

Population Settlement and Forest Cover Dynamics in West Laikipia, Kenya

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&

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Abstract

This paper which discusses the conflict between population dynamics and forest resource utilization is part of a wider Population-Development-Resource nexus that has characterized recent debates in the global arena. In Laikipia District, and West Laikipia in particular, the dramatic changes in land cover and/or land use since the beginning of this century have drastically impacted on forest cover in the district. The study found out that a majority of the small-scale holder in-migrants into the various settlement schemes in West Laikipia largely came from Central Province. Nyeri District contributed 43% of the total in-migrants and was closely followed by Kiambu District with 15%. Landlines *per se* also accounted for 51% of the reasons for out-migration from the area. Forest depletion was largely caused by the Government policy of forest excision for settlement, excessive population pressure on the forest resources for both commercial and subsistence needs, etc. The study concludes by suggesting a wide palette of policy alternatives that could lead to striking a balance between resource availability and utilization for the sustainable development of the district.

Introduction

West Laikipia lies approximately between 36° 15' 6 and 36° 57' 6 East and 0° 00' and 0° 48' 8 North. It covers an area of 4579 square kilometres, and borders Baringo District to the west, Nakuru and Nyandarua to the south and Samburu District to the north (Figure 1). West Laikipia is made up of three administrative divisions namely: Ng'arua, Rumuruti and Nyahururu Divisions (Figure 2). Ng'arua Division covers an area of about 1983.9 square kilometres (about 20.5 percent of the total district area), with a total population of 92610 (1995), and lies mainly in the agro-ecological zone II.

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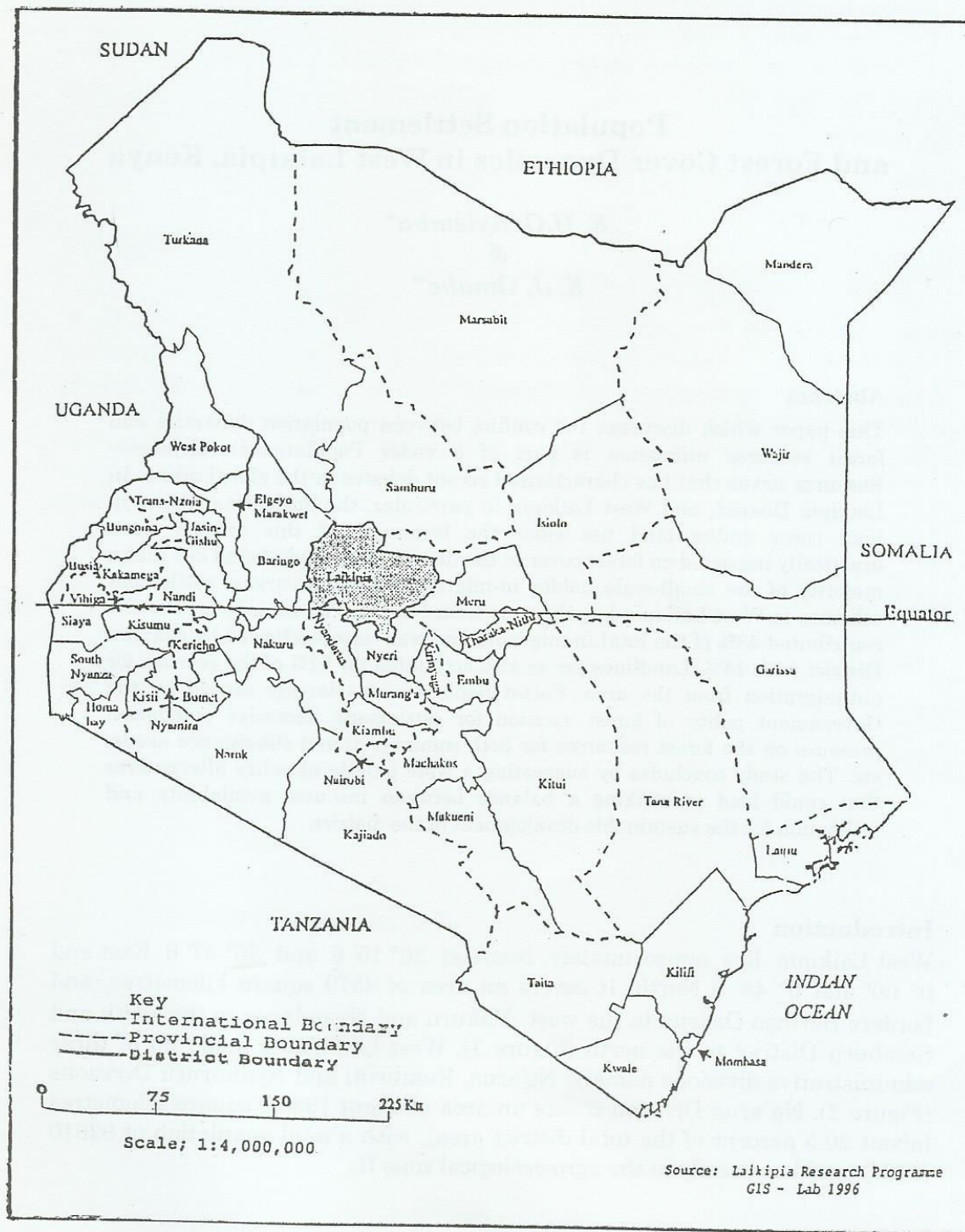


Figure 1: Laikipia District in Northern Context

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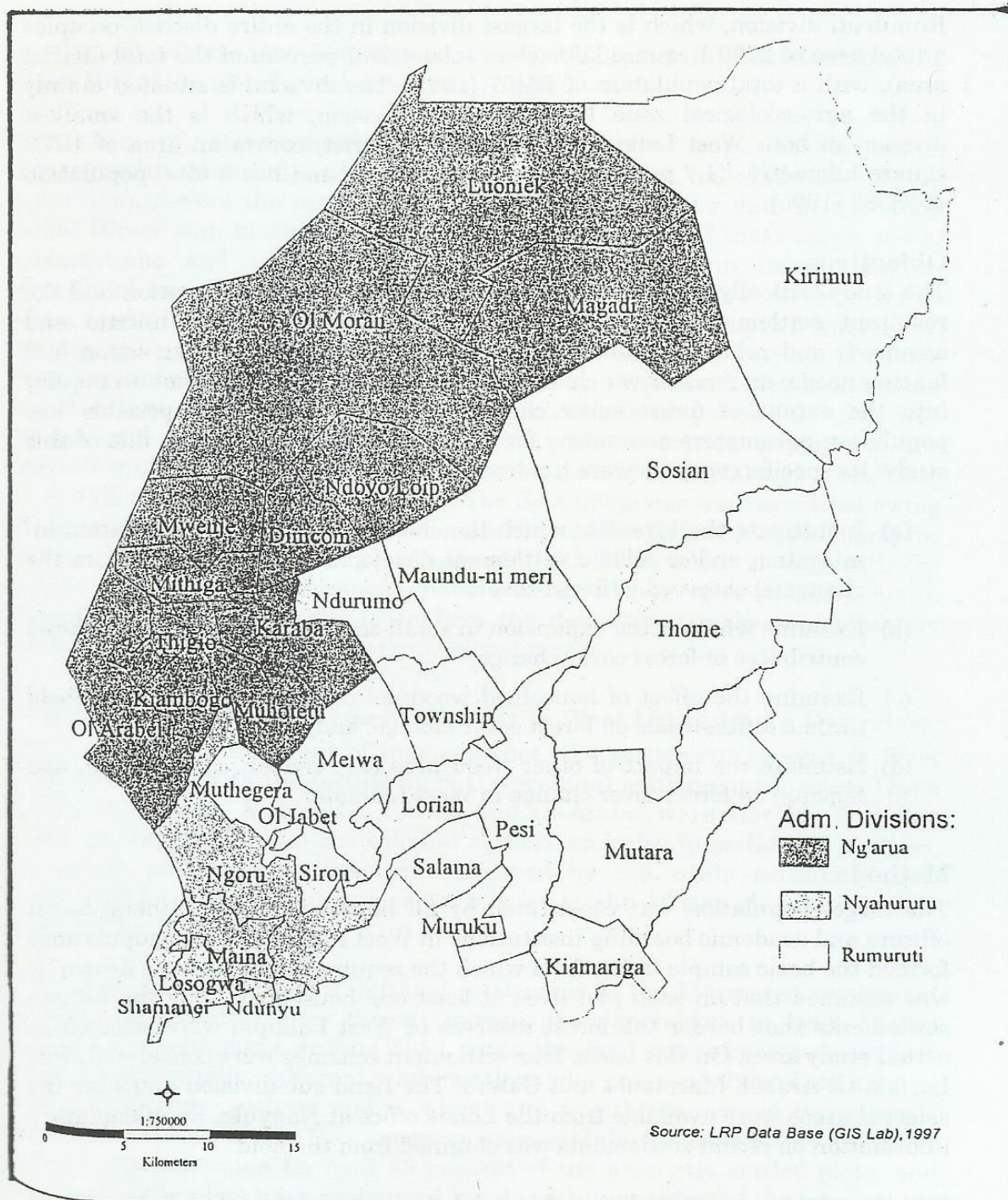


Figure 2: Administrative Divisions of West Laikipia

Rumuruti division, which is the largest division in the entire district, occupies a total area of 2786.1 square kilometres (about 28.7 percent of the total district area), with a total population of 72407 (1995). The division is situated mainly in the agro-ecological zone II. Nyahururu division, which is the smallest division in both West Laikipia and Laikipia district, covers an area of 167.3 square kilometres (1.7 percent of the district area), and has a total population of 38383 (1995).

Objectives

The study critically examines the impact(s) of population in-migration and the resultant settlement, selected population characteristics (both innate and acquired) and related population needs (firewood, farming, construction and fencing needs) on forest cover change in West Laikipia. It also makes an inquiry into the extent of forest cover change in the area and the possible key population parameters accounting for this change form the bottom line of this study. Its specific concerns were to:

- (a) Investigate the extent to which the changes prevalent in population in-migration and/or related settlement development over time explain the change(s) observed in forest cover;
- (b) Examine whether the expansion in small-scale farming in West Laikipia contributes to forest cover change;
- (c) Examine the effect of household woodfuel consumption and household income differentials on forest cover change; and,
- (d) Estimate the impact of other wood uses (e.g. timber, construction, and fencing) on forest cover change in West Laikipia.

Methods

The target population was constituted by all households, saw millers, forest officers and academic boarding institutions in West Laikipia. These populations formed the basic sample frame from which the required samples were drawn. It was assumed that on each plot lives at least one household. Only the human settlements that border the forest reserves of West Laikipia were selected as actual study sites. On this basis, four settlement schemes were considered, viz.: Lariak, Ol-Arabel, Marmanet and Gatero. The Land sub-division maps for the selected areas were available from the Lands office at Nanyuki. Supplementary information on recent settlements was obtained from the field.

Sample selection was randomly done. All the plot numbers for each selected actual study site were first listed down. As at February, 1997, there were a total of 210 plots in Lariak settlement scheme, 370 plots in Ol-Arabel settlement scheme, 480 plots in Marmanet settlement scheme and 850 plots in Gatero

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settlement scheme, totalling approximately 1910 plots in West Laikipia. At least 10% of the plots in each area were selected.

The use of standardized questionnaires, direct map measurements, photographic material and observations (both direct and indirect) of the interviewers were the main tools used to compile primary data in the study area. Direct map measurements and the interpretation of these maps, aerial photographs and satellite imagery were used to obtain information on forestland cover change in the designated years. Change(s) in forest cover in West Laikipia over the selected years (1961 to 1996) was compiled from aerial photographs (1: 50,000, 1: 10,000 and 1: 12,000), SPOT imagery (1: 250,000), and base maps of the study area (1: 50,000). From the aerial photographs, the areal extent of coverage of the forests at designated periods in time was transferred according to change detection onto a tracing paper and the reduction of aerial photographs of large scales namely 1: 10,000 and 1: 12,000 to 1: 50,000 done and the data digitized. The Spot imageries were mosaiced owing to their many flight paths, and this process was then followed by photographic processing and enlargement to a scale of 1: 50,000 in order to tally with the scales of the other data sources, namely aerial photographs and base maps. Ground truthing was done to confirm the details and make the necessary corrections for the production of provisional maps.

Migration and the Settlement Process in West Laikipia: An Overview

Soon after the attainment of independence, the settlement process in West Laikipia began with the setting up of Government settlement schemes. Three schemes, namely, Marmanet, Lariak and Ol-Arabel were started. This was done in order to replace the colonial settlers and also to settle the landless, squatters and workers formerly employed by the white settlers. Later, organized land-buying companies, mainly led by the African elite, also bought land in the area.

The Government of Kenya initiated settlement in the Marmanet settlement scheme immediately after the attainment of independence in 1963. It was opened for settlement around 1967 when the land subdivision process was completed. Initially, different white settlers who practised dairy farming and cultivated crops, such as maize, wheat and pyrethrum, owned the scheme. The beneficiaries of this loan program were, mainly, landless Kenyans. These allocations accounted for over 83 percent of the presently settled plots, and the rest of the plots have exchanged hands with time. Most of the immigrants came from Central province with about 37.5 percent coming from Nyeri District, 25 percent from Kiambu District, 16.6 percent from Murang'a and the rest of the immigrants from other parts of the country. By 1996, the total

number of plots (settled and unsettled) was 480¹, and the average plot size per household was 35 acres². Notably, whereas the settlement process in Marmanet scheme started in 1967 and accelerated to reach its peak in 1968, the process still continues, albeit at a slower pace. Most of the plots were acquired in 1967 and a fairly large proportion (41 percent) of them were settled in the same year, followed by 25 percent in 1969 and the rest spread over time up to the present. The high rate of settlement in the scheme is reflected by the fact that 64 percent of the immigrants settled immediately once they acquired the plots. Some of the in-migrants, however, settled much later.

During the colonial time, the white settlers who owned Lariak settlement scheme practised mixed agriculture, wheat and maize being the main crops, beef and dairy cattle, sheep, goats and horses for livestock production. The process of land subdivision took place in 1968 and 1969. The in-migrants into the scheme mainly came from Nyeri (38.1 percent), Murang'a (19.7 percent), Kiambu and Kericho (9.5 percent each) and the rest from Nandi, Nakuru, Meru, Laikipia and Nyandarua Districts. A look at the ethnic composition of the immigrants in this settlement showed that a large proportion of the beneficiaries were the Kikuyu from Central Province. Perhaps this resulted from the population pressure in their area of origin during the time, their proximity to the settlement area, the tendency for the Kikuyu to search for job opportunities both in the farms and urban areas, and land scarcity, among other considerations.

The Lariak scheme has about 210 plots with an average plot size of 26 acres per household. Of these plots, the Government of Kenya initially allocated about 57 percent to the settlers and the rest have exchanged hands over time. About 80.9 percent of the present plots were acquired in 1969 and 9.5 percent in 1970. The process of land acquisition is still going on through subdivisions resulting from buying and selling, although at a slow pace. Although most of the plots in Lariak settlement scheme were acquired 1969 and 1970, 71 percent of the immigrants settled in 1969 and only 9.5 percent settled in 1970. The rest of the immigrants settled in the years 1971, 1972 and 1975. This immediacy in settlement is a reflection of the great demand for land at the time, mostly for settling the people from the highly populated districts of the Central Province and other areas, and also for agricultural purposes.

The Ol-Arabel settlement scheme, during the colonial era, was mainly under mixed agriculture. Land subdivision in the scheme took place in 1968 and 1969. The scheme has about 370 plots with an average plot size of 31.8 acres.

¹ According to the land registry record as at December 1996.

² Calculated on the basis of the 48 plots sampled in the study.

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Whereas 83.7 percent of the plots are those that were given out by the Government of Kenya, 16.4 percent of the plots have either been bought or sold recently. Only 8.1 percent of the plots were acquired in 1968. 67.5 percent of the plots were acquired in 1969 and 10.8 percent in 1970. The rest of the plots have been acquired in recent times. A majority of the immigrants (83.7 percent) settled immediately after being allocated these plots while the rest have been settling quite gradually. The degree of settlement in the scheme is quite high, except in a few areas, which are not settled, but under cultivation. Most of the in-migrants into the scheme came from Nyeri (42.3 percent), Kiambu (16.2 percent), Uasin-Gishu (8.1 percent), Baringo (8.1 percent), and Kericho (5.4 percent). The rest came from Murang'a, Laikipia, Embu, Nyandarua, Nakuru and Keiyo Marakwet Districts. Although the Kikuyu population still predominates in the immigrant population, the proportions of settlers in Ol-Arabel scheme show a fair representation in terms of ethnic composition and together with Marmanet and Nyahururu schemes, forms the oldest schemes in the district.

Gatero Settlement Scheme (Marmanet Extension Scheme) forms part of the area recently excised from the Marmanet forest and allocated for settlement by the Government of Kenya. The process of plot acquisition in the scheme depicts that 16.6 percent of the plots were acquired in 1976, 30 percent in 1977 and 23.3 percent in 1978. However, while plot acquisition, which started in 1974 and accelerated to peak in 1978, reflects a serious need for land, the consequent settlement process in the area portrays a relatively slow process. This situation would be attributed, though partially, to the insatiable need for land among the settlers. The Government of Kenya, in order to settle people, excised about 10,000 hectares of forestland in the area. The in-migrants came, in a descending order, from Nyeri (50 percent), Murang'a (16.7 percent), Laikipia (13.3 percent), Kiambu and Nyandarua (6.7 percent each) districts of Central Province. The rest came from other districts in Kenya, particularly from Kericho (3.3 percent) and Samburu (3.3 percent) districts of the Rift Valley Province. From these statistics, it is evident that, like in the other settlement schemes, the Kikuyu population was predominant among the settlers in west Laikipia, though varying in their sizes from one settlement scheme to another.

The overall settlement process in West Laikipia shows that the pace of settlement has been rather quick to reach its peak and thereafter being characterized by a slow progression. Population changes, as a result of both the natural increase and in-migration, would also be reflected in the resultant changes observed in plot sizes since the time of plot acquisition in West Laikipia (Table 1). These changes have occurred through processes such as buying, selling, and land partitioning among family members.

Table 1: Details of change in plot sizes in West Laikipia

Area Surveyed	Sampled Plots	No Change* Plots	Increased in Size	Reduced in Size
Lariak Scheme	21	16	0	5
Ol-Arabel Scheme	37	26	0	11
Marmanet Scheme	48	22	1	25
Catero Scheme	30	28	1	1
Total No. of Plots	16	92	2	42
Percentage	100	67.6	1.4	31.0

Source: Omoke, K.J. (1998).

From Table 1, it is noted that despite the fact that 67.6 percent of the plots in the area of study have not undergone any change, a good number of them have either increased or reduced in size. 31 percent of the plots have reduced in size and only 1.4 percent has increased in size. An examination of the reduction in plot sizes shows that while 21.1 percent of the reduction has been due to selling of land to in-comers, only 8.9 percent has occurred due to partitioning of land among family members. Although the pace of settlement in these areas has already reached its peak, the process seems destined for posterity, albeit more slowly.

As has been established, the majority of the small-scale holder in-migrants into the various settlement schemes in West Laikipia largely came from Central province. It is apparent that Nyeri district contributed profoundly (43 percent) to the total number of in-migrants, and was therefore the main source of immigrants into West Laikipia. This was closely followed by Kiambu district, which contributed 15 percent of the in-migrants. The rest of the in-migrants came from other areas in the country. All in all, Central province contributed a majority of the immigrants into the area. The high population density in the areas of origin and the proximity of the populations could, among other factors, explain this situation.

Population Dynamics

The settlement process in West Laikipia started at a quick pace in 1967, reached its peak in 1969 and 1971, and then slowly stabilized on to a low progression to date. Nyeri District in Central Province was the main source of in-migrants into West Laikipia as it contributed 43 percent of the total in-migrants, followed by Kiambu (15%). In terms of ethnic composition, the Kikuyu constitute 72% of the total immigrant population into West Laikipia.

Based on the reasons cited by the respondents for migrating from their areas of origin, land unavailability was almost the single determining 'push' factor. Land shortage, whether owing to subdivisions into uneconomic parcels due to

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population pressure, or landlessness *per se* accounted for a significant 51% of the reasons for out-migration from the source areas. However, other push factors, such as the need to farm, to own property, to search for jobs, especially in the urban areas in Laikipia District, and the unfavourable climatic conditions, were also important. Looking at the reasons for settling in receiving areas, again, land availability features significantly as a pull factor as it accounts for over 76 percent of the reasons cited. The fact that the Government of Kenya opened the area for settlement after the exit of the former occupants of the area designated as the *White Highlands* heightened the search for land for settlement and farming. The populations that came to settle in West Laikipia, especially from Central province, are mainly agricultural populations. However, other reasons such as the presence of relatives in the area of settlement, pleasant weather conditions, and the need to evangelize explain the later migrations into the area. The in-migration trends into West Laikipia are shown in Figure 3.

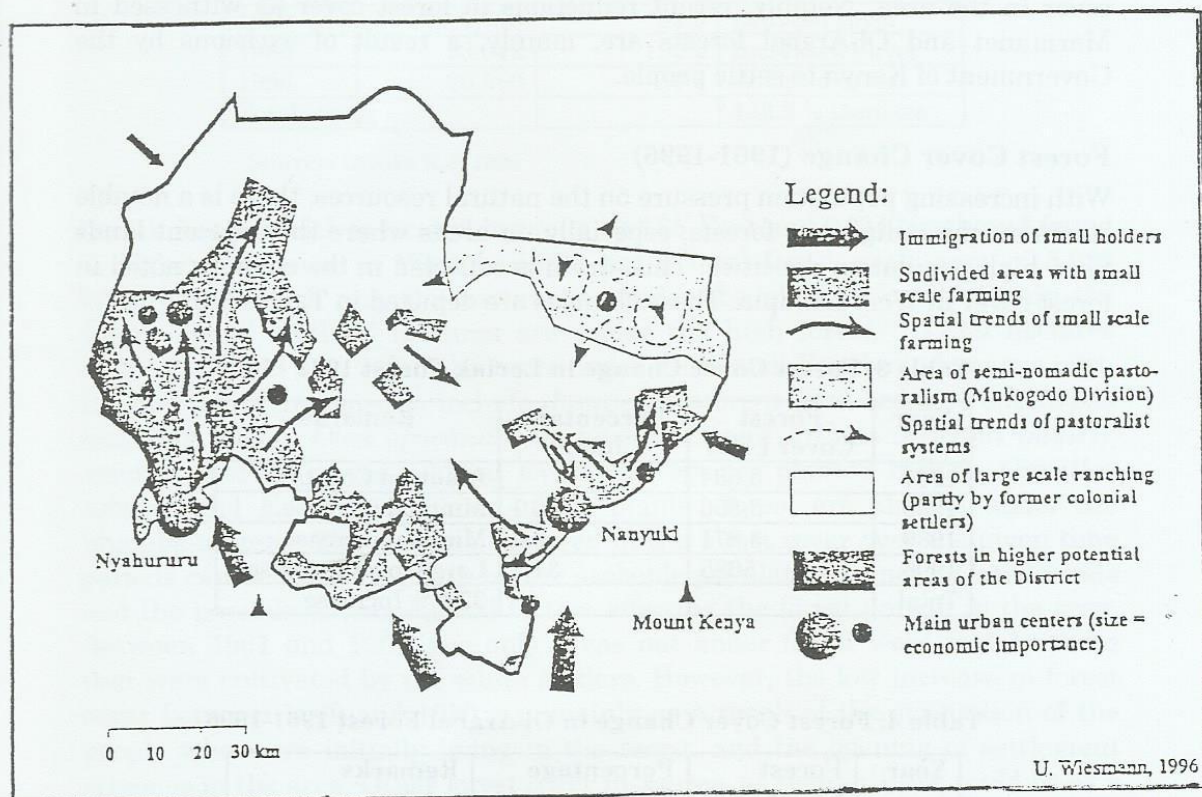


Figure 3: Migration Trends in Laikipia District

The relationship between the rate of population in-migration and/or settlement and forest cover change in West Laikipia is summarized in Table 2.

Table 2. Rate of Settlement and Forest Cover Change in West Laikipia

Year	Rate of Settlement (%)	Rate of Forest Cover Change (%)
1969	49.3	-27.7
1980	25.0	123.2
1996	35.0	-1.6

Source: Omoke, K.J. 1998

The rate of settlement in West Laikipia over time has influenced, at least significantly, the rate of forest cover change in the area. An increase in in-migration and/or settlement accounts for 80 percent of the reduction in forest cover in the area. Notably, recent reductions in forest cover as witnessed in Marmanet and Ol-Arabel forests are, mainly, a result of excisions by the Government of Kenya to settle people.

Forest Cover Change (1961-1996)

With increasing population pressure on the natural resources, there is a notable strain on the indigenous forests, especially, in areas where the adjacent lands have high population densities. This strain is reflected in the changes noted in forest cover in West Laikipia. These changes are depicted in Tables 3-6.

Table 3: Forest Cover Change in Lariak Forest 1961 - 1996

Year	Forest Cover (Ha)	Percentage Change	Remarks
1961	3,634		Assumed Constant
1969	3,856	6.1	Minimal increase.
1980	3,871	0.4	Minimal increase.
1996	5085	31.4	Large cover increase
Total			37.9 % Increase.

Table 4: Forest Cover Change in Ol-Arabel Forest 1961-1996

Year	Forest Cover (Ha)	Percentage Change	Remarks
1961	5,350		Assumed Constant
1969	2,815	47.3	Reduced Cover.
1980	9,781	247.5	Increased cover
1996	7,067	27.5	Reduced cover
Total			172.7 % increase

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Table 5: Forest Cover Change in Rumuruti Forest 1961-1996

Year	Forest Cover (ha)	Percentage Change	Remarks
1961	5192		Assumed Constant
1969	4322	16.8	Reduced cover
1980	6420	48.5	Increased cover
1996	6450	0.5	Increased cover
Total			32.2 % increase

Table 6: Forest Cover Change in Marmanet Forest 1961-1996

Year	Forest Cover (Ha)	Percentage Change	Remarks
1961	16,503		Assumed Constant.
1969	7,780	52.9	Reduced cover.
1980	23,042	196.2	Increased Cover.
1996	20,556	10.8	Reduced cover.
Total			132.5 % increase.

Source: Omoke K.J, 1998

Lariak forest, which is located between 36 ° 35' East and 0 ° 34' North and found in Ng'arua division in West Laikipia has a total forest cover area of 5,085 hectares, of which only 0.2 hectares is under the planted forest. Within the forest, about 3,146.93 hectares are under the high forest, 1,173.9 hectares under bushland and 746.17 hectares under grassland. For the indigenous part, the dominant tree species include *Juniperus procera* (Red cedar), *Podocarpus latifolius* (podo), *Olea africanum* (mutamaiyu), and *Prunus africana* (muiiri), among others. For the planted forest, the species planted include *Grevillea robusta* and *Eucalyptus*. Trees in the planted forest are planted under the 'shamba-system'. The changes observed in the forest cover over the given time periods can be explained both by the probable population trends, related needs and the possible environmental factors affecting the forest growth in the area. Between 1961 and 1969, the only areas not under forest were mainly those that were cultivated by the white settlers. However, the low increase in forest cover between 1969 and 1980 was mainly as a result of the evacuation of the people who were initially living in the forest, and the opening of settlement schemes in the area. Other forest cover increases, as seen in 1996, could be as a result of tree planting using the shamba system.

Like Lariak forest, Ol-Arabel forest which is situated between 36 ° 25' East and 0 ° 33' North in West Laikipia is mainly an indigenous forest, although a very

small fraction of the forest is under exotic trees. Other than the role played by environmental factors in determining the present forest cover in this forest, population factors seem to be predominant. The white settlers formerly farmed the present Ol-Arabel scheme. The overall 172.7 percent increase in forest cover in Ol-Arabel forest over the years could be a result of the removal of people from the forest, especially in 1980, to allow for forest density regrowth. However, there seems to be an insatiable need, among small-scale farmers, to encroach on the forest areas for cultivation, possibly to meet their increasing food needs owing to the increasing population pressure. Of the three indigenous forests in West Laikipia, and probably the entire district, Ol-Arabel forest is the most threatened with extinction mainly from very recent land allocations and consequent settlement. The settlers have put up 'seemingly' makeshift house structures in the forest and are using these new abodes as bases from which to clear, at least wantonly, the forest for cultivation and settlement.

Rumuruti forest (*Kambi ya Simba*) lies between 36° 43' East and 0° 18' North in Rumuruti division. It is mainly an indigenous forest, though with a small portion (227 hectares) under the exotic trees, with the main tree species being eucalyptus (numerous species) and cedar. This indigenous forest contains species such as *Olea*, *Podocarpus* (especially along the watercourses), "*mbarakira*", "*mileleshwas*" and *Dodonea* in stony areas, and the "*munuga*". The standing volume of trees in Rumuruti is not known. The loss in forest cover in Rumuruti forest, realized between 1961 and 1969, was due to, among other possible considerations, the 600.1 acres excised and given to a white settler by the name *John Cordarving*³ to cultivate. Also, it was due to some settlements and cultivation in the forest during that period. Most of the forest was opened up for such practices. However, this was reversed later by the government of Kenya in a bid to protect these forests from destruction. This would explain the 48.5 percent increase in forest cover especially between 1969 and 1980. Like Lariak forest, Rumuruti forest has not been interfered with so much by the human activities except the illegal charcoal burning, cutting of cedar trees for fencing and construction purposes, and illegal honey hunting which leads to occasional forest fires. In terms of the tree species, the *Oleas* have reduced drastically due to their high demand for charcoal and firewood.

Marmanet forest, which is an exotic forest, lies between 36°3' East and 0°17' North. It is constituted by three forest substations namely, Marmanet north, Marmanet south and Gitundaga. Gitundaga forest substation occupies the largest area (55.6 percent) followed by North Marmanet, occupying 26.5 percent and South Marmanet covering only 17.9 percent of the total forest area. The total area covered by these forests as at 1996 was 20,556 hectares. The major tree species available in these forests include *Pinus* (three species) and

³ Rumuruti forest station office.

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Eucalyptus. For the sections with indigenous trees, species such as *Olea africana*, *Podocarpus* and *Juniperus procera* are predominant. The planted forest is mostly sawn into useful timber. Over 30 sawmills are stationed in these forests. Products such as sawn timber and off-cuts are produced. The indigenous trees are, mainly, harvested for firewood, charcoal and poles for construction and fencing purposes. These are some of the main causes of the forest cover reduction experienced over the past years.

From the changes observed in Table 6 above, it is apparent that Marmanet forest has experienced some cover oscillations between reduction and increase during the designated periods in time. Notably, there was a 52.9 percent reduction between 1961 and 1969 possibly due to increased temporary settlements within the forest during the period. This was followed by a substantial increase in forest cover of 196.2 percent between 1969 and 1980 owing to the fact that all the settlers had been evacuated from the forest, and cultivation within the forest banned to allow for vegetation re-growth. However, the excision of some part of the forest to settle people led to a small reduction in forest cover of 10.8 percent which is reflected between 1980 and 1996. The excision, which took place in 1974, formed Gatero settlement scheme, particularly, to settle the landless people formerly working in the forest plantations. Increased saw-milling activities could also explain this situation. However, over the years, there was a notable overall increase of 132.5 percent. Most of the Marmanet forest area has been put under the shamba system for a longer period than any of the forests in West Laikipia. This is both a positive and negative aspect with regard to forest cover change.

It was realized that the total forest cover in West Laikipia reduced tremendously from slightly over 30,000 acres in 1961 to slightly lower than 20,000 acres in 1969. Interestingly, forest cover increased from 18,773 acres in 1969 to peak at 43,114 acres in 1980, and only to begin a downward trend reaching slightly below 40,000 acres in 1996. Generally, there occurred an overall increase in forest cover in all forests in West Laikipia since 1961. It must be pointed out here that this change is, mostly, due to the regeneration of the vegetation within the forest to cover the areas that were left bare as a result of settlement and cultivation, especially in 1961 and 1969. It was also due to the tree planting efforts by the Forest Department through the shamba system. However, an examination of the changes in the forest cover of the individual forests shows wide variations. There was a general reduction in forest cover between 1961 and 1969 in West Laikipia. This tremendous reduction was a result of an increase in the number of settlers in the forests in the hope of having the forestland subdivided among them by the Government of Kenya. This was coupled with increased cultivation to meet the growing demand for food as a result of the increased human population within the forests. It is also observed that saw-milling activities within these forests were rampant.

Between 1969 and 1980, there was an overall increase in forest cover of about 129.6 percent. This followed the removal of the people from the forests. It was also due to an increased afforestation programme through the shamba system. However, an examination of the individual forests shows that while there appears to be an overall increase in Marmanet forest cover (196.2 percent) between 1969 and 1980, mostly due to regrowth, a substantial area of the forest was excised in 1974, creating what is, presently, called Gatero Settlement Scheme. Such excisions are one way through which forestland is being lost. Between 1980 and 1996, there seems to be a general decline in forest cover in all forests in West Laikipia except in Lariak and Rumuruti forests. The reduction in Ol-Arabel forest is mainly due to an excised part of the forest that had been turned into an area for settlement. The reduction in forest cover in Marmanet forest could be attributed to the increased saw-milling activities in the forest. The slow increase in forest cover in Rumuruti forest (0.47 percent) could be attributed to the relative non-interference of the forest by the human population surrounding the forest. The increase of 31.4 percent witnessed in Lariak forest between 1980 and 1996 is explained by the 'shamba' system practised, especially in the southern part of the forest. Also it is due to the relative non-interference of the forest by the human population owing to its good management and the poor soils, with some rock outcrops, which are not suitable for farming activities. However, some new settlements encroaching on the forest, especially in the southern part of the forest around Sipili area, are threatening this forest. Some new markets coming up, especially in the southern part of the forest, are also drawing so much from this forest in terms of wood for construction and woodfuel.

Population Characteristics and Related Forest Resource Utilization

Both the innate and acquired household population characteristics examined here relate to forest resource use over a specified time frame. Based on the changes observed in the selected household characteristics, and how they affect consumption and/or utilization of the forest resources, projections are attempted:

Population size, density and distribution

In West Laikipia, population characteristics such as size, composition, growth rates and density are linked to the variations in the agro-ecological potentials, security and subsistence, off-farm activities, migration trends and the human/wildlife conflicts. These parameters are area-specific and inter-linked.

Based on the 1979 population census results, the total population of West Laikipia was approximated at 83147 (Table 7), with a density of 18 persons per square kilometre. Following the 1989 population census, the total population was estimated to be 129849 people, with a male population of 64499 and a

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female population of 65350. This gives a ratio of 50.3 to 49.7 in favour of females. On the basis of these statistics, the general population growth rate was calculated at 4.39 percent per year, compared to the district growth rate of 4.65 per year. It takes about 16 years for the population in the area to double itself as compared to the district population, which takes 15 years to double. This means that in the year 2005, the population in West Laikipia, assuming that the current rates of growth will continue, will be 259698.

An examination of the population doubling times for the administrative divisions of West Laikipia shows that the population in Ng'arua division will take a relatively shorter time of 11.3 years to double itself as compared to the 25 years of Rumuruti Division. Notably, at this rate, the population is destined to strain the available natural resources, especially the forest resources. This is because the forest resources do not regenerate at that rate. It is also worth noting that over 26 percent of the population at any one given year in this area consists of children under 15 years of age and persons over 60 years of age, i.e. the dependent population. This large dependent pool puts a lot of strain on the available resources in the area.

Table 7: Population Distribution Change in West Laikipia (1979-1989)

Administrative Area	Population 1979	Population 1989	Index of Spatial Change (IC)
Rumuruti Div.	48,279	63,941	1.324
Ng'arua Div.	34,868	65,908	1.890
West Laikipia	83,149	129,849	1.561
Laikipia District	134,534	218,957	1.627

Sources: CBS, 1979, 1989, Omoke, K.J. 1998.

The spatial changes in the population distribution in the area between 1979 and 1989, depicted in Table 7 above, show that in comparison with other areas in the district, Ng'arua division has the highest index of spatial change (1.89) as compared to Rumuruti division with an index of 1.32. West Laikipia has an index of 1.56. Laikipia District, compared with its specific administrative divisions, has a slightly higher index of 1.62.

Forest Resource Related Population Needs and/or Activities

Household Energy Utilization

Fuelwood constitutes the single main source of energy, particularly, for cooking and warming purposes in West Laikipia. Although over 81 percent of the households in the area commonly use a combination of firewood, charcoal and kerosene to meet their household energy needs, firewood alone accounts for over 90 percent of these needs. However, household wood fuel consumption varies significantly with household characteristics, such as, household size,

education levels and income differentials. Firewood is the only alternative source of energy for most households in the area and, consequently, one of the main causes of deforestation in the area. Firewood, which is mainly collected by women and children, comes from three main sources, namely, indigenous forests, planted forests, and woodlots. In Lariak Settlement Scheme, over 66 percent of the households meet their fuelwood needs from the indigenous forest, and the rest from woodlots. In Ol-Arabel, 43 percent of the households meet their fuelwood needs from the indigenous forest, 45 percent from the planted forest and the rest from woodlots. In Marmanet, 32 percent obtain their fuelwood from the indigenous forest, 32 percent from the planted forest, and the rest from woodlots, and in Gatero Settlement Scheme, 10 percent of the households meet their fuelwood needs from the indigenous forest, 40 percent from the planted forest and the rest from woodlots.

Apart from firewood, charcoal is the main alternative source of energy, especially for cooking purposes. However, this source of energy is predominantly used by over 78 percent of the households in West Laikipia, for warming purposes, especially, during the wet and cold months in the year and also during cold nights. Charcoal is mostly produced as a by-product of clearing both at home and in the forest reserves either for settlement or cultivation or both. The local people also view it as a supplementary income-generating activity.

Apart from firewood and charcoal, kerosene forms the third most important source of energy for the local people in the area as it is used by 95.6 percent of the people. The rest of the people use either electricity (2.9 percent), or solar energy (1.5 percent) for lighting purposes. These other alternative sources of energy, such as, electricity, solar, gas etc are not common sources as only a handful of the people use them, either because they don't know that they exist or can't afford them.

An examination of the housing needs shows that the materials used in the construction of the walls include sawn timber, wood, rafters, tin sheets, drums, corrugated iron sheets, stone/bricks, and mud/cow-dung. Among these, sawn timber is the most widely used as over 35 percent of the households in the areas have made use of it. However, most of the construction reflects a combination of materials. Notably, stone (permanent) houses in the area account for only by 3 percent of the houses, while the other types of houses are constructed using a combination of materials. In fencing, fences made of barbed wires are not uncommon in the area. However, fences made of combinations of materials such as poles, natural bushes/twigs, and barbed wire are dominant, as they constitute 54 percent of the fences in the area. While most of the fencing poles are easily obtained from the saw-milling activities

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predominant in the area, others are illegally obtained from the natural forest reserves. This is one way of depleting our forest resources.

Human Activity Effects on Forests Cover Change

The need to increase the area under cultivation in order to keep abreast with the increasing demand for food is inevitable. The study found out that the expansion in small-scale farming in West Laikipia has contributed significantly to the loss in forest cover on the plots in the study area as shown in Figure 4 below.

It was observed that as the area under cultivation increases, there occurs a corresponding reduction in the area under forest cover on the plots. The expansion in the area under small-scale farming, since the time of plot acquisition and settlement, accounts for 66 percent of the loss witnessed in the area under forest cover in West Laikipia. 44 percent of the loss in forest cover could be explained by other factors. These factors include land subdivisions, unfavourable climatic conditions, low afforestation efforts, and an increasing need for wood and wood products, among other factors.

It was noted that only 12.5 percent of the household population owned small shamba in the forest reserves in 1996. This number reduced to 6.25 percent in 1997, reflecting the declining importance of the practice. By 1996, Lariak forest had about 200 shambas of one acre each and Marmanet forest had over 400 shambas of 0.5 acre each. The shamba system was not prevalent in Ol-Arabel and Rumuruti forests. The practice is seen largely as a success in the afforestation efforts because it is not demanding in terms of labour input and that it is easily managed. It is also seen as one way of reducing the problem of forest fires given the fact that the shambas reduce the continuity of bushes and that the owners of these shambas are readily available to quell the fires in cases of outbreak. However, the practice is declining and this is a serious factor in the low planting for trees in the area. It even jeopardizes the existence of timber harvesting practices. These forests are also valuable for medicinal uses. It was found out that 49.3 percent of the respondents used herbs to meet their daily medicinal requirements. These are used to treat illnesses such as stomachache, fresh cuts on the skin, snakebite, etc. Some of the trees used as herbs include *Walbugia ugandensis*, *Pistacia aethiopica*, *Strychnos henningsii* and *Fagara usambarensis*, among others.

Animal grazing is one of the notable land uses that affect forest cover in the area. Over 89 percent of the households keep livestock. The remaining number of households has no livestock either because of financial inability or due to fear of theft, which is rampant in the area. The limited grazing area, especially in Lariak Settlement Scheme, also limits the need to own livestock. These

animals are mostly grazed on the plots, along the roadsides, and occasionally in the forest open spaces. Grazing in the forest, though mostly an illegal practice, comes in handy, especially during the dry spells.

Timber harvesting constitutes another important land use. The commercialization of the forest products (plants or natural) in the area has always been the responsibility of the forest department. The licensing of the felling trees by saw-millers, whose plants are located either within the forest stations, surrounding villages, or along roads, to fell trees, is done by applying to respective district forest offices. Only selected sub-compartments of the forest blocks are assigned to the number of applicants based on the working capacities of the sawmills and the felling cycles prescribed for the various forest stations. Mostly 'short term' licenses are given as one way of controlling the harvesting for sustainability.

People's Perception(s) about the Forest Resources

The perceptions of the people living around the forest reserves about the availability and use of this resource give an insight into why and how they utilize this valuable resource. Their opinions as regards the status of the forests, mostly natural, shows that these forests are declining both in terms of area covered and species diversity. For instance, while 50.7 percent of the respondents indicated that the forests are declining rapidly, just declining or depleted, 41.9 percent of the respondents felt that the forests are still intact, and only 7.4 percent gave no response.

Based on reflections about the future of the forests in West Laikipia, it is noted that 68.3 percent of the respondents feel that the forests should be kept intact. A good 28 percent of the respondents, however, feel that the forest areas should be opened for settlement and cultivation, and only 3.7 percent did not respond. Some of the reasons advanced for the first response include those discussed below. Forests attract rainfall, help in controlling soil erosion, and are a source of firewood and construction and fencing materials. Also, there can be alternative areas for cultivation other than in forests, among other reasons. Those in favour of these areas being opened for cultivation argue that owing to the fact that population is increasing at a tremendous rate, there is increasing landlessness and that people do not have enough food to eat. Moreover, they see forest areas as areas destined to end for they argue that those who occupy these areas do not necessarily come from within the vicinity. This attitude is aptly expressed by the words of one respondent: *"even if we don't move in to cultivate and/or settle in these areas, others from outside will. So it is good for us to do it now."* This perception has been exacerbated by corrupt forest officials who have, without 'official authority', sold tracts of forestland to individuals for

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settlement. This partly explains why there seems to be insatiable 'hunger' for encroachment into the forests in search of land for settlement and cultivation.

Forest Management and Conservation Practices

Like in all other forest reserves in Kenya, the management and conservation of forests is undertaken by the forest department, with the help of other stakeholders. In West Laikipia, the Forest Department tries to balance the utilization of the forest resources and its regeneration for sustainability. It coordinates the protection patrols by forest guards and police in an effort to curb illegal harvesting activities, such as charcoaling and the harvesting of poles for fencing purposes. The forest department also supervises and directs forest activities such as nursery preparation and planting, commercial logging and the shamba system. These efforts are, however, retarded by the unrelenting illegal activities from the people surrounding these reserves, a lack of sound financial support, personnel and equipment, among other considerations. The efforts of the people surrounding these forests towards good use and sustenance are evident. At least 85.3 percent of the people are aware of the need to protect and conserve this vital resource. Their efforts range from planting trees on their plots as alternative sources of their wood and fuelwood needs to using forest resources sparingly, avoiding lighting fires near forests and helping put out the forest fires whenever they break out.

Conclusions And Recommendations

Some key research conclusions were arrived at which should pave the way for relevant recommendations to policy makers and future researchers so as to enhance development in the study area and the district, in general. The conclusions are as follows:

- There has been a significant reduction in forest cover especially within the forests as opposed to reduction in forest cover at boundaries, mainly resulting from excisions as witnessed in the Marmanet and Ol-Arabel forests;
- Population in-migration, almost singly, explains the serious loss in forest cover in the areas;
- The expansion of small-scale farming in the plots has been taking place at the expense of forest cover the area;
- There is a tendency for the households in the study area to over-depend on wood fuel (mainly firewood and charcoal) for their domestic energy requirements, meaning that a lot has to be harvested to meet these increasing fuel needs;

- Sawn timber alone contributes significantly to the depletion of forest cover in West Laikipia forests, given that it is used by about 35 percent of the households in the area.

Further, it is important that a number of measures be taken in time to deal with the problem of population in-migration and the related settlement on one hand and forest cover depletion on the other. These measures should be taken with the aim of discouraging population in-migration and encouraging an increase in forest cover in the area to strike an equilibrium between the forest resource availability and use. Such measures would include the following:

- Population policies should aim at re-directing population migration flows or patterns to other areas other than to forest zones. This can be achieved through the provision of incentives such as water availability, land, and social and physical infrastructure facilities, among others. These incentives are likely to encourage a fair pattern of population redistribution both within West Laikipia and Laikipia district as a whole for balanced resource utilization.
- Emphasis should be laid on other employment and income generating activities to avoid over-reliance on agriculture as a source of income. This will help to reduce the otherwise increasing population densities around the forest zones.
- There is need to control the rate(s) of population growth both within West Laikipia and in Laikipia district as a whole to keep pace with the forest resource potential. Stepping up the already instituted population control methods such as family planning, among other practices, can help stem the alarming rate of population growth.
- An attempt should be made to improve on both the forest management and conservation policies and practices so as to ensure sustainability in the forest resource availability. This would be done through decentralizing the forest management for better services, and equipping the forest department with a sound financial base to facilitate law enforcement and increase the area under forest cover. Other efforts include spirited campaigns to enhance public awareness, especially through means, such as the media, seminars and *baraza* in order to educate the people on the vitality of the forest resource and thus calling for a change of attitude in the local people towards the resource. Concerning these efforts, the shamba system should be re-introduced in a bid to increase the area under forest cover as it provides free labour and allows the local people to take part in the management and conservation of the forest resource. In addition, a policy by the Government of Kenya regarding excisions should be put into practice to curb the many illegal land allocations threatening to deplete forest cover in West Laikipia.

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Areas for Further Study

- Studies should be undertaken on all three main components of population change i.e., fertility, mortality and migration, in order to appreciate these changes and show how they affect forest change, either individually or collectively, in West Laikipia.
- A detailed study on the component of migration per se needs to be addressed. Currently, no study on the aspect of out-migration in the area, and possibly in the district, as a whole, has been undertaken.
- There is need for a comparative study of population dynamics as well as forest cover and composition change between West Laikipia and East Laikipia.

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