with various risks such as crop failure (Burley, 1982). Especially for poor people, keeping livestock has been a deliberate strategy for survival (Chambers and Leach, 1990). Livestock were sold only when owners need cash to buy food in drought years or to meet contingencies such as the sickness of a family member.

Rural people also need some forms of savings or insurance preparing for various social conventions (e.g., wedding and funeral), natural disasters and other immediate cash needs (Chambers and Leach, 1989).

Chambers and Leach (1989 and 1990) reported that trees are replacing livestock as a form of savings because of the diminishing access to grazing lands led by population pressure. Trees can provide a capital reserve for use in emergency, or to meet exceptional cash outlays (Arnold, 1984). However, this observation seems inapplicable to drier areas, where there are difficulties in growing trees and a large number of livestock are still kept as savings. Poor farmers, especially, have no recourse but to keep a large number of less productive animals to deal with the risks inherent in drier regions (Gupta, 1986).

Chambers and Leach (1990) described four advantages and three disadvantages of trees as savings. The advantages of trees are; (a) establishment and maintenance costs are relatively cheap; (b) in good conditions the rate of appreciation is high; (c) trees can be divided to meet needs; and (d) regeneration is often easy by pollarding or coppicing. Another advantage is that, unlike livestock, trees can be kept untouched until needed and usually they increase in value over time (Arnold, 1984).

The disadvantages of trees as savings are; (a) the tenure of trees is sometimes threatened especially in communal lands, state forests and leased lands; (b) producer price per unit is often low compared to retail price (cost of transport is high); and (c) there is always the risk of damage or loss due to disease, fire, termites or wild animals. Another major disadvantage not mentioned by Chambers and Leach is that trees need many years to become valuable.

Trees growing in high rainfall areas seem to have more advantages than disadvantages: For instance, distance from the market is shorter, high rainfall helps trees grow quickly and there is a very low density of wild animals and termites, both of which heavily damage trees in semi-arid areas. In arid and semi-arid areas, disadvantages outnumber advantages. They are a longer distance from

market centres and have harsher climatic conditions. More investment is required to overcome these difficulties to grow trees. Therefore, people so far have relied on livestock and naturally growing trees rather than growing trees themselves.

In Kwavonza, trees are often sold in the forms of charcoal and firewood to meet cash needs. As mentioned, among 150 sample households in the 1988 socio-economic survey, 23 households (15.3 %) produced and sold charcoal in 1987. Their average income from charcoal sales was about KShs. 520. Ten households (6.7 %) sold firewood and their average income from firewood sale was about KShs. 500. These figures were roughly equivalent to the monthly salary for a labourer in this area. Contribution to the household economy of the producers seems significant.

However, charcoal and firewood producers were concentrated near the Council lands (Iida, 1988). Considering the fact that there were no big trees left on private land, these producers obviously obtained wood illegally from Council lands (according to a villager, people consider cultivation of Council lands an offence but cutting trees, acceptable). People living away from the Council lands virtually had no access to such resources.

In 1987, in Kwavonza as a whole, the average household income from charcoal and firewood was about KShs. 126, only 1 per cent of the average off-farm income (KShs. 11,471) shown in Table 2-15. This is also less than 10 per cent of the average income from livestock sale (KShs. 1,664). Despite the contribution to a certain group of farmers, charcoal and firewood production as a risk aversion measure is currently not very important from the economic view point. Also, it is more likely to remain so considering its exploitative, rather than sustainable, nature leading to the depletion of the resource.

Tiffen *et al.* (1994) observed that Kamba people in the long-settled areas are also shifting their risk-management strategies from livestock to off-farm employment. This is particularly due to the decrease of grazing lands as a consequence of land privatisation and sub-division. Tree-growing is not adopted

for this purpose. Contrary to the Chambers and Leach's (1990) view, tree-growing will not be an immediate alternative option for risk-management in marginal areas.

3.3.2 Religious uses

Trees have been used in rituals and religious ceremonies by many Kenyan tribes. Thomas *et al.* (1981) recorded that Kamba people preserved original forests with large trees of *Albizia gummifera* as traditional shrines in 1970s in the Machakos District. Chavangi *et al.* (1985) mentioned such uses among the Luhya people in the Kakamega District. Riley and Brokensha (1988) reported that Mbeere people in the Embu District had protected sacred tree groves. Such traditions were also found in the Kikuyu, Jie, Gabra and Boran tribes in Kenya (Niamir, 1990) suggesting sacred groves were once very common among many tribal groups.

However, such animistic traditions have diminished with the dissemination of Christianity or Islam, accelerated by recent population pressure and the privatisation of communal lands. In the Kitui District, Hill (1991) reported that a church was deliberately built on ground previously occupied by a sacred grove, to demonstrate the superiority of Christianity over the traditional religion. Since Kwavonza is a new settlement, it is unlikely that sacred groves ever existed there. The use of trees for rituals and ceremonies has not been recorded, though witch doctors still practise their traditions. Like a case of Zimbabwe reported by Fortmann and Nihra (1992), religious use is no longer an incentive to protect or plant trees.

Local taboos on certain species, activities or the use of certain tools or land can have a great impact on project success (Hoskins, 1984). Only two cases of cultural restrictions have so far been reported by the villagers of Kwavonza. *Adansonia digitata* (baobab) is usually not cut since its fruits are important supplementary food especially in drought (Iida, 1988). *Croton megalocarpus* should not be planted since it attracts evil spirits (Ongw'eya and Edazawa, 1990). Moreover, these two species are rarely seen in the natural vegetation of this area. According

to villagers, however, this superstition has been forgotten with the influence of Christianity.

3.4 Disincentives and incentives to tree-growing

Gregersen and Houghtaling (1978) identified three main reasons for unsuccessful rural community involvement in tree-growing activities. They are;

(a) Lack of *knowledge* about the benefits which could be derived from the activity;
(b) Lack of *interest* in carrying out the activity due to a variety of economic, social and cultural factors; and
(c) Lack of *capability* to carry out the activity, which can include lack of physical ability, financial ability, and technical ability.

Since Gregersen and Houghtaling primarily addressed this issue in the United States, they stressed the importance of economic or financial aspects in the context of taxation and loans. Although this categorisation seems applicable, it may need modification to suit marginal areas, where the objectives of tree-growing are related to subsistence and daily use rather than direct economic return in monetary forms. In a subsistence society, (b) and (c) are closely related. For example, the lack of land (physical ability) can only be solved by institutional or social arrangements, since farmers often lack the purchasing power to expand their lands. The followings may be a better-suited set of reasons for unsuccessful programs in marginal areas:

(a) Lack of recognition of the importance of trees;
(b) Lack of resources, lack of access to resources and insecure rights on resources; and
(c) Lack of technical capability to manage resources.

Forestry extension programs often assume that rural people do not recognise the importance of trees, hence they do not plant trees and, therefore, farmers need motivation (Dove, 1992). However, as Foley and Barnard (1985) indicated, a

certain number of trees are planted by farmers involved in sedentary farming systems. Even where people have no tradition of tree-growing (most pastoral areas), natural vegetation is often managed by the pastoralists for the collection of fodder, fruits and other uses. A survey result from the Eastern Province of Kenya shows that the farmers' major problems are not motivation or awareness but the lack of resources and technical knowledge to manage trees (Yamashita and Noda, 1990).

As discussed, farmers do plant trees. Therefore the lack of recognition is not a reason for not planting trees. Tree-growing by farmers is limited by other constraints that hinder farmers' efforts or discourage their willingness to grow trees. Unless these constraints are overcome, or certain alternative incentives given, the objective of sustainable tree-growing will not be realised.

CHAPTER 4

PROPERTY RIGHTS - A REVIEW

Having analysed World Bank funded forestry projects, Cernea (1989) concluded that the most critical factors in designing the social strategy of a forestry program were the identification of the social unit able to carry out the program and the definition of the conditions under which this unit can act effectively. According to Cernea, such conditions include existing land ownership and usufruct rights; the local authority system; farmers' traditional attitudes and behaviour regarding tree-growing; and the presence or absence of social structures for collective action aimed at reforestation. Among these, the most commonly encountered constraints in tree-growing are those imposed by tenure conditions. The complexity of tenure for forest resources and the significance of tenure in its wider context have been seriously underestimated (Birgegård, 1993).

The assurance of tenure or usufruct on land, trees or forests is a prerequisite for any spontaneous action by farmers. It is quite pointless for farmers to invest in tree-growing if they have no secure rights on the harvest of trees (Foley and Barnard, 1985). Tenant farmers are usually hesitant about planting trees on leased lands unless their rights over trees are assured in the long term. In a village in the North West Frontier Province, Pakistan, villagers cut all trees on nearby mountains in protest against the claims of absentee landlords to the produce from the mountains (Khattak, 1993). In other cases, planting of trees may change land ownership under traditional rules. Tenants may not be allowed to plant trees, even on land they have used for generations (Hoskins, 1984). In Kenya a conflict over tree tenure on leased lands was reported from the coastal Malindi District. In this case, Arab landlords tried to overturn the ownership of cashew trees planted by African tenant farmers claiming long-term rights to land use (Shambi as cited in Fortmann and Bruce, 1988).

Uncertain tenure of trees, especially on publicly owned common land, affects their value, despite their potential (Chambers and Leach, 1990). Farmers practising shifting cultivation on state land do not have the security of tenure of the land they cultivate. Few will invest in a long-term crop such as trees if they fear that they cannot harvest the trees in the future (Arnold, 1984). In Nepal, the nationalisation of communal forests in 1957 accelerated deforestation, because people lost the rights to trees as well as the responsibility to manage them sustainably (Amatya and Newman, 1993)[7]. The Government of Nepal later acknowledged this failure and started the Community Forestry Program, in which the property rights to forests were transferred to villages. Once the return on the investment to tree-growing was secure, farmers sought out the sources of seedling supply, being driven by factors such as a serious firewood shortage (Carter and Gronow, 1993).

Farmers select crops or enterprises according to tenure arrangements. Sellers (cited in Fortmann and Bruce, 1988) examined the case of farmers in Costa Rica, whose tenure arrangements include land ownership, tenancy and squatting. His sample suggests a clear farmer preference for cash cropping trees on land held in more secure tenure and growing short-term crops on less secure land holdings.

The relationship between local people and forestry is certainly influenced by the prevailing land tenure. Whether the potentially renewable resources of forests are managed sustainably depends on how property rights or user rights are assigned and what incentives are given for conservation or depletion (Gibbs and Bromley, 1989). FAO urged reexamining existing forest tenure in order to encourage local people to have a greater involvement in the management and utilisation of forests (Forestry Department, FAO, 1978).

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[7] There is a discrepancy between observers. Griffin (1988) thinks nationalisation did not accelerate deforestation while most others think it did.

4.1 Definitions and characteristics of property rights

Messerschmidt (1993) summarised the definition of the words *property* and *tenure*: Neither property nor tenure is simply an act of ownership. Nor are they 'things' like land, trees or forests. Rather, property and tenure both pertain to rights, relationships, responsibilities and duties to these resources.

While there is general agreement on the nature of private property, there is no such consensus as regards common property[8] (McGranahan, 1991). There are two definitions for the meaning of *common property*. The first definition is that of *the commons* (Hardin, 1968) as describing a theoretical argument about the behavioural foundation of overpopulated areas (Gilles and Jamtgaard, 1981). Neoclassical economists and followers of Hardin restrict common property to unqualified *open access* (McGranahan, 1991). The second definition is based on observations of traditional communities. In this context, common property refers to a property regime for resources with explicit rights and duties held by an identifiable group (McGranahan, 1991), in which a number of owners are co-equal in their rights to use the resource (Ciriacy-Wantrup and Bishop, 1975).

Serious debate on common property issues was triggered by Hardin's article in 1968, "the tragedy of the commons." The debate on tenure regimes for common property resources, including forests, has been strongly influenced by the 'tragedy of the commons' argument. According to this argument, indigenous tenure regimes have inherent properties which lead to over-exploitation of the commons. Hardin's analysis has been accepted by many people charged with development (Gilles and Jamtgaard, 1981) and the argument has been used as a rationale for far-reaching government intervention, particularly in the field of forestry (Birgegård, 1993).

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[8] The term *common property* here refers only to the resources which are finite and subtractive. Wade (1988) used a term *common-pool resources* instead of common property resources to exclude infinite and non-subtractive resources, such as lighthouse.

Birgegård (1993), after scrutinising literature on common property resource management in sub-Saharan Africa, concluded that the theoretical underpinning of the 'tragedy of the commons' argument was flawed as successful communal management systems do exist. Common property (or communal use of land or trees) is, unlike Hardin's argument, *not* open for all (Cossins, 1986; Bromley and Cernea, 1989).

Bromley and Cernea (1989) defined four general categories of property rights: namely state property regimes; private property regimes; common property regimes; and non-property (open access) regimes. This classification of property regimes seems to be widely accepted.

(a) State property regimes

Ownership and control over the use of resources rests in the hands of the state. Individuals and groups may be able to make use of the resources, but only with the permission or forbearance of the state. The state may either directly manage the use of state-owned natural resources through government agencies or lease them to groups or individuals who are thus given usufruct rights over such resources for a specified period of time.

(b) Private property regimes

Private property is the legally and socially sanctioned ability to exclude others. Private property regimes appear to be stable and adaptive because they have the sanction to exclude others and effectively to resist unwanted intrusions through the power of the state. The best land has usually been privatised and the worst left in the public domain, either as state property, common property, or open access.

(c) Common property regimes

Common property represents private property for a group, since all others are excluded from use and decision making. The individuals belonging to the group have rights and duties in a common property regime. Property-owning groups vary in nature, size, and internal structure across a broad

spectrum, but they are social units with a definite membership and boundaries, with certain common interests, and some interaction among members. In group ownership, the behaviour of all members is subject to rules and visible to all. Conformity with group norms is an effective sanction against anti-social behaviour.

(d) Non-property (open access) regimes

In an open access situation, there are no individual property rights. Each potential user has complete autonomy to use the resource since no one has the authorised ability to keep any potential user out. The natural resource is subject to the rule of capture until it is in someone's physical possession. If property and management arrangements are not determined, and if the investment is in the form of a capital asset such as improved tree species, the institutional vacuum of open access ensures that use rates will eventually deplete the asset.

4.2 State interventions in the past

Third World governments and the previous colonial regimes attempted to prevent the degradation of natural resources by converting traditional common property regimes to Western style tenure systems. Governments have so far adopted two different policies regarding land tenure; either privatisation or nationalisation of communal lands. Although there was no evidence that indigenous tenure systems provide a disincentive to investment (Birgegård, 1993), governments assumed that the traditional tenure arrangements were irrelevant or, more likely, did not recognise the existence of such arrangements. Government officials were also often unable to distinguish between a common property resource and open access land (Shepherd, 1993).

In a predominantly agrarian society, natural resource tenure is a profoundly important social institution touching upon all aspects of rural life. Therefore, forced changes in tenure regimes have ramifications for the entire social fabric of rural societies (Birgegård, 1993). Although the governments have attempted to

protect resources and to enhance production, government intervention often led to the deterioration of natural resources. Many reviews have criticised government ignorance of the efficiency of traditional tenure arrangements (e.g., Bromley, 1989; Birgegård, 1993; and Bardhan, 1993). The following sections discuss these government interventions and their consequences.

4.2.1 Privatisation

Many economic consultants and planners have called for the imposition of private property rights to halt the 'tragedy of the commons' (Runge, 1981) by reducing uncertainty and inducing individuals to husband resources (Bardhan, 1993). In the African context, tenure reform is generally not considered to imply a redistribution of land or other natural resources. Contrary to debates on tenure reform in Latin America, land redistribution has never figured as an important consideration since resources and incomes are relatively equitably distributed (Birgegård, 1993).

A few countries have pushed for the privatisation of tenure through nationwide programs. The most systematic compulsory reform program is that in Kenya. From the 1930s, traditional communal tenure was regarded as an impediment to agricultural development (Fleuret, 1988). The Kenyan tenure reform was part of the so called Swynnerton Plan prepared by the colonial administration in the early 1950s for the development of agriculture among Africans (Birgegård, 1993). The Swynnerton Plan saw private tenure as essential to revolutionise the agricultural practices among native Africans through land consolidation, the registration of individual titles, and the cultivation of profitable export crops (Tiffen *et al.*, 1994).

The process of land reform continued after independence in 1963 (Burley, 1982). The plan focused on tenure in terms of agricultural productivity only (Birgegård, 1993) and initially emphasised the more heavily settled areas. Later, it was extended to many parts of arid and semi-arid lands (Burley, 1982). In the post-independence era the very same arguments supporting the continued

tenure reform program have been repeated in national development plans (Birgegård, 1993). As a result, land ownership in rural Kenya is on a private tenure basis, supported by title deeds issued by the Land Registration Office (Chavangi *et al.*, 1985). Over the last few centuries, the share of resource-use regulated by common property regimes has declined drastically in favour of private property (McGranahan, 1991).

Negative consequences of privatisation

One hidden drawback of privatisation is that the fair enforcement of formalised private rights and duties may be prohibitively costly compared to customary tenure arrangements. Private rights require a mechanism to adjudicate disputes when they arise. The more things for which exclusive rights are assigned and defined, the greater must be the social overhead investment. Though this overhead cost is often hidden from view in developed Western economies (Runge, 1986), in developing countries, it can be a burden and can make the private property system unworkable.

The argument is sometimes raised that private property regime is inefficient compared to common property regime. For example, Bardhan (1993) argued that the time preference rates of private users may be higher than what is appropriate for the community as a whole and hence private ownership may be socially inefficient. However, this is not always the case. As Berkes (1989) says, privatisation is economically more efficient for certain resource types. Evidence from many parts of Kenya (e.g., Riley and Brokensha, 1988; Dewees, undated) also suggests that the number of trees increased dramatically after the privatisation. This will be discussed as a positive consequence later in this chapter.

Increasing inequality is possibly the most serious consequence of the privatisation. Privatisation tends to concentrate wealth in the hands of a few, at the expense of equity (Berkes, 1989). Many private property schemes throughout the developing world have contributed to rapid degradation of resources and

increased inequality in an already unequal distribution of wealth (Runge, 1986; Shipton, 1988).

Inequality is a matter for particular concern because the poverty of the low-income groups is so extreme in developing countries (Johnston and Kilby, 1982). Individual tree-growing is easier to initiate and often less costly, but the results often fail to aid the needy segments of the community and only enhance the situation of already well-off farmers (Kirchhofer and Mercer, 1984). Often the economic inequality in a society has led social forestry programs to fail, especially in India (Dargavel *et al.*, 1985; Hedge, 1987), Pakistan (Cernea, 1981 and 1989; Dove, 1992) and other countries where serious inequality exists.

In some parts of India, the introduction of a farm forestry program enhanced tree-growing on farms and people even converted their food crop areas to trees which were more profitable. The result was that only large scale farmers benefited from the program. Poor farmers did not have enough land to grow trees commercially and suffered from food price rises as many people were now growing trees rather than crops. Landless people also lost their jobs since tree growing required less labour[9] (Hedge, 1987; Rorison, 1988).

In a stratified society those with less economic and political power are generally more at risk of adversity than the well-off. The poor may (rightly) question the wisdom of participating in creating a resource (e.g., planting trees), if they suspect that the well-off will use their power at harvest time to gain an unreasonable share of the benefits (Birgegård, 1993). It has been argued that unless there is as egalitarian distribution of land, village-level forestry projects cannot help those most in need of them - the poor and the landless (Agarwal as cited in Arnold, 1984).

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[9] Rorison (1988) reported the case of a farmer in Gujarat, India. Adopting farm forestry, labour requirement on his farm decreased 50 per cent.

Kenya is a country that strongly implemented privatisation. Many observers commented that they have seen concentration occurring, recognising that it was explicitly planned in the design of Kenya's policy of tenure reform (Shipton, 1988). The Kenyan experience is that the privatisation of tenure for arable land has contributed to increased inequality (Birgegård, 1993).

Inequality seems to have three causes: unfair land-registration; uneven reliance on commons; and uneven distribution of resources.

Unfair land-registration

In theory, land reform could help to absorb some of the growing population. It could provide opportunities for farm and non-farm employment, but only if (as in South Korea or Taiwan) the government imposed a ceiling on maximum farm size (Hunt as cited in Riley and Brokensha, 1988). Hunt suggested a ceiling of 7.5 ha, in more fertile areas, or 45 ha, in the marginal semi-arid lands of Kenya. Such drastic restriction does not, however, seem likely at present (Riley and Brokensha, 1988).

Lands formerly held in common are often transferred to individuals, such as high-ranking government bureaucrats, who can influence the allocation of ownership. Kenyans with wealth tend to have access to political power and to legal and educational resources. They have good chances of being able to accumulate land (Shipton, 1988). These individuals, in many cases, have failed to manage these resources effectively (Runge, 1981 and 1986), since they are often non-resident owners rather than resource managers. Shipton also reported the cases of the abuse of authority in Western Kenya. Members of land-adjudication committees implicitly demanded bribes or feasts in the process of settling land-dispute. Poorer farmers could not meet their demands and often lost the case. Unfortunately there is nothing to prevent the enforcing authority abusing its position and putting the control of land into the hands of a favoured few (Runge, 1981).

Uneven reliance on commons

Communal lands are often the only sources to replenish the wood requirement of the poor, small-scale farmers and landless people. Modern land-privatisation programs tend to place priority on intensive land-use for the enhancement of production. The land title programs seldom incorporated the subsistence needs of poor farmers, herders or landless people (Hoskins, 1984). When implemented, restrictions on access in order to resolve commons problems, have led to tragedies through the dispossession of people's livelihoods by the enclosure of common lands (Ciriacy-Wantrup and Bishop, 1975). As seen in the case of India, the collective loss of poor people from a decline of common property resources has not been compensated (Jodha, 1986). These dispossessed people often have no alternatives for vanished common property, and have been further impoverished. Richer people, on the other hand, had opportunities to intensify their production activities under a more secure title.

Uneven distribution of resources

Due to the random distribution of natural resources such as soil, water and fodder in time and space, viable grazing ranges generally have to be of considerable size (Runge, 1986; Birgegård, 1993). Where the productivity of the resource base is low and varies spatially and with time, as in the case of rangelands, individuals require varying access to the commons from season to season and year to year (Runge as cited in Lawry, 1990). In periods of extreme drought, pastoralists must be able to leave their traditional grazing lands and wander far in search of adequate feed resources. Large expanses of common pastures facilitate such movement (Gilles and Jamtgaard, 1981).

The privatisation of such resources can yield an inherently unfair distribution, compared to the assignment of joint rights of access to these resources. Such distributions may tend to become further skewed as individuals with an advantageous initial endowment acquire more resources

over time (Runge, 1986). Private property might then displace far more people than it would sustain (Birgegård, 1993).

Positive consequences of privatisation

Although privatisation may have negative impacts such as inequality, it may also have positive impacts.

Increased investment

A comparatively secure tenure in a private property regime assures the farmers' investment in land improvement, fencing, perennial crops, improved livestock breeds, equipment and structures (Birgegård, 1993). There is a direct correlation between the security of title and the willingness to make long-term investments such as planting trees (Riley and Brokensha, 1988). In semi-arid Kenya, where individual titles have been given, there has been a noticeable increase in tree-growing for fuelwood and building posts (Burley, 1982). Riley and Brokensha (1988) reported that with land reform in the Mbere Division, Embu District, there was an increase in investment such as tree-planting and terracing. In contrast, Evans (1990) observed that in lower parts of the Embu District, where land adjudication was incomplete, farmers were unwilling to plant trees without a secure title.

Access to credit

Access to credit usually requires the farmer to be able to provide security for the loan. Without legal ownership or tenurial rights, such security may be difficult to achieve (Arnold, 1984). In the Machakos District, farmers regarded land registration as valuable for improving access to credit (Tiffen *et al.*, 1994). However, the availability of a credit is limited for farmers in high rainfall areas, where cash crops can be cultivated. In marginal areas, frequent crop failure makes taking loan a riskier proposition for farmers

(Meyers, 1982). Not one official sector loan has been reported from Kwavonza.

Social consequences

Apart from obviously negative or positive consequences, privatisation triggered other changes in rural societies.

Establishing individual ownership of lands or trees clearly restricts accessibility. In the past, the distance involved was a major constraint in fuelwood supply because of the time required in carrying the wood. Today, cost has become a factor related to access. Owners may still allow a neighbour to use their lands for petty uses (such as hanging a beehive in a tree), but they are unlikely to permit the cutting of any valuable tree without compensation. They may refuse to allow others to gather firewood or make charcoal on their land, unless a fee is paid. A house builder will almost certainly have to make some payment if he obtains timber from another person's land (Riley and Brokensha, 1988).

In the Mbere Division, Riley and Brokensha (1988) observed: declining traditional self-help groups; more disputes over land boundaries; diminishing traditional farming systems such as shifting cultivation; and increased inequality as the resalts of privatisation. The modernisation process has reduced incentives for individuals to participate in localised collective arrangements, has undercut the economic viability of common property institutions, and has reduced the political legitimacy of local management authorities (Lawry, 1990).

Van Duijl (cited in Shepherd, 1993) described the results of land privatisation in Kamba societies in the Machakos District. Kamba men used to be hunters, livestock keepers and long distance traders, but have turned increasingly to sedentary agriculture as population densities have increased and land registered. Household heads, who control the ownership of both trees and land, have become more important than clan or kin leaders with the privatisation and registration of land. Management has moved from the clan to the household (Dilelen, 1982).

Chambers and Leach (1990) highlighted the change in people's strategies to cope with unpredictable cash needs. With increased privatisation of land and diminished access to common grazing land, the scope for keeping livestock as savings has diminished in areas of high population density and where tenure of trees is secure. They have observed a tendency for tree cover to increase, substituting with the role previously played by livestock.

4.2.2 Nationalisation

Although privatisation has its problems, those associated with the nationalisation of a local common property resource are arguably much worse (Bardhan, 1993) and historically the record has been disappointing (Bromley, 1989). Most literature shows government take-over of management responsibility for common property resources has simply weakened local customary regimes (Bromley and Cernea, 1989), resulting often in the emergence of open access situations (Bromley, 1989; Bromley and Cernea, 1989; Birgegård, 1993; Shepherd, 1993).

On the whole, governments of developing countries in sub-Saharan Africa have proven incapable of managing common property resources (Birgegård, 1993). The centralised bureaucratic systems have no capability to manage resources in remote areas. Governments have often lacked expertise to manage the resources in both technological and social contexts. Policing seems to be the only option that governments could ever practise. Usually understaffed and often corrupt, government authorities simply undermined traditional communal controls and were unable to replace these controls with an effective alternative system (Berkes, 1989).

Dismantling the community structure of rules in the interests of 'modernising' the land tenure system will involve the erosion of institutional capital, which a purely state-enforced system could find very difficult and costly to replace (Cramb and Wills, 1990). The nationalisation of Nepal's village forests by the government in 1957 converted a common property regime into a state-property regime. However, in the absence of consistent administration and enforcement the

forests became open-access regimes (Bromley, 1989). In sub-Saharan Africa, the tenure rules established by governments have often been in conflict with the needs and perceived rights of local residents. The ability to enforce the rules has been totally inadequate (Birgegård, 1993).

In other cases, governments have attempted to manage resources being driven by economic or other interests. The Chipko movement in India (e.g., Joshi, 1983) may be one of the well-known examples of this situation. In the case of semi-arid Africa, conflicts on forest resources have not been as serious because the commercial value of dry-woodland is generally low. However, other forms of development sometimes affected the communal land-use. Lane (1993) reported the case of pastoral Barabaig people in Tanzania, in which the most productive part of their communal land was taken by the government for a large-scale agricultural scheme.

4.2.3 Implication of interventions in Kwavonza

Traditional tenure

In sub-Saharan Africa, two types of tenure arrangement were predominant until the introduction and enforcement of Western property rules by both colonial and independent governments. A combination of these two, involving family control of a plot of cultivated land (private property), and clan or village control of a territory (common property), has been the characteristic pattern of resource regulation used in most traditional agricultural societies (Birgegård, 1993).

Family or individual rights are less prevalent when the resource involved is not produced but actively sought. Foraging for resources such as fuelwood entails the use of relatively large tracts of land which are often controlled by somewhat larger groups of people such as a clan or village (Gadgil and Iyer, 1989). In India, through the supply of fodder and grazing space, common property resources allow individuals to save their land for crops. These common property resources help to sustain a greater number of animals (for draught and livestock production) than

would have been possible on an individual's land, especially if they are small-scale farmers (Jodha, 1986).

Arable land has long been under a private property regime in much of sub-Saharan Africa. Collective management of arable land is rare in these indigenous tenure systems. Individual farmers control land use and reap the benefits themselves (Birgegård, 1993). In most parts of Kenya, land has traditionally been regarded as a collective and functionally homogeneous asset (Chavangi *et al.*, 1985). It is the investment of labour which creates ownership of land. For farmers this meant being the first to clear and plant land previously under forest or woodland (Shepherd, 1993). As long as land was plentiful, newly formed families could be granted user rights or ownership of as much unclaimed land by the community (e.g., Riley and Brokensha, 1988; Hill, 1991) as their labour permitted then to develop. Access to labour became the limiting factor for how much land could be cultivated. Differences in size of holdings resulted primarily from different household sizes. As a result, land distribution in sub-Saharan Africa has been relatively equitable (Birgegård, 1993).

Ostrom (1990) observed similar cases in Swiss and Japanese villages where a traditional form of communal land tenure has been successfully used and, at the same time, private ownership exists with intense cultivation of highly productive land by small family units. In the rural areas of Switzerland and Japan, communal land tenure is used where the value of production per unit area, the frequency and dependability of use or yield, and the possibility of improvement and intensification are low under these conditions. The area required for effective use is large, so a large group is needed for labour or capital investment.

In Kamba society in the past, only farmed land was privately owned. Unsettled land was open for all members of a community (Dilelen, 1982). Unsettled land, called *weu*, was available for communal grazing, firewood collection and for the establishment of new settlement. Land once cleared became a family farm or

ng'undu, which was saleable, transferable and inheritable without reference to others in the community (Tiffen *et al.*, 1994).

Traditional inheritance laws in sub-Saharan Africa generally give sons an equal share in the user rights of their father. In high population areas, as a consequence, farms have become divided to such a degree that they are now incapable of providing the subsistence needs of the families living on them (Chavangi *et al.*, 1985).

Women do not inherit land rights. Whereas this leads to sub-division of holdings, it ensure that all future heads of families have access to some land (Birgegård, 1993). According to Iida (1988) the inheritance practices of the farmers of Kwavonza are, in principle, patrilineal, as Birgegård described.

Implication of privatisation and nationalisation

In previous section, the consequences of land privatisation were discussed. In Kamba society, the privatisation of farms caused few incentives or disincentives in farming practices. In Kamba society, land titling was not a prior condition of development. Tenure in Kamba society was already notably individualised in so far as land once cultivated was concerned (Tiffen *et al.*, 1994). In the Machakos District, the intensification of farming practices (e.g., terracing and tree-growing), which is often attributed to the privatisation, occurred before the land adjudication program begun (Tiffen *et al.*, 1994).

In Kwavonza, the nationalisation of tribal land occurred just after colonisation. According to villagers, population pressure in the villages around Kwavonza turned the area into an open access situation. The Government of Kenya privatised a portion of the crown land in Kwavonza (5,000 ha out of 80,000 ha) to alleviate the population pressure. Another part of Kwavonza, now under the Kitui County Council, has been protected from further settlement or illegal cultivation, though the grazing and collection of wood are uncontrolled.

The most serious consequences of privatisation and nationalisation occurred on *weu* (grazing land). Grazing land was owned by communities and the only source of firewood, construction materials, fodder and other products for most people. It was also a land for new settlement and the expansion of farms. Due to the privatisation and nationalisation, grazing lands now belong to individuals and the government. Farmers, fortunate enough to have a large area of grazing land, secured their needs. Small-scale farmers lost access to these resources, or their access was rendered illegal. They also do not have enough arable land for next generation. Insufficient common grazing land, rather than insufficient arable land, seems to be at least as important in low rainfall regions (Dewees, 1992).

In Kwavonza, Council lands currently fill the role of the now absent common land as a source of wood and rangeland. Farmers' reliance or dependency on Council lands greatly varies depending on their economic situation, current land holding, land use and proximity to Council lands. However, this dependency is not necessarily a result of population pressure and the consequent depletion of wood resources on their own lands. These farmers were traditionally dependent on commons. Unequal self-sufficiency and dependency in Kwavonza are probably the result of both nationalisation and privatisation.

In Kwavonza, the size of land owned by a household varies from 0.8 ha to 80 ha (average 7.9 ha) as mentioned previously. However, according to some villagers, this inequality was not the consequence of acquisition by politically powerful individuals. The inequality in Kwavonza stemmed from the previous open access situation in a nationalised land.

According to the villagers, this state-owned land (now under Kitui County Council) had been exploited freely well before privatisation and the establishment of Kwavonza Location in the 1960s. Many people cut large trees and made charcoal. Some people even cultivated land under the risk of expulsion by authorities. These illegal early settlers eventually increased their area. The division of Kwavonza was completed on a first-come-first-served basis before the announcement of land adjudication, with the government eventually

recognising the boundaries drawn by the settlers (Iida, 1988). In adjacent Yatta area in the Machakos District, some settlers deliberately cleared a large plot without cultivating crops, since initial clearing traditionally created ownership (Tiffen, 1991). The same strategy may have been used by the early settlers in Kwavonza.

4.3 Gender issues

Analysts tend to ignore important gender-based differences within the household (Bruce, 1989). Gender issues should not be overlooked since women often have disproportionately small property rights compared to men.

Women gather firewood for cooking family meals, fodder for livestock, fruits, medicinal plants and materials for handicrafts. Men are usually not involved in these household chores. Women are the first to suffer from deforestation (Williams, 1992), because deforestation directly impinges on their primary needs and duties. However, several constraints have limited women's participation in forestry activities: restricted cultural and physical mobility; limited access to land; restricted tree ownership and usufruct; lack of materials such as water and tools; inadequate access to extension, education and training programs; limited cash resources, income and credit; lack of formal and informal organisations; and lack of time (Williams, 1992).

In sub-Saharan Africa, women are usually ascribed inferior rights to men in indigenous tenure systems. Generally men get access to land through their lineage or clan, and women get access to land through their husbands. At the same time, men are obliged to allocate land to their wives, which can be used at the wife's discretion (Birgegård, 1993). The introduction of modern law allowed women to inherit land. Cases have been reported (e.g., Fleuret, 1988), but the number is still limited.

Women often have limited access to land and restricted tree ownership or user rights (Williams, 1992). The relationship between women and trees varies substantially between regions, ethnic groups and classes, and is mainly based on

differences in customs (Rocheleau as cited in Fortmann and Bruce, 1988). In Luhya society in western Kenya, women are not allowed to plant trees as trees demarcate properties and demonstrate land ownership (Chavangi *et al.*, 1985). In contrast, in nearby Luo society, men and women often manage separate farm plots and women are fully entitled to select the crops suited to their needs, including trees (Rocheleau as cited in Fortmann and Bruce, 1988). The restriction upon women planting trees found in Luhya society does not exist in Kamba society.

Women's use of forest resources differs significantly from men's. In the Kakamega District, Kenya, for example, men mainly plant tree crops while women want to plant firewood species (Chavangi *et al.*, 1985). In a Himalayan village of India, the men wanted to sell forest but this move was defeated by the women as selling the forest would increase the time they spent searching for firewood (Chowdhry, 1984). As Poffenberger and Singh (1993) suggested, the establishment of groups solely comprised of women may be appropriate since women are the primary users of forest resources and men often migrate from the village for extended periods.

CHAPTER 5

PROPERTY REGIMES FOR PRIVATE AND COMMON LANDS

The relevant social unit which is best suited to be the 'agent of development' should be carefully identified (Cernea, 1985). Privatisation can sometimes be the best solution whilst community-based management systems may be best in other situations (Birgegård, 1993). This involves several questions: who are the best social units; where they practise; and under what circumstances they can be successful resource managers?

Fortmann and Nihra (1992) used the concept of *tenurial niche* to describe the relationship between resource ownership and social units as resource managers. Applying this concept, six tenurial niches can be identifiable and should be considered in Kwavonza. These are the combination of two property regimes (state-owned Council land and private land) and three possible social units (government, communities and individual households):

(a) Management of Council land by government (either national or local);
(b) Management of Council land by communities;
(c) Management of Council land by households;
(d) Management of private land by government (either national or local);
(e) Management of private land by communities; and
(f) Management of private land by households.

Option (a) is nothing more than the current situation of Council land in Kwavonza. This means that the Council land will remain under *de facto* open access situation for villagers. As discussed in the previous chapter, government is often incapable to control an open-access situation. Government can neither manage nor police its vast national territory (Arnould, 1990). It is also unlikely that the government management of Council land will improve in foreseeable future. In most semi-arid regions of Kenya, the Forest Department has little

authority as the gazetted forests and trust lands for which the Department is responsible are confined to high rainfall areas (Owino, 1982). Currently the Location Chief is responsible for the Council land in Kwavonza. However, the Chief has neither expertise nor staff to control the situation.

Among above six options, (d) seems unrealistic. Individual farmers will not accept government control over their lands for the fear of takeover.

The option (c) is also unlikely to happen. There are cases in which farmers have certain rights in forest reserves managed by the Forest Department. One is the *shamba* system, a Kenyan version of *taungya* agroforestry (Nyaga, 1989). Another case is the issue of tickets to collect minor produce such as firewood or graze livestock in forest reserves (e.g., Castro, 1991). In these cases, however, users do not have the tenurial rights with respect to trees. Users are temporally permitted either to use spaces between trees or to collect non-timber products.

The option (f), the management of private lands by individual households, is obviously the most stable condition. The family, seen as a production unit, is a microsystem with extraordinary capabilities, resilience and flexibility, historically and structurally well-equipped to perform multiple functions (Cernea, 1989). The management of tree-growing and resources can be sustainable and self-reliant under this regime but it has several limitations. The two communal management options (b) and (e) seem indispensable to overcome these limitations. In this chapter, tree-growing by individual households will be discussed and existing social units will be identified as possible resource managers using observations and data collected through the operation of the Kenya/Japan Social Forestry Training Project.

5.1 Management of private lands by individuals

The tenurial rights of lands and trees are most secure under this regime. Kamba people had a notion of private property (though limited to cultivated land) before the introduction of the Western-style private property right. Their private land titles are now further strengthened by land registration backed by law. Since all

the households of Kwavonza are owner-farmers, there is no disincentives for growing trees on private lands from the viewpoint of property rights.

According to Cernea (1989), the merits of private property are that: management authority over the planted trees is invested in household members; land tenure and tree tenure are much less ambiguous; the divisive problems of intra-group benefit distribution are eliminated; and correlations between the farmers' inputs (labour or cash) and the output becomes clear to farmers.

Private property is preferable when tree growing involves new investment. Active land management involves greater individual control over the resource and more intensive management (Watson, 1989). In a heavily farmed landscape the preferred management system is to have the trees on the farm. A publicly owned forest is an anachronism and often represents the imposition of the will of outsiders on the local population (Shepherd, 1993).

In Kwavonza, farmers' efforts in tree-growing have so far been confined to private lands. Farmers' practices on private lands indicate their perceptions of tree-growing needs and the problems they face, and may give insight on both individual activities and communal management, as discussed later. The current situation in Kwavonza clearly shows that a private property regime cannot solve the problem. In this section, farmers' achievements are reviewed, and the limitations of private property in Kwavonza are discussed.

5.1.1 Availability of seedlings

The availability of seedlings is a key variable to enhancing tree-growing by farmers. If this problem is not addressed, other important variables affecting farmers' efforts cannot become apparent.

In Kenya, the Forest Department nurseries grow industrial plantation species, such as *Eucalyptus saligna*, *Cupressus lusitanica* and *Grevillea robusta* for distribution to farmers under the assumption that farmers need trees for poles and timber. This may be a reflection of the forest policy in Kenya previously pursued

the establishment of industrial plantations in high rainfall areas. As a result, people only have information about these tree species (Kenya/Japan Social Forestry Training Project, 1987). Peoples' needs are more diverse and they are often discouraged by realising that the species they seek (e.g., fruit trees) are not available from nearby nurseries. The number of tree nurseries is also a bottleneck. The Forest Department nurseries are limited in number and mainly located at District or Division headquarters. People living in remote areas often have no access to tree seedlings. The Kitui District nursery operated by the Forest Department is more than 20 km distant from Kwavonza.

Although some farmers of Kwavonza had tried to grow trees, the number of trees planted was minimal until the Kenya/Japan Social Forestry Training Project started the distribution of seedlings in 1987. Until then, there was only a small nursery belonging to the Location Chief (production capacity was less than 1,000 seedlings per year). In 1987 about 65,000 seedlings were distributed in and around Kwavonza. According to the 1988 socio-economic survey (Iida *et al.*, 1989), 92 per cent of households sampled in Kwavonza planted trees in the 1987 planting season (around November). The average number of trees planted by a household was 27.

In 1988 about 105,000 seedlings were distributed in six Locations and, in 1989, 65,000 seedlings in 10 neighbouring Locations including Kwavonza. The demand for seedlings was very high and the Kenya/Japan Social Forestry Training Project organised the tree-planting days with local authorities. This method seemed effective and planting techniques were demonstrated. In 1988 the Project also started a program to establish small-scale nurseries to enhance the supply of seedlings. This program will be discussed in detail later.

5.1.2 Number of seedlings planted

The number of seedlings planted has increased year by year. In the 1989 planting season, each household planted an average number of 82 seedlings (Edazawa, 1990). Edazawa also counted the number of trees which survived on

the lands of 158 sample households and recorded the years of planting. Table 5-1 shows the result. Although some trees planted in 1989 (which were only six-months old at the time of the survey) would not survive, the total number of trees has significantly increased since the Kenya/Japan Social Forestry Training Project started the supply of tree seedlings.

Table 5-1: Average Number of Trees being survived.

Years planted	Average number of trees per household
1986 and before	5.4
1987	4.5
1988	9.3
1989	51.7
Total	70.9

Source: Adapted from Edazawa (1990).

As the seedlings became readily available, landscape and living environment around farmers' house compounds have improved remarkably. Well-tended trees have reached up to 8 m high within four years. The problem of limited seedling-supply was, for the majority of farmers, solved, though sustainability after Japanese aid ends is still questionable. However, this does not mean that the depletion of tree resources has stopped. It should be admitted that, in Kwavonza as a whole, the impact of tree-growing is still limited considering that;

(a) Each household consumes, on average, 0.52 m^3/caput of firewood a year for domestic use alone;

(b) There were less than nine planted trees per ha in 1990 (average land size of a household is 7.9 ha; see Table 2-7); and

(c) Many trees were not planted for production purposes (this issue is discussed later).

The growth of species in semi-arid areas is relatively slow, due to large biomass allocated downwards to develop a deep and extensive root system; an adaptive strategy to low rainfall conditions (Toky & Chaudhary, 1987). Although so little is known about growth rates in African woodlands (Jackson as cited in Shepherd, 1993), some literature suggests mean annual increment (MAI) of

savanna woodlands varies from 1 to 5 m^3 per year per ha. Mnzava (1981) stated that 2 m^3 is a commonly quoted figure. Getahun (1989) estimated annual biomass growth in the semi-arid areas of Kenya from 2 to 4 m^3. Jackson's figures (cited in Shepherd, 1993) are 5 m^3 for the Sahel zone and 1 m^3 for the Sudan zone[10].

Assuming the average figure of 3 m^3/year for MAI[11], a household of average family size (8.5 persons) in Kwavonza needs about 1.5 ha of woodlot[12] for firewood for home-consumption. Even without considering the other uses of trees (e.g., fodder and construction materials), the number of trees in 1989 (70.9 trees per household; see Table 5-1) seems far from self-sufficient.

The most likely reason for the limited number of trees is the conflict between tree-growing and farming regarding the seasonal labour demand (Arnold, 1984). Especially in arid and semi-arid areas, the season suitable for tree-planting is limited to the short rainy season during which farmers also have to plow their fields and sow their crops (Foley and Barnard, 1985; Finan, 1988). According to Heyer (1971) maize planted in the first week of the rains can be expected to give 10-15 per cent higher yields than maize planted in the second week. Planting later than the third week reduces expected yields by 30 per cent or more. Concerning trees, the planting site should be completely ready well before the first rains are due, because the trees must be transplanted as soon as sufficient rain has fallen to moisten the top soil. When planting is delayed, survival rates decrease greatly. Transplanted trees need the entire rainy season to get a good start (Weber and Stoney, 1986). Priority is usually given to food crops and, therefore, only a small number of trees can be planted.

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[10] As Applegate *et al.* (1988) pointed out, these figures are not necessarily appropriate to assess growth rates fulfilling farmers' multiple needs including small branches as well as large timber.

[11] Iida (1988) used 5 m^3 for MAI in Kwavonza though he commented this figure might be overestimated.

[12] As Poulsen (1983) questioned, the calculation of growth based on a woodlot may not be relevant to assess farmers' management. Trees planted by farmers along boundaries, on farms and around houses cannot be measured acurately by using the conventional mensuration measures.

Small holders tend to weigh the opportunity cost of labour more than planners usually realise (Cernea, 1989). This must be true considering their resource-poor situations. For farmers, labour is the only resource they can invest and the labour itself, rather than money, is probably the measuring unit of opportunity costs.

5.1.3 Objectives of tree-growing

Evans (1990) reported that farmers from high rainfall areas who settled in the marginal areas of the Embu District had a tendency to plant trees familiar to them, regardless of their suitability to the new environment. The same tendency was observed during the survey conducted in the marginal areas of the Eastern Province (which also included the Embu District) in 1988 (Yamashita and Noda, 1990). In Kwavonza, however, this tendency was not so visible. This is partly due to the difference in culture and origin. Embu people were from higher altitude areas and familiar with tree-growing. Kamba people were semi-pastoralists in lower altitude areas and tree-growing, on a large scale, may be a new experience for them.

At the beginning of the Kenya/Japan Social Forestry Training Project, farmers' demands for seedlings were not very specific. Farmers simply mentioned what they did not have, such as ornamental trees and firewood sources. Table 5-2 shows the results of the 1988 survey on the objectives of tree-growing mentioned by the farmers of Kwavonza. Since this survey was carried out prior to extension services becoming available, the table shows the reasons why farmers need trees rather than why they planted trees.

Table 5-2: Farmers' Objectives of Tree-growing in Kwavonza.

Objectives	Ratio (%)
Shade and ornamental	89
Firewood	67
Construction timber and poles	56
Fruits	41
Charcoal production	12
Live-fence and marking borders	7
Fodder	1
Others	41

Source: Adapted from Iida *et al.* (1989). Plural answers were obtained.

However, farmers now request specific species for specific purposes. Farmers now became selective. The seedlings of some less liked species were even left in the nursery. It was also observed that some introduced species became popular. For instance, farmers started planting *Parkinsonia aculeata* as live-fence (Ongw'eya and Ishibashi, 1992) for which only *Euphorbia tirucalli* had previously been used. *Parkinsonia aculeata* is a multi-purpose tree, which can provide fodder and firewood, while *Euphorbia tirucalli* has no other use.

As seen in Table 5-2, the first priority was for shade and ornamental trees around the houses. Another survey carried out in 1992 supports this perception. Ongw'eya and Ishibashi (1992) interviewed three farmers each from all 34 farmers' groups producing tree seedlings in group nurseries in 1991. Among the 16,935 seedlings planted by the interviewees, 42 per cent were planted in house compounds mainly for shade and ornamental purposes (see Table 5-3).

Table 5-3: Where Farmers planted Trees.

Place	Objectives of planting	Proportion (%)
House compound	Shade and ornamental	42
Fence and boundary	Fencing	25
Cultivated land	Fruits	19
Grazing land	Fuelwood, timber and fodder	11
Others	-	3

Source: Adapted from Ongw'eya and Ishibashi (1992).

There is a discrepancy between the expressed needs (shown in Table 5-2) and the trees planted (Table 5-3). Firewood, construction timber and poles, and charcoal production were ranked in the second, third and fifth respectively in 1988 (Table 5-2). However, only 11 per cent of seedlings were planted for these purposes in 1991 (Table 5-3). Considering that farmers had accumulated experience of tree-growing for 5 years (1987-1991), and that farmers in Table 5-3 produced the species of their choice, it is likely that Table 5-3 more accurately represents the farmers' perceptions in Kwavonza.

It has often been reported that fuelwood supply alone is not a good reason for farmers to plant trees (Foley and Barnard, 1985; Fleuret, 1990). In Gujarat, India, farmers do not count the supply of fuelwood as a benefit despite obtaining

substantial amount from farm forestry (Rorison, 1988). According to Dewees (1992) the possible reason is that woodfuel can be obtained from various materials such as recycled construction materials. If trees are depleted from an area, people cannot continue walking indefinitely, they have to economise on wood or switch to alternatives (Barnard, 1985). Riley and Brokensha (1988) observed Mbeere farmers using cow dung, maize stalk and some woody vegetation, formerly only used for kindling, as fuels. They also observed that accessibility was more important than preference for firewood, though village women were aware of the different quality of wood.

Dewees (1992) pointed out that once trees are harvested it will take another 5 or 10 years for regrowth, and the value of woodfuel derived from any single source used to be small. In contrast, fruit trees can be harvested every year once mature. In practice therefore the perceived cost-benefit ratio for fuelwood planting is often significantly small. Cases of farmers growing fuelwood species in high rainfall areas (Kinyanjui, 1987; Dewees, undated) are, in fact, market-oriented rather than self-sufficient. Owino (1982) argued that the sustainable commercial production of wood is not technically feasible in semi-arid areas.

Apart from the economics of production, Mbeere people see trees as sources of timber, fruit, fodder, or shade, rather than as providers of fuelwood (Riley and Brokensha, 1988). In the Kakamega District, when fuelwood exhausted, women progressed directly from collecting to purchasing. The deliberate production, or cultivation of fuelwood trees lay completely outside normal perceptions (Engelhard *et al.*, 1986).

Another possible implication is that farmers have a particular perception regarding the role of grazing land. It should be noted that grazing land occupies about 62 per cent of total area of private lands (see Table 2-7), though only 11 per cent of trees were planted there (Table 5-3). Farmers clearly distinguish the home compound, cultivated land and grazing land. A particular tree species is planted on a particular site. For example, most fruit trees are planted on cultivated land,

a few in house compounds, but hardly ever on grazing land. Although the number is limited, those on grazing land are usually species which produce wood.

Before the privatisation, grazing land belonged to whole community. Communal land (called *weu*) was, in reality, unsettled land available for grazing. Under communal ownership, this land was a place to forage various resources rather than nurture them. There was little incentive for individual farmers to do so as all members of community had access. Investment was made only to establish a private property right (see previous chapter). Despite privatisation, farmers' perceptions of grazing land may have not changed. In Kwavonza, it is still rare to see a farmer investing money or labour on grazing land. A model farmer in Kwavonza was asked to plant trees on his grazing land with the workers of the Kenya/Japan Social Forestry Project as a test case. Although he is recognised locally as a progressive farmer and was later employed as an extension foreman of the Project, he never tended the trees he planted on grazing land (Asakawa, 1992).

5.1.4 Mortality of seedlings

According to the 1988 survey, the survival rate of trees planted in 1987 was inversely proportional to the number of trees planted. Trees were planted in November 1987. Survival counting was carried out February-March 1988. In Block III, an average of 12 seedlings were planted and the survival rate was the highest at 53 per cent. In contrast, in Block I, an average of 40 seedlings were planted and the survival rate was 24 per cent, the lowest (Table 5-4). Ten out of 150 households interviewed planted more than 100 trees (the maximum number was 300). The overall survival rate was 28 per cent though, in the case of the above 10 households, the average survival rate was only 14 per cent (Iida *et al.*, 1989).

Table 5-4: Number and Survival Rate of Trees planted by Farmers.

Administration Block	No. of households planted trees	Total No. of trees planted	Average No. of trees planted per household	Total No. of trees survived	Survival rate (%)
I	31	1,246	40	300	24.1
II	27	782	29	238	30.0
III	15	182	12	96	52.7
IV	19	349	18	148	42.4
V	26	856	33	210	24.5
VI	20	622	31	149	24.0
Total	138	4,037	29	1,141	28.3

Source: Adapted from Iida *et al.* (1989).

Farmers who received small numbers of seedlings restricted planting areas around their houses for shade and ornamental purposes while the farmers who received large numbers, extended tree-growing onto their farms and grazing lands. For the trees planted around houses, farmers can provide extra care, by giving them waste water or chasing away livestock. However, when a large number of trees are planted, such intensive care cannot be expected. It is also likely that farmers who got a large number of seedlings used improper planting method Since the labour and time required for planting trees compete with that for ploughing fields and sowing, the number of seedlings which can be planted by a household becomes smaller if a proper planting method is used.

The reasons for the mortality of the seedlings planted by farmers were almost always termite attack, drought or livestock damage. Table 5-5 shows the results of a series of surveys conducted in Kwavonza. Since these surveys had respective objectives, all questions were not asked every time. Termite attack has been especially serious and more than 80 per cent of people have experienced this problem every year since the supply of seedlings began. Cheboiwo and Iida (1991) also pointed out that damage caused by termites and livestock could be more serious in drought years, since there may be fewer alternative food sources. Termites and livestock also damage the seedlings in the nurseries. In 1988, 15 out of 22 group nurseries experienced termite attack and goats invaded 13 nurseries (Ongw'eya and Edazawa, 1990). As a consequence, the farmers of Kwavonza have become aware which species are vulnerable to termites or preferred by

goats. Farmers now request or raise seedlings of species which are termite resistant, drought tolerant and disliked by goats (such as *Cassia siamea*).

Table 5-5: Causes for Damage on Trees planted by Farmers.

Year of survey	Causes of seedling mortality		
	Termites	Drought	Livestock
1988[a]	88.0 %	68.7 %	16.0 %
1989[b]	83.3 %	n/a	52.8 %
1990[c]	92 %	75 %	n/a
1991[d]	n/a	n/a	78.4 %

Source: [a] Iida *et al.*, 1988; [b] Ongw'eya and Edazawa, 1990; [c] Edazawa, 1990; and [d] Cheboiwo and Iida, 1991.

The high population density of termites, frequent drought and the large number of livestock are problems. However, these problems can be overcome technically. Nevertheless, farmers cannot cope with these problems. Only a few farmers can afford chemicals to control termites. Fencing around trees is laborious and watching and chasing out goats is time consuming. Farmers know that watering enhances the survival rate and the growth of trees. One farmer even invented a bottle-watering method. However, this is not practical when the number of trees increases. It is impossible to bring a large quantity of water and used bottles are not free in Kenya. Therefore, the real problem lies in the fact that the resources (both cash and labour), which individual farmers can allocate to tree-growing, are very limited.

5.1.5 Inequality in Kwavonza

A common mistake of social forestry programs is the assumption that the target group is homogeneous. Real communities are far from being homogeneous; they are divided by economic class, caste, religion, ethnicity, gender, geographical origin and length of settlement (Fortmann and Bruce, 1988). This diversity often complicates the equitable distribution of rights on lands, forests and trees, as described in the previous chapter.

Kamba society, in general, is traditionally more homogeneous and democratic than other African societies. Kamba people did not develop any caste or hierarchical structure (apart from age classes) in their society (Hill, 1991). They

did not have any inheritable leadership. The women of Kwavonza often do not have *de jure* land title, though they are *de facto* resource managers and decision makers. In Kwavonza there are virtually no politically or economically powerful individuals who may affect other persons' interests.

Inequalities found in Kwavonza are the problems of uneven resource distribution and job opportunities. Large scale farmers have self-sufficiency in wood supply, at least for the current generation. Salary earners have higher chance to cope with crop failure or firewood shortage by intensifying farming practices or purchasing alternative fuels and building materials.

Small-scale farmers with a little or no grazing land have physically no chance to become self-sufficiency in the supply of tree resources. In Kwavonza, about 30 per cent of households have less than 4 ha of land (see Table 2-7). The average size of privately owned grazing land in this group is 0.9 ha, which is smaller than the minimum size required for self-sufficient firewood production discussed before. Consequently, these farmers heavily rely on Council lands or, in some cases, neighbours' lands.

Poor farmers[13] without a reliable non-farm income source often depend on livestock or charcoal making to cope with crop failure in the years of drought. Diminished common grazing land resulting from land privatisation and nationalisation, affects poor farmers most. They cannot obtain enough fodder or trees from their own lands and they rely heavily on Council lands.

5.2 Communal resource management

The degradation of natural resources is not the fault of the property regime, but rather of the breakdown in the incentive mechanism necessary for the concept of property to have any meaning (Bromley, 1989). It has been suggested

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[13] 'Small-scale farmers' and 'poor farmers' are not synonyms. Small-scale farmers have physically small lands but may have some off-farm income sources. Poor farmers may have a large tract of land but with no job opportunity and a large family to feed.

(Cossins, 1986; Bromley and Cernea, 1989) that the 'tragedy of the commons' is, in reality, the tragedy of non-property (open access) situations. If there is any profit at all to be made, an open access situation is still likely to attract new entrants despite a terrible decline in the productivity of the resource (Crutchfield and Pontecorvo as cited in McCay and Acheson, 1987). People are unlikely to restrain their behaviour if they are the beneficiaries of their actions and any costs are passed on to society (McCay and Acheson, 1987). There is general agreement that this type of situation needs to be avoided (Birgegård, 1993). A requisite for any successful development assistance effort is that the property regime be converted away from open access (Bromley and Cernea, 1989).

Many development theorists argue that converting open access to common property is superior to conversion to private property systems (Cernea, 1989). Using a simple dynamic model of the farm household, Larson and Bromley (1990) showed that adopting a common property system does not necessarily lead to greater degradation than under private property system. When farmers are producing primarily for subsistence, and the rural political economy is relatively decentralised, common fuelwood collection is an obvious option, and common property regulation is likely to be the most effective response to scarcity (McGranahan, 1991). Poverty, natural resource dependency and resulting uncertainties create an incentive structure that may make common property a comparatively rational solution to certain problems of resource management (Runge, 1986). Since common-property systems provide, in effect, long-term and 'grass roots' institutions, these systems are the most important candidates for popular participation in development decision-making (Berkes and Farvar, 1989).

Fortmann and Bruce (1988) discussed a number of advantages of direct control of forests by a community:

(a) The resource can be managed as a whole, eliminating the unanticipated cumulative effects of myriad individual management strategies;

(b) Use can be spread over a wide area rather than be concentrated in a single spot;

(c) Forest products can be distributed more equitably across the community; and

(d) The community can use the forest as an asset to meet community needs.

To achieve this, management responsibility must be devolved from the government to the users of the resource (Birgegård, 1993). Common-property regimes are said to ensure that the resources on which all persons collectively depend will be available sustainably. The same assurances could not be provided by the adoption of private or state-property rights since the consequences for productivity, sustainability and equity would be different. For people in the developing world who are directly dependent on the availability of renewable resources, common-property regimes can provide equitable and sustainable access to the resources with minimal cost (Gibbs and Bromley, 1989).

Collective forest tenure refers to arrangements under which certain groups hold specific rights to forest lands, trees and their products. Even if land is privately or state owned, the responsibility to manage the forest may be vested in a local group. Thus collective forest management may be based on common property or vested in common institutions (Mol and Wiersum, 1993).

5.2.1 Social units for resource management

It is important to identify which social units and definable groups can sustain social structures for long-term production activities (Cernea, 1985). In order to act as a group, the people concerned need to be a social group, not a simple set of unlinked individuals (Cernea, 1989). Cernea (1989) identified three possible units of social organisation able to carry out tree-growing programs:

(a) Natural social units such as the individual family household or a tightly knit kinship group;

(b) Groups organised purposely to plant, protect and cultivate trees; and

(c) Groups established for purposes other than forestry, but which are able to undertake forestry related activities as well.

As Cernea (1985) pointed out, the identification of the social unit likely to undertake the program (and able to do so successfully) is perhaps the most important factor in designing the social strategy of forestry programs. Even if a drought results in the death of planted trees, the local organisation survives to plant another day: institutional arrangements survive to ensure that enthusiasm for planting will not be dissipated by the same forces that led to the original resource degradation (Bromley and Cernea, 1989).

Sustainable use of common-property resources is possible, but requires special conditions (Gadgil and Iyer, 1989). An important prerequisite for group management is a set of institutional arrangements which enable a specific group of people to control resource maintenance and exploitation (Mol and Wiersum, 1993). Such social units of organisation can be either natural (existing) social groups or deliberately created groups (Cernea, 1985).

The logical approach for development planners is to deal intelligently with existing community structures, including those for handling production and resource-management issues (Berkes and Farvar, 1989). Cooperative work groups were found in many small-scale societies where certain tasks, particularly in agriculture, can most conveniently be done by larger groups than one household could muster (Riley and Brokensha, 1988).

However, the combination of population growth, technological change, climate and political force has destabilised many existing property institutions (Runge, 1986). Traditional collective working groups have diminished in both Mbeere society (Riley and Brokensha, 1988) and Kamba society (Hill, 1991). Instead, farmers' groups called *mwethya* groups, which can be considered as the modern version of traditional labour-exchange or self-help groups of the same name, have emerged in Kamba society (Hill, 1991). Riley and Brokensha (1988) also reported a similar proliferation of women's working groups in Mbeere society. In Kenya women's groups are generally widespread and effective (Cernea, 1989). The Government and NGOs such as the Green Belt Movement

are assisting women's groups, especially in establishing their own nurseries (Maathai, 1985).

Bromley and Cernea (1989), and Cernea (1989) pointed out that some units of social organisation, such as communities and villages, are geographical residential units, which are usually heterogeneous population clusters, stratified and split into subgroups of different power and with fragmented socio-economic interests. These units are not necessarily capable of undertaking collective or coordinated action. Fortmann and Bruce (1988) stressed that the diversity in communities, combined with multiple and sometimes mutually exclusive uses, complicates the equitable distribution or rights of access. In India, for example, *panchayat*-based management groups have had difficulties reaching a consensus regarding the management of community forest resources due to their inherent political nature and often diverse constituencies (Poffenberger and Singh, 1993).

Common property arrangements extant under former social and economic conditions may not have the ability to manage successfully resources under contemporary circumstances (Lawry, 1990). Group formation is an acute need particularly in development programs that involve natural resources under a common property regime, or group management under a state property regime (Cernea, 1989). User groups for particular natural resource assets are more likely to be aggregated upwards from the household, rather than from a sub-section of a larger collectivity, because the kinship system no longer has political meaning (Shepherd, 1993). Chaiken (1990) reported that, in Luo society, women's groups based on kinship became inactive, since kinship was not an incentive to cooperate.

Creating social units and organising them is a task that requires both the correct social understanding of what is to be done, and the appropriate methods for social organisation (Cernea, 1985). It is essential to analyse the property rights institutions, and their social meanings, in the context of local social organisation (West, 1978). The need to establish social units introduces a clear sociological

dimension in forestry development projects and in the work of forestry departments (Cernea, 1985).

5.2.2 Existing social units in Kwavonza

In Kwavonza, existing social units include 'village' (Location as a whole); farmers' groups; churches and schools. Churches and schools are effective as the centres of education, extension and possibly for the supply of seedlings. However, these institutions are usually not capable of a long-term resource management.

A village is a unit of social organisation. In some parts of Asia village is a basic unit of rural life mobilising collective action and maintaining social-overhead capital (Hayami as cited in Wade, 1988). In the Community Forestry Development Program of Nepal, the village (*panchayat*) was used as the unit responsible for the management of forests. However, that is not synonymous with saying that a village is a unit capable of undertaking collective or coordinated action (Cernea, 1989). As discussed previously, a village may be segmented in economic, ethnic and other various classes. In the case of the Lamjung District, Nepal, there are distinctive ethnic groups in a village. Each group forms an independent community using specific forests (Noda, 1985). The village as a whole, therefore, is not automatically a unit suitable for the management of a particular forest.

In Kwavonza, people are relatively homogeneous. Nevertheless the village is still not a suitable unit for resource management. A Location is an administrative unit demarcated by government rather than a social unit naturally formed. The Location Chief is a government officer assigned by the District Commissioner, not a leader democratically elected by farmers. There is no such 'village' representing all farmers in Kwavonza (and probably anywhere else in Kenya). As in the case of India (Wade, 1988), a territorially defined unit is not automatically a focus for the identity and needs of the farmers of Kwavonza.

5.2.3 Farmers' groups in Kwavonza

In Kwavonza farmers' groups are the only social unit (except families) used for resource management. Some groups were formed as early as the establishment of Kwavonza Location. In 1990 there were 63 farmers' groups in Kwavonza, of which 46 groups were officially registered. Many groups participate to the programs organised by the Kenya/Japan Social Forestry Training Project. This section introduces the farmers' groups of Kwavonza and discusses their suitability as resource managers.

Nature of farmers' groups

Kamba people traditionally have an experience of collective action. According to Tiffen *et al.* (1994), there were three types of traditional groups before the emergence of modern groups.

(a) *Mwilaso*

Mwilaso was a small group of friends or neighbours who worked on each other's farms on a strictly rotational basis.

(b) *Mwethya*

Mwethya was called by an individual who needed assistance with a definite, short-term task. It was not rotational, but people who participated in a *mwethya* could expect help from others when they need it.

(c) *Vuli*

If the task was too large, several mwethya groups were called to join in a *vuli*. The caller would slaughter a bull and brew beer. This group was used by comparatively rich persons for projects such as building a house.

In Kamba society, current farmers' groups are also called *mwethya* groups. These farmers' groups can be considered as the modern version of traditional labour-exchange or self-help groups of the same name based on kinship (Hill, 1991). The modern type of groups evolved in the late 1960s. Their

distinguishing characteristics from older versions are long-term objectives, elected executive members, legal recognition and registration with the Ministry of Social Services (Tiffen *et al.*, 1994).

In the early 1970s, Hill (1991) found that there were two types of *mwethya* groups in the Kamba society of the Kitui District. He named these groups 'workgroup *mwethya*' and 'self-help *mwethya*.' Contemporary farmers' groups in Kwavonza seem to have similar characteristics to both types in the 1970s. In addition, farmers' groups these days carry out some enterprises using collective actions. This is probably the projection of the increasing relative importance of non-farm income in farmers' household economy. Therefore, there are three types of group activities currently conducted.

(a) Workgroup *mwethya* (reciprocal labour exchange)

Workgroup *mwethya* is a reciprocal labour exchange between neighbourhood members. All individuals are expected to carry out the same amount of work or pay an equivalent amount of money. The most direct aspect of the transaction is the work done by one person for another. Examples of workgroup *mwethya* are the cultivation and terracing of members' farms. Return from the labour exchange is immediate and tangible.

(b) Self-help *mwethya* (equal contribution to the community)

Self-help *mwethya* also expects a similar labour (or monetary) contribution from all the members. However, groups are often larger (often the whole community) and the transaction takes the form of the individual fulfilling a general obligation to the community. Examples of the self-help *mwethya* are the maintenance of earth dams and the construction of primary schools. Although there may be no immediate return, these works will certainly benefit the communities and therefore all the participants. Benefit from this type of activity is also predictable.

Most groups carry out public works (see Table 5-8). These activities are also called *harambee* in Kenya. The difference between self-help *mwethya* and *harambee* is sometimes obscure. However, in the case of *harambee*, the government or local authority often plans the project (Thomas, 1987) and expects the labour contribution from groups. In other words, *harambee* is carried out by request while self-help *mwethya* is spontaneous. In addition, *harambee* itself does not mean an equal contribution of labour. In richer communities, the contribution of a household is determined by the wealthiness of the household (Thomas, 1987) and paid in cash. In poorer communities like Kwavonza, a flat rate is usually applied and the contribution often takes the form of labour.

(c) Group enterprises

Most of the groups carry out various enterprises for revenue. For each individual, the share of revenue may take the form of cash, or commodities such as kitchen wear and clothes. The commonly practised enterprises are basket making, beekeeping, rearing improved goats and brick making. Every group member is expected to invest the same amount of money or labour. Usually the benefit is expected in the short-term to avoid risk and, probably, due to the turnover of memberships. These enterprises allow farmers to diversify their sources of income, which is often difficult, if not impossible, for individual households.

Membership

Farmers' groups in Kwavonza are often called women's groups. Although women play a major role in group activities, there are many male members and few groups consist solely on men. The Government of Kenya officially promoted women's group activities in 1985 (the International Year of Women), even though many ethnic groups in Kenya have a long tradition of group work. Men have been discouraged in government programs to avoid the groups becoming political. However, at the local level, men have also been involved in group activities. In 1987, at least 580 women and 191 men were involved in Kwavonza (Table 5-6).

This is about 20 per cent of the total population, 45 per cent of adults aged 20 and over, and includes 70 per cent of the women.

Table 5-6: Membership and Gender Composition of Farmers' Groups.

Item	Number of members		
	Men	Women	Total
Total	191	580	771
Average	4.2	12.9	17.1
Ratio	25 %	75 %	100 %

Source: Adapted from Iida *et al.* (1989) and modified.

There are usually two categories of members, namely working members (80 per cent) and non-working members (20 per cent). Men were often non-working members. Non-working members usually have to pay a higher registration fee, annual fee and group hiring price than working members. In return, non-working members usually have no obligation to work. Farmers are usually not allowed to become members of two or more groups at the same time. However, several households have family members who belong to different groups enabling them to access more resources.

Most groups consist of neighbours. Since the groups carry out collaborative works, the proximity to each member seems essential. A few groups consist of mainly kinship members but these members are also neighbours. Hill (1991) reported that in Nzambani Location, about 40 km to the east of Kwavonza, there were more kinship groups. This is probably due to the different history of Nzambani and Kwavonza. Nzambani was formed by the slow expansion of a population that originally lived there while people of various backgrounds rushed into Kwavonza in the 1960s when the government allowed settlement.

Joining a group is usually open to anyone. However, many groups charge a non-refundable registration fee. The registration fee varies from KShs. 5 to 200 depending on groups. An average, a working member pays KShs. 30 and a non-working member pays KShs. 70. Leaving a group is relatively easy. It only needs the approval of the group committee but a share of the common assets

cannot be claimed. The numbers of members of a few groups have fluctuated while others have remained stable (see Table 6-3).

Group activities

Table 5-7 shows the results of interviews of 45 registered groups in 1987. Some objectives such as 'soil conservation' were often listed to register groups or obtain official support from the government and do not necessarily indicate the activities being carried out. Soil conservation, which was mentioned by all groups, received support from the Ministry of Agriculture. Soil conservation was one of the major tasks imposed by the colonial government to so-called 'communal labour' (compulsory labour) and also later adopted by the *Harambee*[14] Movement of the independent government (Hill, 1991).

Table 5-7: Objectives of the Establishment of Groups.

Objectives of establishment	No. of groups mentioned	Ratio (%)
Soil conservation	45	100
Goat keeping	32	71.1
Manuring	28	62.2
Basket making	23	51.1
Bee-keeping	15	33.3
Poultry	9	20.0

Source: Adapted from Iida *et al.* (1989) and modified.

Table 5-8, based on interviews of 26 farmers' groups in 1989, shows the objectives being pursued. Public works include self-help *mwethya* programs such as school construction and the maintenance of earth dams. In 1989 rather vague 'soil conservation,' which was predominant in 1988, disappeared and more specific 'terrace cutting' was, instead, highly ranked. However, the groups in Table 5-8 are the participating groups in the Kenya/Japan Social Forestry Training Project programs (plantation and/or nursery). The data may not accurately reflect average data for all groups in the area as the participating groups possibly are more active than other groups.

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[14] *Harambee* means "let's pull together" in Swahili language (Thomas, 1987).

Table 5-8: Group Activities in 1989.

Group Activities	No. of groups practising	Ratio (%)
Public works	24	92.3
Terrace cutting	23	88.5
Cultivation	17	65.4
Goat keeping	16	61.5
Firewood collection	10	38.5
Bee-keeping	10	38.5
Brick making	7	26.9
Fencing	7	26.9
House construction	6	23.1
Basket making	6	23.1
Harvesting	6	23.1
Grass cutting	5	19.2
Poultry	5	19.2
Water fetching	4	15.4
Manuring	3	11.5

Source: Adapted from Iida (1989).

Other activities involve making money. Groups invest in a new breed of goats, chickens, or a new type of beehive for commercial production. These activities need amounts of money unavailable to individual farmers. If a surplus is made through these activities, groups distribute benefits to the members often in the form of commodities such as clothes and kitchen wares. Buying in bulk allows groups to buy these commodities at less than the market price.

Table 5-9 shows the income and expenditure of groups participating in the Kenya/Japan Social Forestry Training Project programs. The year 1989 was an exceptionally good year for crop production, and many groups invested a large amount of money in purchasing goats, chickens and beehives. These expenditures were often met by collecting an ad hoc fee (a 'donation') from each member.

The largest source of income was basket making (contributing more than 50 per cent of total income). The price of a basket is KShs. 30 and the materials (sisal fibres) cost about KShs. 3. Women in Kwavonza, and elsewhere in the Kitui District, weave baskets whenever they find time. It takes 10 days on average to complete a basket.

Table 5-9: Group Income and Expenditure, Sep. 1988 - Aug. 1989.

Group	Members' fees (KShs.)	Group enterprises (KShs.)		Balance (KShs.)
		Income	Expenditure	
Ikinya cut off	1,000	1,000	25	1,975
Kavingo	1,150	1,910	0	3,060
Manyanzaani	0	0	0	0
Muli	3,460	3,830	400	6,890
Isaalala	2,200	0	855	1,345
Mukilye I	1,160	0	780	380
Kamanzee	2,660	2,800	3,840	1,620
Kiima Kimwe	300	2,520	0	2,820
Kaumoni	1,300	9,480	6,790	3,970
Top	990	200	1,400	-210
Mukilye V	0	2,040	350	1,690
Kasau Kakya	14,480	22,100	3,252	33,328
Ikungu	25	612	1,290	-653
Ityoa Ngingo	500	3,440	300	3,640
Maithya	1,820	285	280	1,825
Masola	25	2,485	870	1,640
Kavongoloka	100	400	0	500
Mwende	0	7,145	60	7,085
Kyanduu	2,500	5,400	10,475	-2,575
Mutile	200	15	90	125
Wiwano wa Mikuyuni	0	2,600	940	1,660
Kuweta	0	775	75	700
Kyeni	2,200	2,300	1,200	3,300
Matyuva	300	1,550	250	1,600
Mutethya	180	2,140	450	1,870
Vinya wa Masaani	2,790	980	600	3,170
Total	39,340	75,987	34,572	80,755
Average (group)	1,513	2,923	1,330	3,106
Average (member)	87	169	77	179

Source: Adapted from Iida (1989).

Rules and decision making

Some collaborative works, such as cultivation and terracing, involve actually the exchange of labour. Every member can hire the whole group, to which he/she belongs, free or for a nominal fee. At the same time, he/she has an obligation to work on other members' lands for the same hours. In a case where fees are charged, they become the income of the group. If additional labour is needed, he/she can hire the group by paying a fee lower than that in the labour market.

To assure an equal contribution, a fine is charged if a member does not attend the obligatory works. Group rules sometimes supported by fines, usually discourage members hiring workers other than their own group members. In the

case of the Masola group, if a member worked for a non-member, KShs. 100 is charged. Table 5-10 shows the rules of 20 groups participated in the program organised by the Kenya/Japan Social Forestry Training Project in 1989. All groups have clearly written rules on working hours, fines and fees.

Table 5-10: Group Rules on Working Hours, Fines and Hiring Fees.

Group	Working hours			Fine (KShs.)		Group hiring fee (KShs.)	
	Begin (o'clock)	End (o'clock)	Total (hours)	Absentee	Late coming	Labour exchange	Additional
Ithyoangingo	9:00	13:00	4	10	1	-	50
Masola	9:00	13:00	4	5	0.5	-	30
Ikungu	14:00	17:00	3	5	-	-	30
Top	9:00	13:00	4	5	1	-	20
Wiwano wa Mikuyuni	9:00	13:00	4	10	1	5	15
Wendo Wawo	9:00	13:00	4	5	1	5	15
Isaalala	8:00	13:00	5	15	2	10	-
Kaumoni	9:00	13:00	4	10	1	20	50
Kavongoloka	8:00	16:00	8	10	1	10	100
Maithya	9:00	13:00	4	10	1	30	50
Kiima Kimwe	8:00	13:00	5	10	2	10	50
Kavingo	8:00	17:00	9	15	2	-	50
Kyeni	8:00	13:00	5	5	1	20	30
Mathuva	9:00	13:00	4	5	1	20	30
Kuweta na Kwika	8:00	13:00	5	5	2	20	20
Vinya wa Masaani	8:00	13:00	5	10	-	10	20
Mutile	9:00	13:00	4	10	2	5	25
Mukilye I	9:00	13:00	4	5	1	-	-
Kamanze	9:00	13:00	4	10	5	5	50
Mukilye V	9:00	13:00	4	5	2	5	50

Source: Adapted from Iida (1989) and modified.

The fine shown in Table 5-10 reflects the value of group labour. When a member is absent from a group work for a whole day, fine is KShs. 5 to 15. If non-members hire a group, they pay KShs. 100-200. Assuming the average number of working members per group is 15, the labour charge per person is about KShs. 10 a day. Considering that most groups work for only four hours a day, KShs. 10 is equivalent to the minimum wage of around KShs. 20 a day (eight working hours), set by the government.

All groups have committees for decision making, and general meetings are called once or twice a year, though some groups meet monthly. Group executives

(i.e., chairperson, secretary and treasurer) and committee members are elected by democratic voting, though they rarely change.

CHAPTER 6

MANAGEMENT BY FARMERS' GROUPS

This chapter examines the farmers' groups of Kwavonza. Communal management by farmers' groups will be examined using findings obtained from tree-growing programs in which farmers' groups have been involved.

6.1 Communal management by farmers' groups

Establishing local-level common property arrangements may be difficult. The changing nature of village economies and social relations, coupled with growing pressures on local resources, may limit the scope for local action (Lawry, 1990). Although farmers' groups are active in Kwavonza, they are not automatically competent as managers of common natural resources.

6.1.1 Difficulties of group management

Complexity

Social forestry modelled on group management has to address complexities resulting from the actions of the group, rather than a family/household from an individual farm. These complexities include issues such as the joint dependence on a piece of land and group tenure over trees; group management including labour allocation and monitoring; and, probably the most sensitive, the distribution of benefits. Organising groups requires designing clear social arrangements for tenure, management and distribution (Cernea, 1989).

In Kwavonza, farmers' groups currently manage various resources and carry out various enterprises. The complexities have been overcome by introducing a set of rules clearly defining the responsibilities and rights of group members as discussed later.

Incentive to individuals

A common is administered by a community, but its continued existence ultimately depends upon whether the members of the community consider that its benefits to them outweigh its costs (Bruce, 1989). Social forestry programs sometimes aim at the fulfilment of community needs by the participation of the whole community. However, every individual farmer has his or her particular interests and ideas (Carter and Gronow, 1993). Individuals will normally choose between participation in group action or private action based on their perception of which activity brings them the most benefit or profit (Mol and Wiersum, 1993).

This is particularly true in the case of farmers' groups in Kwavonza. Groups are usually formed by people who have a common interest in a particular task such as terrace cutting. Each farmer retains freedom to join in or quit from a group. If the tree-growing program is not attractive, people simply do not join.

In the case of the People's Plantation Program, the sizes of the participant groups of the program have increased slightly in recent time, despite the high labour demand and the poor survival rate of the trees planted. According to some participants, however, these new members were attracted by a set of farming tools distributed by the Project to every participant. This is the problem of program design and implementation rather than the farmers' perceptions and will be discussed in a later section.

6.1.2 Preferable characteristics and conditions

Tradition of collective action

For communal tree solutions to be feasible, there needs to be: a tradition of communal action (Noronha as cited in Arnold, 1984); the presence of traditional or indigenous communal land based on group control (Noronha as cited in Arnold, 1984; National Academy of Sciences as cited in Bromley and Cernea, 1989; Lawry, 1990) rather than on hierarchical control (Mol and Wiersum, 1993); and prior experience with organisations for solving problems

(National Academy of Sciences as cited in Bromley and Cernea, 1989). In heterogeneous societies, the costs of identifying mutual gains (search costs) and negotiating an agreement on one of them (bargaining costs) are as costly as the costs of monitoring and enforcing the agreement (Singleton and Taylor, 1992). The tradition of communal management allows cooperative behaviour with relatively low real expenditures on enforcement and can be thought of as invested capital associated with the existing institutional arrangements (Field, 1984).

Kamba people have a long history of collective management. Before nationalisation and privatisation, grazing land belonged to the whole community without a hierarchical structure. When an investment was needed to other forms of resources such as infrastructure, every household was required to contribute equally (Hill, 1991). This feature was inherited by current farmers' groups.

Clearly defined membership

The essence of control over resources is that there exist socially recognised and sanctioned rules and conventions that make it clear who is the owner of the resource in question (Bromley, 1989) and on what basis the rights will apply (Gibbs and Bromley, 1989). There must be a clear definition of the membership of the group having rights to the resource (Gibbs and Bromley, 1989; Mol and Wiersum, 1993; Birgegård, 1993) which is very specific (Chowdhry, 1984) and inclusive of its transference to a new generation (Gibbs and Bromley, 1989; Mol and Wiersum, 1993).

The farmers' groups of Kwavonza have very clearly defined membership. There are rules defining how to get and quit membership. Although the membership is not inheritable, the next generation can readily get membership since these groups are based on neighbourhoods.

Members' sole rights on resource

Authority and benefits must be restricted to the members of the group, not left open to free riders (Cernea, 1989). Trees going to urban-based timber traders or

charcoal makers exemplify how external intrusion can destroy any attempt to manage forest resources on a communal basis (Birgegård, 1993). In Samburu society, permits to cut charcoal given by the local elders and the Chief's office are only allocated to the poor local Samburu. Non-local charcoal burners are discouraged by refusing them permits (Perlov, 1984).

The creation of exclusive rights for one group means the exclusion of other groups. The creation of selective closed access is accompanied by injustices to the people who are excluded (Grima and Berkes, 1989). Therefore, the abilities of the group to exclude non-members (Fortmann and Bruce, 1988; Birgegård, 1993) and resolve conflicts are particularly important (Birgegård, 1993).

Conflicts between group members and non-members have so far not been reported in Kwavonza. Generally villagers respect the rights of groups since most households have family members who belong to groups. However, if forest resource becomes much scarcer and if the available lands are allocated solely to some groups, there will be a danger of conflicts.

Authority to make decisions

An important issue concerns the control of local users by the government in exercising local initiatives regarding management (National Academy of Sciences as cited in Bromley and Cernea, 1989). This may require a decentralised approach to institution building based on the conventions of traditional culture (Runge, 1981). It seems fundamental that community-based organisations have the final authority over their own membership (Poffenberger and Singh, 1993), internal consensus on management policy (Lawry, 1990), and a clearly defined decision making mechanism with self-selected leaders (Mol and Wiersum, 1993). However, Gibbs and Bromley (1989) have stressed the need to clarify where control resides, for example, in a community board or in village elders.

In Kwavonza, all farmers' groups have mechanisms for decision making. Day-to-day issues are handled by elected group executives. Committee meetings are held periodically and more important issues are discussed in general meetings.

Rules

Although a common property regime will be efficient if disputes are minimal (or absent) (Gibbs and Bromley, 1989), there is a potential for conflict in any situation where a variety of people use land and trees in different ways (Rocheleau *et al.*, 1988). Population growth and technological change have increased pressures on natural resources to the extent that minimum common property rules do not provide effective regulation. (Lawry, 1990). To ensure both the immediate use and the long-term renewal and sustainability of a commonly owned natural resource, the owners must act in consensus, as a group in which all are subjected to the same rules (Cernea, 1989). Information, organised as a set of rules, reduces uncertainty (Runge, 1981).

In the traditional common property regime, rules for the use of collective goods develop in the face of uncertain or limited resource-availability (Gibbs and Bromley, 1989). To replace open access requires the establishment of a new set of rules, irrespective of which new regime is chosen (Bromley and Cernea, 1989).

The rules prescribe individual functions within the group eliminating the need for members to negotiate every new transaction with each other (Gibbs and Bromley, 1989). Equally important is the assurance as to how individual members will participate in management activities and benefits (Mol and Wiersum, 1993). Rules must be clearly formulated (Mol and Wiersum, 1993), made known to all pertinent individuals (Bromley and Cernea, 1989), be understood by the participants (Ostrom, 1990) and predictable in their effects (Mol and Wiersum, 1993). The management of common property resources cannot work if there is no agreement on the rules of management (Fortmann and Bruce, 1988).

Groups seem to survive if they have clear-cut rules that are enforced by both users and officials (Bruce and Fortmann as cited in Fortmann and Bruce, 1988).

However, Runge (1981) points out that co-operative institutional rules are endogenous adaptive responses to the problem of uncertainty about the expected actions of others, and enforcement from outside is a second-order solution when these co-operative strategies are insufficient.

There are two major issues for which rules should be established and enforced:

(a) Rules on harvesting

To manage the scarce resource sustainably, there must be rules for the exploitation and distribution of forest products (Cernea, 1989) regulating the behaviour of group members (Mol and Wiersum, 1993). There are social sanctions against excessive individual gain from a communal resource and against the accumulation of surplus (Berkes and Farvar, 1989).

(b) Members' contribution or taxation

Some resources need additional inputs, such as tree-growing, to be sustainable. This involves reinvestment of part of the benefits from communal forest management (Mol and Wiersum, 1993), a simple rule for member contributions (Cernea, 1989) or the taxation of group members as a means to raise funds needed for payment of required management and maintenance (Thomson as cited in Fortmann and Bruce, 1988; Mol and Wiersum, 1993).

Where interests are heterogeneous and views toward appropriate resource use vary, strong support for enforcement of rules will not emerge. Reliance upon existing structures of elite authority, such as Chiefs, may be appropriate in some situations (Lawry, 1990). However, the involvement of the government may jeopardise the autonomy of participants.

As discussed, farmers' groups in Kwavonza have a set of rules. It is also observed that these groups make new rules when a new activity is introduced. For example, the participant groups of the small-scale nursery program established rules defining the working hours, contribution of each member and

distribution of seedlings. According to the rules, members who did not work in the nurseries cannot get any seedlings unless they pay.

There also must be clearly defined rules for the relation between various participating units such as groups and government organisations (Mol and Wiersum, 1993). In the case of Kwavonza, the rights and responsibilities of the government (the Kenya/Japan Social Forestry Training Project or Kenya Forestry Research Institute) and participant groups are defined in a written contract (see Appendix) and necessary amendment is made in the form of written agreement.

Rule enforcement and dispute settlement

Democratically constituted user groups must rely on the sanction of their membership to enforce rules (Lawry, 1990). These rules originate within the group, are mutually accepted by the group, and contain their own means for resolving conflicts (Gibbs and Bromley, 1989). Credible common property rules will emerge from social and economic relationships which can sustain rule-making and rule-enforcing institutions (Lawry, 1990). Effective sanctions for non-compliance are necessary as well as the participants' willingness to adhere to management rules (Fortmann and Bruce, 1988). Management patterns and social authority systems must be established to ensure rules are followed (Bromley and Cernea, 1989). It is also important to clarify what constitutes agreement - unanimity, consensus or majority (Gibbs and Bromley, 1989).

Collective action will be a greater possibility when a local community has the capability to both make rules and enforce them (Thomson as cited in Fortmann and Bruce, 1988). For a large group, relatively strong and generally accepted community institutions for decision making and rule enforcement are necessary (Mol and Wiersum, 1993).

The community organisation should have the power to enforce tenure rules within the community (National Academy of Science as cited in Bromley and Cernea, 1989; Gibbs and Bromley, 1989; Birgegård, 1993), to resolve conflicts among members of the community (Gibbs and Bromley, 1989; Birgegård, 1993),

and to ensure exclusion of non-members from using the resource (National Academy of Science as cited in Bromley and Cernea, 1989; Birgegård, 1993). This power includes the imposition of necessary sanctions (Fortmann and Bruce, 1988; Gibbs and Bromley, 1989). The sanctions incur costs to violators which exceed the benefit gained from breaking the code (Gibbs and Bromley, 1989). The absence of rules allows unchecked, contradictory, and counterproductive individual behaviour such as free riding, which will ultimately lead to the destruction of the natural resource (Cernea, 1989).

Chiefs are responsible for the use of state-owned lands in their Locations. In Kwavonza, in 1990, a group of outsiders was arrested by the Chief in Council land. They were cutting trees illegally and loading them on to their truck. A villager, collecting firewood in a nearby forest, was also arrested but released soon after. This incident shows the willingness of local authority to protect forests from exploitation by outsiders, though currently there is little effective control of exploitation by village members. Chiefs have authorities to arrest and sentence petty criminals. In addition to these legal authorities, they often act as a guardian of traditional rules (Hill, 1991). If the Chief of Kwavonza is properly informed and involved in the procedure, the rights of groups can be protected.

Legal structure

Related to community membership is the issue of what legal structure will be used to represent it (Seymour and Rutherford, 1993b). Plantilla (1993) questioned the legal personality of participant groups of a social forestry program in the Philippines, and this issue is particularly important when the lease of state-owned lands or forests are considered. In West Bengal, India, the legal personality of communities was assured by registering them with the District Forest Office (Roy, 1993). In the case of Sarawak, Malaysia, communal lands were registered as community holdings (Cramb and Wills, 1990).

When the Kenya/Japan Social Forestry Training Project launched the People's Plantation Program, in Kenya, there was no precedent for leasing state-owned

land to farmers' groups. The first step, therefore, was to clarify the legal status of the groups. The Attorney General's office eventually decided that farmers' groups were legally eligible for such a contract. Although this program has, at best, achieved very limited success, the recognition of the legal status of farmers' groups by the government was notable.

Group size

It is generally agreed (Runge, 1981; Noronha as cited in Arnold, 1984; Hoskins, 1984; National Academy of Sciences as cited in Bromley and Cernea, 1989; Ostrom, 1987; Gadgil and Iyer, 1989; Cernea, 1989; Mol and Wiersum, 1993; Messerschmidt, 1993; Bardhan, 1993) that small user groups are more successful in common resource management. For example, experiences from both India and Nepal demonstrate that smaller community groups often comprised of 10 to 50 households were more effectively mobilised to establish management systems than whole villages (Poffenberger and Singh, 1993).

To succeed, projects need to be based on groups with shared economic objectives, and a measure of socio-cultural homogeneity (Noronha as cited in Arnold, 1984). If there are different ethnic groups within an area, the operating assumption must be that the tenure systems are different in important ways (Bruce, 1989). Members of a small group are more likely to be homogeneous in economic, political and social status and have common interests, objectives, and patterns of resource use (National Academy of Sciences as cited in Bromley and Cernea, 1989, Cernea, 1989; Poffenberger and Singh, 1993; Mol and Wiersum, 1993; Birgegård, 1993).

Widespread experience shows that larger community units such as villages are ineffective because they are not homogeneous communities (Cernea, 1989). A rare exception is the success of the village tree-growing program of the Republic of Korea in the 1970s. However it should be noted that the Korean villages are exceptionally homogeneous (Noronha, 1981). Disparities in wealth in Korean villages are relatively small and are not segmented by caste or tribal affiliations.

The advantage of a small group is not due to the 'size of the group' *per se*, but because the assurance of the actions of others is largely conveyed through transactions and communication (Runge, 1981). Members of a small group sometimes have an incentive to build reputations for behaving in certain ways (Seabright, 1993). A small group can enforce rules through peer pressure and mutual control, and this could prove more functional than a larger community (Cernea, 1989). Small size allows members to agree on the agenda of activities for both the short and the long-term (Mol and Wiersum, 1993).

In Kwavonza, the size of farmers' groups is relatively small. On average, each group had about 17 members in 1987 including non-working members (Table 5-6). In 1991, the participant groups of the People's Plantation Program had 12 to 24 members (Table 6-3). These groups were formed on the common interests of the members. Members of each group are homogeneous; they are the neighbours to each other, living in same social conditions, facing to same natural environment and having similar problems.

Equity among members

Another important characteristic of successful user groups of common property resources is the equity among members. Members should share a perception of fairness with respect to access to forest resources, inputs and harvests (Gadgil and Iyer, 1989; Gibbs and Bromley, 1989; Mol and Wiersum, 1993). Otherwise a common property resource may become the property of a privileged few (McCay and Acheson, 1987). Where an institution of inequitable distribution exists, collective projects are likely to be resisted by those who benefit least (Alexander, 1975).

As repeatedly stressed, Kamba society and farmers' groups are based on equity and reciprocity. All members are expected to contribute equally and, in return, get a equal benefit.

6.2 Management of Council lands by farmers' groups

As discussed, state-owned lands have often been turned into an open-access situation. Kwavonza is no exception. There are also significant land areas under state control for which the public sector may not have the investment resources required for tree-growing (Cernea, 1989). The establishment of groups as action units opens up opportunities to mobilise and put to use resources that would not be used otherwise. By leasing land to organised groups ready to invest their labour in planting and protecting trees, those lands are put to use without the risk of fragmentation or alienation and with lower transaction costs (Cernea, 1989).

Poffenberger and Singh (1993) reported some successful joint management schemes of state forests in India. In these cases, only the usufruct rights of state forests were given to communities. The government objective was to produce timber while the primary concern of the communities involved was access to non-timber products. In some states, the government and communities even agreed to share timber products.

The Kenya/Japan Social Forestry Training Project initiated the People's Plantation Program in 1988 (a pilot program started in 1987). In this program, interested farmers' groups were invited to plant trees on state-owned land (former Council land transferred to the Kenya Forestry Research Institute, counterpart organisation of the Project). Unlike the above cases in India, the primary concern of this program is the supply of wood either for self-consumption or as a cash crop. Neither the government nor the Project expects any economic return.

So far 18 farmers' groups have participated but their achievements have been significantly lower than expected. Table 6-1 shows the number of trees planted by groups. On average, a participant had planted only 14.5 trees in this program during the 1987-1991 period. This figure is significantly lower than the number they achieved on their own lands (compare to Table 5-1 and Table 5-4).

Table 6-1: Number of Trees planted by Groups.

Group	Area allocated (ha)	Number of trees planted in each year by groups						No. of trees planted by a member
		1987	1988	1989	1990	1991	Total	
Muli	3.67	400	180	350	387	511	1,828	29.0
Top	3.88	160	36	184	186	271	837	8.3
Ityoa Ngingo	3.30	-	52	88	318	198	656	11.7
Kavongoloka	3.65	-	48	36	370	199	653	14.2
Kiima Kimwe	4.46	-	65	171	194	259	689	9.2
Maithya	4.09	-	182	111	144	268	705	10.7
Masola	4.22	-	120	133	160	199	612	10.9
Mukilye I	4.29	-	259	89	87	352	787	21.9
Kaumoni	4.30	-	346	310	540	322	1,518	24.1
Mukilye V	4.32	-	217	273	322	347	1,159	19.0
Ikinya Cut-off	4.50	-	688	148	127	355	1,318	20.3
Mwende	4.59	-	352	115	204	253	924	12.7
Kasau Kakya	4.58	-	131	159	-	270	560	9.3
Manyanzaani	4.48	-	348	109	226	592	1,275	19.9
Kavingo	4.37	-	207	142	-	-	349	9.2
Isaalala	3.38	-	598	132	76	266	1,072	17.6
Ikungu	2.85	-	201	340	315	373	1,229	17.1
Kamanze	3.44	-	231	220	325	123	899	13.8
Total	70.37	560	4,261	3,110	3,981	5,158	17,070	14.5
Average	3.91	80	236.7	172.8	221.2	286.6	948.3	-

Source: Adapted from Ongw'eya and Ishibashi (1992).

This program has so far continued with considerable input from the Kenya/Japan Social Forestry Training Project but is far from being self-sufficient or sustainable. In the initial plan, more groups were to be invited over several years. However, due to the poor performance of the scheme, the Project decided not to expand this program and to concentrate on helping existing groups.

As Lawry (1990) says, local common property management will not emerge simply by giving greater official rein to local action. Policy initiatives will have little impact unless an important array of incentives supportive of common property management are operating at the local level. The People's Plantation Program shows both the possibility and limitation of communal forest management on the state-owned land of Kwavonza.

6.2.1 Outline of the People's Plantation Program

During the preliminary survey carried out in 1987, many groups in Kwavonza were interested in the tree-growing program. Eighteen groups were selected

because: (a) they were active and strongly interested in tree-growing; (b) they had a reasonable number of working members; (c) they lived within walking distance; and (d) they were not politically aligned.

Several meetings were held before signing of the contract. The representatives of groups demanded that the Kenya/Japan Social Forestry Training Project (a) pay wages in cash or provide an equivalent quantity of maize and (b) allow intercropping on leased land, indicating that group members did not think this program would be beneficial to them. Another possible reason for these demands was that farmers in Kwavonza had suffered from three consecutive drought years at this time. The Project ultimately offered (a) to allow groups to practice agroforestry on leased lands; (b) to provide necessary tools; and (c) to provide an improved firewood stove to every member that participated.

In addition, the Kenya/Japan Social Forestry Training Project provided transport to and from the site allocated to each group, helped repair and improve fences and introduced an award system (US$ 310 in 1990 and US$ 590 in 1991) dependent on the achievements for that year. The Project also approved the collection of firewood and grasses for fodder and thatching. The provision of transport seemed a good incentive. Agroforestry, on the other hand, had not been practised. It was a possibility that wild animals, such as monkeys and small antelopes, dwelling in the adjacent forest area would destroy the crops. Since the plantation site was distant from residential areas, crops were unprotected.

There were four major points in the contract (see Appendix) between groups and the Kenya Forestry Research Institute:

(a) The duration of the lease was initially for 10 years and was extendable;
(b) Groups should not carry out activities other than tree-growing on the leased lands;
(c) Trees grown by a group were to be the property of the group; and
(d) The Kenya Forestry Research Institute was to give technical guidance and other necessary assistance.

Although land was leased free of charge and the ownership of trees was legally assured, the annual target was set by the Kenya/Japan Social Forestry Training Project and all the works were carried out under the guidance of the Project. It is therefore hard to say that the land is under the full control of groups.

6.2.2 Possible reasons for poor performance

After realising the low performance of the program, the extension staff of the Kenya/Japan Social Forestry Training Project interviewed the chairpersons of all the 18 groups participating in 1988 with the followings results:

(a) The biggest problem was the distance to the plantation from residential areas (average 4 km);

(b) As shown in Table 6-2 the most important benefit from this program was the free issue of farming tools (cost about US$ 20 per set) followed by the acquiring of tree-growing techniques and free collection of firewood (but nobody mentioned the trees they would get in future!);

Table 6-2: 'Benefits' from the Peoples' Plantation Program.

Order	'Benefits' mentioned by farmers	Rating (%)
1	Provision of tools	100
2	Learning tree-growing techniques	78
3	Free collection of firewood	39
4	Free issue of seedlings	28
5	Enhancing cooperation within the group	11

Source: Adapted from Ongw'eya and Edazawa (1990).

(c) Two groups out of 18 employed paid workers for pitting last year (indicating the workload was too high);

(d) Twelve groups out of 18 said the number of participating members would increase in the 1989 operation because of the free tools given to each participant;

(e) The hardest work was clearing bush and pitting;

(f) Thirteen groups out of 18 said there were misunderstandings between groups and the Kenya/Japan Social Forestry Training Project in 1988 (many groups thought they had been hired and not invited);

(g) In 1988 there was a food shortage in the area due to drought and group members were concerned with searching for food (indicating the farmers' priority); and

(h) Requests from the groups were: transportation arrangements, the provision of improved stoves as promised, clearing of bush by the project-employed workers, replacement of old tools, provision of lunch, insecticide to control termites, provision of fruit trees, permission to cut trees for house construction, permission to collect grasses for thatching, training in the training centre operated by the Kenya/Japan Social Forestry Training Project, permission to intercrop, permission to construct a temporary shelter at the site and financial assistance to open a bank account respectively.

Nature of the resource

The existence of clear resource boundaries, small (manageable) resource size and scope, and accessible information about the condition of the resource are critical (National Academy of Sciences as cited in Bromley and Cernea, 1989; Birgegård, 1993). Manageable in size means that a resource should be small enough to easily detect use by outsiders, and to detect if members of the community break user rules (Birgegård, 1993).

In the People's Plantation Program, the average size of plantation areas allocated to a group was less than 4 ha (see Table 6-1). This figure is rather small compared to the average land size of 7.9 ha per household (Table 2-6). There has been so far no report on theft or other 'free-riding.' Therefore, the physical nature of the resource itself may not be a problem. However, this does not mean that farmers fully understood the nature of the resource. Before the program began, the groups and the Kenya/Japan Social Forestry Training Project staff were optimistic. Both parties did not realise the economic and ecological difficulties that would eventuate. These issues are covered in following sections.

Distance from resource

Evidence suggests that communal management is successful when the user population lives close to the resource (Ostrom, 1990; National Academy of Sciences as cited in Bromley and Cernea, 1989; Poffenberger and Singh, 1993). The proximity to resources is a necessary condition of monitoring (Fortmann and Bruce, 1988). The local managers of the commons could directly observe how the rules they were using affected the yield of the commons (Ostrom, 1987).

The participants of the People's Plantation Program complained that the plantation sites were far from their residences (some groups live more than 5 km from the plantation). However, this claim has different meaning from the argument made in the literature. The literature (e.g., Ostrom, 1990) suggests that the proximity is important for monitoring. In the case of Kwavonza, group members claimed that it is too far to come to work. Usually farmers come to plantation sites twice a week to carry out bush-clearing, weeding and other routine works. Around planting seasons, they come more often. A 5 km distance seems not very far since many farmers in Kwavonza walk longer every day to fetch water and graze their livestock. However, these daily activities provide tangible, short-term returns. In the case of the plantation, there is no such immediate benefits. Therefore, the problem of long distance is, in reality, a problem of incentives, or a question of investment and return.

Supply-demand conditions

The resource's relative scarcity vis-a-vis the demand placed on it will be critical, as will situations in which some users have a sufficiently large stake in the careful management of the resource (National Academy of Sciences as cited in Bromley and Cernea, 1989). In successful common property management, supply is moderately scarce compared to demand and is subject to multiple uses requiring management and coordination (Ostrom, 1990). Blomquist and Ostrom (1985) called this situation *a commons dilemma*. In this situation, joint users interfere each other's use. The private costs resulting from private behaviour are, without

collective actions, relatively high, and may exceed the costs of organisation (Wade, 1988).

In the case of the state-owned lands of Kwavonza, the commons dilemma does not exist. Although it has already turned into an open-access situation, there has been no reported competition between users. The peaceful enclosure of a large proportion of land allocated to the Kenya/Japan Social Forestry Project including the People's Plantation sites is testimony to this. In addition, many members of the participant groups are, in fact, not even daily users of the resource in question. As discussed some of them live more than 5 km from the plantation sites. They were invited to plant trees for the future, not for immediate needs. Many farmers expressed concerns about fuelwood scarcity, though they have so far managed to obtain fuelwood somehow.

Higher risks

Greater assurance on tenure and incentives is required for growing trees on communal lands. The use of communal lands is often the only way to replenish the wood requirement of the poor, small-scale farmers and landless people. Additionally, communal tree-growing usually involves more risk than private growing. For example, communal lands are more prone to theft and other hazards (Thomson as cited in Fortmann and Bruce, 1988).

The question of higher risks is important in the situation of Kwavonza. Although the tenure of trees is secured by a written contract, farmers cannot cut their trees unless the government consents (see article 2 in Appendix). Although the contract is extendable, the lease term is currently limited to 10 years. The 10-year term did not derive from any consideration of the appropriate rotation for trees but from the dictates of the government. As many strict conditions in the contract imply, the government does not fully trust farmers' groups.

Even if group tenure were assured, it does not mean that all participants can get benefits. Table 6-3 shows the change in the numbers of group members. All groups in the table are the participants of the People's Plantation Program.

Although some groups have been stable these years, many groups have changed in size almost every time surveyed. The participants who once quit from groups have no access to trees. Therefore, a long-term investment like tree-growing may be risky for individual members.

Table 6-3: Change in the Numbers of Group Members.

Group	Jan. 1988[a]	Sep. 1988[b]	Sep. 1989[c]	May 1990[d]	May 1991[e]
Ikinya Cut-off	20	21	22	20	20
Kavingo	15	19	19	19	19
Manyanzaani	18	19	21	19	19
Muli	22	21	22	21	24
Isaalala	13	19	19	22	22
Mukilya I	15	10	18	11	12
Kamanzee	15	15	18	18	21
Kiima Kimwe	10	21	10	22	22
Kaumoni	13	19	20	21	18
Top	21	19	21	22	23
Mukilya V	12	12	17	17	15
Kasau Kakya	18	18	18	21	21
Ikungu	-	18	18	18	18
Ityoa Ngingo	17	9	17	15	17
Maithya	15	20	18	20	18
Masola	17	18	12	19	24
Kavongoloka	10	9	10	10	15
Mwende	18	19	17	19	20
Average	15.8	17.0	17.6	18.6	19.6

Source: [a] Iida *et al.* (1989); [b] Edazawa (1990); [c] Iida (1989); [d] Ongw'eya and Edazawa (1990); and [e] Ongw'eya and Ishibashi (1992).

Costs and benefits

Trees-planting on communal lands and tree-planting on private properties may have different objectives. Trees grown for the farmers' basic needs are often found on communal lands and the use of these trees is usually free to members of the community. In contrast, trees for strictly commercial purposes are often restricted to private lands (Fortmann, 1985). Trees growing on communal lands often have low value in the household economy, which may discourage the investment to communal lands (Burley, 1982).

Although it is quite difficult to translate all the supplies and services offered by common property resources into income flows (Jodha, 1986), group members need to perceive a clear correlation between their contributions and the returns

they get, and with this awareness be prepared to act consensually (Cernea, 1989). The productivity of the common forests should be sufficiently high to allow for profitable returns to investment. There should be early and clearly visible benefits in the form of products to be used either in the household or an enterprise (Mol and Wiersum, 1993).

Economic incentives gained from common property resources are often insufficient to stimulate individuals to participate in or sanction local-level resource management. The net returns to collective action will, for many individual users, be marginal or even negative (Lawry, 1990). For example, fuelwood forms a relatively minor component of overall household income, particularly in relation to agriculture. The costs of extraction may not be sufficiently high to offset costs associated with intensifying management of natural forests.

Lawry's point is applicable to the People's Plantation Program. Farmers incur costs with respect to labour. Table 6-4 shows the labour required in plantation operations. Figures are the sums of all participating groups (17 in 1988 and 18 in 1989). The increase in clearing in 1989 was due to denser vegetation, the growth of which had been enhanced by the enclosure of the area in 1988 and good rainfall in 1989. Although the labour input was increased in 1989, fewer trees were planted due to the increased labour needed to clear bush and dig planting holes. These two works occupied more than two thirds of the total workload in both years. Assuming that the average proportion of working members in a group is 75 per cent (for group size, see Table 6-3), in 1988, an average participant worked more than 10 days to plant 21 trees. In 1989 an average participant worked more than nine days to plant only about 13.5 trees.

Table 6-4: Labour Input of Groups to Tree Plantation.

Year	Group labour allocated to each type of work (person•day)							Number of trees planted
	Fencing	Clearing	Pitting	Refilling	Planting	Weeding	Total	
1988	230	636	646	201	215	118	2,046	4,261
1989	0	1,036	722	113	114	154	2,139	3,110
Total	230	1,672	1,368	314	329	272	4,185	7,371

Source: Ongw'eya and Edazawa (1990).

Although the final return cannot be expected for some time, it is likely that the result will be disappointing. Only 20 per cent of trees planted for over the first five years since 1987 were surviving in 1992. Although farmers do not carry out a cost-benefit analysis in monetary terms, they have their own (empirical or intuitive) way of analysing the costs and benefits of tree-growing activities. The unprofitableness of the People's Plantation Program is apparent for group members because of the high labour demand and low survival rate.

Jodha (1986) argues that a low cost of using common property resources, with human labour as the main input, matches well the labour surplus situation of the poor. However, it should be noted that Jodha is referring to the extraction cost, not the additional investment to improve common property resources. The question arising here is the necessity and possibility of the intensification of forest management like the People's Plantation Program, which requires substantially higher labour inputs to be invested a long time prior to extraction of the product.

6.3 Management of private lands by farmers' groups

There are few reported cases of this option. Gregersen (cited in Fortmann and Bruce, 1988) reported a case in South Korea where private forests were managed by proxy, and voluntary agreements between owners and the local Village Forestry Associations were backed up by law and the strong government.

In Kwavonza a pilot plantation program on private lands started in 1991 using one farmers' group. Unlike the People's Plantation Program on state-owned lands, the participating group has greater self-determination rights. The group decides where to plant, how to share produce, and how to work. The Kenya/Japan Social Forestry Training Project provides the necessary tools and technical advice but does not attempt to control the group's activity.

The pilot group decided to plant on one member's land every year in a rotation. Trees planted will be the property of the land owners, and at the end of a rotation,

all members will have their own trees. The small size of this group (consisting of only six members) makes this rotation method practical.

Since this is a new program, its success is still to be assessed. However, this program may be successful for several reasons:

(a) It is an extension of traditional workgroup *mwethya* activities, in which farmers already have experience of reciprocal labour exchange for farming and soil conservation works;
(b) Trees are privately owned by land-owners. Therefore, there is no trouble of sharing or uncertainty about future ownership; and
(c) Costs are substantially lower than the People's Plantation Program since there is no need to walk a long distance.

It should be noted that the pilot group spontaneously chose the private ownership of trees rather than common property. The difference between this program and the private tree-growing previously discussed is the introduction of a traditional collective action into tree-growing under a private property regime.

6.4 Collective action

Collective action as introduced in the previous section is a variation of common property resource management. The resource in this case, however, is not land or forest, but labour pooled for equal access by members (e.g., ploughing and terracing) or money collected to invest to short-term enterprises (e.g., bee-keeping and basket-making). The evidence suggests labour is the single most important resource that farmers manage. In the case of poor women farmers of Kwavonza, group labour is virtually only the resource to which they have access (Iida, 1988).

Farmers' groups are specialised to manage labour rather than the resource itself, as the group rules shown in Table 5-10 demonstrate. These rules concern members' access and contribution to pooled labour rather than how to use a particular resource. One reason is that the benefits of group activities belong to individuals either directly (in the case of reciprocal labour exchange such as

ploughing) or through a simple and unmistakable sharing of cash income or commodities (in the case of group enterprise such as basket-making).

The most important merit of collective actions is the efficiency in labour use. It is frequently not the nature of the innovation but the economies of scale and the perceived advantages of cooperation that make collective actions desirable, especially for poorer strata (West, 1983). Working in a group makes laborious and monotonous routine work such as ploughing easier, more pleasant and productive (Tiffen *et al.*, 1994). Households with less family labour may also suffer labour shortages at several times in the crop cycle. Group work effort increases the rapidity of progress and perhaps the efficiency (Finan, 1988). Since the timing is critical in a farming calendar (e.g., sowing, weeding and harvesting), group works are almost indispensable, especially for small households with little work force. The cumulative impact of the individual contributions enables farmers to perform works that might not be attained by each acting separately (Cernea, 1989). Terracing is a good example.

Another merit is the collective adoption of new technology, enterprises or farming systems. Individual farmers usually have different rates of adoption or different abilities to adopt. Collective adoption reduces the inequity problems inherent in individual activities (West, 1983) and this is particularly important for extension programs.

6.4.1 Small-scale Nursery Program

Groups provide opportunities to mobilise and put to use resources that would not be used otherwise (Cernea, 1989). The small-scale nursery program discussed below is a good example of collective action in this context.

As noted earlier, the Kenya/Japan Social Forestry Training Project started the distribution of seedlings in 1987. However, it was found that the distribution of seedlings was uneven. Farmers living near the Project nursery or seedling depots have greater access and other farmers have no access (Iida, 1988). Distribution of seedlings required many vehicles for a short period at the beginning of rainy

seasons. Some seasonal roads become impassable thereby limiting seedling distribution. There was also no guarantee seedling distribution would continue after Japanese financial aid ends. As Mung'ala *et al.* (1988) suggest, seedling production by farmers is possibly the best solution because the distribution from a few large central nurseries faces difficulties in satisfying demand.

Seedling production by groups and schools seems successful (Cernea, 1989). In 1988 the Kenya/Japan Social Forestry Training Project assisted the establishment of small-scale nurseries managed by local organisations such as farmers' groups and schools, in addition to the free distribution from the Project nursery. The Project gave various forms of assistance which included the provision of tools (e.g., watering cans and wheel barrows), supply of tubes and seeds, and technical assistance including training at the training centre. Table 6-5 shows the constantly increasing numbers of participant groups and seedling produced. In the 1988/89 season, each nursery was jointly operated by two groups. In other years each group operated its own nursery.

Table 6-5: Number of Small-scale Nurseries.

Year	Participants	Schools	Groups	Total
1988/89	No. of nurseries	4	9(18)	13(22)
	No. of seedlings raised	3,820	4,660	8,480
1989/90	No. of nurseries	4	26	30
	No. of seedlings raised	8,489	38,170	46,659
1990/91	No. of nurseries	5	24	29
	No. of seedlings raised	13,961	21,336	35,297
1991/92	No. of nurseries	6	34	40
	No. of seedlings raised	22,572	77,856	100,428

Source: Adapted from Ongw'eya and Ishibashi (1992).

The effect of the small-scale nursery program was significant. In 1989, the participants of the program planted an average of 125 trees per household while non-participants planted only 45. The average number of trees owned by the participants in 1990 was 82 while non-participants average 25 trees (based on 158 samples out of 474 households).

Although the small-scale nurseries still depend on the Kenya/Japan Social Forestry Training Project for the supply of materials, there has been no conflict

between groups and the Project. Unlike the People's Plantation Program, group members have never demanded payment for their work. In 1990, one group even employed casual workers to fill seedling pots. This indicated that this group thought the program was profitable even though a cash return was not expected. The Project has encouraged the use of locally available materials, such as milk packs and tins instead of tubes, and also the collection of seeds. Since 1989 some groups have sold seedlings, though the number has been too small to cover costs.

Although the small-scale nursery program seems highly successful, it has a limitation. Small-scale nurseries cannot supply seedlings to the whole community. In Block III, for example, there are no small scale nurseries in operation. This is due to the lack of water nearby. Other Blocks have direct access to rivers, where even in drought water is available from holes dug in the river (though salinity levels are a problem). Groups are also unwilling to give their seedlings free to non-members or even to members who do not contribute.

6.4.2 Comparison with the People's Plantation Program

Comparison of the 'benefits' from the two programs is interesting (Table 6-6). Awards have been given to groups using good nursery management since 1988. The Kenya/Japan Social Forestry Training Project interviewed all participating groups (18 farmers' groups in the People's Plantation Program, and four schools and 18 farmers' groups in the small-scale nursery program). In the case of the People's Plantation Program, no one mentioned the objective of the program, raising trees, as a benefit. In contrast, the objective of the small-scale nursery program, 'seedlings,' was in first place.

Table 6-6: 'Benefits' from the Programs (1989).

Order	People's Plantation Program	Small-scale Nursery Program
1	Provision of tools	Seedlings
2	Learning tree-growing techniques	Learning nursery techniques
3	Free collection of firewood	Provision of tools
4	Free issue of seedlings	Awards of the contest
5	Enhancing cooperation within the group	Shorter distance from seedling source

Source: Adapted from Ongw'eya and Edazawa (1990).

The same questions were asked of participants (24 farmers' groups) in the small-scale nursery program in 1991. Table 6-7 shows the result. Answers became very specific compared to 1989. Farmers mentioned the objectives of tree-growing. Incentives given by the Kenya/Japan Social Forestry Training Project, such as tools and awards were no longer considered as important benefits in 1991. Although trees had not yet produced any products at the time of interviews, farmers were expecting benefits from the trees planted rather than listing something given by the Project.

Table 6-7: Benefits from the Small-scale Nursery Program (1991).

Order	Benefits from Small-scale Nursery Program
1	Shade trees
2	Fruits
3	Having trees in the house compounds
3	Firewood
5	Ornamental trees
6	Learning nursery techniques
6	Better future life
8	Awards of the contest
9	Construction timber
9	Seedlings

Source: Adapted from Ongw'eya and Ishibashi (1992).

What is the difference between the successful small-scale nursery program and the unsuccessful People's Plantation Program? As discussed, there are three categories of group activities: namely workgroup *mwethya*, self-help *mwethya* and group enterprises. It seems that these three categories are the basis of group members' perceptions. The success and failure of the group activities promoted by the Kenya/Japan Social Forestry Training Project can be explained in the context of the above three categories.

Seedling production in group nurseries (small-scale nursery program) may be a group enterprise. Farmers invest their labour (and sometimes money) to get the seedlings of their preference (or cash when seedlings are sold) in return. The gestation period of this program is short (seedlings of most species reach the plantable size within six months) and participants appear to have clear images of what they will get. Most nursery works are done cheaply during a dry season.

In the dry season, the opportunity cost of labour may be low since farming does not require a large amount of labour.

On the other hand, the People's Plantation Program does not readily fit any of these three categories. This is not a workgroup *mwethya* since the labour input is not reciprocal. This is not a self-help *mwethya* since the plantation is not a part of a community project. As an enterprise, it is a risky investment because of the long gestation period, harsh environment and the uncertainty of tenure. Many group members will have left groups before the trees have matured. It is important that group members feel their efforts receive "fair" remuneration relative to the amount of labour and capital invested (Poffenberger and Singh, 1993). The participants, therefore, seem to consider this program an opportunity of *de facto* employment, receiving remuneration from the Kenya/Japan Social Forestry Training Project in the form of various incentives.

CHAPTER 7

CONCLUSION: TOWARDS SUSTAINABLE TREE-GROWING

In previous chapters, farmers' perceptions on tree-growing, various tenurial forms, the problems encountered and possible management options were discussed. Data collected through surveys on the programs conducted by the Kenya/Japan Social Forestry Training Project provided case study materials.

Much of the literature covering these issues was written from the view point of the management or tenurial arrangement of a particular resource. Discussions therefore centred around the resources rather than users.

The same can be said for the programs carried out by the Kenya/Japan Social Forestry Training Project. These programs were carried out independently rather than coherently. The Project identified a particular resource (such as a state-owned land in the case of the People's Plantation Program) and asked farmers to manage it regardless of the farmers' interaction with other resources. Hence in previous discussions, the issues centred on the possibility of the sustainable management of a particular resource (or a program) rather than the possibility of sustainable tree-growing by a farmer.

Tenure is only one factor affecting tree-growing, and its importance relative to other factors varies from one situation to the next (Bruce, 1989). The complexity and interactions between the elements in small-scale farming systems were underestimated (Heyer, 1971). Land size, the availability of labour, access to off-farm income sources and distance to certain resources (such as water) also affect farmers' decision-making.

A household is usually involved in a system that overflows the individual holding into commons and sometimes into government reserves. A household's options concerning trees in any one of these situations cannot be defined in isolation (Bruce, 1989). Since farmers have to use many resources simultaneously

under this complex system, a discussion like "Which is the best property regime for this forest?" may not appeal to farmers. Forest policy and implementation structure should provide at least equal attention to a people-centred forestry paradigm as to the currently more dominant forest-centred one (Mol and Wiersum, 1993). It is, therefore, necessary to rearrange the information and streamline the discussions on tenurial niches along the farmers' needs and priorities. The question, therefore, should not be "How can a forest resource be managed in a better way?" but "How can farmers manage forest resources around them in better ways?"

7.1 Filling tenurial niches from farmers' perspectives

Regarding trees, the primary concern of most farmers is the improvement of living environment around their houses. In the initial stage, the objectives of tree-growing by farmers are limited to amenity purposes (especially for shade and ornamentals), and only a small number of trees are planted in and around house compounds. In this stage, farmers do not need tenure arrangements additional to the private property rights which they already have and which are quite secure.

Trees are planted within a close proximity and farmers (if they wish) can care for trees intensively by giving waste water, applying manure and chasing livestock away. Planting and caring for a small number of trees does not incur heavy workload. Apart from the supply of seedlings, logistic, technical and institutional supports from outside are not necessary or can be minimal. However, these amenity trees rarely produce wood or other products necessary for daily life. Farmers are aware of this limitation and are moving towards the next step.

7.1.1 Further integration of trees into the current production systems

In the arid areas of Kenya, trees alone are unattractive to small-scale farmers and packages that combine trees and crops, or trees and livestock, or all three are more desirable (Owino, 1982). The current production system in Kwavonza already involves these three elements to some extent. Farmers are well aware of the necessity of investment in crops and livestock. However, trees were

traditionally considered free or obtainable for collection costs only. In farmers' perceptions, grazing land was often the only sources of tree produce. This notion is changing due to the increasing scarcity of trees. The willingness of farmers to plant trees indicates this change. Tree-growing has been gradually expanded from house compounds to fences and cultivated lands (see Table 5-3).

Further integration of tree production into current farming systems (agroforestry) is an option available for all the farmers in Kwavonza, since there is no landlessness. For the farmers who do not have a large area of land, integration is the only option under a private property regime. In Kenya, traditional silvo-pastoral systems practised by nomadic tribes are described by Barrow (1988) and Niamir (1990): experiments in inter-cropping by Jama and Getahun (1991). However, it seems that there are still no reliable agroforestry techniques for dry land farming.

Agroforestry systems are not always a panacea and their application should be considered carefully. Budowski (1982) points out:

(a) Yields of crops (or pastures) are, in some cases, lower than in a monoculture because of light, moisture or nutrient competition; and
(b) Agroforestry systems often require more labour than monoculture systems.

If the integration of trees results in the poor yields of food crops, such a system is unacceptable for farmers since the crop production for subsistence has still the primary importance. Systems like alley-cropping are likely to cause competition between crops and trees under the dry condition of Kwavonza. A high labour requirement is also unlikely to be accepted as labour has already been limiting the areas that can be cultivated.

Rocheleau *et al.* (1988) categorised agroforestry systems practised in dryland Africa. Among them, followings are the systems which may avoid the competition:

(a) Trees in home gardens;

(b) Agroforestry in cropland (e.g., dispersed trees on cropland and contour vegetation strips);

(c) Agroforestry with structural conservation measures (e.g., trees on terraces and protection and stabilisation of waterways and gullies); and

(d) Agroforestry for in-between places (e.g., living fences, trees on boundaries, windbreaks and trees and shrubs along roads and paths).

Some systems (e.g., trees in home gardens and on terraces) have already been practised in Kwavonza. Further research on others is necessary.

Tree-growing technologies that maximise the use of interstitial locations and other marginal land patches are particularly suitable for individual small-scale farmers because they do not compete with existing land uses and other crops (Budowski, 1982). An example is a live-fence. More and more farmers nowadays expect fences and farms to play multiple roles. Some farmers have already started to replace the unproductive live-fences and thus this option seems suitable and readily acceptable by farmers in Kwavonza. Fruit trees can also be planted along terraces for both fruit production and stabilisation of the terraces.

7.1.2 Improving the management of private grazing lands

Literature on pastoralists, farmers, and other land owners throughout the world shows that resource conservation is not ensured by the private-property status of resources alone (Gilles and Jamtgaard, 1981). In the case of Kwavonza, privately owned grazing lands exemplify this situation.

In agriculture, the primary way to increase production is through the intensification, which is both a capital and labour intensive process (Reyna and Downs, 1988). Although secure land title through privatisation encouraged the intensification of farming practices, farmers did not (or could not) intensify the management of their grazing lands, which are still the major source of wood

resources. Security in tenure arrangements alone has not improved the situation of grazing land, even under a private property regime.

As discussed, grazing land has been considered as a place for forage. Farmers used to think that resources such as firewood were available endlessly like water (Engelhard *et al.*, 1986). Therefore, to improve the management of grazing land requires first of all, a change in farmers' perceptions.

Farah (1991) reported two examples of improved grazing land management in Masii, Machakos District:

(a) The owner of an ancestral land restricted free grazing during rainy seasons. Livestock were fed on crop residues in dry seasons. Although some tree species had decreased due to collection for charcoal-making and construction timber, vegetation was maintained and erosion was controlled.

(b) A farmer bought some degraded grazing land in 1950. He closed this land for 10 years after purchase and transplanted grasses from riverside. In 1960 he started grazing. After repeatedly experiencing the livestock death during droughts, he reduced the number of livestock and now prefers fewer high grade cattle to a large herd. He now obtains firewood from this land.

These examples in an early-settled area indicate the flexibility and ability of Kamba people to adjust their perceptions. If certain conditions are met, farmers can improve the management of their grazing lands. Showing an alternative management system to them may prompt farmers to improve their practices.

However, it should be noted that these two farmers had alternative sources of feed during dry seasons or while the site was enclosed. In other words, they are relatively large-scale, resource-rich farmers. These two farmers also had no need to invest a substantial amount of money or labour. The management was improved but not substantially intensified. In Kwavonza, many farmers do not

have these alternatives and continuously use their grazing lands (see Table 2-7 and Table 3-1). Most farmers in Kwavonza need more intensification to achieve sustainable management of grazing land.

One possibility is to extend group activities to grazing land to overcome the lack of labour in a household. Although it has been confined to cultivated lands, farmers in Kwavonza have constructed terraces by using group labour (see Table 5-8). As mentioned, a group tree-growing program on private land was commenced under the guidance of the Kenya/Japan Social Forestry Training Project. Groups work reciprocally on each member's land while trees belong to the land owner.

Before group activities can become effective, a forest management technology needs to be developed to suit particular conditions of grazing land in marginal areas. Currently no such technology exists. Once the technology is developed, the combination of government assistance and group activities is likely to be effective in sharing responsibilities. The government may meet or subsidise the initial costs for structural improvement such as terracing, since the terracing of degraded grazing land may require far more labour than cultivated land. Groups, on the other hand, may raise seedlings, plant them and maintain trees.

7.1.3 Sustainable management of state-owned lands

Under current conditions, if a household owns a large area of grazing land, they use it. If not, they may ask neighbours for access to their land for grazing and wood collection. Otherwise, they illegally collect wood from, and graze animals on, state-owned land (see Table 2-7). Even if the management of privately-owned grazing land is successfully intensified, many farmers will not have sufficient land to meet all their needs. In fact, 10 per cent of farmers have no grazing land and many others also have no choice but to use state-owned lands (see Table 3-2). The result is an open-access situation on state-owned lands. Unfortunately, an attempt to rectify this situation by introducing a group management was unsuccessful, as seen in the case of the People's Plantation Program.

The government does not appear to be able to manage state-owned lands properly in semi-arid areas. There is no government organisation directly responsible for forest management on Council lands. However, the government does not accept the control of state-owned lands by individuals. Therefore, the only possibility of farmers' legal access to and management of state-owned lands is through communal management by farmers' groups.

The failure of the People's Plantation Program raised two questions. One is the ability of farmers' groups to manage communally a leased state-owned land. The other one concerns the adequacy of the management options employed in the Program.

Farmers' groups fulfil most of the necessary social conditions for communal management such as the tradition of collective actions, decision making mechanisms, and clearly defined rules. The success of the small-scale nursery program indicates that they are actually able to carry out not only traditional activities but also newly introduced enterprises. Therefore, the failure of the communal management in the People's Plantation Program was more likely caused by negative external conditions.

One of the external conditions is the uncertainty of tenure under a state-property regime. It seems that, in the case of the People's Plantation Program, the agreement between farmers' groups and the government is not giving the participant groups enough rights. The initial term of the lease was limited to 10 years (see Appendix) but may be extended. The conditions of lease agreement were somewhat inflexible. Farmers may not be allowed to carry out anything other than tree-growing. Infringement of this or other conditions may terminate the lease agreement without compensating the farmers for efforts already made.

As Adeyoju (1982) said, the users of communal forests generally live below or close to subsistence level and deserve flexible and practical concessions such as the choice of crops. Participating communities that invest labour in forest

management and expect to benefit from future production need greater assurance from the government (Poffenberger and Singh, 1993). Where possible, social forestry efforts should begin with a process of community organisation in forestry management activities that eventually culminates in a formal agreement, rather than attempting to use a formal agreement to initiate that process (Seymour and Rutherford, 1993b).

Another and potentially a more detrimental external condition is the intensified management system. In the People's Plantation Program, intensive tree-planting was carried out. Groups invested a substantial amount of their labour. However, the productivity of already degraded state-owned land was low, the cost of protecting trees high, and the plantation sites were often distant from the farmers' homesteads. Therefore, the cost-benefit ratio is low and the risk is high compared to trees on private land. An assessment should have been carried out of both in social and technical contexts before introducing intensified management.

The long production period of trees poses problems for farmers' groups. Since entering into and withdrawal from a group are frequent, a long production period is an obvious disincentive for participation. Management systems should be designed to fit the characteristics of groups rather than the other way round.

There are two alternative options for group management. One is the use of external subsidies. The construction of large scale water-catchment to improve the productivity (hence profitability) of degraded state-owned land and intensive initial enrichment planting are two possible examples. Poor farmers usually have no reserves to call on in adverse conditions. Even if tree-growing is beneficial, waiting a relatively long term for tree growth is a severe disadvantage for poor farmers (Burley, 1982). Therefore, some assistance or insurance may be necessary until the tree-growing system becomes sustainable and self-sufficient.

Another alternative is the adoption of less intensive management systems. Under the current natural and social conditions, a system involving an intensive tree-growing seems too risky for farmers. As the quick recovery of natural

vegetation in the observation plot (Hayashi, 1992) shows, woody biomass still has potential to recover if livestock (especially goats) are excluded for a certain period.

A system such as a cycle involving grazing, the collection of firewood, and a period of rehabilitation may require minimal investment. Some works, such as guarding a plot allocated to a group (or groups), can be done by assigning a group member rotationally in the context of reciprocal labour exchange, with which farmers' groups are already familiar. However, this system needs a further research on the impact of grazing on the growth of woody biomass to determine the acceptable grazing pressure.

Although firewood, fodder and thatching grasses are obtainable from communal plots on Council lands, long-term products, such as construction timber, may not be produced in this rotation system. Private property is more suitable for long-term (hence more valuable) products since it provides the maximum security in tenure and the possibility of a faster growth due to more intensive care.

In any case, it is important to determine which areas of the forest, and which aspects of forest resource management would best be devolved to local groups and which should remain under the control of government authorities (Gow, 1992). Since forests have multiple functions, the government should retain responsibility on issues such as watershed management. Overlapping institutional arrangements and organisations are needed to complement the resource management effort (National Academy of Sciences as cited in Bromley and Cernea, 1989). In some situations government action can help create the conditions for local action by clarifying group territorial rights and adjudicating boundary disputes (Lawry, 1990). The presence of the regulations in respect to tenure of cooperative organisation such as farmers' groups is favourable.

Although open-access on Council lands can be converted to communal management by groups, one problem remains. As Seymour and Rutherford

(1993a) pointed out, the closing of an open-access situation may mean the exclusion of some members of the community. While such side-effects may not affect the direct costs and benefits of a project, the equity issues need to be considered (Bruce, 1989).

In Kwavonza, there are some farmers whose dependency on Council lands is significantly larger than others. An example is the household No. 8 in Table 3-4. This farmer produces charcoal even in good years by cutting trees on nearby Council lands. There is also a report of a farmer grazing more than 40 cattle on Council lands (Iida, 1988). Although the number is small, the impact of these farmers' activities could be far more detrimental than occasional users. These farmers could undermine communal management if their access is limited or denied. Graziers often resist or even sabotage communal forestry efforts (West, 1983). In Lesotho, opposition from stock owners to the establishment of woodlots occasionally leads to the destruction of fencing and young trees (Turner as cited in Bruce, 1989). Both the equity and economic conditions of these farmers need to be considered.

7.1.4 Alternative areas for communal management

Even if the communal management of state-owned lands is successful, the shortage of wood for many farmers would not be alleviated. The size of the state-owned lands is not a problem since they occupy about 75,000 ha (over 90 per cent) of Kwavonza. The problem is their uneven distribution. Most state-owned lands are concentrated in the northern part of Kwavonza. In southern part, where people reside, there are only tiny fragments of the state-owned lands along rivers and on isolated hills. Therefore, many people physically do not have access to a state-owned land.

In Kwavonza, any land currently belongs to either the government or an individual farmer. There are no legally recognised communal lands or any other types of land property. Therefore, alternative lands for communal management must be identified on private lands.

As mentioned, it seems that farmers in Kwavonza do not consider the opportunity costs of lands unless some extra expenditure or labour inputs are incurred. Lands are often leased without the payment of any rent. In the case of the small-scale nursery program, group nurseries are usually established on a member's land. The member who owns land neither has additional rights on the seedlings nor is exempted from nursery works. Groups also do not compensate for land used for the nursery. This suggests that some private lands could be made available for communal purposes.

Under-utilised grazing lands owned by large-scale farmers are possible candidates for communal management. In this case, the assurance of tenurial rights is essential. Both the ownership of trees and the ownership of lands should not be challenged. However, more research is needed as to how both parties, land owners and farmers' groups, can be convinced that the program is beneficial. The purchase of lands by groups or the government should also be studied to avoid the risk of the future subdivision of the land and possible conflicts due to inheritance practices or any other changes in land ownership.

7.2 Reducing current labour requirement

If the above four tenurial niches are successfully filled, the needs of most farmers could be satisfied or the depletion of forest resource could be at least mitigated. Although collective actions by groups are usually more effective than individual actions, the total labour requirements to each individual farmer could increase by managing more resources in various tenurial niches. As mentioned, labour shortage is already a limiting factor in tree-growing. If this issue is not properly addressed, the whole system suggested above could be undermined. Although finding a way to reduce workload in farmers' production systems is beyond the scope of this paper, it is important to assess how the labour constraint may influence a tree-growing program. Forestry programs should consider how to increase available labour rather than how to divert limited labour in competition with other activities of higher priorities.

There are two distinguishable types of labour requirement, peak season requirement and daily requirement.

7.2.1 Peak season labour requirement

As mentioned, the beginning of a rainy season is the busiest time for farmers in both farming and tree-growing. In marginal areas, both food crops and trees must be sown or planted during a short period. Priority is usually given to food crops. Therefore, the availability of labour greatly affects the number of trees planted.

Since labour needs are concentrated and timing is critical for rainfed agriculture, the average pool of family labour may come under strong pressure during the course of the agricultural year (Finan, 1988). The introduction of oxen-ploughs was an important innovation to reduce the workload. Another widely practised way to improve labour efficiency is group ploughing. The procurement of oxen-ploughs and assisting the organisation of groups especially for poor farmers could reduce the workload at peak times.

7.2.2 Daily labour requirement

Apart from essential production activities such as farming and herding, farmers, especially women, in rural areas spend substantial amounts of labour and time on other daily works. The most laborious work is the transport of water from sources to homesteads. Long walking distances to fetch water seriously constrain the productivity of women, who are the major providers of labour for agricultural production (Tiffen *et al.*, 1994). In the Mbere Division, Embu District, water collection accounts for the biggest proportion of time of all household tasks (Riley and Brokensha, 1988). The same tendency was observed in Ghana and Tanzania (Bryceson and Howe, 1993). In Kwavonza, an average household consumes 111 litres of water a day (see Table 2-17). Since the average distance from water sources is 3 km, this poses a substantial labour requirement.

A study conducted by Whittington *et al.* (1990) concluded that people of a Kenyan coastal village evaluate the time spent for water collection as high as the

market wage for unskilled labour. In Kwavonza, the estimation of opportunity cost is more difficult because of limited job opportunities. However, 77 per cent of household own donkeys to fetch water (Table 2-17). Considering that the price of donkey is equivalent to the wage of an unskilled labour for three months, the weight of water collection is substantial in both household labour allocation and financial balance sheets.

If a household does not need to spend so much labour and money collecting water, these resources can be used for more productive activities. Especially any reduction in women's time and effort could be redirected at improving production and rural household welfare (Bryceson and Howe, 1993). If the value of water becomes lower, trees could also have more chance to get a share of this labour.

7.2.3 Development of techniques

Along with the extension program mentioned, the Kenya/Japan Social Forestry Training Project has carried out silvicultural experiments to develop tree-planting and growing technologies for marginal areas, using technology that would not require cash inputs or unaffordable materials. However, the labour requirement was assumed to be insignificant and not taken into account.

Some farmers have shown the ability to innovate or improve tree establishment techniques. Their techniques are always simple and readily adopted by other farmers, as the following examples demonstrate.

(a) Raintree (1987) reported that a farmer in a marginal area of the Machakos District did not follow the technical advice on digging planting holes, but improved on it; instead of digging holes in the dry season (when the soil is very hard), he simply scraped soil and made a shallow water catchment. Then he dug holes at the beginning of the rainy season after the soil had been softened after by rain. This simple technique greatly reduced the workload for digging.

(b) In Kwavonza a farmer used empty rum bottles to water his trees. Bottles filled with water are inserted into soil surface near the trees. Then water can reach to root systems with minimum evaporation. This method conserves water, which is precious in this dry area.

These two examples indicate that farmers try to minimise the labour requirement. Farmers may reject a technology that requires significantly higher labour inputs, even if it assures a higher survival rate. Technology development should focus on the reduction of labour requirement as well as the improvement of survival rate.

7.3 Beyond Kwavonza

In this paper, discussion was based mainly on the case of Kwavonza. Most marginal areas of Kenya also have similar natural conditions, histories of settlement, cultural backgrounds, production systems and lifestyles, because most inhabitants belong to Bantu tribes such as Kamba. Therefore, issues discussed in this paper are often observable in many of marginal areas. However, modification is still necessary to accommodate regional differences. Such differences include local politics, traditional tenure arrangements, the presence or absence of state-owned lands, the size of private lands, the delay or progress of land adjudication, especially in remote areas and newly settled areas, and the characteristics of farmers' groups.

In some areas there are minority ethnic groups, often Nilotic tribes such as Masai, Samburu and Turkana. These are traditionally semi-nomadic pastoralists. Because the Government of Kenya has strongly promoted their settlement, some of them have adapted sedentary farming systems. They have different cultures and traditions, and are likely to have different perspectives, different sets of rights and other social variables concerning land and trees. Several studies on their resource use exist (Niamir, 1990). However, their rapidly changing societies need further monitoring to identify viable options for resource management.

Although available resources, tenurial niches, and other natural and social conditions differ from one place to another, it is always important to identify as many management options as possible. Options identified should be carefully studied. Necessary measures (e.g., legal arrangements on tenure and the development of suitable techniques) should be taken to ease the access or participation of local farmers either individually or through organised groups. In addition to the regional and cultural differences, each household has its unique conditions, needs, priorities and preference functions. Presenting available resources and possible management options to farmers may expand the opportunity sets of the household. With wider opportunity sets, each household would have more chance to optimise the resource allocation towards sustainable resource management.

REFERENCES

Ackello-Ogutu, C. (1991). Livestock production. In M. Tiffen (Ed.), Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Production Profile (pp. 45-89). *ODI Working Paper No. 55*. London: Overseas Development Institute.

Adeyoju, S.K. (1978). People's participation in forestry for local community development. In *Proceedings of the Eighth World Forestry Congress, Volume II* (pp. 101-121). Jakarta: Organizing Committee of the Eighth World Forestry Congress.

Adeyoju, S.K. (1982). Agro-forestry and forest laws, policies and customs. In L.H. MacDonald (Ed.), *Agroforestry in the African Humid Tropics* (pp. 17-21). Tokyo: The United Nations University.

Agnew, A.D.Q. & Waterman, P.G. (1989). Drought-deciduous woodland in Kora National Reserve, Kenya. *African Journal of Ecology, 27*(1), 53-62.

Alexander, P. (1975). Innovation in a cultural vacuum: The mechanization of Sri Lanka fisheries. *Human Organization, 34*(4), 333-344.

Amatya, S.M. & Newman, S.M. (1993). Agroforestry in Nepal: Research and practice. *Agroforestry Systems, 21*(3), 215-222.

Applegate, G.B., Gilmour, D.A. & Mohns, B. (1988). The use of biomass estimations in the management of forests for fuelwood and fodder production. *Commonwealth Forestry Review, 67*(2), 141-148.

Arnold, J.E.M (1978). Wood energy and rural communities. In *Proceedings of the Eighth World Forestry Congress, Volume II* (pp. 603-626). Jakarta: Organizing Committee of the Eighth World Forestry Congress.

Arnold, J.E.M. (1984). Economic constraints and incentives in agro-forestry. In J.K. Jackson (Ed.), *Social, Economic, and Institutional Aspects of Agro-forestry*, (pp. 3-9). Tokyo: The United Nations University.

Arnould, E.J. (1990). Changing the terms of rural development: Collaborative research in cultural ecology in the Sahel. *Human Organization, 49*(4), 339-354.

Asakawa, S. (1992). *Zourin bun'ya tanki senmonka houkokusyo* (Report on Silvicultural Issues). A report submitted to the Japan International Cooperation Agency.

Bardhan, P. (1993). Symposium on management of local commons. *Journal of Economic Perspectives, 7*(4), 87-92.

Barnard, G. (1985). Comment made in an international conference on bioenergy. In H. Egnéus, A. Ellegård, P. O'Keefe & L. Kristrofferson (Eds.), *Bioenergy 84. Vol. V. Bioenergy in Developing Countries, Proceedings of an International Conference on Bioenergy held on 15-21 June 1984, Göteborg, Sweden*, (p. 171). London: Elsevier Applied Science Publishers.

Barrow, E. (1988). Trees and Pastoralists: The Case of the Pokot and Turkana. *Network Paper, 6b*. London: Social Forestry Network.

Berkes, F. (Ed.). (1989). *Common Property Resources: Ecology and Community-based Sustainable Development*. London: Belhaven Press.

Berkes, F. & Farvar, M.T. (1989). Introduction and overview. In F. Berkes (Ed.). *Common Property Resources: Ecology and Community-based Sustainable Development* (pp. 1-17). London: Belhaven Press.

Birgegård, L. (1993). Natural Resource Tenure. A Review of Issues and Experiences with Emphasis on Sub-Saharan Africa. *Rural Development Studies No.31*. Uppsala: International Rural Development Center.

Blomquist, W. & Ostrom, E. (1985). Institutional capacity and the resolution of a commons dilemma. *Policy Studies Review, 5*(2), 383-393.

Bromley, D.W. (1989). Property relations and economic development: the other land reform. *World Development, 17*(6), 867-877.

Bromley, D.W. & Cernea, M.M. (1989). The Management of Common Property Natural Resources. *World Bank Discussion Paper 57*. Washington, D.C.: the World Bank.

Bruce, J.W. (1989). Community Forestry: Rapid Appraisal of Tree and Land Tenure. *Community Forestry Note 5*. Rome: Food and Agriculture Organizations of the United Nations.

Bryceson, D.F. & Howe, J. (1993). Rural household transport in Africa: Reducing the burden on women? *World Development, 21*(11), 1715-1728.

Budowski, G. (1982). Applicability of agro-forestry systems. In L.H. MacDonald (Ed.), *Agroforestry in the African Humid Tropics* (pp. 13-16). Tokyo: The United Nations University.

Burley, J. (1982). *Obstacles to Tree Planting in Arid and Semi-arid Lands: Comparative Case Studies from India and Kenya*. Tokyo: The United Nations University.

Butterworth, M.H. & Lanbourne, L.J. (1986). Productivity improvement and resource conservation in the use of African rangelands. In P.J. Joss, P.W. Lynch & O.B. Williams (Eds.), *Rangelands: A Resource under Siege. Proceedings of the Second International Rangeland Congress* (pp. 111-114). Canberra: Australian Academy of Science.

Carter, J. & Gronow, J. (1993). Participatory vs. promotional approaches to tree cultivation on private lands: Experiences in the middle hills of Nepal. *Forests, Trees and People Newsletter, 19*, 4-9.

Castro, A.P. (1991). The southern Mount Kenya forest since independence: A social analysis of resource competition. *World Development, 19*(12), 1695-1704.

Cernea, M.M. (1981). Land Tenure Systems and Social Implications of Forestry Development Programs. *World Bank Staff Working Paper 452*. Washington D.C.: World Bank.

Cernea, M.M. (1985). Alternative units of social organization sustaining afforestation strategies. In M.M. Cernea (Ed.), *Putting People First: Sociological Variables in Rural Development* (pp. 267-293). New York: World Bank.

Cernea, M.M. (1989). User Groups as Producers in Participatory Afforestation Strategies. *World Bank Discussion Paper 70*. Washington, D.C.: World Bank.

Chaiken, M.S. (1990). Participatory development and African women: A case study from Western Kenya. In M.S. Chaiken & A.K. Fleuret (Eds.), *Social Change and Applied Anthropology, Essays in Honor of David W. Brokensha* (pp. 84-90). Boulder: Westview Press.

Chambers, R. & Leach, M. (1989). Trees as savings and security for the rural poor. *World Development, 17*(3), 329-342.

Chambers, R. & Leach, M. (1990). Trees as savings and security for the rural poor. *Unasylva, 41*(161), 39-52.

Chavangi, N.A., Engelhard, R.J. & Jones, V. (1985). *Culture as the Basis for Implementing Self-sustaining Woodfuel Development Programmes*. Beijer Institute, Centre for Energy and Development in Africa.

Cheboiwo, J.K. & Iida, S. (1991). *Tree Planting and Livestock - Look for New Relation*. A report submitted to the Japan International Cooperation Agency.

Chowdhry, K. (1984). Agro-forestry, the rural poor, and institutional structures. In J.K. Jackson (Ed.), *Social, Economic, and Institutional Aspects of Agro-forestry*, (pp. 11-18). Tokyo: The United Nations University.

Ciriacy-Wantrup, S.V. & Bishop, R.C. (1975). "Common property" as a concept in natural resources policy. *Natural Resources Journal, 15*(4), 713-727.

Collier, P. & Lal, D. (1980). Poverty and Growth in Kenya. *World Bank Staff Working Paper No.389*. Washington, D.C.: World Bank.

Cossins, N. (1986). Resource conservation and productivity improvement under communal land tenure. In P.J. Joss, P.W. Lynch & O.B. Williams (Eds.), *Rangelands: A Resource under Siege. Proceedings of the Second International Rangeland Congress* (pp. 119-121). Canberra: Australian Academy of Science.

Cramb, R.C. & Wills, I.R. (1990). The role of traditional institutions in rural development: community based land tenure and government land policy in Sarawak, Malaysia. *World Development, 18*(3), 347-360.

Dargavel, D., Hoblet, M. & Kengen, S. (1985). Forestry of development and underdevelopment of forestry. In J. Dargavel & G. Simpson (Eds.), *Forestry: Success or Failure in Developing Countries?* (pp. 1-37). Canberra: Australian National University.

Dewees, P.A. (1992). *Household Economy, Trees and Woodland Resources in Communal Areas in Zimbabwe*. Background paper prepared for the national policy review for forestry and trees. Harare: Forestry Commission of Zimbabwe.

Dewees, P.A. (undated). Social and Economic Incentives for Smallholder Tree Growing. A Case Study from Murang'a District, Kenya. *Community Forestry Case Study Series 5*. Rome: Food and Agriculture Organizations of the United Nations.

Dilelen, H. (1982). *Report of an Agroforestry Survey in Three Villages of Northern Machakos, Kenya*. Wageningen, Netherlands and Nairobi: Agricultural University Wageningen and International Council for Research in Agroforestry.

Dove, M.R. (1992). Foresters' beliefs about farmers: a priority for social science research in social forestry. *Agroforestry Systems, 17*(1), 13-41.

Edazawa, O. (1990). *A Report on Social Forestry Extension Activities of Pilot Forest Sub-project*. Nairobi: Kenya/Japan Social Forestry Training Project.

Eighth World Forestry Congress. (1978). *Proceedings of the Eighth World Forestry Congress, Volume II.* Jakarta: Organizing Committee of the Eighth World Forestry Congress.

Engelhard, R.J., Bradley, P.N. and Shuma, B.R.K. (1986). The paradox of abundant on-farm woody biomass yet critical fuelwood shortages: a case study of Kakamega District. In *18th IUFRO World Congress, Division 3, Forest Operation and Techniques*, (pp. 98-113). Ljubljana, Yugoslavia: Yugoslav IUFRO World Congress Organizing Committee.

Evans, H.B.L. (1990). Forestry extension in EMI districts, Kenya. *Commonwealth Forestry Review, 69*(4), 309-312.

Farah, K.O. (1991). Natural vegetation. In M. Mortimore (Ed.), Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Environmental Profile. *ODI Working Paper No. 53* (pp. 51-66). London: Overseas Development Institute.

Field, A.J. (1984). Microeconomics, norms, and rationality. *Economic Development and Cultural Change, 32*, 683-711.

Finan, T.J. (1988). The farm system under duress: agricultural adaptations on the Cape Verde islands. *Human Organization, 47*(2), 109-118.

Fleuret, A. (1988). Some consequences of tenure and agrarian reform in Taita, Kenya. In R.E. Downs & S.P. Reyna (Eds.), *Land and Society in Contemporary Africa* (pp. 136-158). Hanover and London: University Press of New England.

Fleuret, A. (1990). The impact of fuelwood scarcity on dietary patterns: hypotheses for research. *Unasylva, 41*(160), 29-34.

Foley, G. & Barnard, G. (1985). Farm and Community Forestry. *Network Paper, 1b*. London: Social Forestry Network.

Forestry Department, FAO. (1978). Implementing forestry programmes for local community development. In *Proceedings of the Eighth World Forestry Congress, Volume II* (pp. 831-853). Jakarta: Organizing Committee of the Eighth World Forestry Congress.

Fortmann, L. (1985). The tree tenure factor in agroforestry with particular reference to Africa. *Agroforestry Systems, 2*, 229-251.

Fortmann, L. & Bruce, J.W. (1988). *Whose Trees? Proprietary Dimensions of Forestry*. London: Westview Press.

Fortmann, L. & Nihra, C. (1992). Local Management of Trees and Woodland Resources in Zimbabwe: A Tenurial Niche Approach. *O.F.I. Occasional Papers No.43*. Oxford: Oxford Forestry Institute.

Fries, J. & Heermans, J. (1992). Natural forest management in semi-arid Africa: Status and research needs. *Unasylva, 43*(168), 9-15.

Gadgil, M. & Iyer, P. (1989). On the diversification of common-property resource use by Indian society. In F. Berkes (Ed.), *Common Property Resources. Ecology and Community-based Sustainable Development* (pp. 240-255). London: Belhaven Press.

Gathaara, G.N. (1988). Kenya woodfuel development by the Biomass Energy Technology & Woodfuel Resources Division. In Kenya/Japan Social Forestry Training Project (Ed.), *Proceedings of the First National Seminar on Social Forestry, Muguga, Kenya, 31 August 1988* (pp. 34-44). Nairobi: Kenya Forestry Research Institute.

Getahun, A. (1989). Agroforestry for development in Kenya. In A.M. Kilewe, K.M. Kealey & K.K. Kebaara (Eds.), *Agroforestry Development in Kenya. Proceedings of the Second Kenya National Seminar on Agroforestry held in Nairobi, Kenya, 7-16 November 1988* (pp. 85-109). Nairobi: International Council for Research in Agroforestry.

Gibbs, C.J.N. & Bromley, D.W. (1989). Institutional arrangements for management of rural resources: Common-property regimes. In F. Berkes (Ed.), *Common Property Resources. Ecology and Community-based Sustainable Development* (pp. 22-32). London: Belhaven Press.

Gichuki, F.N. (1991). Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Conservation Profile. *ODI Working Paper No. 56*. London: Overseas Development Institute.

Gilles, J.L. & Jamtgaard, K. (1981). Overgrazing in pastoral areas: The commons reconsidered. *Sociologia Ruralis 21*, 129-141.

Goodland, R., Ledec, G. & Webb, M. (1989). Meeting environmental concerns caused by common-property mismanagement in economic development projects. In F. Berkes (Ed.), *Common Property Resources. Ecology and Community-based Sustainable Development* (pp. 148-163). London: Belhaven Press.

Gow, D.D. (1992). Forestry for sustainable development: The social dimension. *Unasylva, 43*(169), 41-45.

Gregersen, H.M. & Houghtaling, T.W. (1978). Government subsidies to stimulate forestry at the farm and community level. In *Proceedings of the Eighth World Forestry Congress, Volume II* (pp. 943-952). Jakarta: Organizing Committee of the Eighth World Forestry Congress.

Griffin, D.M. (1988). *Innocents Abroad in the Forests of Nepal: An Account of Australian Aid to Nepalese Forestry*. Canberra: ANUTECH Pty. Ltd.

Grima, A.P.L. & Berkes, F. (1989). Natural resources: Access, rights-to-use and management. In F. Berkes (Ed.), *Common Property Resources. Ecology and Community-based Sustainable Development* (pp. 33-54). London: Belhaven Press.

Gupta, A.K. (1986). Socio-ecology of grazing land management. In P.J. Joss, P.W. Lynch & O.B. Williams (Eds.), *Rangelands: A Resource under Siege. Proceedings of the Second International Rangeland Congress* (pp. 288-291). Canberra: Australian Academy of Science.

Hardin, G. (1968). The tragedy of commons. *Science, 162*, 1243-1248.

Hayashi, I. (1992). A preliminary report of an experiment on vegetation recovery of drought deciduous woodland in Kitui, Kenya. *African Journal of Ecology, 30*, 1-9.

Hedge, N.G. (1987). Scope for increasing the profitability of social forestry programme. In P.K. Khoslu & P.K. Kohli (Eds.), *Social Forestry for Rural Development* (pp. 68-85). Dehra Dun, India: Natraj Publishers.

Heyer, J. (1971). A linear programming analysis of constraints on peasant farms in Kenya. *Food Research Institute Studies, 10*(1), 55-67.

Hill, M.J.D. (1991). *The Harambee Movement in Kenya: Self-help, Development, and Education among the Kamba of Kitui District*. London: Athlone Press.

Hoskins, M. (1990). The contribution of forestry to food security. *Unasylva, 41*(160), 3-13.

Hoskins, M. W. (1984). Observations on indigenous and modern agro-forestry activities in West Africa. In J.K. Jackson (Ed.), *Social, Economic, and Institutional Aspects of Agro-forestry*, (pp. 46-50). Tokyo: The United Nations University.

Iida, S. (1988). *Kenya ni okeru ringyô kyôryoku - kazoku, mura, shinrin -*. (Forestry Sector Cooperation in Kenya - Families, Villages and Forests -). A report submitted to the Japan International Cooperation Agency.

Iida, S. (1989). *Kenya syakairingyô chosa hôkokusho*. (Report of a Survey on Social Forestry in Kenya). A report submitted to the Japan International Cooperation Agency.

Iida, S., Cheboiwo, J.K. & Edazawa, O. (1989). Socio-Economic Survey of the Pilot Forest Area. *Project Working Paper No. 3*. Nairobi: Kenya/Japan Social Forestry Training Project.

Jama, B. & Getahun, A. (1991). Intercropping *Acacia albida* with maize (*Zea mays*) and green gram (*Phaseolus aureus*) at Mtwapa, Coast Province, Kenya. *Agroforestry Systems, 14*(3), 193-205.

Jodha, N.C. (1986). Common property resources and the rural poor in dry regions of India. *Economic and Political Weekly, 21*(27), 1169-1181.

Johnston, B.F. & Kilby, P. (1982). 'Unimodal' and 'bimodal' strategies of agrarian change. In J. Harriss (Ed.), *Rural Development, Theories of Peasant Economy and Agrarian Change* (pp. 50-65). London: Hutchinson University Library for Africa.

Joshi, G. (1983). Forest policy and tribal development: Problems of implementation, ecology and exploitation. In W. Fernandes & S. Kulkarni (Eds.), *Towards a New Forest Policy: People's Rights and Environmental Needs* (pp. 25-47). New Delhi: Indian Social Institute.

Kenya Forestry Research Institute. (1990). *A Guide to Tree Planting in Kenya.* Nairobi: Author.

Kenya/Japan Social Forestry Training Project. (1987). Report of the Surveys on Training Needs. *Project Working Paper No. 2.* Nairobi: Kenya/Japan Social Forestry Training Project.

Khattak G.M. (1993). Natural resource conservation through community participation. *Commonwealth Forestry Review, 72*(3), 162-165.

Kinyanjui, M. (1987). Fuelling Nairobi - the importance of small-scale charcoaling enterprises. *Unasylva, 39*(157/158), 17-28.

Kio, P.K.R. (1982). Forest conservation strategies for tropical Africa. In L.H. MacDonald (Ed.), *Agroforestry in the African Humid Tropics* (pp. 36-40). Tokyo: The United Nations University.

Kirchhofer, J. & Mercer, E. (1984). *Putting Social and Community Forestry in Perspective in the Asia-Pacific Region.* Honolulu: East-West Center.

Lane, C. (1993). The Barabaig/NAFCO conflict in Tanzania: On whose terms can it be resolved? *Forests, Trees and People Newsletter, 20,* 24-33.

Larson, B.A. & Bromley, D.W. (1990). Property rights, externalities and resource degradation: Locating the tragedy. *Journal of Development Economics, 33*(2), 235-262.

Lawry, S. (1990). Tenure policy toward common property natural resources in sub-Saharan Africa. *Natural Resources Journal, 30,* 403-422.

Livingstone, R. and Zamora, R. (1983). Medicine trees of the tropics. *Unasylva, 35*(140), 7-10.

Lusigi, W.J. (1986). The Integrated Project on Arid Lands (IPAL) Kenya. In P.J. Joss, P.W. Lynch & O.B. Williams (Eds.), *Rangelands: A Resource under Siege. Proceedings of the Second International Rangeland Congress* (pp. 338-348). Canberra: Australian Academy of Science.

Maathai, W. (1985). Afforestation and public participation - the case of the Green Belt Movement. In H. Egnéus, A. Ellegård, P. O'Keefe & L. Kristrofferson (Eds.), *Bioenergy 84. Vol. V. Bioenergy in Developing Countries, Proceedings of an International Conference on Bioenergy held on 15-21 June 1984, Göteborg, Sweden* (pp. 177-185). London: Elsevier Applied Science Publishers.

Mbogoh, S.G. (1991). Crop production. In M. Tiffen (Ed.), Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Production Profile. *ODI Working Paper No. 55* (pp. 1-44). London: Overseas Development Institute.

Mbuvi, J.P. (1991). Soil fertility. In M. Mortimore (Ed.), Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Environmental Profile. *ODI Working Paper No. 53* (pp. 44-50). London: Overseas Development Institute.

McCay, B.J. & Acheson, J.M. (1987). Human ecology of the commons. In B.J. McCay & J.M. Acheson (Eds.), *The Question of the Commons. The Culture and Ecology of Communal Resources* (pp. 1-34). Tuscon: The University of Arizona Press.

McGranahan, G. (1991). Fuelwood, subsistence foraging, and the decline of common property. *World Development, 19*(10), 1275-1287.

Messerschmidt, D.A. (Ed.). (1993). *Common Forest Resource Management. Annotated Bibliography of Asia, Africa and Latin America.* Rome: Food and Agriculture Organizations of the United Nations.

Meyers, L.R. (1982). *A Sociological Approach to Farming System in Kenya.* New York: Cornell University.

Minae, S., Kamau, I.N. & Juma, B. (1989). Land-use systems in Kenya and their agroforestry potential. In A.M. Kilewe, K.M. Kealey & K.K. Kebaara (Eds.), *Agroforestry Development in Kenya. Proceedings of the Second Kenya National Seminar on Agroforestry held in Nairobi, Kenya, 7-16 November 1988* (pp. 56-81). Nairobi: International Council for Research in Agroforestry.

Ministry of Livestock. (1990). *Annual Report, Kitui District 1988-89.* Nairobi: Ministry of Livestock.

Mnzava, E.M. (1981). Village industries vs. savanna forests. *Unasylva, 33*(131), 24-29.

Mol, P.W. & Wiersum, K.F. (1993). Asia. In D.A. Messerschmidt (Ed.), *Common Forest Resource Management. Annotated Bibliography of Asia, Africa and Latin America* (pp. 24-97). Rome: Food and Agriculture Organizations of the United Nations.

Moslemi, A.A. (1982). Tree biomass. In W.R. Smith (Ed.), *Energy from Forest Biomass*. New York: Academic Press.

Mung'ala, P.M., Kuyper, J.B.H. & Kimwe, S. (1988). *On-farm Tree Nurseries*. Nairobi: Kenya Woodfuel Development Programme.

Murphy, J. (1990). Farmers' systems and technological change in agriculture. In M.S. Chaiken & A.K. Fleuret (Eds.), *Social Change and Applied Anthropology, Essays in Honor of David W. Brokensha* (pp. 17-30). Boulder: Westview Press.

Mutiso, S.K., Mortimore, M. & Tiffen, M. (1991). Rainfall. In M. Mortimore (Ed.), Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Environmental Profile. *ODI Working Paper No. 53* (pp. 3-23). London: Overseas Development Institute.

Niamir, M. (1990). Traditional woodland management techniques of African pastoralists. *Unasylva, 41*(160), 49-58.

Noda, N. (1985). *Community Forestry Development in Lamjung District 1984-1985*. Kathmandu: Community Forestry Development Project.

Noronha, R. (1981). Why is it so difficult to grow fuelwood? *Unasylva, 33*(131) 4-12.

Nyaga, C.R.J. (1989). Trees in food production under the taungya system. In A.M. Kilewe, K.M. Kealey & K.K. Kebaara (Eds.), *Agroforestry Development in Kenya. Proceedings of the Second Kenya National Seminar on Agroforestry held in Nairobi, Kenya, 7-16 November 1988* (pp. 127-129). Nairobi: International Council for Research in Agroforestry.

Ongw'eya, C.N. & Edazawa, O. (1990). Report on Implementation of Social Forestry Extension Activities from 1987/88 to 1989/90. *Project Working Paper No. 7-1*. Nairobi: Kenya/ Japan Social Forestry Training Project.

Ongw'eya, C.N. & Ishibashi, N. (1992). Report on Implementation of Social Forestry Extension Activities from 1990/91 to 1991/92. *Project Working Paper No. 10*. Nairobi: Kenya/ Japan Social Forestry Training Project.

Ostrom, E. (1987). Institutional arrangements for resolving the commons dilemma. In B.J. McCay & J.M. Acheson (Eds.), *The Question of the Commons. The Culture and Ecology of Communal Resources* (pp. 250-265). Tuscon: The University of Arizona Press.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.

Owino, J. (1982). Agro-forestry developments in Kenya: Prospects and problems. In L.H. MacDonald (Ed.), *Agroforestry in the African Humid Tropics* (pp. 137-139). Tokyo: The United Nations University.

Perlov, D.C. (1984). Exploiting the forest: patterns and perceptions in highland Samburu. In C. Barnes, J. Ensminger & P. O'Keefe (Eds.). *Wood, Energy and Households: Perspectives on Rural Kenya*. Uppsala, Sweden. Beijer Institute/Scandinavian Institute of African Studies.

Plantilla, J.R. (1993). Strengthening CSAs in Philippines. In J. Fox (Ed.), Legal Frameworks for Forest Management in Asia: Case Studies of Community/State Relation. *Occasional Paper No. 16* (pp. 73-87). Honolulu: East-West Center.

Poffenberger, M. & Singh, C. (1993). The legal framework for joint management of forest lands in India. In J. Fox (Ed.), Legal Frameworks for Forest Management in Asia: Case Studies of Community/State Relation. *Occasional Paper No. 16* (pp. 3-18). Honolulu: East-West Center.

Poulsen, G. (1982). The non-wood products of African forests. *Unasylva, 34*(137), 15-21.

Poulsen, G. (1983). Using farm trees for fuelwood. *Unasylva, 35*(141), 26-29.

Raintree, J.B. (Ed.). (1987). *D&D User's Manual*. Nairobi: International Council for Research in Agroforestry.

Reddi, G.H.S., Rao, Y.Y. & Rao, M.S. (1981). The effect of shelterbelts on the productivity of annual field crops. *Indian Forester, 107*(10), 624-629.

Reyna, S.P. & Downs, R.E. (1988). Introduction. In R.E. Downs & S.P. Reyna (Eds.), *Land and Society in Contemporary Africa* (pp. 1-22). Hanover and London: University Press of New England.

Riley, B.W. & Brokensha, D. (1988). *The Mbeere in Kenya. Volume I. Changing Rural Ecology*. Lanham, USA: University Press of America.

Rocheleau, D., Weber, F. & Field-Juma, A. (1988). *Agroforestry in Dryland Africa*. Nairobi: International Council for Research in Agroforestry.

Rorison, K. (Ed.). (1988). *Case Studies of Farm Forestry and Wasteland Development in Gujarat, India.* Bangkok: Food and Agriculture Organizations of the United Nations.

Roy, S.B. (1993). Forest protection committees in West Bengal, India. In J. Fox (Ed.), Legal Frameworks for Forest Management in Asia: Case Studies of Community/State Relation. *Occasional Paper No. 16* (pp. 19-30). Honolulu: East-West Center.

Runge, C.F. (1981). Common property externalities: Isolation, assurance, and resource depletion in a traditional grazing context. *American Journal of Agricultural Economics, 63*, 595-606.

Runge, C.F. (1986). Common property and collective action in economic development. *World Development, 14*(5), 623-635.

Salem, B.B. & Nao, T.V. (1981). Fuelwood production in traditional farming systems. *Unasylva, 33*(131), 13-18.

Seabright, P. (1993). Managing local commons: Theoretical issues in incentive design. *Journal of Economic Perspectives, 7*(4), 113-134.

Seif el Dim, A.G. (1982). Agro-forestry research for the humid tropics. In L.H. MacDonald (Ed.), *Agroforestry in the African Humid Tropics* (pp. 17-21). Tokyo: The United Nations University.

Sène, E.H. (1985). Trees, food production and the struggle against desertification. *Unasylva, 37*(150), 19-26.

Seymour, F.J. & Rutherford, D. (1993a). Contractual agreements in the Java Social Forestry Program. In J. Fox (Ed.), Legal Frameworks for Forest Management in Asia: Case Studies of Community/State Relation. *Occasional Paper No. 16* (pp. 31-37). Honolulu: East-West Center.

Seymour, F.J. & Rutherford, D. (1993b). Contractual agreements for community-based social forestry programs in Asia. In J. Fox (Ed.), Legal Frameworks for Forest Management in Asia: Case Studies of Community/State Relation. *Occasional Paper No. 16* (pp. 173-187). Honolulu: East-West Center.

Shepherd, G. (1993). Africa: semi-arid and sub-humid regions. In D.A. Messerschmidt (Ed.), *Common Forest Resource Management. Annotated Bibliography of Asia, Africa and Latin America* (pp. 98-191). Rome: Food and Agriculture Organizations of the United Nations.

Shipton, P. (1988). The Kenyan land tenure reform: Misunderstandings in the public creation of private property. In R.E. Downs & S.P. Reyna (Eds.), *Land and Society in Contemporary Africa* (pp. 91-135). Hanover and London: University Press of New England.

Singleton, S. & Taylor, M. (1992). Common property, collective action and community. *Journal of Theoretical Politics, 4*(3), 309-324.

Sombroek, W.G., Braun, H.M.H. & van der Pouw, B.J.A. (1982). *Exploratory Soil Map and Agro-Climatic Zone Map of Kenya, 1980.* Nairobi: Ministry of Agriculture.

Teel, W. (1984). *A Pocket Directory of Trees and Seeds in Kenya.* Nairobi: KENGO.

Thomas, B.P. (1987). Development through harambee: Who wins and who loses? Rural self-help projects in Kenya. *World Development, 15*(4), 463-481.

Thomas, D.B., Edwards, K.A., Barber, R.G. & Hogg, I.C.G. (1981). Runoff, erosion and conservation in a representative basin in Machakos District, Kenya. In R. Lal & E.W. Russel (Eds.), *Tropical Agricultural Hydrology: Watershed Management and Land Use* (pp. 395-417). Chichester, UK: John Wiley & Sons.

Tiffen, M. (1991). Environmental Change and Dryland Management in Machakos District, Kenya 1930-1990: Population Profile. *ODI Working Paper No. 54.* London: Overseas Development Institute.

Tiffen, M., Mortimore, M. & Gichuki, F. (1994). *More People, Less Erosion: Environmental Recovery in Kenya.* Chichester, U.K.: John Wiley & Sons Ltd.

Todaro, M.P. (1992). *Economics for a Developing World.* 3rd edition. London and New York: Longman.

Toky, O.P. & Chaudhary, M.S. (1987). Amelioration of degraded semi-arid ecosystems through planting of multipurpose shrubs and trees. In P.K Khoslu & P.K. Kohli (Eds.), *Social Forestry for Rural Development* (pp. 120-126). Dehra Dun, India: Natraj Publishers.

Toulmin, C., Scoones, I. & Bishop, J. (1992). The future of Africa's drylands: Is local resource management the answer? In J. Holmberg (Ed.), *Policies for a Small Planet: From the International Institute for Environment & Development* (pp. 225-257). London: Earthscan Publications Ltd.

Trier, H.H. (1978). Model for an economic- and social-geographical classification of Kenya. *Geo Journal, 2*(4), 311-320.

Vandenbeldt, R.J. (1991). Rooting systems of western and southern African *Faidherbia albida* (Del.) A. Chev. (syn. *Acacia albida* Del.) - a comparative analysis with biogeographic implications. *Agroforestry Systems, 14*(3), 233-244.

Wade, R. (1988). *Village Republic: Economic Conditions for Collective Action in South India*. Cambridge: Cambridge University Press.

Wairagu, M.M. (1991). Run-off Harvesting in Kenya: Experiences gained from the Njemps Flats of Baringo District. *Technical Note No. 15*. Nairobi: Kenya Forestry Research Institute.

Warner, K. (1993). *Patterns of Farmer Tree Growing in Eastern Africa: A Socioeconomic Analysis*. Oxford: Oxford Forestry Institute and International Centre for Research in Agroforestry.

Watson, D.J. (1989). The evolution of appropriate resource management systems. In F. Berkes (Ed.), *Common Property Resources. Ecology and community-based Sustainable Development* (pp. 55-69). London: Belhaven Press.

Weber, F.R. & Stoney, C. (1986). *Reforestation in Arid Lands*. Arlington, USA: Volunteers in Technical Assistance.

West, P.C. (1978). Some sociological aspects of forestry community development projects in developing countries. In *Proceedings of the Eighth World Forestry Congress, Volume II* (pp. 215-222). Jakarta: Organizing Committee of the Eighth World Forestry Congress.

West, P.C. (1983). Collective adoptions of natural resource practices in developing nations. *Rural Sociology, 48*(1), 44-59.

Western, D. & Dunne, T. (1979). Environmental aspects of settlement site decisions among pastoral Masai. *Human Ecology*, 7(1), 75-98.

Westoby, J.C. (1975). Making trees serve people. *Commonwealth Forestry Review, 54*(3/4), 206-215.

Whittington, D., Mu, X. & Roche, R. (1990). Calculating the value of time spent collecting water: Some estimates for Ukunda, Kenya. *World Development, 18*(2), 269-280.

Williams, P.J. (1992). *Women's Participation in Forestry Activities in Africa, Project Summary and Policy Recommendations*. Nairobi: Environment Liaison Centre International.

Workman, J.P. & Fowler, J.M. (1986). What is optimum stocking rate? In P.J. Joss, P.W. Lynch & O.B. Williams (Eds.), *Rangelands: A Resource under Siege. Proceedings of the Second International Rangeland Congress* (pp. 101-102). Canberra: Australian Academy of Science.

World Bank. (1986). *Population Growth and Policies in Sub-Saharan Africa*. Washington, D.C.

Worou, L. & Nao, T.V. (1982). Orienting forestry toward the needs of people. *Unasylva, 34*(136), 8-10.

Yagi, H. (1992). *Sinrin dojo bun'ya tanki senmonka houkokusho* (Report on Forest Soils). A report submitted to the Japan International Cooperation Agency.

Yamashita, H. & Noda, N. (1990). Report of the Survey on Training Needs in Semi-arid Areas of Kitui, Machakos, Embu and Meru Districts. *Project Working Paper No. 5*. Nairobi: Kenya/Japan Social Forestry Training Project.

APPENDIX: AGREEMENT BETWEEN FARMERS' GROUPS AND THE GOVERNMENT

Agreement between Kenya Forestry Research Institute

and (group name) Group

on Tree Planting in the Pilot Forest Area

AN AGREEMENT made this (date) day of (month) one thousand nine hundred and eighty-eight BETWEEN KENYA FORESTRY RESEARCH INSTITUTE a body corporate established under the provisions of the Science and Technology Act- Cap. 250 Laws of Kenya - and of Post Office Box Number 20412, Nairobi in the Republic of Kenya (hereinafter called "the Institute" which expression shall where the context so admits include its successors and assigns) of the one part AND (group name) GROUP of Post Office Box Number (postal address) in the said republic (hereinafter called "the Group" which expression shall where the context so admits its successors and assigns) of the other part.

WHEREAS:

A. The Institute is a research organisation engaged in various aspects of forestry research and the promotion of afforestation and for that purpose owns a piece of land in Yatta BII Location of Kitui District in the Republic of Kenya aforesaid which piece of land is situated in a place more commonly known as the Pilot Forest Area being Parcel Number (number) (hereinafter called "the piece of land").

B. The group wishes to undertake tree planting, growing and harvesting and for that purpose desires to utilise a portion of the piece of land.

C. The Institute and the Group wish to enter into an arrangement for the utilisation by the Group for the purpose of tree planting, growing and harvesting aforesaid on a leasing basis of a portion of the piece of land of land measuring (size of land allocated) hectares or thereabouts and the geographical particulars of boundaries of which are shown in the sketch map marked "SM" in red attached hereto.

NOW IT IS HEREBY AGREED AS FOLLOWS:

1. The Institute shall grant to the Group that the use of and the Group shall take from the Institute on lease the said portion of the piece of land for a period of Ten (10) years from the date of this Agreement PROVIDED that the Institute may at its absolute discretion and should the Group so desire grant to the Group an extension of lease of the portion of the piece of land beyond the said period of Ten (10) years for such further periods as the Institute may determine.
2. The Group shall utilise the said portion of the piece of land purely for the purpose of planting and growing trees and the promotion of afforestation aforesaid PROVIDED however that the Institute may on a request made to it by the Group for that purpose grant consent to the Group in writing to utilise and the said portion of the piece of land or any portion thereof for such other purpose or purposes as the Institute may specify.
3. The Group shall protect, tend to otherwise take care of the planted trees in such manner and according to such format and requirements as the Institute may from time to time stipulate.
4. The Group or any member thereof shall not settle, build or otherwise construct any structure whatsoever whether permanent or otherwise on the said portion of the piece of land or portion thereof and any such settlement, building or construction so undertaken in contravention of this clause shall render this Agreement null and void and of no legal effect.
5. The trees planted and grown by the Group under this Agreement on the said portion of the piece of land shall become the property of the Group PROVIDED that neither the Group nor any member thereof shall harvest or otherwise in any manner impose of such planted trees without the consent of the Institute and any harvest or disposal of such planted trees in contravention of this clauses shall render this Agreement null and void and of no legal effect.
6. The Group shall at all times for the duration of this Agreement furnish the Institute with the list of all its members, its address and the names and address or addresses of its leaders or officials and the Group shall inform

the Institute promptly of any change or changes in the membership leadership and address or addresses of the Group or its leaders and officials.

7. The Institute shall give the Group such technical guidance and assistance as the Institute may consider necessary for the purpose of ensuring the Group's success in the said tree planting, growing and harvesting exercise.

8. The Institute may terminate this Agreement on any of the following grounds:

   i) If the Group is in breach of any of its duties and obligations under this Agreement or any other document or memorandum which is supplementary to this Agreement.

   ii) If the Group commits any criminal offence punishable by law in relation to the Group's utilisation of the said portion of the piece of land or the unauthorised harvesting or disposal of such planted trees.

   For the purpose of this clause the expression "Group" shall mean and include the Group and any member or members thereof.

9. The Institute shall not charge any rent or impose any other levy whatsoever on the Group in respect of the utilisation by the Group of the said portion of the piece of land.

10. The Group may not terminate this Agreement without the consent of the Institute in writing (such consent however not to be unreasonably withheld).

IN WITNESS whereof the Institute has caused its Common Seal to be hereunto affixed and the duly Authorised Representatives of the Group have set their respective hands hereto the day and year first above written.

SEALED with the Common Seal of

KENYA FORESTRY RESEARCH INSTITUTE

in the presence of: DIRECTOR_____SIGNED by_____

the duly Authorised Representatives of_____GROUP in the presence of: