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# \\SUSTAINABLE URBAN DEVELOPMENT AND RESOURCES BASE SUSTENANCE;

A CASE STUDY OF ELBURGON TOWN AND ITS HINTERLAND,  
NAKURU DISTRICT. //

By

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A Thesis submitted in partial fulfilment of the requirements for the Degree of Master of Arts in Planning, Department of Urban and Regional Planning, Faculty of Architecture, Design and Development, University of Nairobi.

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Declaration

This thesis is my original work and has not been presented in any other University

Candidate.....  .....

**Muiruri Symon Wairire**

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

Signed.....  .....

**Dr. Elijah N. Ndegwa**

**DEDICATION.**

This work is dedicated to my Mum, for her efforts which saw me get to this height.

## ABSTRACT

The recognition of urban development as a strategy for development is a recent phenomenon in the Kenyan development scene. It was first stated in 1974-78 National development plan. Developing countries have overtime formulated policies directed towards rapid economic growth especially in rural development given that most of these countries are predominately rural. However, the scenario is changing. Urban population is expected to grow to 2 Billion by the year 2000 in the world. Over two thirds of this population is expected to be living in developing world. In Kenya urban growth is very high. It is expected to be 9-10 million by year 2000 compared to only 4 million in 1988.

The crucial development role that towns and cities play has been recognized, although it is questionable whether they will be able to contribute to national economic growth on the desired scale in future. Urban areas are faced with physical and living environment deterioration. Urban areas are also causing serious strains on the resource base they depend on. This puts into question the sustainability of urban development and that of the resource base. Sustainable urban development is dependent upon sustainable use of the environmental

resources on one hand and upon minimization of vulnerability of human settlements to natural and man-made hazards on the other. Resource management per se has been explored but little has been done on sustainable urban development and its relation to resource base sustenance.

The study set out to look at the relationship between resource utilization and sustainable urban development. In this study the resources that were considered were forest and agriculture. The effects of urban development on environment were looked at. Effects of urban expansion on air pollution and its related diseases incidence was also looked at.

The study established that Elburgon's Urban development is dependent on natural resource utilization. It was noted that the resource base is diminishing. Survival rate in established forest plantation is too low. This has its implications: unless the present trend is reversed the industrial sector (saw milling) will collapse, thereby causing unemployment and other socio-economic problems.

In agricultural sector land degradation in form of soil erosion is the major problem. This is coupled with

increase in population. Agricultural land has been subdivided into small units of less economic importance. It was noted that production of major crops in the districts are on a decline.

It is suggested that sustainable agriculture could be achieved by integrating forest and farming. Farmers in the rural areas could be encouraged to practice forest farming which would reduce pressure on forest in form of wood fuel. Non-residential farming should be encouraged in forest reserve on the clear fell areas (areas that forest plantations has been harvested). This can supplement the rural and urban dwellers with food supply and incomes. This region has a rich biodiversity which is a potential for future development. This biodiversity need to be studied and options for sustainable exploitations chosen. This implies there also need for research. This calls for a new development policy with in-built mechanism to ensure sustainable development. Urban management tied with sustainable resource management should lead to sustainable urban development and resource base sustenance.

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## CHAPTER ONE

### 1.0 RESOURCE SUSTENANCE AND URBAN DEVELOPMENT.

#### 1.0.1 Introduction.

Developing countries should view urban development as desirable, unavoidable or even irreversible. From time immemorial cities have grown and expanded in social and economic importance, as developing countries move increasingly in the direction of urban-based economies. Most developing economies depend on cities for the services and goods they can only offer. In most developing countries, cities and towns are the main contributors to National and local tax revenues; in many cases outstripping rural areas not only on per capita index but even in absolute terms (Habitat, 1989 P.2). Cities are the major locations and supporters of employment-generating industries and are the agents of social change necessary for developing countries to move into the mainstream of international commerce and politics.

For urban development to prosper and realise its potential in the development of developing countries, many industrial activities (if not all) have been pegged on the utilization of natural resources. Every economic activity entails the transformation of the natural resources. However, urban development has been counter

productive in some instances especially on natural resources and the environment. National governments expect cities to work and are too willing to reap the direct and indirect contribution to the economy in form of financial, technological, educational, and health services. The governments are however, often unwilling to give cities the support they need and entitled to as a return to their contribution to national economic growth and development. Urban development should be the main framework for social and economic development for public-private sector investment and for resource allocation (Habitat 1989, P 8).

However, cities, towns and urban centres are faced with environmental problems. Environmental problems facing cities and towns today are so real and so universal, that no nation or group of nations can be able to tackle them alone (*Ibid*). This calls for a common front in trying to solve these problems. The major problems facing urban areas are pollution, waste disposal, congestion, growth of squatter and slums settlements. While these problems are experienced in the urban areas, the rural areas are faced with resource depletion and soil degradation. It is now apparent that any development unless guided by environmental, social, cultural, and ethical

considerations will continue to have adverse effects, provide reduced benefits to city and town dwellers or even fail to provide a pleasant home for man all together. Thus the pursuance of unsustainable development goals will only exacerbate the environmental problems that already exist. Some of these goals are exploitation of resources at rates higher than their regeneration, and development goals which lead to resource degradation such as soil erosion and resource depletion. These problems not only reduce productivity but also undermine social stability and public health. These imply costs which detract cities and towns from offering and providing national economies an optimum development roles along sustainable urban development paths. It is even presently questionable whether urban areas are realising their potential.

It is in the light of the foregoing, that this study seeks to examine the relationship between Elburgon centre and its hinterland with a view to ascertain whether the rate of exploitation of natural resource- forest and agriculture in support of activities within Elburgon can be sustained. It is the researchers' view that unguided urban development impacts negatively on natural resources. The exploitation of the resources has



contributed to environmental problems in the town especially air pollution and solid waste (saw dust) disposal management problems. Elburgon's urban development depends entirely on natural resource exploitation mainly forest tied with agriculture. The only way to sustain development activities in this town, is through the adoption of strategies that ensure primary resource base sustenance and conservation. Sustainability of development entails commitment to manage the totality of life support systems and thus becomes a very big challenge in planning. The study of totality of life is too diverse for a study like this to achieve, leave alone the financial and time constraints. Therefore the policy guidelines suggested in this study limits themselves to primary resource base sustenance, conservation and utilization to enhance sustainable urban development.

#### 1.0.2 Statement of the problem

The recognition of urban development as a strategy for development is a recent phenomenon in the Kenyan development scene. During the colonial era most urban centres grew as small towns along the railway line as service and rail repair outposts. The Early White settlers used many towns as gateways to trade

opportunities in the hinterland and not develop these centres. In the immediate post-independence period, that is 1963-1969, there was no explicitly declared policy on urban development. The country's main focus was on achieving economic growth. Since then greater emphasis has been laid on the development of agriculture. There was an omission of urban development policy by policy makers. This omission of urban development policy in the national development programme was so obvious that Laurentic 1972 (in Ndogoni 1990 p.2), concluded that it was an "Overlooked phenomenon".

It was in the 1970-74 National development plan that the government first clearly stated the concern for the development of urban areas. The subsequent development plans that followed, 1974-78, 1979-83, 1984-88, 1989-93, 1994-96 and the Sessional paper No.1 of 1986 have continued to address this issue. The main concern for the government has not been urban development per se, but the pattern it takes. The urban places are perceived as offering markets and services to both urban and rural areas. Urban development policies aims at achieving rural-urban balance and hence the over-all objective of spreading urbanization around the country rather than allow over concentration in major cities, such as Nairobi

and Mombasa. To achieve this goal certain towns were selected as growth centres and service centres. In the 1989-93 National development plan the concept of RTPCs (Rural Trading and Production Centres) was introduced for special development strategy. The rationale behind RTPCs was to invest in infrastructure in rural areas with the hope that provision of these facilities and services will stimulate, create new jobs opportunities especially in non-farm activities and curb migration to large cities. The towns that were chosen especially as the RTPCs are those that showed economic potential for development. Using this policy, many small towns have expanded and continued to attract more economic activities. The first towns to benefit from RTPC programme were Suneka in Kisii, Kapsowar in Elgeyo Markwet, Kimilili in Bungoma, Kutus in Kirinyaga, Mwingi in Kitui, Kinango in Kwale, Kipkelion in Kericho and Ramu in Mandera. Later more towns were identified. These urban areas were to act as market centres for the rural hinterland. They were to have higher level services such as water, telephones, sanitation e.t.c. These was to attract small industrial activities in these towns. Elburgon is such a town.

Since 1909, when the first saw mill was established, Elburgon town has been a saw milling industrial town.

Presently the town has become a centre of attraction for industrialists. For instance, Timsales Limited have three mills- Sokoro Saw Mills, Sokoro Plywood and Sokoro Fibre Board. The other important saw mills are Gachagua Saw Mills and Kenya Saw Mill. There are other 12 relatively small saw mills compared with those named above especially as regards their economic importance. Recently there has been a charcoal brisket manufacturing company establishment though it has not taken off. The problem is that the entrepreneur targeted the local clientele. In the local market fuel wood and alternative charcoal is available. So the entrepreneur should target the outside market or produce charcoal of high quality with lower prices. The pace of development in this town is fast. For example in 1993 a modern tourist hotel (Elburgon Eel) was established. There are also other related informal sector industries such as furniture and fixture, and commercial activities.

With the current government strategy of balanced development through decentralization of economic activities and assuming favourable economic condition both in the country and the world, the town of Elburgon is expected to grow at an even faster rate by attracting more industrial and commercial activities. Unfortunately

urban development in the rural areas is putting additional strains on Kenya's natural resource base especially land, water and forests. Proper management of water catchments and soil conservation has become more urgent concerns as the rural centres expand (Sessional Paper No.1 1986). But with specific reference to Elburgon as stated above, a closer examination of the industrial activities in it reveals that they are tied to forest exploitation and agriculture. The number of saw millers have increased tremendously while the forest reserve has remained relatively the same. The saw millers demand for raw materials can not be met with the current forest supply. The productive function of the forest has been stressed more than the protective function, which has led to forest depletion. Over exploitation of these forests raises the question of sustaining even the very productive function. In addition, disposal of industrial waste (that is, saw dust) has been neglected. Huge mountains of saw dust are seen in the town centre. Also disposal of off-cuts from sawn timber is also a problem. At present, off-cuts are being used to burn charcoal. The main problem is not burning of charcoal but where the charcoal is being burnt. Charcoal burning is taking place in the town centre and residential areas. This compounded with saw

dust burning as means of disposal has made the town very smoky. This smoke is a health hazard. Lack of effective development control has led to incompatible activities to be located adjacent to each other. For example, saw mills are located in three different parts of this town. In some instances they are located in the town centre and even within a residential area as is the case at Kasarani Estate. Lack of waste disposal sites has led to waste (saw dust) being disposed in the no-man land such as railway reserves and river banks. These saw dust gets into the river thereby polluting them.

The main problem since 1987 have been that of the survival rate of seedlings on established plantations. Since 1987, with the banning of forest farming, survival rate has dropped dramatically raising fears of sustainability of forestry activity in and around the town. Most people who earlier on resided in forest land were pushed out of the forest and settled in Elburgon town centre. Those were from Kiptunga, Mariashoni, Sokoro (D.F.O) and Ndoswa forest stations.

The town has experienced a rapidly growing population which has created pressure on land and the use of natural resources. The town, in its spatial growth has

encroached into the forest. In recent years the District Forest Officer has banned the activities of some saw millers and reduced the activities of other big industries (industries licensed for long term basis- five years). As the industries reduced their production capacity or stopped producing altogether, this resulted into unemployment since saw milling is the major employer in the town.

High population increase especially of the poor has led to every available space including those on fragile environment to be used for residential and commercial use such as Eastleigh, Kasarani, and Karoleni estates.

This population is to be fed from the rural hinterland. In the rural areas the main problem is that of soil erosion and soil exhaustion. Increased food production in order to feed the ever increasing population at the expense of soil erosion is not sustainable.

Therefore there is need to establish complementarity between Elburgon town with its rural hinterland. If the relationship between Elburgon town's growth is understood by the industrialists and town's residents to be dependent on natural resource utilization then the basis

for sustainable urban development through sustenance of the resource base would be put in place. We can not talk of sustainable urban development without putting into consideration rural or natural resource sustenance.

This study therefore addresses itself to the factors that seem to be driving Elburgon's development along paths that appear unsustainable. The study focuses on the relationship between Elburgon town's growth and on levels of the utilization of natural resources with particular emphasis on forests and agriculture. As such, it is in this context that Elburgon Towns' growth and its impacts on the natural resource base is examined. Despite the efforts made on trees planting both at the national and local levels, the Department of Forestry is not attaining its targets for tree planting (plantation replenishment). Factors leading to low regeneration rate will also need to be addressed. There is need to establish alternative resource utilization for development and the capacity of the town to provide the ever increasing population with the benefits (income-generating opportunities) and services. The study will also point out indicators towards sustainability or non-sustainability.



### 1.0.3 Objective of the study

Sustaining natural resource bases is quite complex given the problem of the little knowledge we have on the dynamics and use of the known resources. Optimum utilization of natural resources is often misleading, given that entrepreneurs are after profits maximization regardless of the social cost that may occur from their activities. The development obtained from utilizing resources should be sustained and where the resource is so vital that it performs more than one role then one should not be emphasised at the expense of the other. Also ecological balance should be sustained in order to avoid its disturbance thereby threatening human survival. Therefore the objectives of this study are:-

1. Identify natural resource base of the study area;
2. Establish the link between Elburgon urban development and natural resource exploitation;
3. Examine the impact of the town's development on the resource base;
4. Suggest policy recommendation on how best to sustain urban development and utilize natural resource in a sustainable manner.

#### 1.0.4 Hypothesis

$H_0$ . Sustainable Urban development is not dependent on natural resource base sustenance.

$H_1$ . Sustainable Urban development is dependent on natural resource base sustenance.

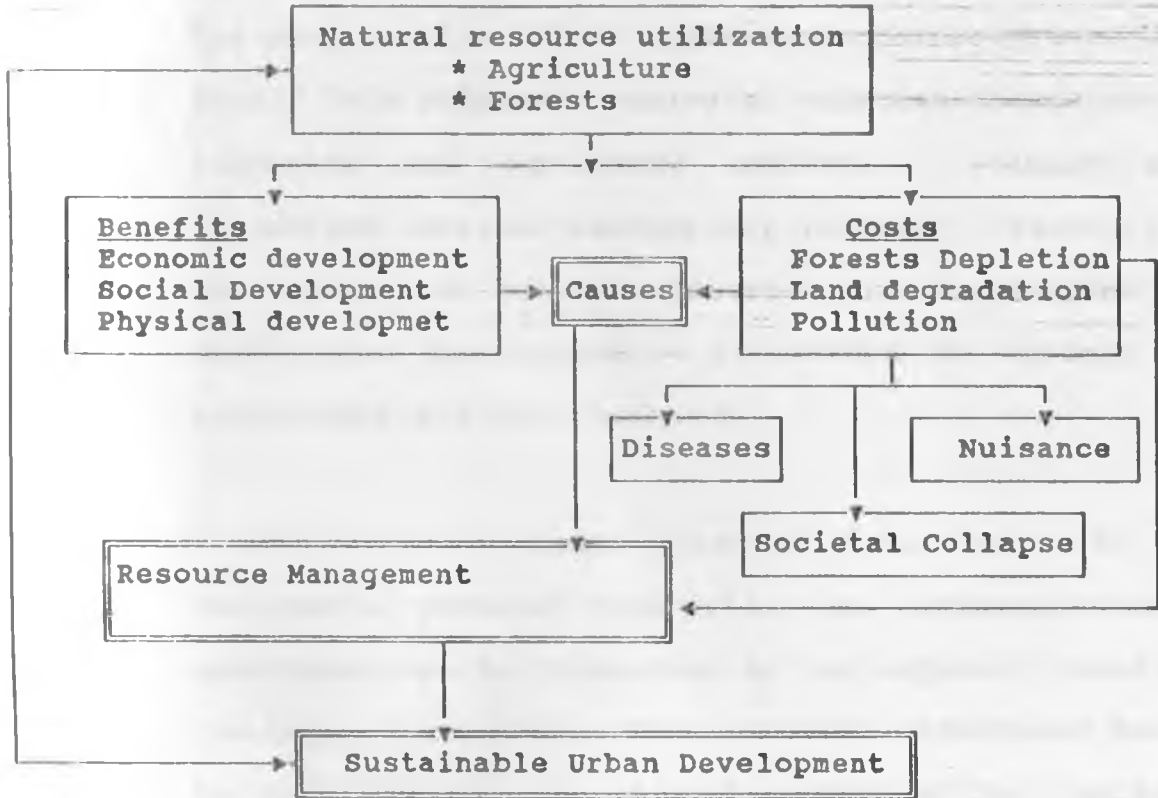
$H_0$ . There are no significant impacts on natural resource as a result of urban development.

$H_1$ . There are significant impacts on natural resource as a result of urban development.

#### 1.0.5 Scope of the Study

The study attempts to investigate what causes development of this specific town and thus makes an attempt to suggest methods of sustaining this towns development. Natural resources base and exploitation rate will be considered both at the district and local level. Then alternatives uses of natural resources in the district will be examined especially in future. Some resources are unique in themselves which need both social and economic preservation. A policy guideline will be suggested so as to guide and sustain urban development in the region through the sustenance of natural resource base.

1.0.6

Conceptual Framework

Sustainable urban development occurs through natural resource utilization. These resources utilization brings about economic, social and physical development on one hand and environmental impacts on the other. Development obtained improves human wellbeing. Environmental impacts are two fold, those in urban area as result of consumption and those on the resource base as result of over-exploitation. These environmental problems have adverse effect on society which implies costs which will detract urban development from its crucial development role.

### 1.0.7 Research Methodology

The study involved first a literature review of secondary data. This consisted review of existing literature in libraries and government offices. Primary data collection involved reading any relevant literature on the concept of natural resources and development and sustainable development. Literature on ecology and environment was also reviewed.

Field survey included personal interview with key informants, personal observation and administration of questionnaires to households in the adjacent areas and the commercial sector. First, a visit to National forest headquarters was made. Annual reports of the district's forest production were reviewed and information regarding employment, incomes, problems facing forests, potential output of forest per acre, problems faced by forest workers, and other issues on forests were collected. Then a visit to Nakuru district forest headquarters was made and a similar exercise undertaken. This was vital in order to establish the resource base and prepare an inventory of existing forests resources showing their volume, age, acreage and major species of trees grown in each station both at National and District level. This has also helped to give an indicator of the level of

forested areas.

A visit to agriculture offices was made. Annual reports of the district's agriculture production were reviewed and information regarding employment, incomes, problems facing farmers, potential output of crops per acre, and other issues on agriculture were collected. Then a visit to Nakuru district agriculture headquarters was made. Agricultural production in Elburgon was examined. Data on gross margins of selected crops such as maize, potatoes and pyrethrum were examined. Ecological production with and without fertilizer application were looked into. This was important to determine the potentiality of the region's production. Present production trends of important crops in the region were analyzed. Then there was need to collect data from rural agriculture to get their incomes and the employment levels on the farm.

Then a survey on the commercial sector in the town was undertaken to establish the level of employment, incomes, services offered, problems and/or opportunities in this sector. Within the urban area saw milling and furniture and fixtures activities were examined. Employment and incomes levels and problems facing this industry were

also looked into.

To test how the relationship between natural resources exploitation and urban development, Elburgon town and its hinterland location in Molo division, Nakuru District were chosen as the main study area. The choice of area was based on a number of considerations:-

- (1) Due to the expansiveness of the area it was practically impossible to cover the whole region, given the limited time and available resources.
- (2) Most of the tree species available in these areas are the same and require the same condition as those in other parts of the district.
- (3) That over 49% of the total area under forest in the district fall in this division.
- (4) The majority of forest based industries are also located in this area.
- (5) Extensive agriculture is undertaken in this division and the composition of crops is similar to what is found in other parts of the district.

Four Forest stations were visited within Molo Division. Systematic random sampling method was used to select the four forest stations. Data collected was subjected to chi-square test to find whether the drop in survival rate of established plantations was significant. A random sample interview of residents living in the town centre was used to select respondents. The interviews were intended to establish attitude of town residents towards forests, their involvement in decision making on forests activities and in order to estimate their demand for forest products. The interviews were also intended to gather information on agricultural activities and commercial activities. The data that was collected was subjected to statistical analysis to measure relationship between the town and its resource base. The linkage between Elburgon's town and its hinterland were analyzed.

### 1.1 Literature Review

The issue of development has been explored for the past several decades, where several paradigms has been developed. The most current is "sustainable development". However, a precise and agreeable definition of what is or constitute development has not emerged. Economist viewed development as economic growth. Gerald Meir (1991) defines economic development

as a process whereby the real per capita income (incomes measured in terms of goods and services it can purchase) of a country increases over a long period of time - subject to the stipulation that the number of people below an "absolute poverty line" (a given level of income that allows an individual to his/her basic needs) does not increase, and that the distribution of income does not become more unequal. What is significant from the standpoint of development is a sustained increase in real income- not simply a short-period rise such as occurs during the upswings of the business circle. Morris (1978) sees development to indicate not only an increase in real per capita over time but such things like decline in infant mortality, increases in life expectancy and basic literacy. Todaro (1977), gives a more comprehensive definition:

"Development is conceived as a multi-dimensional process involving changes in structures, attitudes and institutions as well as the acceleration of economic growth, the reduction of inequality and eradication of absolute poverty"(Todaro, 1977, p.95).

The basic issue has been where to locate spatial growth and thus development which was seen to take place in certain areas and not others. The spatial location may be political because the policy makers are largely politician and they influence the location of certain



activities. Cristaller (1933) brought the issue of central place theory. Later Perroux (1955) noted development do not take place any where. He developed growth pole-model. These paradigms attempted to explain, show the spatial distribution of economic growth but not development. While as where the pivot of development is located is important especially in trying to achieve rural-urban balance in development, the main task is not that of initiating development process but of sustaining development in the long run.

In the past three development decades, there are lessons which are clear. Traditional models equating industrialization and per capita - Averaged currency - denominated GNP and GNP growth have proved failures in developing countries. World Bank 1991, acknowledged the inadequacy of such income based growth indicators. It notes that they do not reflect success in meeting people's basic needs such as food, education, health care, equality of opportunity, civil liberties or environmental protection. Most development process in developing countries stagnated in 1980's and went into reverse in most Sub-saharan African countries. In this report World Bank redefines economic development as a sustainable increase in living standards encompassing material

consumption, education, health and environmental protection. While as this definition is new the development models are still the old ones.

Presently the concept of sustainability is being developed. Sustainable development and the interdependence of the economy and environment are increasingly being accepted as development concept by both economists and planners. The concepts of sustainability grew from the "Limits of Growth" debate of the early 1970s (Meadows et al 1972, Cole et al 1973). This debate discussed whether or not continuing economic growth would inevitably lead to severe environmental degradation and societal collapse on a global scale. However, in the late 1970s an apparent resolution of the problem was reached: economic development could be sustained indefinitely, it was held, if and only if development is modified to take into account its ultimate dependence on the natural environment (Pirages 1977, Cleveland 1977, Coomer 1979).

The broad concept of "Sustainability development" was first widely publicized by the World Conservation Strategy (IUCN, 1980). It has since then become central to thinking on environment and development. In 1987 the

World Commission on Environment and Development (WCED 1987- the "Brundtland Report) and the World Bank Paper "Environment, Growth and Development" (World Bank 1987) further contributed to the popularizing of this concept. The Brundtland Report vigorously promotes the idea of sustainable development, which it defines as:

"Sustainable development is development that meets the needs of the present without comprising the ability of future generation to meet their own needs" (WCED 1987, p.43) and the World Bank is now committed to promoting sustainable development and to this proposition that: "economic growth, the alleviation of poverty and sound environmental management are in many cases mutually consistent objectives" (World Bank 1988 p.1).

Despite these efforts to define what is sustainability, the diversity of and conflicts between these definitions is self-evident, showing that sustainability is just becoming a 'motherhood and apple pie' concept or just a catch word so to say, which everyone supports but no one defines consistently. O'Riordan 1988, laments that it may be a matter of time before the metaphor of sustainability becomes so abused as to become meaningless (O'Riordan 1988 p.30). Sustainable development is development that lasts (World Development Report 1992). The major concern is that those who enjoy the fruits of economic development today may be making future generations worse off by excessively degrading the

earth's resources and polluting the earths environment  
(*Ibid* P.34)

Allen 1980, IUCN 1980, O'Riordan 1983, Eagles 1984, and many others have advocated that environmental resources should be managed to ensure the long-term sustainable utilization of species and ecosystems, minimize survival risk and generally keep open as many future use option as possible. We know too little about the dynamics and capacities of many ecosystems to be certain about the long term effects of our activities. Therefore, current usage pattern must be cut down, or even cut out all together, to minimize the chances of irreversible depletion or harmful feedback effects. These have its implication on: it may even mean the sacrifice of life for some people today for the survival of others in future. This is contradictory given that sustainable development means improving the quality of live to all (Habitat, 1990).

The first proponents of risk minimization and sustainability worked from ecological principles; the preservation of species diversity and minimum environmental changes were seen as essential if the interdependent life support system of the globe were to

be protected. The most extreme and restrictive demands came from the bio-ethics school of eco-radicals, who took the moral view that the whole of nature has rights to survive. These early version of the sustainability concept has been widely criticized (Judith, 1990 p. 28).

Most analysts are in agreement that the reduction of survival risk should be one objective in the development of resource management strategies. There is much less support for the idea that it should be paramount, overriding all other goals. The argument is that unless risk minimization is a costless activity, it can only occur through the sacrifice of other social welfare objectives. Almost inevitably it would necessitate a major reduction in current levels of resources use, with all the harsh implication that this would entail for the present world's population and particularly for the poorest sections of the humanity already living at or near subsistence levels. Taken to the extreme, minimization of survival risks for future generation will be "bought" by the failure of millions of people currently alive to survive today. The welfare implications of the various ecologically based resource management goals are central to their rejection as an alternative to welfare maximization by the vast majority

of economists (*Ibid* p. 325).

Following these criticisms, the protagonists of sustainability as a management goal have shifted their ground and today they talk not of ecological sustainability but of sustainable utilization. Here the emphasis is on improvement of the real and long-term well-being of people, by ensuring that environmental systems remains as 'a resource bank that will continue to be of use, often in unforeseen ways, for the indefinite future' (Eagles, 1984). These however, may not be realistic given that we are not so sure of all the future demands for the future generation, especially demands are culturally defined. More so, if the achievement of sustainability could occur at zero cost, most analysts would accept it unquestioningly as a management goal; but inevitably it would impose costs at least on some sections of the human community. Its desirability will, therefore, depend upon its distributional consequences. The main issue is who meets the cost of development either now or in future.

Sustainability may be acceptable as a policy strategy. However, turning the concept of sustainability into policy raises fundamental questions about how to assess

the well-being of the present and future generations. The issue is even further complicated because our children and grandchildren do not just inherit our pollution and resource depletion but also enjoy the fruits of our labour in form of education, skills, and human capital, as well as physical capital. Thus, in considering what to pass on to future generations, we must take into account the full range of physical, human and natural capital that will determine their welfare and their bequest to their successors (World Development Report, 1992 p.34).

The notion that the global resource base, including environmental systems places an inevitable, absolute limits on economic development has been modified. This modification has rendered obsolete the no-growth solutions to environmental problems which had been so popular in the early 1970s. The emphasis has shifted dramatically, no longer is it a question of totally restructuring society to meet the needs of the environment but of ensuring that the productivity of the environment is maintained in order to further long-term social and economic development. Judith 1990, p.435, posit that no longer does environmental protection mean sacrifice and confrontation with materialist values.

This redefinition of the sustainability concept has clearly injected much more optimism into the environmental future debates.

Sustainable development require a full understanding of what is the environment/development relationship. Its aim is the management of natural resource base and the regenerative capacity of nature in which natural resource maintain their productivity and resilience over time. Socio-economic aspect to sustainable development need to be understood. This involves preventing the friction and imbalance that may occur if the economic development is out of step with the existing natural resource endowments, social, economic constraints and opportunities in an economy (Yusuf Ahmad 1989, UNEP p.18).

Each region has its blessing on resources endowment. Any development that may occur is or should be pegged on these resources. Sustainable development has its goals reliance on "nature income" and not depreciation of the services that its "capital stock" of the natural resources provides. However, Ahmad 1989 notices that economic needs often leads to overuse or misuse of resources. The degradation of resources tends to be



incremental and cumulative. This in turn makes future economic growth harder to realise. In this context it is necessary to bear in mind that environmental resources are not only the basis of all economic actions but also constitute the limits to such actions. If the services and quality of the capital stock of resources are to be maintained over time, the use of renewable resources must be undertaken at rates less than or equal to the natural manageable rate at which they can regenerate. The use of non-renewable resources must be based on optimizing the efficiency with which they are used—subject to substitutability between resources and technological progress.

The idea of utilizing resources at rate less or equal to resource regeneration is in some cases unrealistic given that when the resource is gone its gone. We know too little about bio-diversity of ecosystem to be sure about their future use. More so, economic optimal utilization of resources may not be socially optimal given the benefits accruing from these resource exploitation may be obtained by a small section of the community (Ibid, 1989).

Degradation of the resource base due to short-sighted policies are leading to degradation of the agricultural resource base on almost every continent: Soil erosion in North America; soil acidification in Europe; deforestation and desertification in Asia, Africa and Latin America; waste and pollution of water almost everywhere. Within 40-70 years, global warming may cause the flooding of important coastal production areas (Our Common Future 1987). Some of these effects arise from trends in energy use and industrial production. Some arise from pressure of population on limited resources. But agricultural policies emphasising increased production at the expense of environmental considerations have also contributed greatly to this deterioration. In fact increased agricultural production at the expense of soil erosion is not sustainable. Increases in cropped areas in recent decades have often extended cultivation onto marginal lands prone to erosion. By the late 1970s soil erosion exceeded soil formation on about a third of US cropland, much of it in the mid-western agriculture heartland. In Canada soil degradation has been costing farmers \$1 billion a year (*Ibid*). In the USSR, the extension of cultivation to the so-called virgin lands was a major plank of agricultural policy but now it is believed that much of these lands is marginal. In India,

soil erosion affects 25-30 per cent of the total land under cultivation (*Ibid*). Without conservation measures, the total area of rain fed cropland in developing countries in Asia, Africa, and Latin America will shrink by 544 million hectares over the long term due to soil erosion and degradation, according to Food and Agriculture Organization (FAO in *Our Common Future* p.125).

In Kenya, according to the National Environment Secretariat some 483,830 Km<sup>2</sup> out of Kenya's land of 569,137 Km<sup>2</sup> is already experiencing some form of desertification, that intricate process of land degradation. This implies that about 85 per cent of Kenya's ecosystem is deteriorated and dissimilated or destroyed for plant and animal potential production. According to NES, some 110,500 Km<sup>2</sup> or 19.3 per cent of Kenya is considered to already severely affected by desertification and some 53,500 Km<sup>2</sup> or 9.4 per cent of Kenya shows small signs of deterioration (degradation). Thus in short, the productivity of this country of about 30 per cent has been moderately to seriously affected, with about 55 per cent in eminent danger of declining productivity and only some 15 per cent of the land is in

good condition. To be precise for a country that depends on agriculture as its major source of livelihood, this is a very precarious and serious state of affair. According to Department of Resource Surveys and Remote Sensing (DRSRSS), the actual area under cultivation in Kenya covers 91,238 Km<sup>2</sup> which is 17.2% of the country (Epp, H. et al 1982). The result of this survey shows that all the land area suitable for rain fed cultivation in Kenya is already being used and there has been an extension in the agricultural boundary from the high potential areas to the semi-arid areas. Survey on food producing potential and population of Kenya's high potential areas shows that land's carrying capacity has been exceeded, that is, the number of people or animals that a given area of land can support on a sustained basis at a given level of inputs and technology. Through improved technology and increased level of inputs land carrying capacity can be increased, but the capital required are beyond the average subsistence farmers (Darkoh, 1991, p. 61).

Most studies and efforts are and have been concentrated to semi-arid, the otherwise known as fragile ecological zone yet problems of environmental degradation of similar

or lesser magnitude is manifested in the high potential areas. These environmental problems may not be quickly felt especially in the high potential area in the short-run but in the long run if the ecological zone are not sustainably utilized the effects will be like or more worse than those being experienced in the semi-arid and arid areas (*Ibid*).

But ecology and economic development apparently can be reconciled; environmental quality and economic growth are no longer incompatible, rather they are mutually supportive. The European Community's Fourth Environmental Action Programme (1987) put it:

"there can be no sound environmental policies unless... there is progress on economic and social front,... there can be no lasting economic and social progress unless environmental consideration are taken into account and are indeed seen as an essential part of economic and social development".

According to Tobaró, 1981, desired development is achievable through the optimum utilization of natural resource available in the country. Ahmad Yusuf observes that: "Development process in poor countries is closely tied to the use of natural resources. The widespread deterioration of the productive resource base- soils, fisheries, forest has serious consequences for the future of these countries in particular because of their rapidly increasing population" (UNEP, 1989).

He therefore concludes that it can not make any economic

sense to base development policies on a resource that one day will no longer be available. African countries cannot and must not, for their own sakes, continue with many of their present policies. The only practical course to development is sustainable development, that is, utilizing living resources in a sustainable way (*Ibid*, 1989).

Developing countries have over the last few decades formulated policies directed towards rapid economic growth. Most of these policies and strategies are focused on rural development given that most of these countries are still predominately rural. In most developing countries such as Kenya policies aims at achieving rapid economic growth to absorb the ever increasing labour force. Increase agriculture productivity- food security, and raise rural incomes. Also widespread rural non-farm activities so as to create more employment opportunities, high living standards outside the central cities, a dynamic informal sector, improving the distribution of incomes and provision of basic human needs. Most of these development goals are viewed to be achievable through rural-urban balance by creating a more dispersed urban development. To achieve these goals emphasis is laid on the pattern that these

urban development takes, this include the creation of new market centres and towns throughout the rural areas. Whereas Sessional paper No. 1 of 1986 stipulates these objectives of development, the paper is cautious on the strains that Urban development is likely cause in the rural areas on Kenya's natural resources, especially land, water and forests. The paper notes that proper management of water catchments and soil conservation will become more urgent concerns as rural centres expand their provision of water, sewerage, electricity and roads (Sessional Paper No. 1, 1986). It is also noted that a city's or a town's prospects for growth depend critically on its place in the urban system, local, national and international. So does the fate of the hinterland, with its agricultural, forestry, and mining, on which the urban system depends. In most developing countries the country side is being steadily 'urbanized' (Our Common Future, 1987 p. 235). The main question that remains is whether this urban development will be sustainable in the future. Given that economic growth goals targets are set without a clear evaluation of the available resources sustenance.

Previously development strategies in African countries had their root in the conditions prevailing in the

developing countries in the 1960s and 1970s. The strategies in support of rural development will have to be rethought and new rural-urban links considered. Any strategies for rural and urban sectors will have to be elaborate which activities are mutually supportive taking into account rising urbanization and the subsequent growing importance of the towns and cities in the present and future economic growth of the developing countries. The main reason why towns and cities are becoming increasingly important is the fact that: even when national development is based on an agriculture-led strategy and the bulk of the labour force is employed in the farm, most value-added is generated by non-farm activities taking place in the urban settlements of varying sizes (Habitat, 1989).

Though the crucial development role that towns and cities play has been recognized. It is questionable whether even now the cities are meeting their potential and whether they will be able to contribute to national economic growth on the desired scale in future. Despite the fact that these towns and cities are making significant development contribution they are faced with physical and living environment deterioration. It is therefore questionable whether in the long-term these



cities and towns will be able to play their crucial development role. The deterioration in urban areas manifests itself in form of urban slums and squatter settlements, increasing traffic congestion, air and water pollution, deteriorating infrastructure, and shortfalls of service delivery all with environmental cost implications. These costs detract cities and towns from an optimum development role and sustainable urban development path (*Ibid*).

Environmental considerations need to <sup>be</sup> considered if urban growth over the coming decades is to be truly sustainable. Urban management and planning practices should be geared towards the minimization of resource depletion in the urban-expansion process and ensure that environmental resources such as forest are used rationally (*Ibid*).

The Government policy and responses to the urbanization challenges is paramount to the future of urban growth. The urban population is expected to be 9 - 10 million residents in the year 2000, (Sessional Paper No.1, 1986). But the concern of the of the Government would not be centred merely on the high rate of urban growth, but also the pattern it takes. This is more so because urban

growth in Kenya has largely been centred around the largest towns of Nairobi, and Mombasa.

The Government is thus committed to encouraging development throughout all regions of the country, through an urbanization strategy that focuses on decentralising urban growth. The main objective is to avoid growth of primate cities; where population concentrate, and promote growth of secondary towns and small urban centres to foster linkages between agriculture and other sectors of the economy; and to bring renewed economic growth to all regions of the country, (Kenya National Development Plan, 1989).

The government has therefore undertaken the following strategies:

- (a) Concentrate scarce resources for urban infrastructure in selected small towns, with aim of providing a range of basic physical infrastructure and facilities that support agriculture and other activities.
- (b) Strengthen local authorities to enable them provide competent administration and management in the growing urban centres, and to provide them with sufficient resources to develop, operate, and maintain the centres.
- (c) Promote growth of productive non-farm employment opportunities in the small manufacturing and commercial activities, especially in the informal sector of the urban economy, (Kenya, 1986).

To achieve these objectives, the government initiated a Rural Trade and Production Centres Programme in which small towns were designated Rural Trade and Production Centres (RTPCs) - chosen from existing urban centres which in 1979 had a population of below 5,000 inhabitants, and showed a potential for economic growth. The government support to these centres, have been and will continue to be providing link roads, water, and sewerage networks, market space, telephone, postal, electrical and storage facilities and services, with the hope that the provision of facilities will stimulate, create new jobs opportunities and curb migration to large cities.

On whole, very little has been achieved towards this goal. Small towns suffer considerable shortage of infrastructure; local authorities have remained incapable of managing the urban areas; and the large cities especially Nairobi have continued to lure the rural population into them. The Government does not seem to have developed mechanisms for involving the local authorities, city residents, NGOs and other local development agencies in the management of urbanization processes.

While awareness of the need to incorporate environmental consideration in settlements planning has raised, environmental conditions of settlements have not (UNCHS/UNEP, 1987). Deterioration is evident not only in large cities, but also in the smaller urban centres and even rural settlements. Unplanned development is damaging the resource base upon which human settlement depend (Ministry of Local Government and Physical Planning, 1988a, Ministry of Local Government and Physical Planning 1988b). The damage comes through excessive use of natural resources, and the polluting effects of various wastes generated and borne by air and water. This totally jeopardizes the sustainability of these settlements and thus the overall development.

The World Commission on Environment and Development (WCED) defined sustainable development as "a process in which the exploitation of resources, the direction of investment, the orientation of technological development and institutional change are made consistent with the future as well as present needs" (UNEP, 1991 Pg8).

Within the twentieth century urban transition is confirmed irreversible (UNCHS, 1989a) and involves transforming almost half of the world's population into

urban dwellers by the year 2000, (UNCHS, 1992). Urban decay is one of the most immediate disaster, especially for developing countries. It involves the worsening of urban environment as a result of the inability of the city or national government to provide satisfactory services for sanitation, solid-waste disposal, transport and other facilities and amenities.

However, urbanization processes currently taking place are not necessarily a disaster. They represent a profound socio-economic transformation produced by the processes of modernization and development also dramatized in the recent demographic shifts (*Ibid*). But it would be totally unacceptable to talk about long-term environmental/development sustainability alone, without addressing the short-term problems of more day-to-day survival of city dwellers.

As such sustainability of human settlement in this case would involve evolving environmentally-sound methods of resource utilization to facilitate coping with prevailing and future economic difficulties, and more significantly contribute to improvement of quality of life for all, especially the poor.

A major approach recognized to achieve sustainability is to promote local initiatives as a means of survival. While at the same time not allowing the potential ravages of development to over-exploit the natural environment (UNCRD, et al 1990).

Sustainable development in urban areas can be achieved also by shifting the methods employed in resources exploitation from being survival-oriented to future-oriented methods which do not jeopardize long term sustainability.

Proper 'awareness' is also required though many authors argue that the issue of 'awareness' does not emerge as a constraint to sustainability, (*Ibid*), but imparting technical know-how to prop up awareness is prerequisite to sustainable development.

In Elburgon, the main resource and therefore the prime mover of development is land both under agriculture and forestry. Therefore, if we have to sustain the development of Elburgon town, we must sustain these two primary resource bases (forest and agriculture).

Land under agriculture has been seen in terms of how much cash crop or food can be obtained from a piece of land. However, while there is room for increased productivity per piece of land as has been shown in rice paddy in China, these increments are limited given the law of diminishing returns. Even with improved technology one factor that we must reckon with is land carrying capacity. This determines the levels of incomes, employment on land and/or agriculture related industry holding all the other factors constant. Agriculture is considered as the backbone of Kenya's economy both on incomes and employment.

Forest output has been measured in terms of cubic metres of timber produced and the cash earnings received. Forest outputs have been discussed in terms of sawn logs, cut timber and wood products especially for export. Timber is just but one of many forests products. Forests provide habitats for wildlife, acts as watershed catchment, prevent soil erosion, provide pharmaceutical products, are a source of energy-fuel wood, and charcoal. They also provide building materials, provide biodiversity protection, purify air, and gives a sense of nature's aesthetic (beauty).

The growth of Elburgon town can be attributed to its location in a region blessed with natural resources, mainly forest. Increase in population has increased pressure on natural resources. This has seen increased population in small urban areas of the district especially those with resource based industries such as Elburgon. In 1979 the town had 8,701 people and in 1989, 25,150 people. While in 1993 the population was estimated to be 26,296 people. Increased forestry activities especially logging and saw milling has led to forest over-exploitation. Over the years the town has grown in size, the number of industries has increased and the urban area has encroached into land reserved forest. In recent years the District Forest Officer has banned the activities of saw millers and reduced the activities of some big industries. These was because the rate at sawmillers were exploiting the forest was not sustainable. These has serious implication on employment and incomes of the residents of this town because most workers were laid off. We can not talk of sustainable urban development without putting into consideration rural or natural resource sustenance. The town has also enabled the exploitation of resource base both agriculture and forestry. Agriculture business is practised in the town. The processing of forest resource



has led to disposal of waste disposal of sawdust in the town and to water pollution and other environmental problems. If development of this town is to be sustained, there is need to establish the link between sustainable urban development and the resource base sustenance on a sustainable basis in the long run.

Sustainable development necessarily involves the identification and definition of alternatives and options to development activities, objectives and policies based on opportunity cost in terms of both economic gains and environmental weal (Yusuf, 1989).

This study will try and establish the unexploited alternatives of the two resources base which could maintain a sound environment. This sound environment would necessitate the protection of the bio-diversity of these resources without jeopardizing the opportunity cost of utilizing resource for the social and economic gains.

This however calls for the framework of decision-making which must be firmly geared to a process of built-in dynamic trade-offs between effective resources management and environmental betterment on the one-hand and sustainable urban development on the other.

Most works that has been done has dealt with natural resource management per se but little has been done on sustainable urban development and its relation to resource base sustenance. The link between urban development and sustenance of natural resource base on sustainable basis, has not been established. One thing to bear in mind is that each region has its unique natural resource endowment, thus any special consideration are within the limits and potentials of these resource utilization. This study will therefore try establish the link between Elburgon town with its natural resource.

## CHAPTER TWO

### 2.0 STUDY AREA: Background to Elburgon

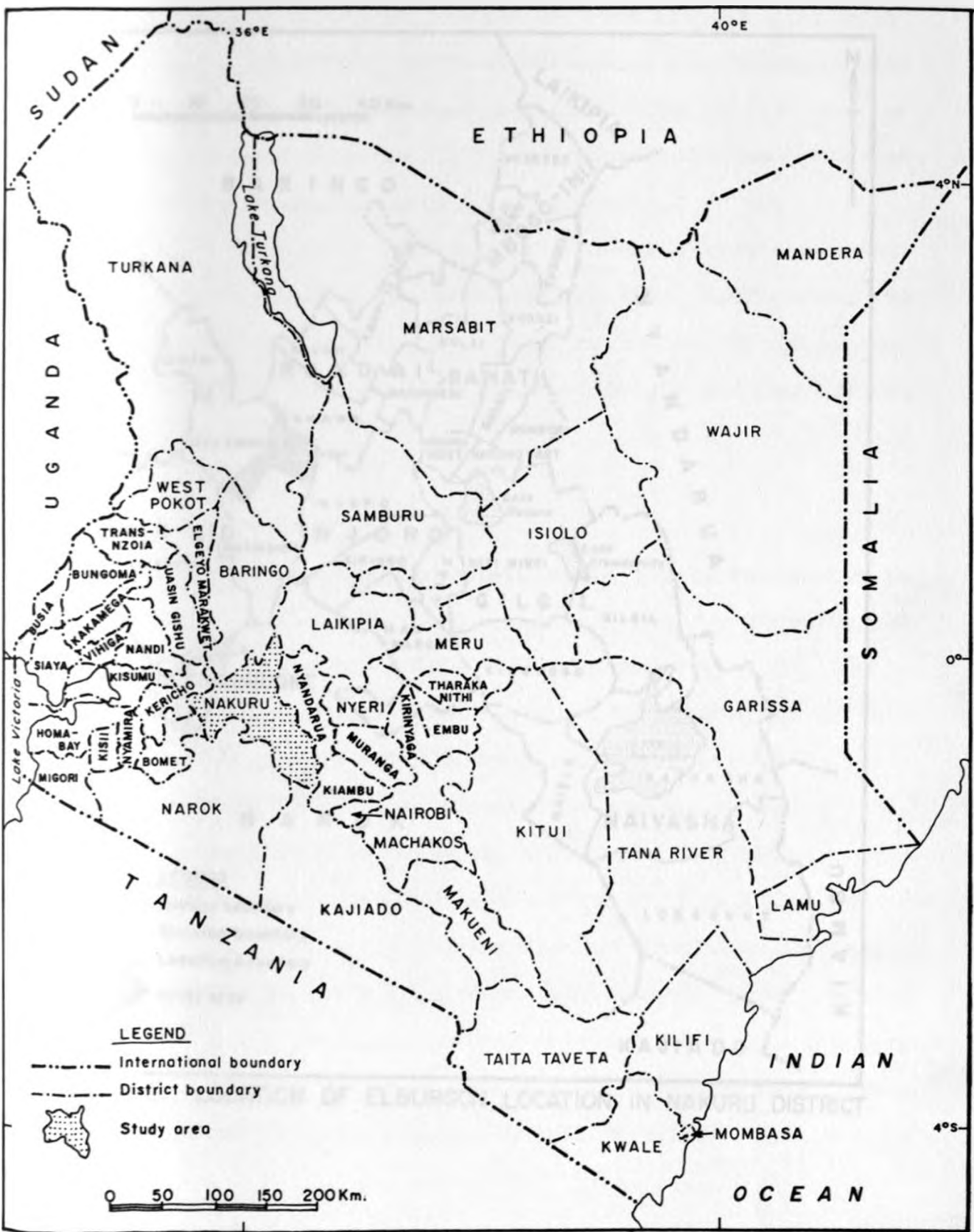
#### 2.0.1 Location

Elburgon town is located in Molo Division, Nakuru district. Nakuru district lies between Latitude  $0^{\circ} 13'$  North and  $10^{\circ}$  South of the equator and Longitude  $33^{\circ} 27'$  West and  $36^{\circ} 8'$  East. The town is located along the C 56 road from Nakuru to Kisumu. This town is traversed through by the Nakuru-Kisumu railway line. Elburgon Town is located to the West of Nakuru district (see Map 1 and 2).

#### 2.0.2 Topography

The study area is situated on the Mau escarpment which is part of the Western Kenya highlands. It is on the Molo plateau which forms the largest relief of the area. The plateau rises between 2000-3000 metre above sea level (with an average of 2438 m a.s.l). Elburgon town is situated at an altitude of 2366m above sea level).

The topography of the country-side around Elburgon town comprises gentle slopes rising from some 2000 feet to 3000 feet in 10 miles stretch of land towards the Upper Mau escarpment.



MAP 1. LOCATION OF NAKURU DISTRICT IN KENYA



The town centre is located on a relatively flat area. The residential estates—such as the Karoreni and Eastleigh—are located on undulating hills as one approaches Michinda high school towards Mariashoni forest on the South Eastern part of the town. On the South-West part of the town, the undulating topography starts immediately one leaves the town centre along the Mariashoni forest road. The open air market is located on a hilly area North of Karoreni Estate and South of the town centre.

### 2.0.3 Geology

The geology of Nakuru District is highly correlated to the tectonic activities associated with the formation of the Rift Valley. The volcanic activities has had a considerable influence on the geology formation of this district. The area is dominated by volcanic rocks which resulted in the formation of the Mau ranges among other features such escarpments, volcanic mountains etc. The volcanic rock in Elburgon-Molo area date from Tertiary to Recent times. The Lacustrine and fluviatile sediments derived directly from them cover the low lying parts of the study region. In areas about Elburgon, tertiary pyroclastic rocks of the Upper Mau predominate. This consist of porous black ash which occurs widely at the

foot of the scarp in the South outcrops over a wide area in the area around Elburgon. Black ash frequently is seen persistently along river beds up to heights of 8800 feet in country side around Elburgon. The rocks are banked against a terraced scarp overlying the grey Eutaxitic welded turfs and Yellow turfs and agglomeration of which Mau is composed. The homogeneity, lack of bedding and columnar jointing suggest an ash flow origin. The flow could have probably emanated from the scarp fault. They have been described as ash fall origin from Menengai Crater (Mc Call, 1957, P. 61).

#### 2.0.4 Soils

Relief and underlying geology has given rise to different types of soils as there are different types of geology and climate. The soils in the district are formed from the weathered volcanic and basement systems. This does not however, rule out the possibility of getting different soil types at localized levels.

The major soils in the district have been broadly classified into seven groups. This includes Andosols derived from ashes, Cambisols-which are young and rich in nutrients, Regasols-which are formed from loose materials, Phalozens-which are rich in organic matter and

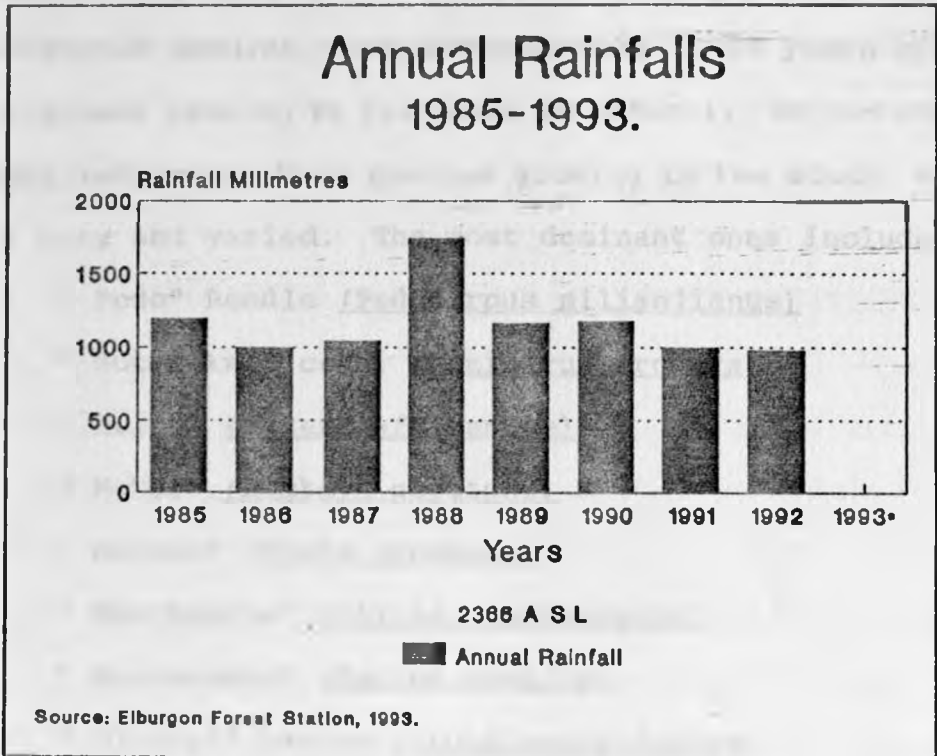
Lithosols-which are limited in depth and other unclassified soils. In the study area the soils are Phalosenolic type. These soils are rich and well drained humic loams with dark-brown subsoils. These soils are very suitable for agriculture and growth of forests.

#### 2.0.5 Climate

The climate of Elburgon is moderately cool and wet. The mean maximum temperatures ranges between 14°C and 18°C, while the mean minimum temperatures ranges between 6°C and 10°C. During the cold seasons temperatures in Elburgon approach freezing point daily. The annual average rainfall is about 1182.8mm (Fig2.1). Rainfall is distributed throughout the year with peaks at April to May. July to August have the lowest rainfall. Elburgon area falls within an area with a sub-equatorial climate and has a moisture index of less than 10. Rainfall received is as a result of condensation due to effect of relief hence it is orographic. Moisture is received from two origins. There are winds from the Indian Ocean which are moisture laden and are cooled due to relief and forms precipitation. Then, we have moisture from the Atlantic Ocean, Zaire basin and Lake Victoria which cools over the Mau Ranges forming rain. Forest cover in the region also helps in containing moisture.



Figure 2.1



#### 2.0.6 Vegetation

Due to a combination of the factors discussed above, that is, relief, geology, soil and climate, the composition of vegetation in the study area varies. In Elburgon has both indigenous and exotic trees species. The exotic tree species grown in this region are: cypress (*cup-lustanica*), pines (*pine patula*, *pine radiata*) and eucalyptus (*saligna*). The exotic trees are found in

monoculture government plantations. They are preferred because they take a shorter time to mature compared to indigenous species (exotic trees take 25-30 years while indigenous take up to 100 years to mature). On the other hand, indigenous tree species growing in the study area are many and varied. The most dominant ones include:

" Podo" Rendle (Pedosarpus milianjianus)

" Mutarakwa" cedar (Juniperus procera)

" Mwiri" (Pygeum africanure)

" Mukeo" (Bombeya goetzeni)

" Mwanda" (Nuxia congesta)

" Mwathathia" (Olinia usambavensis)

" Munderendu" (Teclea nubilis)

" Mirangi" bamboo (Arundinaria Alpina)

Some assorted species of indigenous trees has been planted on steep slopes and in the catchment areas in government plantations. Some of these indigenous species such as cedar are very important for post products and beams, while bamboo are famous for fencing. Bamboo and 'Mikeo' grow along rivers. They are good for water catchment areas. There are also open spaces with kikuyu grass. Elburgon has a total of 8671.1 Ha under forest of which 6165.7 Ha are under exotic trees species and 2108.4 is under indigenous trees.

### 2.0.7 Drainage

The drainage of Molo-Elburgon area is radial with streams radiating from the Mau (Jenning 1982). Elburgon area falls within Uaso Ngiro (is found on the Eastern Mau and part of Molo on Londiani Mountain catchment). Most of the streams originate from the escarpments. Rivers that originate from Eastern Mau Catchment are River Narok and Uaso Ngiro. They flow Southwards into lake Natron in Tanzania. This catchment zone also maintain some of the streams that form River Mara that drain into Lake Victoria South of Kenya-Tanzania boarder. In Elburgon area, Mau and Muru rivers drain into Rongai and Molo rivers respectively. Other important streams are Marioshoni and Elburgon river which drain into Rongai.

On the western side of the Mau escarpment Molo, Perkera rivers and sub-branch of Sondu river forms the drainage rivers. They drain their water into river Nyando and flows westwards into lake Victoria through Kavirondo Gulf. Streams flowing Northwards form a network constituting river Perkera and drain into Lake Baringo.

Underground drainage also contain abundant drainage water because of high infiltration and retention capacities of soils in the area. The area is also forested and thus

the trees prevents high evaporation rates. Rainfall constitutes the main source of water input in Elburgon. Outside the high rainfall zone some of these streams becomes seasonal and dry river valleys as evident during the dry spell.

#### 2.0.8 Agro-ecological zones

Elburgon location has an area of 103 square kilometre excluding urban area. The area can be divided into four agro-ecological zones: UH<sub>1</sub> (3 Km<sup>2</sup>), UH<sub>2</sub> (28 Km<sup>2</sup>), LH<sub>2</sub> (47 Km<sup>2</sup>) and LH<sub>3</sub> (39 Km<sup>2</sup>). To the North of Elburgon town is a wheat-maize growing zone. This zone has an ecological potential of producing 27 bags (90Kg) of maize (Farm Management Hand Book, Vol. 2, 1982). To the South East and West is pyrethrum zone, this region can produce 750 kilograms of dry flowers per annum (*Ibid*). To the Southern side of the Town is the forest zone. The main crops grown in the area around Elburgon are maize, pyrethrum, vegetables, beans and English potatoes. The areas has a natural potential of producing 2,400 kilograms or an equivalent of 26.67 (90kg) bags of maize per hectare in all the agro-ecological zones considered, see Table 2.1. While the same area can produce 7,000 Kilograms or 140 (50kg) bags of potatoes in UH<sub>2</sub> and 6,000

kilograms or 120 (50kg) bags in LH2. The area is also suitable for Merino sheep and diary rearing. A few sheep are presently kept.

Table 2.1 Crop production without fertilizer

Zones	Yields in Kg/Ha	
	Maize	Potatoes
UH2	2400	7000
LH2	2400	6000
LH3	2400	-

Source: Farm Management hand book, Ministry of Agriculture.

Each ecological region has the maximum it can produce with or without inputs application holding a certain level of technology constant. To raise the level of production in each agro-ecological zone, different levels of fertilizer can be applied. Table 2.2. Shows crop production at different levels of fertilizer application or the three agro-ecological zones with the same crop.

Table 2.2 Crop production with fertilizer

Zone	Type of fertilizer (Kg)	Yields in Kg per Hectare					
		Producing levels in Kg					
		Maize			Potatoes		
		Level of inputs	I	II	III	I	II
UH2	Nitrogen (N)	6	48	95	64	104	270
	Phosphates	6	35	85	72	117	300
	Yields	2,600	4,000	5,500	15,000	20,000	30,000
LH2	Nitrogen (N)	13	45	100	-	111	259
	Phosphates	12	43	93	-	126	295
	Yields	2,700	4,000	6,000	-	15,000	27,000
LH3	Nitrogen (N)	3	33	63	-	-	-
	Phosphates	4	28	55	-	-	-
	Yields	2,500	3,500	4,500	-	-	-

Source: Farm Management Hand Book, Ministry of Agriculture 1982.

### 2.0.9 Population

The total population of the town according to the 1969 census was 5,000 people. By the 1979 census the population was 9,163 people and by 1993, the population was estimated to have grown to 26,296 people. The population in this town has more than doubled within the inter censual periods. This is attributed to migration, A part from Olenguruone division, the rest of Nakuru district was part of "the White highlands" before

independence. After independence large European farms were either made settlement schemes for the resettlement of those who were landless or purchased through the land-buying companies and/or cooperatives. The subdivision of land into smaller units increased the population densities. In Elburgon the land was acquired through land-buying companies.

The other attraction in Elburgon are the industrial activities, especially saw milling. Elburgon has been an important saw milling area. This activity has attracted people in search of jobs in this region.

There has been a recent migration into the town by people who were evicted from government forests. Some of those migrants have leased land for annual crop cultivation, while those who had some saving bought land. All these factors have contributed to an increase in the town's population. Table 2.3 below shows the population of Elburgon in comparison with other local urban centres in the district.

Table 2.3 URBAN AND RURAL CENTRES POPULATION:1979

CENTRES	1979	1988	1993
<b>Urban Centres</b>			
Nakuru	94,981	174,619	239,243
Molo	5,643	11,262	15,796
Njoro	6,111	12,215	17,133
Naivasha	12,102	26,289	38,620
<b>Rural Centres</b>			
Gilgil	9,587	19,169	26,411
Elburgon	9,163	18,317	26,296
Mau Narok	2,326	4,650	6,326
<b>Total</b>	<b>139,913</b>	<b>266,521</b>	<b>369,825</b>

Source: Ministry of Economic Planning and Development 1981. Kenya population census 1979- Volume 1, in Nakuru District Development Plan 1989-1993 p.19.

Though Elburgon is designated as a rural centre it has a high population than some urban centres such as Njoro and Molo. Apart from Nakuru town which is the principal town, Naivasha (urban centre) Elburgon compares well as an important urban centres to the rest of the centres in the district. The intercensal population increase is over 63 per cent.

### 2.10 Economic Base

Elburgon is a town busy with various economic activities. This has been made possible by:- first, its advantageous



location a few kilometres from Nakuru town (which is the principal town in the district). Secondly, the town is surrounded by a rich agricultural hinterland. Lastly, the town is located in a region endowed with natural resources, basically forests and good fertile soils.

### 2.10.1 Agriculture

Most people in Elburgon location as well as Nakuru district depend on agriculture as a way of life and income earning. Elburgon is located in a high potential zone with good soils and climate. This region is part of the former white highlands during the colonial era. By then the farm size were big. The white settlers specialized in the production of wheat, barely and sheep rearing. After independence former Europeans farms were subdivided into small farms. This resulted in changing type of farming from the large scale to small scale. The major crops grown here are maize, bean, vegetables, and potatoes. These crops are grown as food stuffs. The surplus is sold at Elburgon market which acts as a collection centre. Basically most of the food stuff most remains in Elburgon town. Some produce finds its market mostly in far places such as Kisumu and Nairobi to mention but a few. This is mostly potatoes and vegetables. Table 2.4. shows gross margins for maize per hectare in Nakuru

District in 1991. It can be reasonably be assumed that the production remains the same. The gross margins however may decline because of changes in prices of inputs.

#### 2.4 Gross Margin/ha of maize pure stand (1991)

<u>OUTPUT</u>	<u>UNITS</u>
Yield/ha 90Kg bags	50
Price/Bag Kshs 300	
Gross output	Kshs 15,000
<u>Variable Costs</u>	
Ploughing	Kshs 1,000
Harrowing	Kshs 750
Seed 25 Kg	Kshs 425
Fertilizer DAP 250Kg @ Kshs 9	Kshs 2,250
CAN 250Kg @ Kshs 7	Kshs 1,750
Stalk borer dust	Kshs 200
<u>Labour requirements</u>	
Planting 25 MD @ Kshs 35	Kshs 875
Weeding twice @ 30 MD @ Kshs 35	Kshs 1,050
Top dressing 5 Md @ Kshs 35	Kshs 175
Stock borer control 3 MD @ Kshs 35	Kshs 105
Harvesting @ Kshs10/bag of maize in cob	Kshs 1,500
Shelling of maize @ Kshs 10/90Kg bag	Kshs 500
Gunny bags 50 @ Kshs 15 (spread over 3 years)	250
Transport @ Kshs 20/90Kg bag	Kshs 1,000
Crop cess and government tax 6%	900
Total	12,730
Miscellaneous	1,27
Total variable costs	Kshs 14,003
Gross margin/ha	Kshs 997

Source: Nakuru District Farm Management Guidelines, Ministry of Agriculture (1991).

Basically the crop production method in the study area is mixed cropping. Mostly maize, beans and potatoes are intercropped. Table 2.5 below shows the gross margins for maize and beans grown together. The gross margin is raised from Kshs 997 on single stand to Kshs 2638.

### 2.5 Gross Margin/ha of maize and beans

OUTPUT		UNITS
Yield/ha	Maize 90Kg bags	50
	Beans 90Kg bags	7
Price/Bag	Maize	Kshs 300
	Beans	Kshs 600
Gross output		Kshs 19,200
<u>Variable Costs</u>		
Ploughing		Kshs 1,000
Harrowing		Kshs 750
Seed: Maize 25 Kg		Kshs 425
Beans 30 Kg		Kshs 600
Fertilizer DAP 250Kg @ Kshs 9		Kshs 2,250
Stalk borer dust		Kshs 200
<u>Labour requirements</u>		
Planting 50 MD @ Kshs 35		Kshs 1,950
Weeding twice @ 33 MD @ Kshs 35		Kshs 2,310
Top dressing 5 Md @ Kshs 35		Kshs 175
Dusting 13 MD @ Kshs 35		Kshs 455
Harvesting @ Kshs10/bag of maize in cob		Kshs 1,500
Harvesting @ Kshs 10/bag of beans in pods		350
Shelling of maize @ Kshs 10/90Kg bag		Kshs 500
Threshing of beans @ 20/90 Kg bag		Kshs 140
Gunny bags 50 @ Kshs 15 (spread over 3 years)		250
Transport @ Kshs 20/90Kg bag		Kshs 1,140
Crop cess and government tax 6%		1,152
<u>Total</u>		14,897
Miscellaneous		1,665
Total variable costs		Kshs 16,562
Gross margin/ha		Kshs 2,638

Note: i) About one 'debe' (18 Kg) of threshed beans equals 1 bag of beans in pods;

ii) About 3 bags of maize in cobs equals 1 bag of shelled maize (90 Kg).

Source: Nakuru District Farm Management Guidelines, Ministry of Agriculture (1991).

Other sources of incomes for farmers in the area include the growing of pyrethrum which is the main cash crop (see Table 2.6 gross margins for pyrethrum), rearing of grade cattle under zero-grazing, potatoes, maize and horticultural products such as vegetables and peas. The rearing of Merino sheep has been reduced to small-scale sheep rearing with many farmers keeping 5-10 sheep. These agricultural activities have been a major supplier of raw materials (inputs) for agro-industries located in the Molo-Elburgon area. These include a Kenya brewery barely plant, Kenya cooperative creameries factor for cooling milk, a cold storage potato plant and a pyrethrum board of Kenya marketing centre. A Cereal and produce board store with a capacity of 50,000 bags is located at Elburgon. The agro-industries are important in the development of the region and employment opportunities.

Table 2.6 Gross Margin for Pyrethrum 1991.

OUTPUT	UNITS
Yield/ha dry flowers in Kg	750
Price/Kg of dry flowers Kshs 43.50	
Gross output	Kshs 32,625
Variable costs	
Weeding 6 times @ 30 MD @ Kshs 35/MD	Kshs 6,300
Cutting back 12 MD @ Kshs 35	Kshs 420
Picking @ Kshs 1 wet flower per Kg	Kshs 3,000
Drying	Kshs 1,000
<b>Total</b>	<b>10,720</b>
Miscellaneous	1,072
<b>Total variable costs</b>	<b>Kshs 11,792</b>
<b>Gross margin/ha</b>	<b>Kshs 20,833</b>

Source: Nakuru District Farm Management Guidelines, Ministry of Agriculture (1991).

\* MD -Man days

Wheat is grown in this area but the hectarage is small due subdivision of land. Wheat growing has been limited to those with large farms. Gross margins for the crop is shown in Table 2.7.

Table 2.7 Gross Margin/ha of Wheat

OUTPUT		UNITS
Yield/ha	90Kg bags	25
Price/Bag	Kshs 565	
Gross output		Kshs 14,125
<b>Variable Costs</b>		
1st Ploughing	Kshs 1,000	
1st Harrowing	Kshs 750	
2nd Ploughing	Kshs 1,000	
2nd Harrowing	Kshs 750	
Seed 150 Kg	Kshs 2,100	
Fertilizer DAP 150Kg @ Kshs 9	Kshs 1,350	
Agro-chemicals: Bucril M 1 Litre	Kshs 250	
Foliar feed Bayfolan 2.5 Litres	163	
Spraying charges	Kshs 450	
Rust control using TIH	Kshs 716	
Harvesting	kshs 875	
Planting 25 MD @ Kshs 35	Kshs 875	
Transport @ Kshs 20/90Kg bag		
Kshs 15 refundable by NCPB	Kshs 125	
5% cess and 1% government tax	848	
<b>Total</b>	<b>10,377</b>	
Miscellaneous	1,038	
<b>Total variable costs</b>		<b>Kshs 11,415</b>
<b>Gross margin/ha</b>		<b>Kshs 2,710</b>

Source: Nakuru District Farm Management Guidelines, Ministry of Agriculture (1991).

\* MD -Man days

Another important crop grown in this region is potatoes.

This crop is grown together with other crops. Where it

is grown alone the acreage is small. Table 2.8 shows the

gross margins as per 1991.

Table 2.8 Gross Margin/ha of potatoes

OUTPUT	UNITS
Yield/ha Kg	16,000
Price/Kg Kshs 3	
Gross output	Kshs 48,000
<b>Variable Costs</b>	
Ploughing	Kshs 1,000
Harrowing	Kshs 750
Seed 63 bags @ 50Kg @ Kshs 240/bag	Kshs15,000
Fertilizer DAP 200Kg @ Kshs 9	Kshs 1,800
<b>Labour requirements</b>	
Planting 30 MD @ Kshs 35	Kshs 1,050
Spraying 6 times @ 5 MD @ Kshs 35	Kshs 1,050
Top dressing 5 Md @ Kshs 35	Kshs 175
Weeding twice @ 33 MD @ Kshs 35	Kshs 2,310
Harvesting @ 30 MD	Kshs 1,050
Guuny bags 50 @ Kshs 15 (spread over 3 years)	250
Transport	Kshs 10,000
<b>Total</b>	36,060
Miscellaneous	3,600
Total variable costs	Kshs 39,660
Gross margin/ha	Kshs 8,340

Source: Nakuru District Farm Management Guidelines, Ministry of Agriculture (1991).

### 2.1.2 Forestry activity

Beside agriculture, forestry industries in Elburgon are very important in terms of their contribution to the growth of Elburgon town and to the district's economy. Elburgon has the highest number of saw mills in Nakuru district. While Molo division of which Elburgon location is part of has the highest number of saw mills in the country. One of the three plywood factories in Kenya and

the only fibreboard in Kenya are located in Elburgon. In total Elburgon has 15 saw mills, one charcoal brisket industry though its not operational. Timsales limited has three major industries, that is, Sokoro Saw Mills, Sokoro Plywood, and Sokoro Fibreboard. The other notable industries are Gachagua Saw Mills and Kenya Saw Mills. The other 10 industries are relatively small compared to above mentioned ones. However, they still contribute significantly to the industrial activity. In total the saw milling industry employs 5,000 people directly in the district (Nakuru Development Plan, 1994-96). More than 30 per cent are employed in Elburgon.

### 2.1.3 Trade and Commerce.

The town offers a wide range of products and services. The trade in the town involves wholesale and retail of various commodities. Then there is service industries that accompanies the above two categories of trade. The goods sold ranges from provisions of consumer goods, consumer durable goods, agricultural inputs and animal feeds, hardware and spare parts. Table 2.9 shows various categorization of commercial outlets. This shows that the town offers high level of services. In total the commercial sector employs about 607 people.



Table 2.9 Commercial Outlets

Outlet	Number
General retail shops	60
Wholesales	5
Hardware	5
Hotels	14
Eating Houses	37
Butcheries	18
Bars	14
Tailoring shops	24
Posho mills	8
Motor works	5
Carpentry	17
Milk and dairy	3
Animal feeds	5
Informal Sector outlets	19
Others	35

Source: Field survey, 1994.

There is also an open air market where agricultural produce (fruits, potatoes, beans, maize etc) are exchanged. The market opens twice in a week but during other week days the market is open but operates at a low scale. However, the space provided for the market has been outstripped by the economic activities. During

market days traders spread along the road going to Mariashoni along the P.C.E.A. Church and next to the railways. This is mainly traders dealing with second hand clothes-"mitumba". Occasionally produce from Kisii and Kisumu are brought to this market.

Furniture and fixtures trade is also increasingly becoming important. In Elburgon we have 17 furniture making workshops. The availability of timber from saws mills, plywood and fibreboard industries has enabled this activity.

On the service industry, there are bars and restaurants, hotels, food-kiosks, saloons and barbers, Guest houses and lodges and repair shops as shown in Table 2.9. The town is growing fast. Presently there is a big and posh tourist hotel- Elburgon Eel. This hotel is also becoming attractive to people who want to have seminars and fora outside the major towns.

The above discussed economic activities indicate the town has the potential for growth. To encourage savings and therefore investment, the town has two financial banks. It is hoped that local community will invest in both Elburgon area and These banks are Kenya Commercial

Bank, and Barclays Bank. The Post Office also offers post saving services.

#### 2.1.4 Informal sector.

Informal Sector in this town especially in furniture and fixture is growing fast. There is a strong link between the forest, saw milling, plywood and fibreboard industries and the furniture industries. Increase in population in this town and the country as a whole has caused increased demand for furniture. The town also serves the demands for the other hinterland which extends as to Nairobi and beyond. The other activities in the informal sector involves vehicle repairs, tailoring and charcoal burning.

With an ever increasing demand and the current Government policy on this sector, it is expected to contribute greatly towards this towns economy. This sector, especially in the furniture making industry, is suffering from lack of materials. This is in respect to hardwood. Since 1985 there was a Presidential directive to ban the exploitation of indigenous species. This has reduced the availability hard wood which is the primary source raw material. Furniture made of hard wood are preferred than those of soft wood.

### 2.1.5 Communication and Transportation.

Elburgon is linked well to other towns by road and railway line. The town is traversed by a tarmac road C 56 which joins the A104 near Nakuru town. This road passes through Turi, Molo and Mau Summit towards Kisumu. And through Njoro to Nakuru. It is along this road that most sawmills, the Plywood and Fibreboard are located in Elburgon. This is because transportation of finished products to other urban centres is easy.

Also running along the C 56 road is the Mombasa-Kisumu railway line. The railway passes through Elburgon. It provides transport of bulky products from the saw mills plywood, Fibreboard and also agricultural produce such as cereals.

However, the inner circulation road network and those leading to the hinterland, that is, in the agricultural and forest area are poorly maintained. Most of the roads are of Murrum surface and are often impassable during the rainy season. It was observed that all roads into the forests are just mere earth roads. They are inaccessible during the rainy season. The vehicles which transport logs from the forest usually get stuck for even several days thus rendering forestry industry uneconomical

undertaking during wet seasons. Most casual workers are laid off. Only industry owners with sophisticated tractors such as timberjack and cartpillers like Sokoro saw mills and Gachagua sawmills do attempt to access the source of raw material though at exorbitant cost.

The town is served by a Standard Trunk Dial (STD) services. The automatic operation call box are not many though. There are 5 five call boxes in the whole town. Most of the time the call boxes are either full of coins especially on weekends. You find long ques of people waiting to use these booths.

## CHAPTER THREE

### 3.0 DEVELOPMENT POLICY

#### 3.1 Introduction

Development to a large extent is steered by government policy guidelines. In this Chapter, various policies related to sustainable urban development are reviewed. Development has impacts on environment, thus environmental policy in Kenya guiding development is important.

#### 3.2 Urban Policy

The government policy and responses to the process of urbanization and the challenges that come with it is vital if urban development is to meet its development potential and avoid an unsustainable human settlements. The urban population is expected to be 9-10 million people by the year 2000 (Sessional Paper No.1, 1986). The main concern of the government has not been only the high growth rate but the pattern it takes. This is more so, because urbanization in Kenya has tended to largely centred around the largest cities of Nairobi and Mombasa.

The Government concern is on encouraging development in all regions of the country, through an urbanization strategy that stresses decentralization of urban growth.

strategy that stresses decentralization of urban growth. The main objective is to avoid growth of primate cities; where population concentrates and promote growth of secondary town and small urban centres to foster linkages between agriculture and other sector of the economy, and to bring renewed economic growth to all regions of the country (Sessional Paper No.1, 1986, Kenya Development Plan, 1989)

The following are the strategies being undertaken:-

- (a) Concentrate scarce resources for urban infrastructure in selected small towns, with the aim of providing a range of basic infrastructure and facilities that support agriculture and other activities such as small industries.
- (b) Strengthen local authorities to enable them provide competent administration and management in the growing urban centres, and to provide them with sufficient resources to develop, operate and maintain the centres.
- (c) Promote growth of productive non-fair employment opportunities in the small manufacturing and commercial activities, especially in the informal sector of the urban economy, (Kenya 1986).

To achieve these objectives, the government initiated a Rural Trade and Production Centres Programme in which small towns were designated Rural Trade Production Centres (RTPCs) - chosen from existing urban centres which in 1979 had a population of below 5,000 inhabitants and showed a potential for economic growth. The support of the government to these centres, have been and will

continue to be provision of link roads, water and sewerage networks, market space, telephone, postal, electrical and storage facilities and services, with the hope that the provision of such facilities will simulate the creation of new jobs opportunities and curb migration to large cities.

On the whole basis, little achievement have been made towards this goal. Emphasis was laid on the provision of infrastructure more than the economic potential. Some of these centres has largely remained administrative centres. Little importance was given to the hinterland of such resources like forests. Some of these centres are growing spontaneously while others are declining according to natural forces. The context within which development is brought about needs to be defined (Ochanda, 1989). Small towns suffer considerable shortage of infrastructure. Local authorities have remained incapable of managing the urban areas, and cities like Nairobi and Mombasa continue to lure the rural population into them. According to 1989 census results, 19 per cent of Kenya's population lives in urban areas (CBS 1991) and the intercensal growth rate of the urban population was 4.8 per cent per annum. For example the population of Nairobi has increased from 827,775 in



1979 to an estimated 1,324,570 in 1989 (CBS 1994). This increase can be attributed to a large extent to rural-urban migration (DHS 1994, p.3). The government has not been committed into involving the local authorities and other local institutions in the management of urbanization.

The major concern of the government in the urban policy has been on how to initiate regional development and maintain a rural-urban balance. The policy however, is silent on how to sustain the purported urban development and regional development. In the Sessional Paper No.1,1986, the government argues that the spread of urban development in the rural areas will add pressure on agriculture, forest land and water. This therefore calls for natural resource base management as a basis for sustainable urban development.

Thus there is need to review the current urban policy growth in view that sustainable urban development stems on sustainable use of environmental resources on the one hand and upon minimization of vulnerability of human settlements to natural and man-made hazards on the other. The linkage between natural resource utilization in urban development should be stressed on mutual-benefit

relationship and not on a master-slave relationship, where one sector benefits at the expense of the other sector.

### **3.3 Forest Policy**

#### **3.3.1 Introduction**

The primary aim of Kenya Government forest policy is to lay down the basic principles underlying the development and control of forestry in Kenya, for the greatest common good for all (Forest Policy, 1968). The needs and aspirations of common man to a large extent are supposed to influence the laws and policies governing the relationship of man and forest resources. However, this is more of rhetoric than reality. If there is clear understanding of this relationship the conflicts arising from high demand for wood production and other basic needs of the population tend to be minimized. The basic principle of forest management is supposed to be safeguarded, in such a way that they can be handed over to the future generations at least undiminished in value if not improved. In this respect, forest policy framework and the existing legislation in this country, is viewed as a tool of ensuring proper management of our forest.

### 3.3.2 Existing Policy and Legislation

Forest department is said to be one of the earliest departments to be established in Kenya (Muiruri 1977, Nicholson 1931, Kamweti, 1979). The first rules governing the exploitation and conservation of forest were set as early as 1902. The landmark was the establishment of forest department and forest reserves demarcation. Nine year later, the Forest Ordinance of 1911 was enacted. This was but a model of the Indian Forest Act, Cap 7, 1878. After independence, 1963, this came to be known as the Forest Act, Cap 385. Unfortunately, these laws were being applied without a proper policy guidelines.

Prior to 1957, Kenya did not have a proper forest policy, forest management was guided by; first, recommendations made by expatriates in the country and two, on borrowed experiences of forest management from other countries of the world. The idea of a forest policy was first conceived during the 8<sup>th</sup> Commonwealth conference in Ottawa, Canada in 1952. In this conference, one of the many resolutions passed under the chairmanship of the then chief conservatoire of forest in Kenya, Mr Waterer, was that each state should formulate and adopt a forest policy. This resolution was implemented five years

later. This led to the birth of the first Kenyan Forest Policy often referred to as the White Paper No.85 of 1957. After independence, forests were recognised as important national assets, in terms of their protective aspects of conservation of climate, water and soil; as source of forest produce of all uses by the inhabitants of this country; and as a revenue earner of high potential. More so, there was a need to incorporate the aspiration of the people. This awareness led to the revision of the White Paper No.85 of 1957 in 1968. This was the birth of a forest policy in independent Kenya. The policy is in the process of being revised because of its inadequacy.

Some of the fundamental principles outlined in the policy aimed at achieving the following:-

### 3.3.3 Reservation

Reserve in perpetuity the existing forests and wherever possible, add them so as to provide sufficient land in order to;

- (i) maintain and improve the climatic and physical condition of the country.
- (ii) conserve and regulate water supplies by protection of catchments and by other means necessary for the purpose including the impounding of water in forest areas.

- (iii) conserve the soil by prevention of desiccation and soil move erosion.
- (iv) to provide for the needs of the country in timber and other forest products adequate to meet the requirement of the community under a fully developed national economy and to provide the greatest possible surplus of those products for exports

#### 3.3.4 Protection

Protect the forest by all means at the Governments disposal. Fire is the greatest danger, grazing in catchment forest is in principle undesirable and it is the government policy to end grazing, where damage is caused to trees and undergrowth.

#### 3.3.5 Management

It is a basic principle of the government's policy that all forests shall be managed in accordance with specific plans, more or less detailed as the objects of management required in each case. These plans shall be in accordance with this statement of policy "Forest shall be managed on the principle of the sustained yield."

#### 3.3.6 Industry

Foster the conception of a mutually interdependent forest industry and integrate to the best advantage of Kenya the

production, harvesting and utilization of forest produce, by ensuring close co-ordination between all interest concerned in these aspects of the industry and wherever opportunity occurs to encourage industrial processes consuming forests products.

### 3.3.7 Finance

Provide adequate funds, within the limits of finance available.

Despite a clear forest policy forest department faces a lot of problems. Forest department is a government revenue earner. Forest contributes 1.5% of our GNP. Yet, forest department do not have enough personnel, vehicles, tools and equipments and autonomy in its management. The management as stated above is stemmed on the "Principle of the sustained yield." But the demand for forest products have outstripped the supply. The researcher bond of contention is the fact that survival rate of established plantation have gone down to unacceptable and undesirable levels. The forest department must realize that the forests products produced are the main source of raw materials to industry sector in forestry activities. If the desired regional development by the government is to be achieved through

establishment and exploitation of natural resources, it should be at sustainable exploitation rate. This calls for a forest stock establishment, then the regeneration rate and thus establish the exploitation rate. The policy should go beyond this because of the fact that forests are resource bank of unknown potential for the future. This means that some forests need to be preserved and alternative economic use such as research and tourism which will leave the forest ecosystem less interferred be introduced.

### 3.3.8 Kenya Forestry Master Plan

A new document on Kenya Forestry Master Plan has been published. This plan is expected to form the basis for forestry development in the country for the next 25 years. It was noted that the 1968 forest policy was not sufficient for providing the basis for national forest development. A new forest policy draft has been written. It is hoped that when accepted in parliament, it will have a major revision of the Forest Act and other forestry legislation. Subsequently new forest management practices could be adopted. This Forestry Master Plan is based on this revised forestry policy (awaiting Government approval).

The objective of this Forestry Master Plan are :-

1. Increase the forest and tree cover of the country thus ensuring increasing supply of forest product and services for meeting basic needs of the present and the future generation and enhancing the role of forestry in Socio-economic development.
2. Conserve the remaining natural habitat and wild life therein, rehabilitate them and conserve their biodiversity.
3. Contributing to sustainable agriculture by conserving the soil and water resources through tree planting and appropriate forest management.
4. Support government policy of alleviating poverty and promoting rural development through income based on trees resources and employment. Also strengthening individual and national economies by promoting equity and participation.
5. Fullfilment of national obligation regarding International environment and other forest-related conventions and principles.

Reviews of both environmental and forest policies and the intensive forest development in Kenya demonstrate the strong commitment of the Government to the follow-up of The United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992. However, Kenya could just have joined the 'band wagon' so that it may not be seen as the odd man out in the international community. The Master Plan outlines a more comprehensive and complete forestry management. But to put this goals in to reality requires government commitment to this plan with more action than words. If history is any thing to go by then we take the 'wait and



see attitude' for past master plan for example on water has not been realised.

### 3.4 National food policy 1981

One of the major objectives of Kenya's development policy during the course of the next decade will be to meet an ever increasing demand for food, caused by a rapidly expanding population and rising per capita income. The agricultural sector must continue to play the leading role in Kenya's development and nearly all the nation's food requirement will need to be met from domestic production. In addition, the agricultural sector must continue to generate foreign exchange earnings to pay for oil, capital equipment and other impacts. At the same time, it must be the major source of new jobs for the rapidly growing labour force.

To meet these needs, Kenya's agricultural development strategy is aimed at the continued expansion of productive investment, with the primary objective of the provision of basic needs and alleviation of poverty through growth in agricultural output. The need to conserve national resources is now well recognized as an essential part of this strategy.

Agricultural production has generally improved. Despite these successes serious problems have emerged, particularly in more recent years. The expansion of production has been achieved at the expense of widespread soil erosion, depletion of the nutrients, content in the soil and the destruction of indigenous forests. The terms of trade between agricultural exports and imports, particularly oil have deteriorated, reducing the real benefits to the nation of the expanded agricultural production. Most importantly, the population has grown rapidly and at an accelerating rate, absorbing the increases in food production and preventing a marked improvement in per capita nutritional intake. Although Kenya has attained a capacity to be broad by self-sufficient in foodstuffs, certain sectors of the population remain malnourished as a result of income inequalities problems of distribution between geographical zones, seasonal fluctuations in supply and a lack of nutritional education among certain groups.

The rapid expansion of the population and a shortage of unexploited arable land in the main high potential areas are beginning to impose a potentially dangerous imbalance in the relationship between the national supply of and demand for food. The nation can no longer enjoy the

advantage of regular surpluses of foodstuffs to cushion the impact of a fall in production in years of crop failures. Whereas present levels of domestic food production would have been broadly sufficient to satisfy demand in the mid-70s. Kenya today faces shortages of maize, wheat, rice and milk.

There is a clear need for a national food policy which will set guidelines for decision-making on all major issues related to food production and distribution. The overall objectives of this policy will be to:-

- maintain a position of broad self-sufficiency in the main foodstuffs in order to enable the nation to be fed without using scarce foreign exchange on food imports;

- achieve a calculated degree of security of food supply for each area of the country.

- ensure that these foodstuffs are distributed in such a manner that every member of the population has nutritionally adequate diet.

The responsibility of feeding the nation must be shared between the public and private sector. The role of Government is to define and formulate policies which are in the best interests of the nation and to create an environment favourable to their implementation. Realization of the goals of these policies requires the commitment and the active participation of the private sector as producers, land-owners, distributors and

consumers.

Successful attainment of the objectives of a national food policy will be dependent upon the efficiency with which detailed policies are prepared and the appropriateness of investment programmes designed to utilize the limited resources available to agriculture.

### 3.4.1 A policy framework for the future

#### 3.4.1.1 Price Policy

Policy decisions on the pricing of the major food commodities will be among the most important factor determining whether the nation achieve the ratio of growth in food production necessary to recover to and maintain a proration of broad self-sufficiency. Consumer prices will be set at levels which cover the domestic producer prices plus processing and distribution costs.

On agricultural inputs, the central objective of the government's policy is to ensure that adequate inputs are made available at the lowest possible prices at the farm-gate and ensure that they are used at the right time and in the correct quantities.

The main aim for seeds will be to ensure a ready increase in the supply of improved varieties and to keep their prices to the farmer at a minimum.

There is also a need to continue the search for more productive crop varieties, while increased emphasis will be placed on breeding programmes aimed at continuous increases in all yields.

#### 3.4.1.2 Food Security Issue

The central objective of national food security policy is to ensure that an adequate supply of nutritionally balanced foods is available in all parts of the country at all times. Given current resource constraints, the immediate aims of food security will be to obtain a calculated degree of security at the lowest cost. This will be achieved through:-

- increasing food production in all areas of the country
- emphasizing drought-resistant crops such as sorghum and millet in the dryland areas
- the establishment of a food commodity maintaining and reporting system
- improved monitoring and forecasting of weather conditions in the main agricultural zones, and wider dissemination of information on expected weather trends.
- regulation of food exports to maintain domestic

supplies and importation of food as necessary to meet nutritional requirements; and,

- accumulation of a multi-commodity strategic food reserve from domestic surpluses and grain supplied on concession terms to be used during periods of crop failures or other emergency situations.

A land-use policy is necessary to ensure that all land is efficiently utilized and developed to meet national food needs while making a growing contribution to foreign exchange earnings. Priority will also be given to measures aimed at increasing rural employment and income and alleviating poverty.

The 1979 census indicated that Kenya's population had reached 15.3 million with an annual growth rate of about 3.8 per cent. The earlier census had indicated that the population was growing rapidly both in absolute numbers and in annual rate of growth. In 1969, for example, the population was 10.9 million with an annual growth rate of 3.3%. The economy of Kenya is not growing fast enough to keep up with the rate of population growth.

**3.0 REAL RATES OF GDP GROWTH (%)**

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>Average</u>
Plan(1979-83)	4.5	7.0	6.5	6.7	6.9	6.3
Revised 1980	3.5	5.8	5.8	5.9	6.0	5.4
Revised 1982	4.2	3.0	3.0	4.8	4.8	4.3

Source: Sessional Paper No.4 of 1982

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The lag between the economic growth and population growth therefore implies that the economy is increasingly facing problems accruing to a fast growing population.

**3.5 Environmental Policy in Kenya**

Kenya cannot be said to have ignored the environment completely. Though there is no environmental policy per se, it is contained in sub-policies guarding the use of other resources such as water, health etc. We have various Acts and directives aimed at arriving towards the conservation of the environment. However, the enforcement of these Acts and directives have remained elusive. A proper evaluation is needed to determine their objectiveness in management and conservation of the environment.

The environment and its conservation started featuring

after the Stockholm Conference on the "Human Environment" in 1972. Its first reflection is in the 1974-78 National development plan in which a programme for the conservation of the natural environment was proposed. The programme included a land catchment anti-water pollution, grazing control and forestation and reclamation research. Though much was not implemented during the plan period, this development plan has acted as a basis for a long-term conservation programme of the country's natural environment.

In the 1979-83 development plan, environmental management was made an objective policy. Thus the plan states that;-

"Environmental consideration must be entertained at the planning stage in order to ensure that the pattern and style of development is consistent with a healthy natural environment."

The plan proposes the establishment of a "National Centre on Environmental Research" to promote environmental education.

Yet this environmental conservation has a cost. But while the cost of environmental degradation and pollution can be high (amounting to 1.5% of GNP), they tend to be far less than those resulting from pollution control and



environmental protection. Moreover, some of those costs can be greatly reduced by appropriate government intervention through sound environmental policies and the incorporation of adequate measures in development projects at an early stage in planning.

The major problem facing Kenya today is that of alleviating poverty. The main environmental problem in Kenya is as a result of poverty. The task of alleviating poverty which is a major source of pollution is more difficult task than preventing environmental deterioration. There are those environmental problems arising out of the process of development aimed at solving inadequacy of development.

Environmental protection in this country has so far remained majorly rhetoric. Most government policy documents have expressed the desire and need to protect and preserve the environment. However, most of this policy(ies) have remained as paper policies, which have not been translated into concrete action. The penalties levied to those who defy them are too low for entrepreneurs to be concerned or worried about.

Kenya is grappling with problems of economic, social and political development. These problems tend to overshadow the environmental protection problem. While developed countries are grappling with the problem of industrial pollution, most developing countries to a larger extent are faced with the problem of land degradation and forest depletion. Previous emphasis was not curbing industrial pollution, given that most of our economies are not industrialized. Environmental protection was left to the industrialized nations. It is today however, that environmental problems have been globalized and the world has called for a common front in tackling them. One nation's effort may not help much if the other nations are not conscious on the need to protect the environment. But, individual nations efforts are compulsory if these nations are to sustain their development in future.

Today, developing nations have also realised that they have much to gain if they protect their environment like their developed counterparts though the two groups of nations must view their environmental problems from different perspectives.

Environmental problems emanating from urban development such as poor sanitation, air pollution, inadequate water

supplies and other social amenities are problems brought and worsened by poverty. The community in a bid to alleviate poverty damages the natural environment (land and forests etc.). The government efforts should be that of creating employment and increase social amenities and more political freedom. The late Indian Prime Minister Indira Gandhi laments this in the 1972 Stockholm Conference on Environment:

"We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of a large number of our people. Are not poverty and need the greatest pollution? For instance, unless we are in a position to provide employment and purchasing power for the daily necessities of the people and those who live in or around our jungles, we cannot prevent them from combing forest for food and livelihood, from poaching and despoiling the vegetation when they themselves feel deprived; how can we urge the preservation of animals? How can we speak to those who live in villages and in slums about keeping the oceans, rivers and air clean when their own lives are contaminated at the source?".

For a long time after the establishment of the colonial rule there was lack of consistent policy on many environmental problems facing various sectors of our economy. The momentum for environmental protection in the country was triggered off by the "National Report on Human Settlements", in the early 1970s. The document was initially prepared for the Stockholm Conference on Environment, 1972. Since then, the government has been

determined to come up with a clear policy guidelines on environmental protection. The first step was to establish a National Environmental Secretariat within the office of the President as the main body charged with the environmental protection.

NESs first report showed the need to have an integrated approach both to the planning and to the mechanical pursuit of development programmes. Only then can there be efficient resource allocation, alongside financial, human and institutional components to achieve maximum benefits and minimal costs in environmental deterioration.

In 1974-78 development plan the government concludes that

"the government recognizes that the conservation of the environment is becoming increasingly important as the growth of population and the impact of development and technology bear on the capacity of the environment to sustain the use being made of it. The government will therefore increase its conservation measures and wherever possible restore damaged environments".

Land use planning and development control were seen as a tool for achieving an integrated approach to land and resources utilization which entails the principle of sustained yields. This calls for the emphasis to develop a national philosophy of resource management. Such a

development philosophy should discourage development geared towards profit maximization irrespective of the damage caused to the environment.

NES emphasises on "environmental impact reports" for any development or industrial projects initiated in urban areas. The reports should show an analysis of what is being done, or what will be done to curb any environmental degradation.

Through the government, the public and non-governmental organizations are aware of various measures arrived at controlling environmental degradation and resource use, the policies have been ineffective in the light of the environmental problem currently experienced in our urban areas and rural areas.

Several factors behind the failure of environmental policy can be highlighted:

(i) Lack of clear policy guiding development. This has led to poor implementation and/or enforcement of stated policies resulting from lack of adequate data as well as lack of commitment and political will from the government officers.

(ii) Contradictory policies guiding development. For

example, it is a well documented fact that Kenya already has severe fuel wood deficits and only 2.7% of the nation is still under natural forest. Yet in February, 1985, Paul Ngei, the then Kenya's Minister for the environment and natural resources, announced that 17,000 hectares of Kenya's natural forests in 10 district would be cut to make way for the Nyayo Tree Zone plantation. The scheme called for deforesting some of the slopes of Mount Kenya, raising fears among foresters of severe erosion and reduced ground water in the highland. In such a case it is what the politicians of the day think is right and not what the technical staff advices.

(iii) Decision on investment is still determined by demand and supply, that is, market situation. The entrepreneurs have very little regard for the environmental costs that access to the larger society. They are interested in the economic profit alone.

(iv) The economic status of our population. A large section of our community is poor. To alleviate this poverty more attentions have been directed towards investments with very little regard to the long term costs of such developments to the society and the environment.

In view of the above discussion, it is important for the

government, non-governmental organizations and other development agencies and people of all walks to re-examine the current policies aimed at environmental protection with a view to actually addressing the real causes of environmental degradation and how they can be curbed. There is need to establish an in built mechanism to protect the environment while at the same time enabling sustainability of development.

### 3.6 Towards Sustainable Development Policy

In the past three development decades, there are lessons which are clear. Traditional models equating industrialization and per capita- average currency - denominated GNP and GNP growth have proved failures in developing countries. World Bank in its World Development Report 1991, acknowledged the inadequacy of such income based growth indicators, noting that they do not reflect success in meeting basic needs such as food, education, health care, equality of opportunity, civil liberties or environmental protection.

Most development processes in developing countries stagnated in 1980s; and went into reverse in most Sub-Saharan Africa countries. In its 1991 report, World Bank redefines economic development as a sustainable increase

in living standards, encompassing material consumption, education, health and environmental protection. This definition is new but development models are still the old ones.

The concept of sustainable development is not new. This is because traditional economic practices and political organization always incorporated environmental considerations. However, the rate of development and the importation of foreign technologies and socio-economic models that are directed towards capital accumulation and conspicuous mass consumption has led to a situation where environment was given little consideration.

Environmental protection should not hinder economic development. In fact environmental protection implies cases which can only be financed through economic prosperity. Environmental protection and economic development should not therefore be viewed to be in conflict. If anything they are supportive of each other.

The world has however awakened to the realization that the environment on whose the world depend is threatened and deteriorating so fast as to destabilise economic development.



Exploitation of natural resources is presently practised in strongly integrated capitalists market. This capitalist systems do not put into consideration the sustainability of the very resources they rely on.

However, all countries should realise that a clear understanding of in built-mechanism regarding natural resource utilisation and waste absorption by the same environment can greatly reduce environmental damage or control them. This would assure the society a high standard of living and sustainable environmental systems. One fact that stands out clearly is:- neither environmental protection or economic growth and development is sustainable without both being given attention as supportive systems.

The present World technologies can be used to ensure sustainable development. The World Commission on environment and development (WCED 1989) has stated that;-

"today we can move information and goods around the world faster than ever before; we can produce food and other materials more efficiently; our scientific and technological skill allow us to understand better the natural system on which the life of our plant depends---thus, we can build a future that is more prosperous and secure, a future of economic and social development based on policies that sustain and expand our environment and resource base; and in so doing we can relieve the great poverty that now afflicts much of the

developing world".

The world has the capacities to ensure effective development which can ensure total development ranging from economic, social, political and ecological. The aim is to provide human progress, not just for a few people or nations but for the entire human race now and in the future.

It has been observed that many development planners and policy makers have constantly adopted and used plans that erode the environment and undermine the health of the disadvantaged groups of people through failures to take account of the following facts:-

(i) For sustainable development to take place, ecological and economic concerns are interdependent. Therefore economics and environment must be integrated from the start in decision-making not just to protect the environment but promote long-term economic development.

(ii) That the environment cannot be protected when development plans consistently fail to consider the costs of environmental destruction and who should meet them.

(iii) That poverty will only be eradicated if and only if there is a structural change in the present consumption

and economic production aimed at profit maximization for a few people in just a few countries.

(iv) That environmental impacts do not respect political boundaries and hence harmful impacts must be dealt with in a political context through well-enforced laws and strict liability legislation.

(v) That a country cannot exploit more than it has in its natural resource base stock. The exploitation of these natural resource if not well managed may lead to social and political strains- this would have an impact on the very fragile ecosystems.

(vi) Lastly, that sustainable development cannot subsist on a deteriorating environmental resource base.

Incorporating the above aspects in urban development planning and policy formulation means that all economic production processes should be integrated with resource conservation, environmental enhancements and equitable development leading to sustainable development in the foreseeable future.

In conclusion, sustainable development includes the

following main components and encompasses the totality of life:

- (1) It has an economic dimension, dealing with creation of wealth.
- (2) Political dimension
- (3) Social dimension
- (4) Cultural dimension
- (5) Ecological dimension.
- (6) The concepts of needs, in particular the essential needs of the whole human race.
- (7) The idea of limitation that are imposed by technology and the society on the ability of the environment to meet those needs.
- (8) Acceptance of consumption patterns and technologies that are within the bounds of ecological possibility and to which all people can rationally aspire and achieve.

#### 4.0 SUSTAINABILITY INDICATORS

In this chapter an overview of what constitute sustainable indicator is presented. The discussion revolves around what is sustainable and how it is can be sustained. Here the state of environment, trends in population, forestry activity and agriculture are looked at. A short introduction of the past experience in development indicators is presented.

Most literature available on sustainability indicators deals with criteria for sustainable development indicators or general characteristics of sustainability indicators. The merits of the indicators developed will hinge on two main criteria:-

- (i) do they relate to human behaviour/consumption
  - (ii) do they relate to the public policy in respective fields of government.
- If these criteria are met, then the indicators will be useful in helping us move towards a more sustainable society.

In this case sustainable development indicators is quantitative and/or qualitative data that describe a given environmental condition that is relevant to policy makers and that is used to asses progress towards the goals of sustainable development. The assessment is done

goals of sustainable development. The assessment is done through integration and evaluation of information on one or more elements of the environment using data handling techniques to produce a description of states and trends, possible cause and effects, corrections, future projection for forecasting and early warning, policy and management.

In this study sustainable urban development is taken to be a function of sustainable resource use. In recent years it has been growing to an understanding that sustainable urban development is dependent upon sustainable use of environmental resources on the one hand and upon minimization of vulnerability of human settlements to natural hazards and man-made on the other. But while this awareness has improved, the environmental conditions of settlements is yet to be realised (UNCHS/UNEP, 1987).

Deterioration is evident not only in large cities, but also in smaller urban centres and even in rural settlements. Unplanned development is damaging the resource base upon which human settlements depend (Ministry of Local Government & Physical Planning, 1988a, Ministry of Local Government & Physical Planning 1988b).

The damage comes through excessive use of natural resources, and the polluting effects of various wastes generated and borne by air and water. This totally jeopardizes the sustainability of these settlements and thus the overall development.

In urban areas, it is the population needs that the society strives to satisfy today and in future. In the case of Elburgon town the population is dependent on two resources: forest and agriculture. In this case:-

#### **4.0.1 Agriculture Sustainability**

Agriculture is indispensable in both urban and rural development. It is an important component in urban development and sustainability. In developing countries like Kenya, it has been referred to as the "back bone of our economy". Agriculture provides the second most important basic need, that is food, next to water. The sustainability of agricultural practices is influenced by both endogenous and exogenous factors in the economy. The major threat in agriculture sustainability is unchecked population growth depending on limited resources holding a certain level of technology constant. Urban population depends entirely on agricultural sector in the rural areas to produce food for their survival and

provision of raw material for industrial activities.

Population growth and economic development depends on the food that may be produced in agricultural land. Agricultural practices and land use as a function of technologies and population are the most important economic activities causing important pressure on natural resources and the environment. In Elburgon the population has grown rapidly while the available land for agriculture has relatively remained the same. Table 4.1 below shows this Population growth.

Table 4.1 Population growth between 1969-1993.

Year	Population
1969	2,000
1979	9,163
1989	25,150
2000	36,410*
2010	52,315*

Source: CBS

\* Population projection

In the last 24 years Elburgon's population have grown in about 12 times. While this population growth has been witnessed, the land sizes has continuously been



subdivided. Currently, the majority of the population (63%) in the rural areas own an average of 1.6 acres. Such kind of land sizes are not much but for small farmers especially in high potential area like Elburgon are adequate. Table 4.2 below shows various households with their farm sizes:-

Table 4.2 Household Farm sizes

Village	No. of Households per Village	Area (AC)	Total Area Under Agric.
Kamirithu	300	2.5	750
Kiruara	10	24.0	240
Ndimu	600	1.6	960
Rumwe	10	12.0	120
Turi Farmers	30	8.0	240
Total Households	950	Total acreage	2310

Source: Field Survey, 1993.

Only 2310 acres are assumably under agriculture. The acreage is further reduced by land used for human settlements. At least a quarter of this land is under human settlements, that is 577.5 acres. This reduces agricultural land to 1732.5 acres. This implies that even if this land was divided equally among the households the average acreage is 2.4 acres. That is not much but for a small farmer in better areas, it is adequate. Elburgon location with only 1.18 ha per

household (2.95 acres) and .26 ha per person is a good example of such an area (Ministry of Agriculture, Farm Management Hand Book Vol. 2).

Each ecological region has the maximum it can produce with or without inputs application holding a certain level of technology constant. To raise the level of production in each agro-ecological zone different levels of fertilizer can be applied. Table 2.1 in Chapter two shows crop production for two important crops in the study area without fertilizer application per selected zones. While Table 2.2 in Chapter two shows crop production at different levels of fertilizer application for the three agro-ecological zones with the same crop.

Without fertilizer application the region has a natural potential of producing 2,400 kilograms or an equivalent of 26.67 (90kg) bags of maize per hectare in all the agro-ecological zones considered. While the same area can produce 7,000 Kilograms or 140 (50kg) bags of potatoes in UH2 and 6,000 kilograms or 120 (50kg) bags in LH2, as shown in Table 4.3 above.

As shown in Chapter Two Table 2.2 production of maize can be raised to 29 bags/hectare using 6 kilograms of

Nitrogen and 6 kilograms of phosphates, 44 bags/hectare using 48 kilograms of Nitrogen and 35 kilograms of phosphates, and 61 (90 Kg) bags per hectare using 95 kilograms of Nitrogen and 85 kilograms of phosphates for UH2. Similar increment are observed in the other agro-ecological zones (LH2, LH3). Also potatoes increase in similar manner with increased input application at different levels.

The soils are rich loamy soil. However, one of the major problem in agriculture is land degradation in form of soil erosion. The ultimate determinant of agricultural sustainability is the maintenance of soil quality in this region. While it is an obvious fact that soil erosion is taking place, annual degradation statistic are difficult to come by.

Degradation of agricultural land requires that increasing amounts of inputs (fertiliser and pesticide) be used to maintain the same level of production. Given an increase in population high potential agricultural land base in shrinking. There is going to be increased pressure to increase yields from land that is continuously degrading in quality. This patterns are clearly not sustainable. According to agriculture officer at Elburgon, land

carrying capacity in this region is 37-45 (90 Kg) bags of maize per hectare or 15 (90 Kg) bags of maize per acre. This region can produce up to 50,000 bags of cereals. Due to this recognition the town has a Kenya Cereal and Produce Board store with a capacity of 50,000 bags. This store also acts as a transit storage for cereals from the neighbouring regions when the produce of Elburgon is low or waiting to be harvested.

From the data collected, 52.5% of the respondents in the rural areas indicated that production levels were increasing. This increase in production levels at individual farms was attributed to the use of fertilizers and adoption of modern techniques. This fact was also attested by the agricultural officer in the region. However, 47.5% of the respondents said production level were falling. The factors behind this decline are soil exhaustion 52.6%, change in climate 10% and lack of capital 10.5%. Other unknown variables contribute to the rest of the decline. The cost of input amounts up to Kshs 2,500 on average. The current question on sustainability is the ever increasing farm inputs prices, that is affordability.

stuffs. The surplus is sold at Elburgon market which acts as a collection centre. Basically most of the food stuff remains in Elburgon town. Some produce finds its market in far places such as Kisumu and Nairobi to mention but a few. This is majorly potatoes and vegetables.

However, the area under maize in the district is declining. See the table 4.3. This decline can partly be attributed to the diversification of farm enterprises, where farmers in large scale farms tends to adopt dairying. High operation expenses required for effective maize production tend to reduce gross margin of maize as shown in Table 2.4 in Chapter Two. There is also a decline in output per hectare. This is attributed to high cost of operation, so that farmer do not use the correct amounts of inputs and decline in soil fertility.

Table 4.3 Maize production for last five years 1988-1992. Nakuru District

Year	Achieved (Ha)	Achieved Yields (Ha)	Total Production	Value K£Million
1988	66,618	40	2,687,180	27,680
1989	61,268	29	1,771,693	1,955
1990	60,475	25	1,511,875	18.75
1991	51,240	28	1,537,200	23.05
1992	49,862	26	1,296,412	38.89

Source: Ministry of Agriculture, Nakuru District 1992 Annual Report.

A major cash crop grown in this region is pyrethrum. This crop is grown in small pockets of land. The crop is collected and weighed at Elburgon town then its transported to Molo. This is a relatively lucrative activity in this region though the area dedicated to it is small because of food crop competition. The gross margins per hectare are high as shown below in Table 2.7, in Chapter two. Its important to note that labour is offered by the family thus payment supposed to be paid to labour accrues to the family indirectly.

Wheat is also grown in this region but only concentrated to those people with big pieces of land. Wheat production in the district has similar trends for the same period (1988-1992) like that of maize. See table

4.4. Area sown declined by 25%, whereas yields rose by 12%. Unavailability of farm machinery especially seed drills and combine harvesters, affect wheat expansion on small and medium holders, who do not own machinery. This is true for Naivasha, Rongai, Mbogoini, Gilgil, Molo and Njoro Division. In this regions the former white highlands were subdivided. The increase in yields is attributed to new release of high yielding varieties of wheat from National Plant breed centre, Njoro.

#### 4.4 Wheat Production for the past 5 years 1988-1992. Nakuru District.

Year	Achieved Ha	Achieved Yields B/Ha	Total Production	Value K£ Million
1988	28991	32.5	943337	19.8
1989	29104	24	698496	15.7
1990	31256	24	750144	17.8
1991	20236	25	505900	21.35
1992	22932	28	642096	27.1

Source: Ministry of Agriculture, 1992 Nakuru District annual report.

Then finally, sustainability of agriculture is a function of productive farmland changed to alternative use. A major threat of agricultural sustainability is the conversion of agricultural land to urban land use. Land located adjacent to urban areas is quickly being changed from agricultural land into urban land use. In Elburgon

the process is slow but positive. The situation is grave especially given that most urban areas are located in high potential areas. An increase in population in both rural and urban areas is responsible for this conversion. This increase in population exerts pressure in the rural area first. This population runs into urban areas to seek employment. Urban areas and the people at the foot-print of the town has to offer these population with shelter and other services. Due to this pressure potential agricultural land at the periphery is converted into urban land use (residential areas). Agricultural land in Elburgon is being converted into urban land use around Turi farmers as one moves out of Elburgon town towards Njoro. Unchecked urban development will reduce the amount of land dedicated to agriculture. Uncontrolled urban development will render agricultural production unsustainable. Unfortunately, this land conversion is taking place without a land use monitoring program in place at the national or local level to guide this activity. The maintenance of soil quality on land that has not been converted into urban development is the ultimate determinant of agriculture sustainability. In Elburgon subdivision of land to a minimum economic production level should be a guiding factor towards sustainability. Unless levels of technologies are



improved and new invention are invented our population growth rate will need to be reduced. Population growth control can be through family planning method. What is important is to educate the community on the need to march the population with available resources presently bearing in mind the needs of future generations.

Urban development, however small and so long as there will be increase in population in both rural and urban areas there will be further strains on agricultural land use. While in Elburgon town migration in search of jobs is a major population increase factor, we can not ignore the fact that up to 60% of the population increase in urban areas nowadays is as a result of natural population growth in towns (Habitat 1989 p.2). It is an obvious fact that urban areas will and can accommodate all the extra population in rural and urban areas. This implies that resource management is necessary to achieve sustainable urban development. The extension of agricultural land to marginal lands has become a reality. In Elburgon some of the population have settled in relatively marginal land in Mukinyai area towards Rongai. While as these marginal lands are large in quantity, they require more energy and inputs to get the same production levels as those in high potential area. These lands

although abundant do not have same climate regime as the prime agricultural land in the high potential areas.

Urban development is dependent on rural areas for the production of food and raw materials. If rural areas are not sustainability utilized then they will not sustain the needs of rural population leave alone the urban population's needs. There are many factors that interplay to enable agricultural sustainability. The immediate danger to urban development sustainability through agricultural sustenance is population increase holding the level of (technology) production constant. We should not however loose sight of the fact that Elburgon urban development is not a closed economy. The Town does receive goods and services from other parts of the country. It also supplies goods and services to people outside the town and its immediate hinterland. Assuming that this exchange of goods and services will remain in equilibrium then sustainability of Elburgon development is put into question. This is especially so if it is to be sustained by this small acreage of agricultural land. It may be possible that today the population is meeting its demand/needs but given that sustainability has a future component, sustainability of the town is even questioned more in the future. However,

sustainability of agriculture will need a more critical analysis. People must not eat what they grow. The basic principle is that of raising rural and urban incomes so that access food stuffs thus ensuring food security to all. The present production trends shows a decline while the population is on the increase. Thus unless the present agricultural production trends are reversed and population controlled then the Town's development sustainability is questioned.

#### 4.2 Forest Sustainability

Forests plays a very critical role in the development of Elburgon town due to their ecological functions as well as the resources they provide. The possibility of following the evolution of the gains and losses of forests at local, district and life-zone level will provide useful indications for the design of management policies for these resources. To use forest resource at sustainable level will be a guarantee for the conservation of goods and services they provide. Therefore appropriate indicators should show which is the supply and demand as well as the stock of the resource. The fauna and flora posses an economic, ecological and social importance that goes beyond their utilization as a resource.

The biological diversity has become a great concern at local, regional and international levels. Indicators should be those that will show state of the biological diversity and the policies adopted for its protection at country or life-zone level (the region it can survive).

In Elburgon, the forest resource is diversified. A part from the indigenous trees of different types growing along the rivers valleys and in catchment areas, we have pine and cypress for industrial use. Eucalyptus is planted to provide fuel wood for Sokoro Fibre Board. The most important indigenous plants along the river are Bamboos, 'Mikeu', 'Mitati' and other assorted types. Forest department at Elburgon have had its efforts directed to production of plantation for industrial use. But they have not been very successive. A guiding factor to sustainability of forest is a sustained yield. In Elburgon the number of industries have grown from one in 1902 to 17 by 1993. The demand of raw materials is higher than the supply. In both the study area and the district the volume of exploitable timber is falling as shown in table 4.6 and 4.7. For the last three years the supply was below the demand. Table 4.5 show the demand and between 1990-1992.

Table 4.5 Total Removal in Cubic Metres

## DEMAND VERSUS SUPPLY 1990-1992

Year	Demand (M Cu.)	Supply (M Cu.)
1990	87210	63149.991
1991	87210	52935.335
1992	87210	49975.755

Source: Field survey, 1993.

The supply in volume is falling. This is attributed to lack of raw material. The income that were realized in 1993 fell by Kshs 6 million from Kshs 18 million in 1992 to Kshs 12 million in 1993. The provincial conservatoire linked this to lack of forest materials (Nation Newspaper, January 14, 1994). In the district the volume of exploitable timber is decreasing as shown in Table 4.6 (Trend of Timber and firewood production 1989-1991). The firewood exploitation is increasing. This shows that the local community are not self-sufficient in terms of firewood.

Table 4.6 Trend of Timber and Firewood Production (M<sup>3</sup>)

Year	Timber(M Cu.)	Fuelwood M Cu.
1989	148,260.74	153.0
1990	145,192.00	1,356.0
1991	134,042.03	5,603.0

Source: District Forest Office, Nakuru National Development Plan 1994-96, p46.

This lack of raw materials is seen and reflected in allocation of young plantations to saw millers. Just adjacent to Elburgon town a plantation of 17 years have been clear felled, while the minimum age should be 25 years. See plate 4.1.

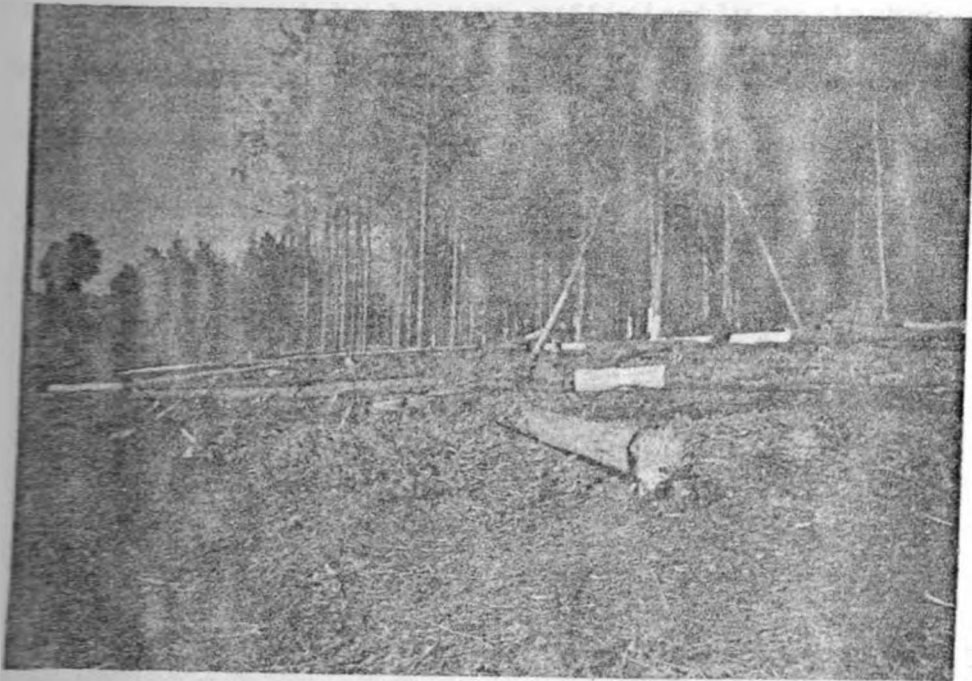


Plate 4.1 17 year old trees clear felled before maturity (25-30 Years).

This is a clear indicator that there is a danger of lack raw materials. The sustainability of forest activity is dependent on the successful regeneration of our forests. A certain percentage of harvested are normally assumed to regenerate naturally but many hectares requires human efforts to establish a viable second growth. In Elburgon most of the plantations established are monoculture and

virtually require human regeneration efforts to re-establish the plantation.

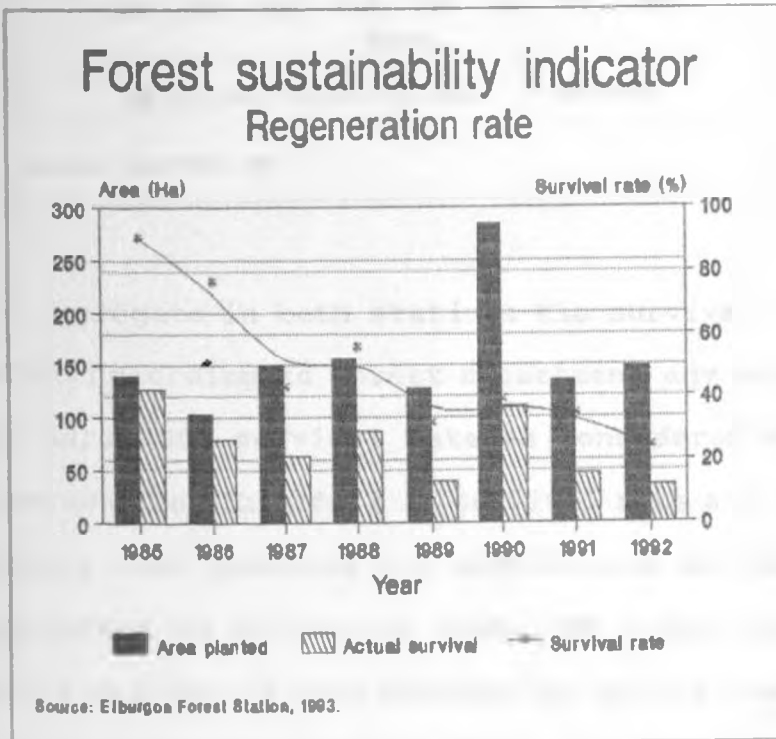
One of the major concern in the forestry sector over the years has been the gradual build up over time of forest land considered to be not sufficiently restocked- land harvested but not successfully regenerated to levels that would sustain new forest growth equivalent to that cut (See plate 4.2).



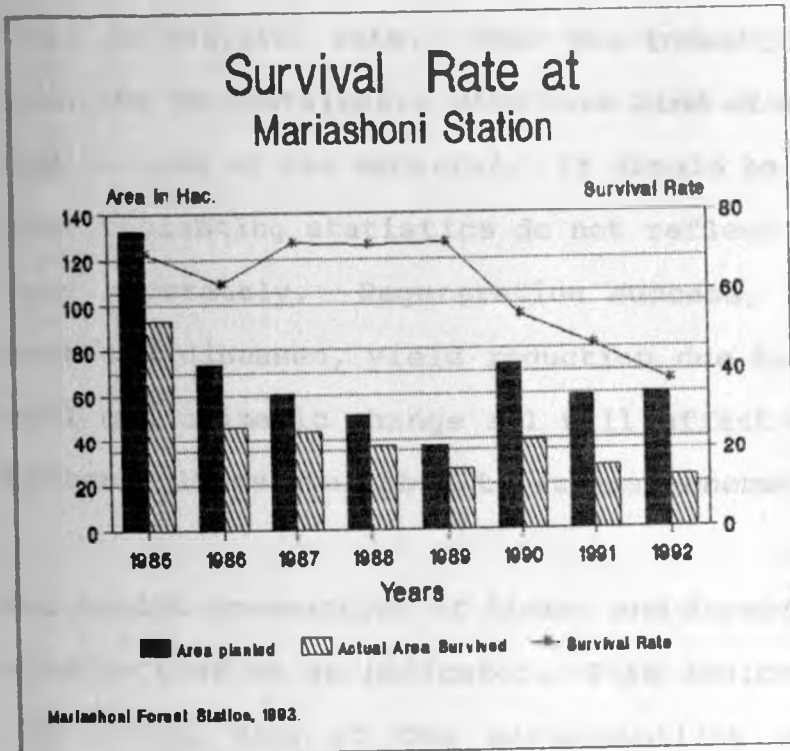
**Plate 4.2** Plantation not successfully replenished. At the background trees are also drying because of being eaten by rodents.

The indicator presented for forestry sustainability is regeneration success versus total forest area harvest. In Elburgon the survival rate of established plantations has been falling. In 1985 to 1987 the survival rate was

over 90.25%. We can reasonably assume that this is a good success of regeneration. However, since 1987 the survival rate has fallen to 23.9%. In some instances there has been complete failure. The table below show the survival rate of selected stations, that is, Elburgon and Mariashoni. These two stations falls within the study area hinterland.







On aggregate in both stations the survival rate is below 65%. According to Forest department any plantation that is below 65% survival rate is considered obsolete. To test whether this fall in survival rate and therefore the actual area survived was significant the data above was subjected to Chi-square test. At a confidence level of 95% a chi-square test between the actual area planted and the actual area survived shows  $X^2$  calculated (426.092) is greater than the  $X^2$  critical, that from the table (14.067) at 7 degrees of freedom. For the calculations see appendix 1. This implies that there is significant

fall in survival rate. Thus the industrial activities will not be sustainable with this kind of survival rates due to lack of raw material. It should be further noted that replanting statistics do not reflect future supply very accurately. Regeneration success, loss to fire, pest and diseases, yield reduction due to poor quality soil and climatic change all will affect second growth timber volumes available to future generations.

Per capita consumption of timber and forest products can also be used as an indicator. This indicator addresses the demand side of the sustainability of the forest sector. Reduced consumption levels can reasonably be assumed to translate into less pressure on the resource base. This allow more time for regeneration and preservation of more critical habitat areas. Given the expected increase in population of Elburgon and Kenya in general in the coming decades a continued increase consumption of timber products will add continued pressure to Kenya's forestry resource base. Already there is a looming wood fuel crisis (FAO, 1980).

In Kenya, people in rural areas rely on firewood as a source of energy. While those in the urban areas still rely on charcoal as a form of energy. Elburgon is not an

exception. It being located in a forest endowed area, charcoal and wood fuel are the major source of energy. In Elburgon rural, 100% of the respondents uses fire wood for cooking and warming themselves. Farmers collect fire wood from far distances. This distance ranges from 2 kilometre to 8 kilometre. The availability of firewood is a function of what is taking place in the forest. If there is thinning, pruning and/or clear-felling the rural residents and in fact a section of the town residents have to travel to where this activity is taking place. Sometimes firewood can be collected in far distance as far as 10 kilometres away. This is made possible by use of donkeys as a mode of transport. The other alternative is to purchase off-cuts from saw millers. The off-cuts however, burns quickly and are sold dearly. So rural residents and some town residents prefer to purchase wood from forest department at kshs 18 per month. The only problem is that if one only manages to collect firewood once per month because of other commitment then one can not realise that price differential advantage. For sustainability of urban development we need to establish how much wood and charcoal is required by the population. The consumption of fuel wood is one cubic metre per head per year or one backload which is equivalent to 25 kilograms is used for four days. The annual expenditure

on fuelwood is about Kshs 1800 per family per year (Nakuru Development plan, 1994-1996 p. 47). The pressure exerted on the forest resource is 1 M<sup>3</sup> per head per year in form of energy (firewood). This has made charcoal burning a survival business for some 600 women in Elburgon. The raw materials is the off-cuts waste from saw millers. This is a step towards sustainability. However, the charcoal that is obtained is of low quality. It burns, mould quickly and therefore its not economical. There has been shortage of off-cuts and the prices of a bag of charcoal have gone up from kshs 70 to kshs 150. Some town residents insists on charcoal burned from hardwood. The hardwood can only be obtained from the forests. But there is a ban of hardwood utilization. However, illegal burning of charcoal takes place especially deep in the forest next to the river bank. This is especially so because smoke can easily be mistaken with water vapour by forest guards mostly in morning. During the day smoke is not very visible because of heat radation and as the days brightness smoke tend to take the colour of the atmosphere. In such places no forest guard dare get into because of there own security. The option is to wait for them when they are transporting charcoal out of the forest. The charcoal burners know how to elude them.

Some of the forest guards also collaborate with charcoal burners or are even themselves burning charcoal after all they are poorly paid.

In urban and rural areas shelter is a basic need. Shelter is important because its where the population resides after their daily activity. In Elburgon town 69% of the residential houses are made of timber. These are found in Eastleigh Estate, Kasaraini, Parts of Karuri and Mathitima Estates. Using the standard housing requirements, the demand for houses in this town is high. Unless the preferences changes, demand for construction timber is going to remain high presently and in future. Table 4.7 show timber requirement per standard house, the economy type.

Table 4.7 Timber Requirement for Standard House

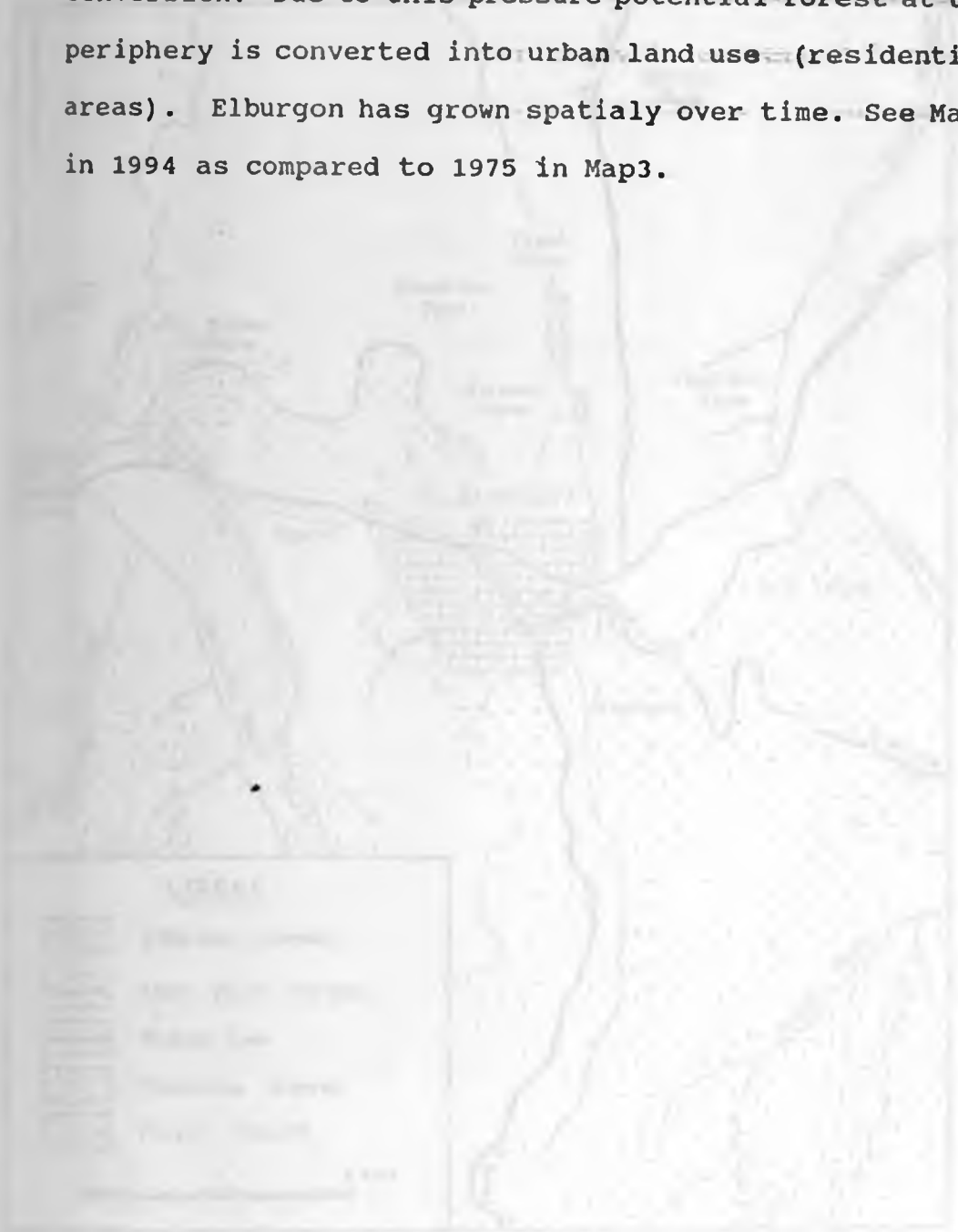
Total Timber Required(M Cu.)		
Type	Area	Volume
3 b/room	77	8.793
2 b/room	48	5.48

Source: Timsales Ltd, 1994.

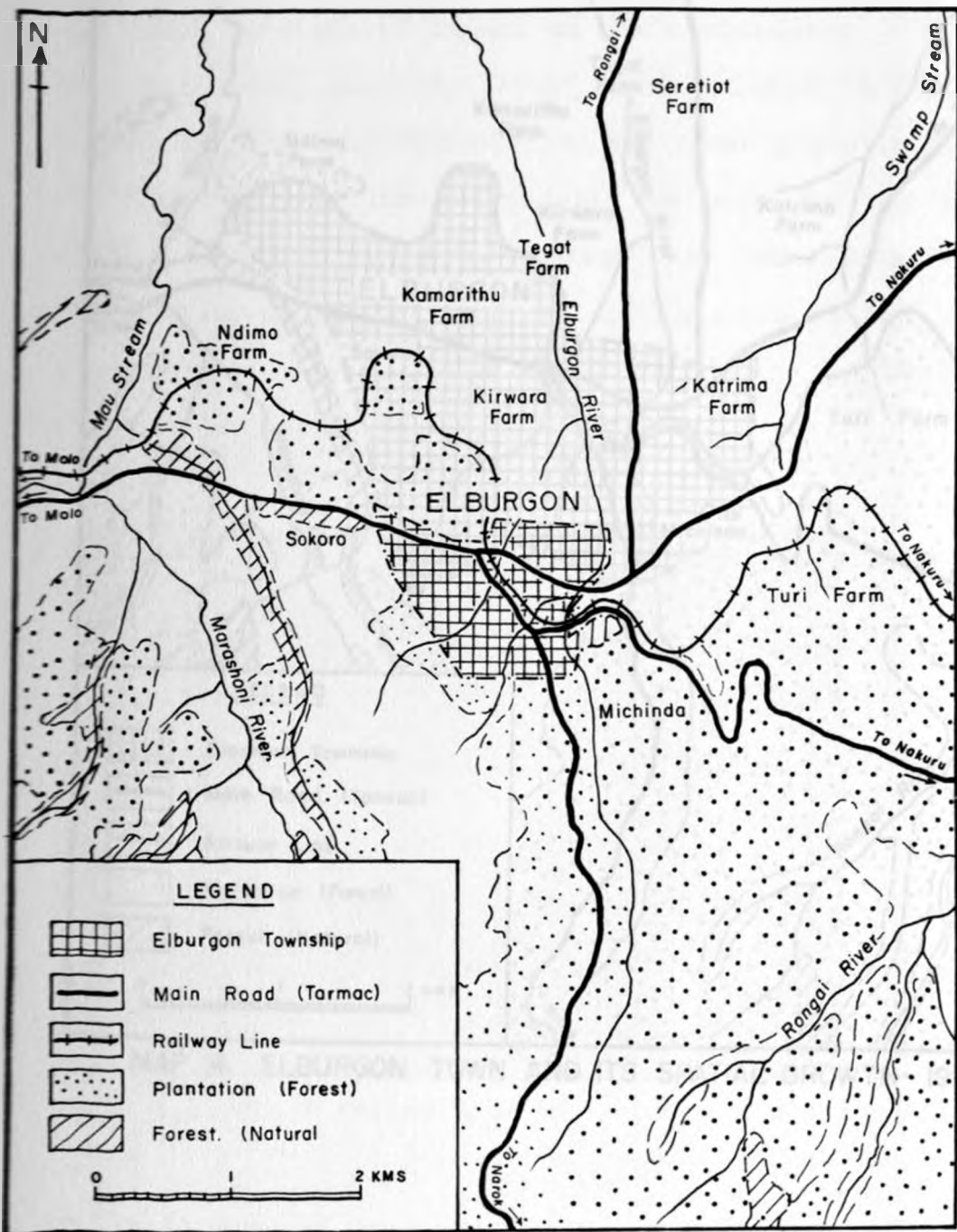
Then we should have a bio-diversity indicators. This should show the state of biological diversity. Biological diversity constitutes one of the main sources for the development given the potential use of plants and animals. In the case of Elburgon, this potential should be conserved and studied appropriately in order to be used adequately. The region has a wide variety of trees and plants. These are: "Podo", "Mutarakwa", "Mwiri", "Mukeo", "Mwanda", "Mwathathia", "Munderendu", "Mirangi", "Mutati" and other numerous types of plants. For example "mirangi" (Bamboo) are very important as a catchment tree because it covers the ground, preventing soil erosion and is used for fencing. Research into other uses of the bio-diversity in this area is needed. Also they can offer a small amount fuelwood.

Sustainability of forestry is also a function of forest land changed to alternative use. A major threat of forest sustainability is the conversion of forest land to agricultural and urban land use. Land located adjacent to urban areas is quickly being changed from forest land into urban land use. In Elburgon the area to the North-Eastern part of the town has been converted to urban land use from forest land. An increase in population in both rural and urban areas is responsible for this

conversion. Due to this pressure potential forest at the periphery is converted into urban land use (residential areas). Elburgon has grown spatially over time. See Map4 in 1994 as compared to 1975 in Map3.

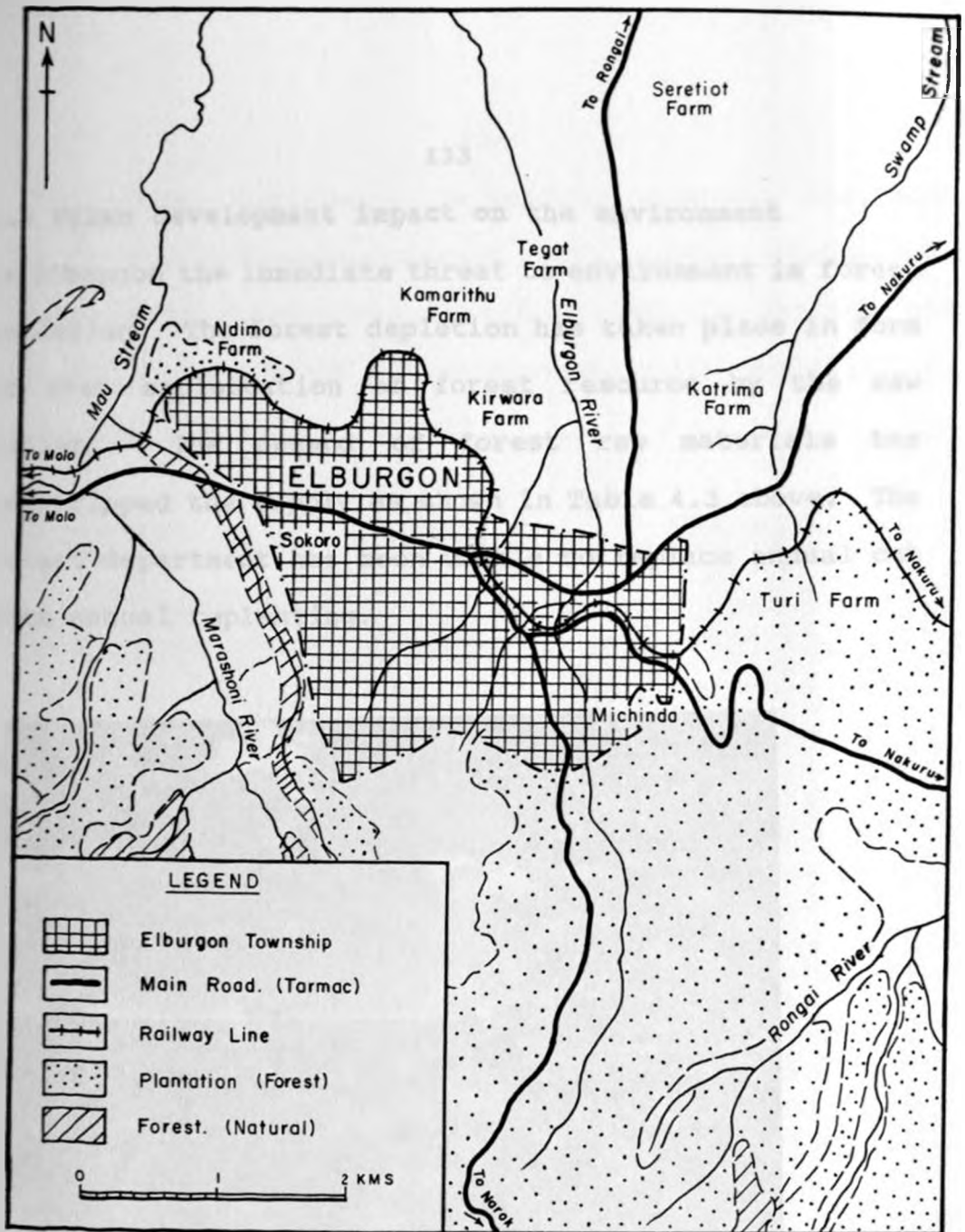


Map 4. Elburgon Town and its surrounding areas in 1994



MAP 3. ELBURGON TOWN AND ITS HINTERLAND—1975

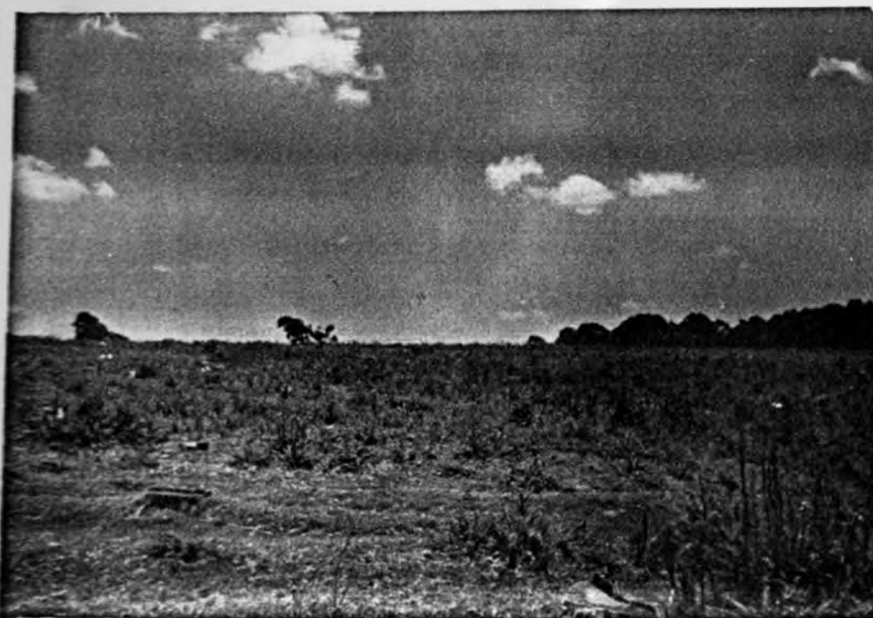




MAP 4. ELBURGON TOWN AND ITS SPATIAL GROWTH-1994

#### 4.3 Urban development impact on the environment

In Elburgon the immediate threat to environment is forest depletion. The forest depletion has taken place in form of over exploitation of forest resource by the saw miller. The demand of forest raw materials has outstripped the supply as shown in Table 4.3 above. The forest department has been unable to replace annual cut with annual replanting.



**Plate 4.3.** Clear felled area not replenished for years.

In the foreground decaying stumps are seen. This implies long duration since the area was clear felled.

Where the efforts have been attempted the survival rates are very discouraging as seen in Table 4.4 and Table 4.5.

The forest department is slowly changing the once beautiful indigenous forest with exotic plantation. Later this plantations have been left to be bush and shrubs which are not of any economic value especially to industrialists (see Plate).



Plate 4.4 Established plantations changing into bush. In the foreground the trees are choked by creepers.

From the data collected the residents of this town attest to the fact that the climate in this town is slightly changing. The argument is that some crops which do well in a relatively warmer climate such as maize is said to be doing well unlike in the past. Most residents argue that this is a result of the area being opened-up. This slight change in climate is just but a signal of what may

be coming in future if prompt remedies are not sought to the prevailing situation.

The other problem on the environment is waste disposal. Basically almost all the industries in the region are dry industry apart from Fibreboard. Fibreboard is involved in the making of soft boards. The major menace is saw dust disposal. The saw dust is disposed any where in the town and is seen in huge mountain in the town as shown in plate 4.5.

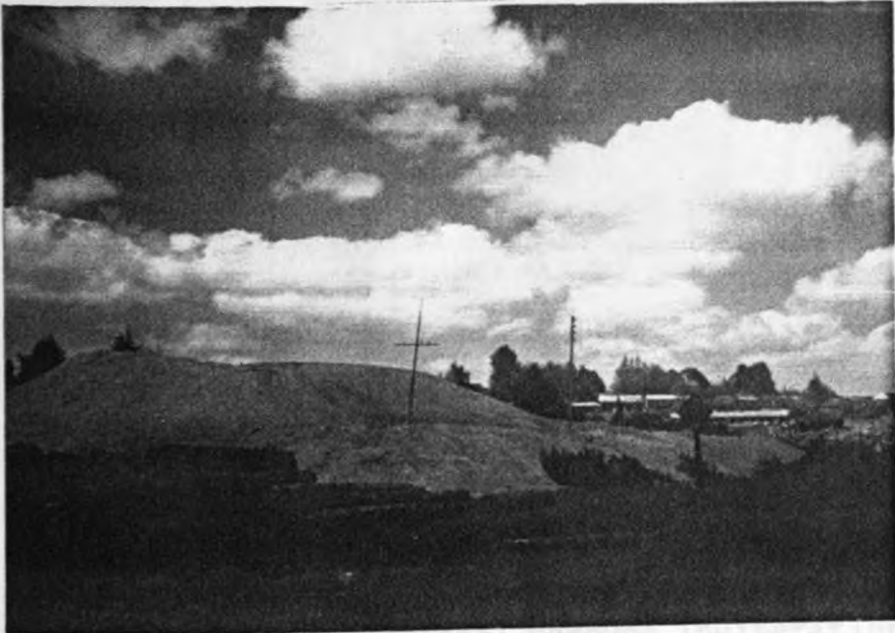


Plate 4.5 Saw dust disposed in the town centre. Note also logs has been kept in this area which a railway reseve.

The popular method of disposal is incineration. This

process produces a lot of inconvenience to Elburgon residents especially at night. Sustainability is about improving welfare of people, this inconveniences is not towards welfare improvement. This is coupled by dust which is caused by tractors and lorries ferrying logs to the saw mills. One of the major road from the forest is of earth and ia located next to the market. The other phenomenon, that cause dangerous smoke is charcoal burning in the town.



Plate 4.6 Saw dust disposal through incineration method.



Plate 4.7 Charcoal burning in residential access street.

All these has resulted in the area reporting a high incidence rate in Upper Respiratory Trunk Infection (URTI). The Public Health Officer and the area Chief has banned this activity in the town but the charcoal burners were given no other alternative place. They have retreated into their residential estates where the activity is taking place. The emission of carbon monoxide especially at night has led to a lot of suffering. The table below illustrates the increase of selected diseases:

Table 4.8 Disease Incidence of Selected Diseases

Year	Type of Disease		
	Diarrhoea	Malaria	URTI
1990	137	4640	5950
1991	237	6526	10607
1992	254	7112	11378
1993	251*	4989*	7798*

\* Month of December data not include.

Source: Elburgon Nyayo Ward, 1993.

There is low incidence of diarrhoea which is a water borne disease. Thus dirty water which causes stomach respiratory problems is not a major issue. URTI is common because of dust and smoke and changes in temperatures. Dust is caused by tractors transporting logs on dusty roads which passes in the town. The trend is on the increase in dry windy months especially the months of February and November/October.

One perplexing issue is the high incidence of malaria case in this region. The climate of this region is cool which is not conducive for mosquitos breeding. However, the Public health officer in this town attributes this to the high mobility of Elburgon residents into areas such as Kisumu. However, a closer examination revealed that

bushes and tall grass do harbour mosquitos in the town.

The other problem related to saw dust is dumping. Saw dust have been dumped in the river and this have reduced water flow down the stream. This is evident in river Muru, see plate 4.8.



Plate 4.8 Saw dust disposed into the river. This has reduced the river flow.

While the water may be portable the decomposition of saw dust produces an odour smell. This smell is very unpleasant for water consumption.

Liquid waste is generated from Fibre Board. The water is recycled and the final waste is drained in open. The



liquid is a nuisance as it produces a foul smell. This liquid end up in the river and the water is consumed down stream.

The other issue on the environment is soil degradation. This is caused by soil erosion. Soil erosion takes place in the forest when logging is taking place. This has been neglected to the extent of not being noticed. Poor logging practices are in such a way that heavy logs have to be pulled to the loading bay. This logs removes the top soil which is washed away by rain. The other place that soil erosion is taking place is in rural area due to poor agricultural practices. The terrain is steep and the area receives high rainfall. More soil erosion takes place during the transportation of logs. The roads are of earth. During dry season dust is raised by moving tractors and lorries. While during the rainy season, tractors get bogged and heavy timber jacks are use to get them out of mud. These tractors create wide gullies where water flows through.

## CHAPTER FIVE

### 5.0 FINDINGS AND POLICY RECOMMENDATION.

#### 5.1 Introduction

In this chapter the finding of the study is presented and policy recommendation are given.

The study set out to look at the relationship between resource utilization and sustainable urban development. In this study the resources that were considered were forest and agriculture. Basically forest and agriculture were given more emphasis because of their importance in this region. The effects on the environment of urban development on the environment were looked at. Effect of urban expansion on air pollution and its related diseases incidence was also looked at.

The town of Elburgon was chosen for this purpose because of its location on a divide between a rich agricultural hinterland and forest endowed region. This forest endowment has enabled saw milling activities for several decades now. Over time, the town has witnessed rapid growth both in area and population. This has been the context of the analysis of the relationship between urban growth and the implications of such growth and the environment.

Generally, it is hard to categorically point out the factors that has led to the growth of this town. We can only rank the factors identified as having contributed to the growth of the town in their order of importance. Having done that, an attempt has been made to link current development and the present state of environment.

Historically, Elburgon town grew as a railway station along the railway line between Nakuru and Kisumu.

Secondly, the town is located along C56 road from Nakuru to Kisumu. Thus the town is strategically located and linked to other parts of the country. Thirdly the establishment of Sokoro saw mills to tap the Londiani forest has had a significant effect on the growth of the town.

## 5.2 Summary of Findings

First, the region is endowed with good climate and fertile soils. Forest resources are the most important resource in this region. The forest has supported the thriving forestry based activities such as saw milling, furniture making for example tea chests, building materials etc. The rich agricultural hinterland has supported the production of maize, potatoes, vegetables, beans, pyrethrum and dairy products.

In what we have referred as Elburgon rural over 80% of the population is engaged in agriculture. The food crop grown are a major source incomes given that there is a surplus always. Surplus agricultural produce is sold at Elburgon market which acts as a collection centre. The surplus food stuffs are marketed in such places as Nairobi, Kisumu among other areas.

From both the area's Agricultural officer and 52 per cent of the respondent interviewed crop production at individual farms is said to be increasing. This is attributed to the use of fertilizer and adoption of modern technologies of crop production. There is also increased intensity in level of utilization. However, in absolute terms the food production is on a decline. This region used to get a major boost from forest farming. Forest farming was banned in 1987.

Good climate and fertile soil allows for multiple cropping. According to area's Agricultural officer This region has a crop carrying capacity of about 37 (90 kilograms) bags/ha-15 (90 Kilograms) bags per acre -47 (90 kilograms) bag/ha of maize. The area has a potential of producing 140 (50 Kilograms) bags of potatoes. However, to achieve this yields farm inputs are required

which implies increased costs of production especially now that the price of these inputs have sky-rocketed.

The farmers are quick to mention that the soil condition has been declining, that is why they have to use fertilizer. This is attributed to soil erosion and continuous farming of the same crop on the same piece of land.

Like farmers elsewhere in our economy, farmers in this region face the following problems; price fluctuations, delayed payments, unpredictable weather and transportation problems especially during rainy seasons.

The industrial sector in this town basically relies on forest as a source of raw materials. The trees mostly used are pine and cypress. Eucalyptus is used as firewood by Sokoro Fibre Board. The majority of Elburgon residents are employed in forestry activity - either in forest department (guarding, planting and pruning), saw milling and furniture making. These activities are the major a source of income for town's residents. The income earned have had a strong influence on the town's commercial sector.

The people both in the industrial, commercial, public and informal sectors are supplied with food stuffs from the agricultural sector. The area is presently self-sufficient in food. Basically the town is a cosmopolitan type of population. The residents in this town are all migrants from other parts of the country as it is the case in the whole of Nakuru District population. Some the migrants to the district settled in the former white settlers farms and others have migrated into this region in search of jobs. The inter-ethnic relationship has always remained good apart from the recent tribal clashes.

The residents of this town rely on charcoal as a form of fuel while those in the rural areas use firewood. The charcoal is supplied from within town where it is burned from offcuts made from saw mills wastes. The rural population obtain firewood directly from the forest. Where firewood is collected is dictated by the kind of activity that is taking place in the forest. The firewood is either pruned lofters, or head tops of clear fell forest. Alternatively, they fetch off-cuts from sawmills. This has proved to be expensive and rural folks prefer to collect firewood from the forest at a lesser fee of Shs.18/- per month. One trailer of a

tractor is Kshs 300, this offcuts can last for one and half months.

The focus of this study is sustainability of Elburgon urban centre. It has been shown that the town depends on forests and forests-related activities. If the industrial sector which is the heart of Elburgon is to be sustained, then the forest resource must be sustained. One sure way of ensuring that saw mills would always have sufficient supplies of wood in the future is to ensure that felled trees are replaced on a continuous basis. In this region however, the survival rate of regenerated plantation has fallen from 90.25% in 1987 to 22% in 1993. From the forest department policy guideline any plantation that is below 65% is considered obsolete. Since 1987, the survival rate has been below 65%. Sometimes there has been a complete failure of a plantation. The reasons for the low survival rate is due to overgrowth. The overgrowth has choked young seedling in plantations and provided habitats to rodents which eat up young trees. Forest creepers are yet another problem which inhibit the easy movement of forest worker thereby lowering their efficiency and output.

The recovery rate by the saw millers is about 45%

(Njoroge 1986). The head tops and lofters are left in the forest to rot and are usually burned during clearing a region for replanting. The offcuts are used for building, fencing and charcoal burning materials. They are also used as firewood.

Agriculture has improved. But population in this town is growing at about 6 per cent. The intercensal increase has been around 63 per cent. The farm sizes are small that is .26 Ha. per person and the population pressure has started to be felt. To sustain high yields, more farming inputs will be required. Though food production may increase, there is the issue of the maximum production that a farm can produce. Thus this increased population raises the question on how the population will be sustained holding all other factors constant.

The town is also slowly encroaching into agricultural land through the change from agricultural to residential areas. Experience in the Greater Cairo show how Cairo city encroached into Egyptian fertile agricultural land. Also the spatial expansion has been encroaching into the forest. Recently, the town acquired 200 acres for town expansion.



Exploitation of the resource has brought about adverse effect on the environment. The major menace in this town is smoke from burning saw-dust and charcoal burning in town. The worst is smoke from charcoal at night. The charcoal burning has been banned in the town access street where it was taking place. The chief and the Public Health Officer have banned these activity in the town because it was a nuisance but the residents have resulted into burning charcoal in their residential compound in the residential areas. This implies that the effects still remains.

Saw-dust dumping is also a problem. Heaps of mountain in the town are evident. Some saw-dust have been dumped into the river. At a certain point, it has even blocked the railway line culvert.

The town is dirty and dusty especially in the dry season. Very high cases of URTI (Upper Respiratory Tract Infection) are reported. Also high cases of malaria disease have been reported. One perplexing thing is that this region is cool but malaria and common cold are frequently reported. According to the Public Health Officer, this can be attribute to the high mobility of Elburgon residents to other parts of the country for

business.

In this town, development is taking place without the developer adhering to the council development plan. Development has taken place haphazardly with saw-mills even located in residential estates such as Kasarani and in the middle of town (for example Babu Sawmill). Though not well provided for, the study reveals that the major land uses in the town are industrial, residential, commercial and agricultural. However, very little concern has been given to other types of land uses such as recreational, public purpose such as sewage etc.

Little sawdust is used in the making of fibre boards. A charcoal brisket making using sawdust has been established but it is not operational. One of the major problem is the availability of charcoal in the local markets. This implies that if the factory is to take off they must target the outside market or make charcoal briskets which are cheap than the other type charcoal burned from trees and/or offcuts.

The availability of timber and offcuts as building materials has enabled more than 90% of the houses in this region to be constructed with timber. This also goes for

the fencing. As the population increases, the demand for houses will also increase. This means that unless preferences change, demand for timber will remain high.

It was also noted that the town has no sewerage system. In residential estates people use pit latrines. No study on the impact of this situation in the area has not been done. If we infer from studies done elsewhere, the water will be contaminated which may lead to respiratory health problem. This is more so, given that the population uses water from boreholes. Presently the population is relatively safe because these boreholes are located far from the residential areas. But with population increase virtually all land will be settled on.

Presently, the waste collected from septic tanks is drained in the outskirts of the town in the forest. This waste drains into the rivers especially during rainy season. Though the impact today is not severely felt as the population grows this may be a major problem unless this issue is addressed promptly.

Land degradation is also an issue to reckon with. Soil erosion has been a problem especially is due to poor logging methods by saw millers. Sometimes however, soil

erosion is difficult to control especially if forest stand is on very difficult terrain. These forest stands should be left unexploited as catchment areas. Transportation of logs during rainy season using heavy tractors have attributed to soil erosion. In agricultural land, soil erosion occurs on steep areas given that this region has high rainfall. Efforts have been made to curb soil erosion by planting of trees, digging of terraces etc.

### 5.3 Policy Recommendations

The centre of interest of this study was to have a sustainable urban development. However, it should be noted that anything to do with development encompasses the totality of life both human and non-human. This study concentrated on how to sustain the resource that the town depends on. This is an ecological stand. The policy guidelines that are recommended are only those directly or indirectly related to natural resource utilization.

1. The forest department should ensure that the survival rate of established plantation mainly the exotic trees is high, above 65 per cent. Evidence show that when shamba system was being practised,

the survival rate was above 90 per cent. The eviction of forest workers from forest land was political. The shamba system entailed the allocation plots to farmers (forest residents) to cultivate for four years. Trees were planted on the second year. After the third year, trees were assumed to be big enough to grow on their own. Forest workers took care of trees as they tended their crops. This also did cut maintenance cost by forest department. Thus the non-residence shamba system should be introduced. Forest farmers can reside in the urban area and be commuting to the farms in the forest. Forest management guidelines shows the number of animals that can sustainably be kept in the forest. The shamba system would go along way in creating employment and increase food supply to the town residents as well as the country as a whole.

2. The saw-miller should adopt better methods of resource utilization. Technologies exists which can be used to raise the recovery rate up to 100% by use of wood debarker such as those used in Finland. The saw millers are still clinging to old production methods. The least they have done is to

change the type of saws. So long as they make profits who cares for the other consequences.

3. Off-cuts can be used to make medium density fibre. This is a light wood which can be used for furniture making. This type of technology is presently used in South Africa and Finland. The investors should diversify into this kind production.
4. On the issue of charcoal burning in the town, the community should be organised and helped with a piece of land out side the town. On this land they can establish charcoal kilns and produce commercial charcoal. This can go along way in improving peoples income. This type of charcoal burning is practised in Britain. The chimneys remove the smoke from the ground. The kilns also reduces the smoke.
5. They also need to diversify the industrial sector from saw-milling activity. Timsales have started with the making of fertilizer from wood bark. The fertiliser is being used in planting of trees in nurseries. Farmers have also started using it.

The success of this fertilizer can be a major breakthrough of producing organic fertilizer.

6. Saw dust can be used for cooking using improved type of stove. It could be used to make charcoal briskets. With improved technologies, the saw dust could be used to make pulp and paper. This could curb the problem of dust disposal and reduce smoke in the town. This will lead to improved environment.
7. The forest department should have autonomy in the management of forest. Political interference has led to banning of forest farming. According to the Director of Forest Department the Ministry of Environment and Natural Resources regrets this action. The damage has already been done but this can be rectified. An attempt to go back to the shamba system was again politicised in the area. This has led to the stopping of forest farming when people had already prepared their allotted plots leading to a lot of waste of both labour, money and time.
8. Agricultural land should not be sub-divided beyond

economical agricultural production plots. Rural Elburgon has small agricultural plots sizes. The farmers should be encouraged to revert from production for subsistence to commercial farming. This could go along way in ensuring food security (ensuring accessibility and affordability of adequate food stuffs at all times). Increasing rural incomes should be one goal to ensuring food security and improving rural peoples welfare. The excess population in rural areas can be sheltered in urban areas. Farmers should be encouraged to practice forest farming. This could reduce the pressure on forest to supply fuelwood. Some of the available trees could also be used as fodder crops for animals.

Change of use from agricultural land to urban land use should be guided by development controllers to avoid prime agricultural land being changed into urban development. There should be land monitoring institution in place to inform policy makers on the appropriate direction to take urban development and also avoid land use conflicts.



9. Lastly their need to explore the alternatives that exists. The bio-diversity in this region could offer avenues for future development. Within these bio-diversity lies the larger life-zone of the tropical forests, which are threatened. Given the international concern over this unique resource, it should be conserved. Where necessary it should be preserved. The 'do-nothing' solution is not sustainable. Thus minimal use should be encouraged. If well managed this bio-diversity could be used to attract tourists in the region. There is a tourist hotel already in place and if need be more hotels should be established. This bio-diversity also offer an opportunity for research and development. The medicinal herbs could be abundant given this region is on a sub-equatorial zone.

#### 5.4 Further Research

Elburgon is a small urban area designated as a rural centre. The links looked at were limited to the town and its hinterland. The resources that were considered were forest and agriculture. However, a more holistic approach to sustainable urban development is needed. Other resources that should be considered such water and

also commercial sector activities. It is the understanding of the researcher that sustainable urban development need to be approached from more than just a mere resource sustenance. Sustainable urban development should take into account the importance of infrastructure, institutional, resource development, and political consideration. Further research should take all the important component of urban development as a package to sustainability. If the resources are available, can the institutional and the infrastructure handle the expected urban development in a sustainable manner?.

The conservation of indigenous forests goes beyond the Kenyan boundary into the concern of international community on tropical forest depletion. This calls for a wider study on the impact of urban development to the depletion of tropical forests. It might be interesting to find ways and means on how to sustain urban development while sustaining tropical forests.

The assumptions that Elburgon is a closed economy is not true. Thus more rigorous studies on its interactions with other parts of the economy and even abroad are necessary to consider. Other towns which do not

necessary rely on their hinterland for raw materials such as Thika and Athi River (Mavoko) similar studies would be important to show how they contrast. This would be important because while resource may not come from the urban centre immediate hinterland the urban centre may have a far distance hinterland. Any activities taking place there may also affect the sustainability of the local activities.

### Conclusion

It has been shown that Elburgon town's development is linked to the exploitation of natural resource. Basically both urban areas and their hinterland are interdependent. It is therefore important for the two support each other. Elburgons industrial activities relies on forests while town residents and rural farmers rely on agricultural sector to provide food. Having understood the interdependency of urban areas to its hinterland, sustainable urban development could be put in place by sustaining the resource base holding other factors constant. This however calls for the framework of decision-making by policy makers and NGOs which must be firmly geared to a process of built-in dynamic trade-offs between effective resources management and environmental betterment on the one-hand and sustainable

urban development on the other. However, a more a holistic approach need to be studied where institutional framework, supportive infrastructure, political and socio-economic factors are taken as important domain to determine sustainable urban development.

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# APPENDIX 1

## Calculation of $\chi^2$ Test

Year	Area planted Expe. (e)	Actual area Obs. (O)	O-E	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E
1985	140.1	126.47	-13.63	185.78	1.326
1986	103.5	79.12	-24.38	594.38	5.743
1987	152.0	64.0	-88.0	7744.0	50.947
1988	143.0	52.26	-90.74	8233.75	57.579
1989	127.0	39.8	-87.2	7603.84	59.873
1990	284.3	109.9	-174.4	30415.36	106.98
1991	134.9	46.26	-88.64	7857.05	58.244
1992	147.5	35.26	-112.24	12597.82	85.409
					$\Sigma$ 426.092

Degree of Freedom (Row -1) \* (Column-1)  
8-1 \* 2-1 = 7

Significance Level 95%

$\chi^2$  Critical at 95% confidence Level is 14.067 d.f 7

Decision rule:

If  $\chi^2$  Calculated is greater then  $\chi^2$  Critical reject  $H_0$