UNIVERSITY OF NATAL

# STUDY OF ECONOMIC ASPECTS OF THE WOODCARVING INDUSTRY IN KENYA: IMPLICATIONS FOR POLICY DEVELOPMENT TO MAKE THE INDUSTRY MORE SUSTAINABLE

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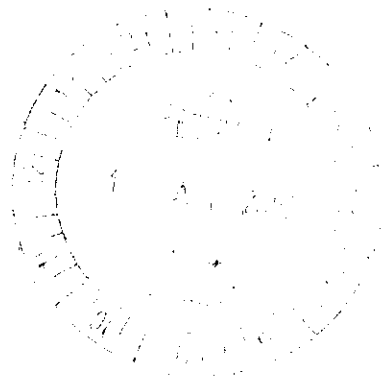

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# ABSTRACT

This thesis reports on the findings of a three year study on the economic aspects of the woodcarving industry in Kenya. Woodcarving provides one of the most important uses of wood in Kenya both in terms of economic returns (export value estimated at US$ 20 million annually) and generation of self-employment opportunities (60,000 carvers and estimated 350,000 dependants). The industry is facing an imminent collapse owing to the depletion of prime carving tree species which has supported it since 1919. The key objectives of the study were; (a) To quantify the diversity of species in trade (volumes) and their pricing trends both for the raw materials and products (carvings); (b) determination of profit margins that accrue from carving activities and prices of these species for alternative uses; (c) to look into the possibility of on-farm production of fast growing species (*Azadirachta indica*) for carving, as well as *Brachylaena huillensis* . Each of these was pursued mainly through field surveys at seven main areas where carving is carried out in Kenya.

The annual carving volume consumed in Kenya is in excess of 15,000 cubic metres concentrated on about ten tree species. However about 57% of this volume is contributed by *Brachylaena huillensis*. Diameter profiles of logs of the carving wood is dominated by 10-16 cm diameter timber which is an indication of resource scarcity where juvenile trees are increasingly being targeted. The prices of carving wood are distorted and are far below the market prices largely due to the prevalence of illegal sourcing from state forests. The study has estimated that the stumpage level for *Brachylaena huillensis* should be raised from Ksh 4 053 to Ksh 12 000 per $m^3$ if control on the current level of depletion is to be ensured. For the other species, the current stumpage levels need to be raised three fold. The weaknesses of the existing policies and legislation governing the access to carving wood have been examined and appropriate recommendations have been given.

However, as a long term measure to benefit the carvers and conservation of the last remaining East African forests, changing buyer and carving wood sourcing behaviour from unsustainable felling of slow growing hardwoods to sustainable on-farm production is discussed. The study demonstrates that *Azadirachta indica* can attain a carvable size with a dbh of 16 cm in 17 years.

The study has also established that potential profits (revenue) which can accrue from carvings made per unit wood volume (one cubic metre of wood or equivalent to about 20 logs of 1.5m long, 20cm diameter) can be as high as Ksh 270,000 within a period of four months. This is about four times the unit value of sawn timber of some of the finest hardwoods in the Kenyan market. The study therefore calls for restrictions on the utilization of these prime carving species on uses other than carving.

# PREFACE

The research described in this thesis was conducted in Kenya in Collaboration with the School of Life and Environmental Sciences, University of Natal, Durban during 1998-2000 as a Masters degree by Research. The work was supervised by Prof. W. N. Ellery and Dr. Tony Cunningham as a Co-supervisor.

This thesis represents original work by the author and has not been submitted in any form to another university . Where use has been made of the work of others, it has been duly acknowledged in the text

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# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

# CHAPTER ONE

# INTRODUCTION

## 1.1 Forest decline

The accelerating decline of many of the world's forests represents one of the greatest threats to the conservation of biodiversity. Forest loss constitutes the profound and often irreversible degradation of both the biosphere and humanities prospects for future survival (Myers, 1996). First and most obvious amongst the goods and services supplied by forests are timber and other wood products. They are worth well over US$400 000 000 000[1] per year or 1.8% of the global economy and 4.1% of the economies of developing countries (Arnold, 1991; Alexandratos, 1995; Dudley *et al.*, 1995). Already, there is a growing shortage of specialist hardwoods from the tropics due to over-harvesting of timber stocks. This has continued to impose severe economic limitations on many tropical forest nations where timber revenues have a sizeable contribution to GNP (Barbier and Burgess, 1994; Sharman, 1992).

The loss of local self-sufficiency in favoured wood species is being experienced by carvers in many places in Africa. Examples are the depletion of *Pericopsis angolensis* (muwanga) in Malawi (Marshall *et al.*, 2000), *Polycias fulva* (mwanzu) in Cameroon, *Dalbergia melanoxylon* (mpingo/ebony) in Malawi and Kenya, *Brachylaena huillensis* (muhugu) in Kenya, *Santalum album* in India and *Cordia subcordata* in Vanuatu and the Solomon Islands (Cunningham and Choge, 1999) (Table 1.1).

Kenya's economic fortunes are greatly dependent on the environment in general and natural resources in particular. Kenya's forests generate revenue, employment opportunities and provide a wide range of ecological services. The forests provide 95% of rural energy supply and generate value added products amounting to US$200 million annually, an equivalent of 1.5% of GDP (Mugabe *et al.*, 1997), and an estimated 3.3% to the GNP (MENR, 1995).

[1] Figures are given in US$ assuming an exchange rate of Kshs. 80 that was applicable at the time of writing this thesis. Whenever the international trade is described, figures will be given in US$ or occasionally in Pound Sterling (£), but local figures will otherwise be given in the local currency.

**Table 1 Major carving tree species for woodcarving trade in Africa**

| Country | Main Carving Species | Trade name | Notes |
|---|---|---|---|
| Cameroon | *Polyscias fulva* | | |
| Burundi | *Polyscias fulva* | | Not commercial trade |
| Rwanda | *Polyscias fulva* | | |
| Malawi | *Dalbergia melanoxylon*<br>*Pericopsis angolensis*<br>*Combretum imberbe*<br>*Albizia spp*<br>*Camelina sinensis* | Phingo<br>mukura,<br>Nkolong'onjo<br><br>Tea | Commercial trade |
| Kenya | *Dalbergia melanoxylon*<br>*Brachylaena huillensis*<br>*Olea europaea*<br>*Azadirachta indica*<br>*Spirostachys africana*<br>*Combretum schumanii* | mpingo/ebony<br>muhugu/muhuhu<br>Olive<br>Mwarubaini<br>Mutanga<br>Mkongolo | |
| Tanzania | *Dalbergia melanoxylon*<br>*Brachylaena huillensis* | mpingo/ebony<br>muhugu/muhuhu | |
| Zimbabwe | *Afzelia quanzensis*<br>*Pterocarpus angolensis*<br>*Kirkia acuminata* | | Commercial trade |
| South Africa | *Olea europaea*<br>*Vepris lanceolata*<br>*Pterocarpus angolensis*<br>*Berchemia dicolor*<br>*Spirostachys africana* | | Commercial trade |
| Zambia | *Pterocarpus angolensis* | | |
| Uganda | *Polycias fulva*<br>*Antiaris toxicaria*<br>*Ficus exasperata*<br>*Funtumia africana*<br>*Bosqueia phobiros* | | Commercial trade |
| Indonesia | *Swietenia mahogany*<br>*Swietenia macrophyla* | | |

Despite the significant role that forest resources play in Kenya's economic life, they are being degraded at relatively rapid rates of approximately 5 000 hectares of forest cover per year, a loss valued at US$0.8 million per year in revenue (Mugabe *et al.*, 1997). The loss of these resources is associated with the rapidly growing population and changes in the social modes

of production accompanied by limited development of knowledge and skills to manage the ecological resource base. The irreversible degradation of natural resources undermines prospects for future economic development. The rising concerns about the lack of sustainability in Kenya's woodcarving as a consequence of depletion of favoured carving timber resources means that a concerted effort will be required to provide long-term solutions. The woodcarving industry has not received the same amount of attention as the commercial timber industry, yet the woodcarving industry provides one of the most important uses of timber in Kenya, both in terms of economic returns and generation of self-employment opportunities.

## 1.2 The importance of the study

The handcraft industry is an important source of livelihood to millions of people in rural and urban areas of many developing countries. In Africa, for example, international trade in African crafts from weavers and carvers occurs on a larger scale than is widely recognized, and the volume of the trade is gradually growing. The woodcarving industry is commonplace in many countries of Africa such as Kenya, Uganda, Tanzania, Malawi, Zimbabwe, Namibia, Cameroon, Rwanda, Burundi and South Africa (McKenzie, 1997; Tooley, 1996). In South Africa for example, woodcarving was practiced in the past as a traditional activity geared towards production of utilitarian items such as spoons, bowls, walking sticks and objects of religious significance. In recent decades the industry has expanded to include production of ornaments and figurines destined for sale to the tourist market (Steenkamp, 1999). The largest value and volume of African carvings in international trade come from Kenya. Today 60,000 Kenyan wood carvers produce commercial carvings for export, providing household income for an estimated 350,000 dependants with an export value estimated at US$20 million annually (Obunga, 1995). The international trade in carvings is having a serious impact on resources and habitats of local and in some cases global significance (Obunga and Sigu, 1996). The Kenyan wood carving trade started eighty years ago (see history and structure of trade given in Chapter 3). Due to the enormous growth of the industry in Kenya over the decades, the most favoured tree species have been severely depleted from their natural habitats. As the trend of growth in the industry is projected to continue, corresponding pressure on the remaining populations of preferred species is inevitable. This has serious implications for the environment, the viability of the industry, and the livelihood of hundreds of thousands of people who depend on the industry for economic prosperity and survival.

While the wood carving industry is an important sector of the Kenyan economy, its dynamics have not been extensively documented. Indeed, management of natural resources in Kenya is constrained by the lack of up-to- date information on relevant environmental processes as well as the poor integration of existing information for policy makers. Policy makers thus lack access to reliable data on the status of natural resources, the economic value of the resources, and the economic costs of environmental degradation (Mugabe *et al.*, 1997). Thus, there is a need to develop approaches that increase the sustainability of scarce forest resource use for the wood carving industry.

### 1.3 Aim and objectives of the study

The overall aim of this study was to develop an understanding on the socio-economic aspects of the use of indigenous trees in the wood carving industry in Kenya for the development of policy guidelines that will make the industry more sustainable. Specific objectives were to:

- determine the quantities of the favoured indigenous and exotic tree species entering the wood carving market, and identity of their sources,
- document the statutory and informal rules of access to wood species from areas where they are harvested,
- compare the prices of raw materials, returns per unit labour, and profit margins in the carving process along the entire market chain,
- compare the price per unit volume of different wood carving species in alternative uses at appropriate points in the marketing chain, and
- develop an understanding of the viability of cultivating *Brachylaena huillensis* and *Azadirachta indica* as alternatives to harvesting trees from the wild

### 1.4 Component studies addressing concerns about lack of sustainability in the Kenyan woodcarving industry

The interest of this study is to promote sustainable development of Kenya's woodcarving industry in general and to contribute towards a balance between carvers' needs and conservation in particular. It forms part of a broader study funded by WWF/UNESCO/Kew 'People and Plants Initiative' in collaboration with national institutions in Kenya (KCCU, KENGO, KEFRI and NMK). These studies have jointly addressed various socio-economic

concerns about wood scarcity in the carving industry in Kenya as well as the impact of wood over-exploitation on forest habitat and species conservation. These component studies were:

- a study of the woodcarving trade and it's dynamics including the number of people involved, importance to household incomes and the tree species used in the trade
- a study of the ecological impact of the woodcarving trade on and birds and other animals which nest in hollow stems of *Brachylaena huillensis* trees.
- development of a macroscopic and microscopic anatomical key to species
- a theatre production to emphasize depletion of prime carving wood in Kenya
- production of a slide pack, tourist brochure and fact sheet aimed at raising tourist awareness of what carvings to buy and to avoid.

This thesis thus forms part of the larger study and is tailored to address these prevailing bottlenecks facing the carving industry in an attempt to provide long term solutions.

# CHAPTER TWO

# SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF A DEVELOPING COUNTRY

## 2.1 Introduction.

Many poor people, particularly in developing countries rely on natural resources for their livelihood, and these people are very vulnerable to deterioration of the resource base. Ideally, one would want to harvest resources at the rate equal to or less than the rate of resource renewal, or simply general demand exceeds supply, due largely to the spatial separation of regions of supply. The lack of connection of the end uses of resources with the resource base must contribute greatly to the widening gap between demand and supply.

In this chapter, the principle of sustainability and the notion of sustainable development are discussed and linked to the sustainable use of natural resources for sustained economic gains. These concepts are examined in a broad framework as it applies to the use of wood to sustain the woodcarving industry in Kenya. The commitments made by the Government of Kenya on sustainable management of natural resources are also highlighted as these clearly have a direct bearing on the woodcarving industry.

## 2.2 Sustainability, Sustainable Development and Natural Resource Use

The concept of sustainability does not possess a single definition as its manifestations are within ecological, economic and social dimensions (Gow, 1992). However, a commonly accepted definition of sustainability was proposed by the World Commission on Environment and Development (WCED, 1987) where the need was recognized to link development and environmental protection in order to achieve economic growth that meets the needs of the present without compromising the ability of future generations to meet their own needs. Recently, scholars and practitioners from many disciplines have began to build a theory of sustainability (Brown *et al.*, 1985; Milbrath, 1989; Panayotou, 1990).

Perman *et al.*, 1996) identified at least five alternative conceptualizations of sustainability as treated by different sectors with regard to natural resources. An ecological conceptualization is described by Conway (1985) as one which satisfies minimum conditions of ecosystem stability and resilience through time. It deals with the propensity of a system to withstand collapse under stress and recover once the stress is removed. Howling (1986) interpretes stability as property of individual species or populations within an ecosystem, and the ability to return to an original equilibrium condition after being subjected to disturbance. Common and Perrings (1992) defined a system as being ecologically sustainable if it is resilient. Resilience is measured by the ability of a system to maintain organization in the face of disruptive perturbations without undergoing catastrophic, discontinuous change or to recover. Conway (1985) goes further to discuss stability and sustainability in the context of agro-ecosystems in less developing countries and notes that given rapidly increasing populations, increased productivity has been the major goal in that context.

Forestry and agriculture increasingly depends on a narrower genetic base than ever before (Harlan, 1977), and genetic diversity should be maintained by preserving natural areas containing potential cultivars or through artificial banks of reproductive material. It also requires large inputs of artificial fertilizers and of tillage practices that are unsustainable in view of the energy demand being greater than the yield and of unacceptably high rates of soil loss.

The ecological concept of sustainability is also expounded by Daly (1974) and Boulding (1966) as that where resources are managed so as to maintain a sustainable yield of resource services. This is often used in biological models of renewable resource stocks in which some stock is held at a constant level and delivers a constant flow of resource service over time. The maximum sustainable yield of a resource is the highest feasible flow of services that can be maintained over time from a given environmental system. The Brundland Commission (WCED, 1987) similarly refers to sustainability as the maintenance or enhancement of resource productivity on a long term basis.

The core of a standard economic concept of sustainability is the Hartwick model (Hartwick, 1977). Here, sustainability is interpreted in terms of non-declining consumption. He argues that if the rents (surplus of revenues over product costs) derived from exhaustible resource extraction are saved and

invested entirely in reproducible capital, the level of output and consumption will remain constant over time. However this concept has been criticized for the lack of requirements on how large the non-declining level of consumption should initially be. The point of departure for Hartwick model is the 'cake eating' model proposed by Solow (1991). In this concept, a sustainable state is one in which resources are managed so as to maintain production opportunities for the future. He conceptionalizes a situation in which only the natural resource available is a finite stock of non-renewable resource (cake) and recycling is impossible. A cake of finite size cannot be divided into an infinite number of pieces of equal size, hence sustainability is impossible in this analogy because the present generation have no knowledge of future preferences, future technologies and the lifespan of human species. Dasgupta and Heal (1979) argue that knowledge appears to be a good substitute for exhaustible resources such that falling quantities of these resources could be more than compensated for by increasing human and intellectual capital, hence economic sustainability seems possible in this way.

George (1999) regards the principle of inter-generational and intra-generational equity as two fundamental pillars of the sustainable development concept or themes of the Brundland Report (WCED, 1987). The two principles are combined in the revised definition of sustainable development described in the Rio Declaration on Environment and Development as development which equitably meets developmental and environmental needs of present and future generations. It is argued that the inter-generational equity is a necessary condition for sustainability while intra-generational equity is a necessary condition for development, and that although several other principles have a role to play in their interpretations, criteria for sustainable development can be based on these two principles alone.

According to Stedman (1992), sustainable development is about human well-being but our dependence on natural resources for economic improvement should take place in such a way that short-term economic gains are not traded for long-term ecological or economic losses, particularly in developing countries.

A broad definition which probably captures the various dimensions with regard to the natural

resource base is provided by FAO (1989) as:

*"Sustainable development is the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in agriculture, forestry and fishery sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable".*

This definition captures the multi-dimensional aspects involved in management and conservation, institutional and technological change and the satisfaction of present and future human needs. It also emphasizes on stewardship of responsibility for future generations through pursuit of a type of development which is sustainable on both environmental and social criteria.

Underlying this is a belief shared by many recent writers on poverty in the developing nations that sustainable development means increasing the capacity of rural people to influence and control their future on a long term basis, a goal that can be achieved by strengthening capacity, supporting equity, and fostering empowerment (Gow, 1988). Capacity has both individual and collective implications and involves changes in the individual, the community and the nation. Environmental degradation is not a problem of relationship between people and their habitats but among people competing for access to productive resources for their livelihood (Horowitz, 1988).

### 2.3 Towards Sustainable utilization of Woodcarving Resources in Kenya

Sustainable resource use is a process by which the concept of sustainable development is applied to the use of natural resources, renewable or non-renewable in an integrated way that takes into account the functioning of entire ecosystems (Dunster 1992). He notes that sustainable development is only achieved if there is sufficient understanding on what is to be sustained, how this can be done, and the expected results.

In the Kenyan woodcarving industry, the increasing scarcity of prime carving tree species and the impact of their utilization on forest habitat and forest conservation, is a common concern.

Conservation in this context is the sustained management of these genetic resources (woodcarving species) so that they may yield the greatest sustainable benefit to the present generation of carvers, while maintaining their productive potential to meet the needs and aspirations of future carvers.

In Kenya, like most of the developing nations, a large percentage of forest resources is owned by the state and are found mainly in areas of high agricultural potential where high human population densities constantly generates high demand for wood products and land for cultivation. Most of the wood used in the woodcarving industry in Kenya is mainly obtained from indigenous forests which have continued to experience pressure from various human activities. Over the decades, indiscriminate felling of trees in indigenous forests occurred until 1979 when a technical order on the management of natural forests was introduced (Odera, 1987). The order presented guidelines for selective felling of commercial indigenous species as a measure to achieve sustained production of wood, to maintain its structure and diversity, as well as to improve the quality of the growing stock.

In theory, achieving sustained production of forest products in perpetuity, while maintaining the structure and diversity of the forests through selective logging is difficult to implement largely due to the commitment and discipline that is required for managers. The management system has been greatly abused, and this led to a Presidential ban on the logging of indigenous wood for commercial purposes in 1986, which still stands today. The ban has caused artificial wood shortages leading to increased illegal extraction that has been aided by access and poor control. In this way, the opportunities for quick, short-term earnings are high, with severe long-term consequences to the carving industry owing to the progressive indiscriminate removal of valuable regenerative wood.

The growing understanding of the potential use of more environmentally friendly alternative woodcarving tree species, and the need to shift from over harvested wild tree populations to on-farm supplies is seen as a viable option so that conservation impacts are reduced without carvers losing their livelihoods. Bidwell (1992) observes that major resistance to change may arise in cases in which no alternative exists or if the alternative requires a major modification of lifestyle or utilization.

## 2.4 Sustainable Development and Environmental Policy in Kenya

Recognition of the importance of sustainable use of natural resource conservation and environmental protection in Kenya dates back to 1965 when the first assertive government policies were made. For example, Sessional Paper No. 10 of 1965 on 'African Socialism and its Application to Planning in Kenya' states that the heritage of future generations depends on the adoption and implementation of policies designed to conserve natural resources and to create physical environment in which progress can be enjoyed (GOK, 1968)

Most of Kenya's national development plans and sessional papers reflect a commitment to sustainable environmental policy. The 1974-1978 Development Plan for example articulated the need to manage the environment for ecological, socio-cultural and economic reasons (GOK, 1977). The current National Development Plan (1999-2001) makes a commitment to achieve successful environmental management through, among others, the implementation of environmental laws, provision of economic incentives and penalties to encourage sustainable use of natural resources, increasing resource allocation for environmental management, and making adjustments in taxation to promote sustainable use of natural resources (GOK, 2000)

Although the issue of sustainable utilization of natural resources has been at the top of national agenda for a long time, many of these initiatives have been started without much consultation or coordinated planning, thus generating a body of information that is scattered and not coordinated. In an effort to address this problem, a number of amendments have been proposed to Kenya's policies and laws which relate to natural resource use and environmental management, most notable is the drafting of a National Environmental Bill. The Bill seeks to establish a legal body with responsibility for national environmental conservation, to coordinate environmental management between different sectors, and to set binding standards and liabilities against environmental damage (Emerton *et al.*, 1998).

The environment reforms proposed are part of the Policy Framework Paper (1996-1998) which describes all the reforms that the government has committed itself to undertake in the short-term. The PFP was largely developed by the Government and negotiated with the World Bank and the

International Monetary Fund (IMF). These reforms are in agreement with international agreements relating to environmental conservation and protection to which Kenya is a signatory. These include the Convention on Biological Diversity; the Framework Convention on Climate Change; the Convention on Drought and Desertification; Convention of International Trade in Endangered Species of Wildlife Fauna and Flora; the Convention for the Protection, Management and Development of the Marine and Coastal Environments of the East African Region; The RAMSAR Convention; and the African Convention on the Conservation of Nature and Natural Resources (Emerton *et al.*, 1998).

### 2.5 Conclusion

When all is said and done, natural resources and poverty are both about people. The principles of sustainable development support the maintenance of ecological integrity, particularly the conservation and enhancement of the productive capacity of the natural resource base for the benefit of present and future generations.

There is a growing awareness of the relationships among the environment, sustainability and poverty, linkages that require a multi-disciplinary approach in order to formulate practical solutions. This study focuses on addressing actions that may reduce the demand for carving wood extracted from increasingly threatened natural habitats, by encouraging the use of substitutes and/or promoting commercial silviculture of indigenous hardwoods in Kenya.

# CHAPTER THREE

## THE WOODCARVING INDUSTRY IN KENYA

### 3.1 Historical background to woodcarving trade in Kenya.

Woodcarving in Kenya is a big business and holds a significant position in Kenya's national economy. The industry provides direct and regular employment to carvers themselves as well as raw material dealers and brokers, resource owners, middlemen, apprentices, transporters, curio vendors, hawkers, stockists/wholesalers, retailers and exporters of carvings and a range of other allied sectors.

The largest domestic buyers of woodcarvings have generally been tourists who visit Kenya. Indeed, growth of the woodcarving trade in Kenya is strongly correlated to the rise in tourism arrivals to Kenya from the early years of 20th century to the present day (Table 3.1). However, the actual trade volume is not solely related to the incoming tourist numbers alone. A significant proportion of the carving trade in Kenya is through direct exports carried out by nearly all of the stakeholders in the industry. These include the carver's cooperative societies, established dealers, individuals and traders with long term offshore trade linkages.

The origin of the woodcarving trade in Kenya is well documented (Elkan, 1958; Obunga, 1995; Troughear, 1987). For over 80 years, the general trend in the growth and development of the industry has been gradual and strongly linked to tourism. It is now a permanent element of Kenyan tourism. Growth in the industry may be divided into three main parts based on the historical accounts of the early European settler immigration and tourist arrivals in Kenya.

**Before 1920**

Tourist arrivals to East Africa's coastland from pre-christian times to 1890 included Greeks, Arabs, Indians and Portuguese. After 1890, a large number of foreigners began to penetrate inland as immigrants, administrators, missionaries, pioneer campany personnel and tourists. Records of tourist arrivals are very fragmentary until after the great depression of the 1930s (Ouma, 1970).

**Table 3.1: Tourist arrivals and revenue statistics for Kenya from 1938-1968**

| YEAR | Tourists ('000) | Revenue (£ million) |
|---|---|---|
| 1938 | - | - |
| 1939 | - | - |
| 1946 | 16.09 | - |
| 1947 | 19.74 | - |
| 1948 | 20.64 | - |
| 1949 | 17.56 | - |
| 1050 | 24.06 | - |
| 1951 | 33.44 | - |
| 1952 | 36.01 | - |
| 1953 | 32.15 | - |
| 1954 | 33.23 | - |
| 1955 | 39.54 | - |
| 1956 | 40.46 | - |
| 1957 | 43.12 | - |
| 1958 | 41.20 | - |
| 1959 | 44.93 | - |
| 1960 | 35.80 | 4.30 |
| 1961 | 42.04 | 4.80 |
| 1962 | 49.92 | 5.50 |
| 1963 | 61.35 | 7.20 |
| 1964 | 65.45 | 7.00 |
| 1965 | 81.45 | - |
| 1966 | 106.52 | - |
| 1967 | 117.15 | 14.50 |
| 1968 | 262.00 | 16.40 |

Source of data: E.A.T.T.A. Ann. Repts. 1948-1963, Government Statistics Abstracts, *African* Repts.
In: Ouma, P.M. (1970)

Woodcarving was practiced in the early years of nineteenth century by the Duruma, Giriama, Kamba and Taita tribes but on a very limited scale that was restricted to the carving of traditional stools, spoons, snuffing horns, calabashes and other cultural items (Elkan 1958). However, woodcarving as a purposeful commercial business owes its origin to the efforts of

one legendary Kamba tribesman, Mr. Mutisya Munge who lived at Wamunyu Village, Machakos District. He was a talented carver known to carve ceremonial walking sticks before 1914 having developed his carving skills from the Makonde Tribe in Tanzania (then Tanganyika) when he was serving as a soldier in the Kings African Rifles during the World War 1. It was also while he was there that he learnt of the huge commercial potential of trade in woodcarvings. On his return from the war, he devoted most of his time to woodcarving. His friends and neighbours around Wamunyu village admired his work and learnt from him, and the art spread rapidly among the Kamba Tribe. European settlers and early administrators in Kenya provided the initial market for the carvings.to the extent that mass production of carvings started after the World War 1.

**1920-1960**

After World War 1, European settlers, administrators and tourists began to enter Kenya in large numbers and provided a considerable market for the Kamba carvings. Carvers started hawking their products outside their ancestral lands through selling expeditions to distant towns and cities in search of markets. The volume of trade gradually grew.

During World War II and immediately after, another sharp rise in demand for carvings was experienced owing to the arrival and internal movement of British forces, the Kings African Rifles as well as pioneer and carrier corps. The soldiers and tourists stimulated internal re-distribution of wealth and incentives for increased production of food crops, other consumer foods and carvings in Kenya (Ouma, 1970). Street selling of carvings in Nairobi became very profitable and traders and middlemen specialized in the woodcarving trade entered the industry.

In 1949 soon after the World War II, there was devaluation of the English pound (£) and this affected tourism in East Africa. This was followed by the outbreak of the Korean War in 1950 which provided much uncertainty in world tourism and hence the travel trade (Ouma, 1970). Soon afterwards, trouble erupted in Kenya where the Mau Mau freedom movement frightened off prospective tourists. Thus, Kenya suffered a 10% drop in foreign arrivals in 1953 compared to 1952 (Table 3.1).

Uganda and Tanganyika realized a modest increase in arrivals partly because international flights were diverted from Nairobi. Generally, during these periods of uncertainly in the local tourist markets, overseas orders for carvings grew steadily as exporting firms in Kenya established links with curio importers abroad. For example in 1954, the direct export value for carvings was estimated at *English Pounds* (£) 75 000 (Elkan, 1958).

In the 1950s it is believed that woodcarving trade took root in the Kenyan coast largely because the Kenyan coast was not affected by the Mau Mau movement. Interestingly, other Kamba woodcarving traders took longer selling expeditions to Tanzania, Uganda, Zimbabwe, Zaire (now DRC) and Zambia in search of markets (Troughear, 1987). When the Mau Mau uprising ended, tourist arrivals increased such that by 1956, tourism had become the 4$^{th}$ largest source of foreign exchange in East Africa (Ouma, 1970).

During the period up to 1960 the carvers were poorly organized and production of carvings was largely an individual basis. The colonial government was generally slow to encourage or support the cooperative movement in Kenya. Asian, and European entrepreneurs took advantage of the trade gaps in the market place and set up specialized curio shops in nearly all the major towns, particularly in Nairobi and Mombasa where they traded in large export consignments of carvings. Lack of education, experience and expertise was the major undoing for the Kamba carvers.

In 1956, simmering Middle East squabbles erupted into open warfare and Suez Canal was closed. When it was opened two years later and the Mau Mau struggle was over, internal and external conditions improved leading to an upsurge of tourist arrivals to Kenya such that by 1958/59, tourism was Kenya's second foreign exchange earner after coffee (Ouma, 1970)

**1960-2000**

The frequent unhappy checks on the steady progress of East African tourism were soon to re-assert their presence. The depressing influence of the independence movements in East and central Africa soon culminated in the Congo tragedy of 1960-1965, leading to a significant drop of tourist arrivals in 1960 and 1961 (Table 3.1). In addition, the East African independence revolts (Kenya, Uganda and Tanzania) up to 1964 generally kept tourist arrivals low.

When the independence revolts and the Congo crisis ended, East Africa tourism recovered very sharply with a corresponding increased trade in carvings. By 1968, tourism was the fastest growing and the most valuable single industry in Malindi and the Kenyan coastal towns in general (Bradley, 1973). According to Troughear (1987), the latter 1960s and early 1970s was a period of crafts boom in the western countries sparked by increased wealth and greater appreciation of hand-made goods from natural materials as opposed to plastics around the world. In 1974, the cooperative movement attained its fully fledged Ministerial status as the Ministry of Cooperative Development as the government was fully convinced that it had a vital role to play in the economic and social development of the nation. The national objectives and the ultimate goals of public policy in Kenya were initially spelt out in the KANU Manifesto of 1963 and the Sessional Paper No 10 of 1965 headed "African Socialism and its Application to Planning in Kenya". Through this strategy, citizens were encouraged to establish cooperatives[1]. The first functional woodcarving cooperative society was formed in 1965 at Wamunyu, Machakos district. This was followed by several others in the subsequent years in different part of the country mainly in Machakos, Nairobi, Nanyuki, Makindu through to the Kenyan coast (Figure 3.1)

Like many other cooperative societies in Kenya, the woodcarving cooperative societies have undergone periods of turbulence and success. They have managed to survive despite stiff competition from established dealers, independent exporters and middlemen who have continued to dominate the carving industry in Kenya over the decades. Generally, marketing channels for the carvings remained elusive for a long time. In 1982, all the six woodcarving cooperative societies came together to form one umbrella organization known as the Kenya Crafts Cooperative Union (KCCU). KCCU was formed to facilitate export of carvings and to perform other regulatory functions such as eliminating destructive competition, standardizing the product prices and consolidating resources to meet large export orders.

As part of the solution to this problem, the government intervened in 1987 through the Kenya External Trade Authority (KETA). KETA was to bridge the gap by facilitating direct export

[1] These are essentially associations of persons who have voluntarily come together to achieve common economic goals through democratically controlled organizations with equitable contribution to capital and sharing of risks and benefits accruing from the bussiness organization.

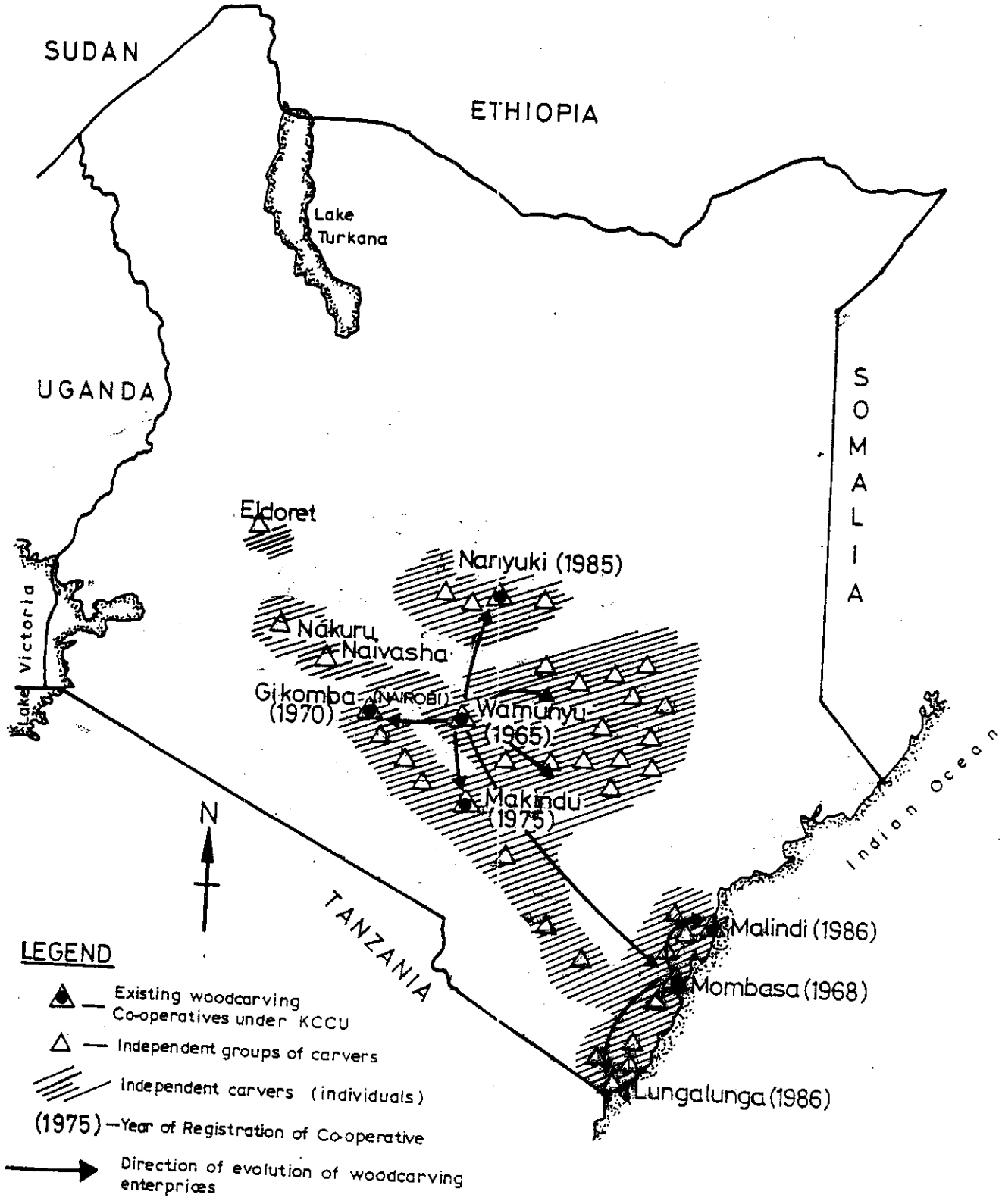



Figure 3.1: Evolution of woodcarving enterprises in Kenya.

market contacts between the carvers cooperatives and overseas buyers as well as through active promotion abroad. The success of KETA was modest but the marketing problems for carvings still persist to this day. The number of carvers have dramatically risen in response to the growing tourist market over the years in Kenya. In 1989 for example, the number of tourists visiting Kenyan National Parks and reserves were 730 000 (Juma and Ojwang, 1996). From the late 1980s, Kenya's economic slow down was partially a result of political instability in the country leading to a decline in agricultural outputs and poor performance in the tourism industry. As it is made clear in the coming chapters of this thesis, the unprecedented slow down in economy coupled with the shortage of raw materials for the carving industry has led to a low rate of growth of the industry in the recent years.

## 3.2 Structure and organization of the Woodcarving Industry in Kenya

### 3.2.1 The Kenya Crafts Cooperative Union (KCCU)

The main objective of KCCU is to distribute carving export orders to the member cooperatives as they are received from buyers abroad .It is governed by a board of directors elected from each of the six member wood carving cooperative societies. A general manager and an administrative assistant oversees the daily activities of the Union.

Once an order for specific carvings is received, KCCU distributes it among the cooperatives, and production managers at the respective stations distribute the work among the members (carvers). Traditionally, the society buys the carving wood either directly from the Forest Department or from wood dealers (see chapter 8), and sold to the carvers. The carving wood can also be loaned to the members and recovered when the carved products are sold Carvers may also make individual arrangements to source the carving wood or buy it directly from dealers without necessarily buying through the society.

Completed carvings are taken to the society's showrooms, warehouses or they are sold directly to meet outstanding export orders. In the absence of orders, the products are displayed at the warehouses, either for retail or for wholesale.

Most of the carvers usually carve within the cooperative workshops or sometimes outside the premises, usually at their homes or at places close to the sources of raw materials. The

advantages of working at the workshops are that new models are tried, prototypes carved and eventually put to production. Morever, carving tools and other materials may be shared or even expert assistance on the finishing lines may be sought among the colleagues.

The finished carvings find their way to sale outlets in a number of ways. The most common is through the cooperative society warehouses. The cooperative societies have two different warehouses, retail and wholesale. The retail warehouse is usually meant for tourists and similar products attract higher prices than they would in the wholesale warehouse. Dealers in carvings and other local (domestic) buyers usually buy from wholesale warehouses. Each member usually keeps a constant number of carvings in each warehouse that have to be replenished each time an item is sold. Daily records of sales are pinned on the society's notice boards for the attention of members. When export orders for carvings are received, they may be filled directly from the items on display at the warehouses. However, for cases when the orders are of a specific design or size and are lacking, they have to be carved. Members may also sell their products directly to middlemen or to other buyers, particularly after replenishing all the items sold through the society. Such carvings sold outside the cooperative often attract very low prices because many carvers are tempted by the instant cash offered by these dealers and middlemen. The effect of poor marketing strategies by the cooperatives on the sustainability of the industry are addressed in Chapter eight of this thesis.

KCCU has started addressing the issue of shortage of raw materials as a priority area, as without the resources there is no future for carvers. Unfortunately, these efforts are not being well coordinated across all the cooperatives. The material inputs towards this programme by the KCCU management in terms of finance is yet to gain momentum. At the moment, the Mennonite Central Committee[2] (MCC) has made contributions towards this programme through a 3% surcharge of all the carving sales which it markets on behalf of KCCU.

[2] MCC is a relief and development agency of the Mennonite and Brethren in Christ Churches in North America. Job creation is an important MCC program priority in East Africa, and part of this job creation agenda includes the marketing of handicrafts to the USA and Canada through the 'Ten Thousand Villages Program'

### 3.2.2 Other participants in the woodcarving industry in Kenya

#### 3.2.2.1 Independent carvers

Individual carvers, families and carving groups generally sell their products independently, usually to middlemen. Independent groups consist of dealers who own workshops and employ a number of full time carvers. The carvers are supplied with wood and are paid for whatever is produced. In some cases, families may also be involved in the carving, with labour differentiated according to gender (Obunga, 1995). Men exclusively do the carving while the few female members, including men who are less skilled in carving, are involved in the finishing touches such as painting and polishing the carved products. The members usually have a shelter within the compound where the carving is done but the finishing may be done within their houses. The finished carvings can be sold to middlemen or to individual members of the established cooperatives and other dealers. They are also sold at local markets within the rural areas during market days when traders of a wide range of commodities bring their products for sale. Carvers from the surrounding countryside also come in with what they have carved at home to sell their products alongside the other traders. In most cases, carvings made by such individuals and independent groups are usually semi-finished and often have to undergo further finishing stages. The disadvantage of the home based industry is that it is not sufficiently responsive to sudden changes in demand of new models and specific designs that may be desired by the market at a given time. However, they get access to market information through regular middlemen and dealers who buy the carvings from them during the market days, or through relatives who are members of the cooperatives.

#### 3.2.2.2 Dealers

Curio/souvenir shops dominate the retail trade in carvings in Kenya because of their strategic locations, usually concentrated near top class hotels and prime downtown areas. Such shops are modern, spacious, well established and dominated by the Asian community. They also accept credit cards and modern forms of payment other than cash. Because of their long experience in the trade, they exploit both the local and abroad markets. Carvings sold at these shops/galleries are of very high quality and hence attract higher prices. They get their carvings from middlemen who are often linked to the carvers cooperatives or individual artisans. Such carvings undergo additional finishing touches before they are sold at such

shops. An inventory in 1995 of high quality art galleries in some sections of three cities in Kenya revealed that there are over 105 such shops in Nairobi, and 93 in Mombasa (Obunga, 1995). More modest street stalls (kiosks) are owned by indigenous wood carving entrepreneurs who generally suffer from several disadvantages. They operate from small wooden, polythene covered or tin structures located outside the prime tourist circuits constructed on borrowed vacant premises in towns, and often harassed[3] by the city administration.

Some stall owners are carvers themselves, manufacturing their own wares or else obtaining them from cooperatives and middlemen. Licensed mobile vendors along the city streets, sidewalks, alleys and other strategic locations within the cities can also sell their carvings freely to tourists. There are an estimated 550 street stalls and vendors in Nairobi and 108 in Mombasa (Obunga, 1995)

### 3.2.3 The Carving Process

The process of carving entails the transformation of a piece of wood of a given size into a standardized animal, human figure, spoon, bowl or any other article the market desires (Troughear, 1987). Most carvers work extremely fast by virtue of experience and talent Generally, the complete process takes several stages as outlined in Figure 3.2.

[3] A recent incident in Nairobi (1998) is on record where a Nairobi city council bulldozer flattened over 150 structures in a few hours over a protracted land dispute between hundreds of carvings traders and the council. The traders lost hundreds of millions of shillings worth of stocks during the incident

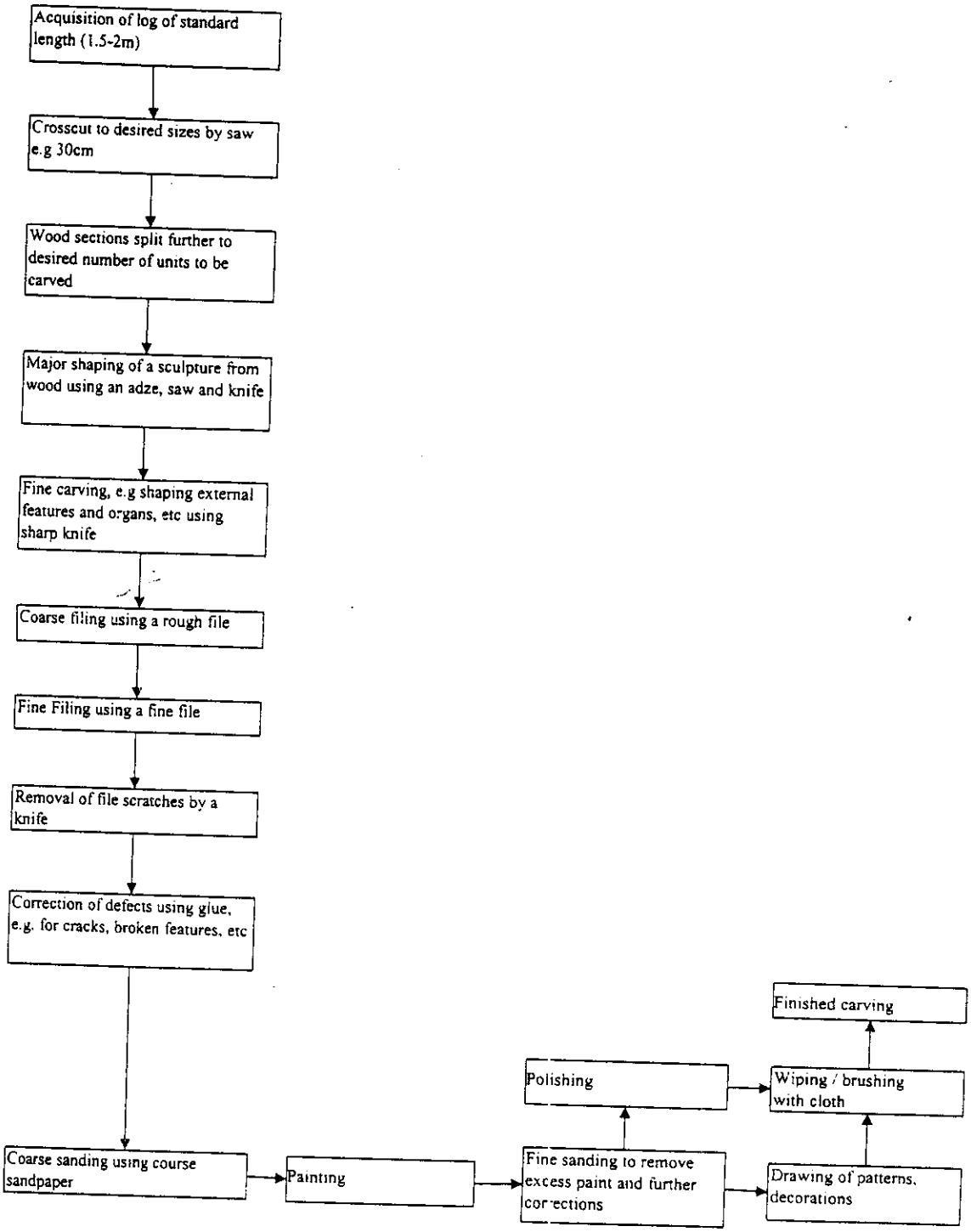



Figure 3.2 Stages for the carving process

### 3.2.4 Training and working experience in carving

The majority of the carvers are people between 20 and 40 years old. The number of young school leavers entering the industry is rising (Obunga, 1995). The industry is characterized by a minimum operational capital out-lay and therefore is accessible to a large number of people, particularly to jobless school leavers. Others have confided that they opted to drop out from school to enter the industry because they got tempted by the prospect of monetary gain that the trade offers. These young apprentices learn the carving skills from other older members or neighbours. They usually start by working alongside the experienced carvers, providing free labour and gradually learning and perfecting their carving skills within months or years.

### 3.2.5 Woodcarving Products

Generally, the bulk of Kamba carvings are produced for one reason, to make money. In this endeavour, the Kamba have been remarkably successful (Troughear, 1987). Their carvings are generally market–driven since they carve what sells in the market at any given time. The carvings which have dominated the markets in Kenya over the years may be categorized in the following way:

- animal figures dominated by the 'big five' such as elephant, rhino, giraffe, lion and leopard;
- human figures such as Maasai warriors, old men, stickmen, and Maasai women clad in traditional regalia;
- traditional household implements such as spoons salad servers, fruit/sugar/salad dishes and stools;
- masks derived mostly from Zaramu, Makonde and central Africa traditions;
- cultural items such as walking sticks ; and
- innovative items such as devils, letter openers among others.

# CHAPTER FOUR

# WOODCARVING TREE SPECIES: THEIR STATUS, DISTRIBUTION, ECOLOGY AND PROPAGATION IN KENYA

## 4.1 Introduction

The woodcarving industry relies on indigenous hardwoods from natural forests and woodlands in Kenya. However as these forests are under pressure of having to support larger, rapidly growing human populations besides fulfilling additional demands for extra incomes and specific forest products, the issue of sustaining the resource base looms large. *Brachylaena huillensis* (muhugu), *Dalbergia melanoxylon* (mpingo/ebony), *Olea europaea* (mutamaiyu) and *Spirostachys africana* (mutanga) and a few others have continued to dominate the Kenyan wood carving industry. As the industry expanded, so the populations of the favoured hardwoods diminished over time, leading to elimination of some of these species from specific localities altogether due to over utilization by the woodcarving industry as well as other competing users of these resources. Two examples stand out: the depletion of *Brachylaena huillensis* and *Dalbergia melanoxylon* from local sources within Machakos District in the 1950s (Obunga, 1995).

There are growing fears that this is likely to be repeated elsewhere in Kenya for these and other prime carving species if the present off-take and utilization trends are not checked. The current exploitation trend is such that the remaining juvenile stands in the forests where these species occur are being targeted. The current conservation status of some key tree species are given in the remaining sections of this chapter including utilization history, ecology, distribution and propagation in Kenya.

## 4.2 *Dalbergia melanoxylon* Guill. et Perrot

### 4.2.1 Introduction

*Dalbergia melanoxylon* (African blackwood, mpingo) is ecologically and economically a very important component of many of Africa's woodlands. The genus *Dalbergia* is a major genus of woody legumes in the sub-family Papilionaceae. It includes some of the most valuable

tropical hardwoods commonly grouped as rosewoods because of the colour of the heartwood which range from rose to black.

### 4.2.2 Utilization in woodcarving industry in Kenya

*Dalbergia* is economically the most important genus, particularly on account of a number of species in the genus producing rosewood timber that is internationally famous for its rich colours, beautiful grain, pleasant fragrance and superlative technical qualities (NAS, 1979). In Africa, *D. melanoxylon* has been valued as a source of timber for at least three centuries. The character of *D. melanoxylon* wood is heavy and hard, having high density and fine texture with natural oiliness. It is most famous for its prominence in the manufacture of musical instruments. It gives an excellent musical tone and exceptional durability being preferred for the manufacture of clarinets, oboes, bagpipes and other musical instruments (Hall and Moore, 1987), hoes, pestles, mallets, walking sticks (Beale, 1995), handles of surgical instruments, pattern making, screws, fancy articles, hair-pin combs and paper cutters.

The use of *D. melanoxylon* for carving is believed to have started with the Makonde people at the turn of the century originally in northern Rhodesia (now Zambia). Over the years, they developed the use of *D. melanoxylon* timber for production of elaborate carvings which were increasingly sold to a rising number of export contracts and tourist buyers (Beale, 1995). Important attributes that characterizes species suitability for carving include durability, resistance to borers, workability, and aesthetic values (grain texture, colour, patterns and others). *Dalbergia melanoxylon* combines all these attributes and therefore commands the highest prices compared to any other standard item made from any other carving species. In Kenya, *D. melanoxylon* products are marketed as ebony, and it is by far the most valuable, consistently and intensively utilized hardwood species in the 80 years of woodcarving history in the country. However, owing to the severe decline from their natural habitats, the current proportion of *D. melanoxylon* carvings in Kenya constitutes only a small proportion of the total volume utilized in carving.

### 4.2.3 Ecology and present conservation status

*Dalbergia* is a pantropical tree genus with 100 species distributed in different parts of Asia, America and Australia. *Dalbergia melanoxylon* grows in a variety of conditions including semi-arid, sub-humid and tropical lowland habitats. It occurs in at least 26 countries south of

the Sahara as far west as Senegal across to Eritrea and northern Ethiopia in the east, and as far south as northern South Africa (Nshubemuki, 1993). However, it is found mainly in the miombo deciduous forest and savannas of the coastal regions of Tanzania and Mozambique. It is in these regions where it has recently been suggested that populations of *D. melanoxylon* are declining and heading towards commercial extinction due to over-exploitation. (Hall and Moore, 1987; Read, 1984). *Dalbergia melanoxylon* is described as being found in the lowland dry forest and lowland woodland (Sharman, 1995), in deciduous woodlands, deciduous secondary or coastal bushland and wooded grassland, at altitudes between sea level and 1350m (Albrecht, 1993).

Lowland woodland is a common habitat type in tropical Africa, dominated by *Afzelia quanzensis*, *Brachystegia spiciformis* and *Trachylobium verrucosum* in areas with freely drained soils and rainfall between 600m - 1000mm per annum (Sharman, 1995). *Dalbergia melanoxylon* is moderately drought resistant but prefers areas where moisture is readily attainable and relatively high water table. The mean minimum temperature in its native range is 18°C and the maximum temperature is 36°C, with no frost. It requires high light intensities and grows poorly under cover of a closed tree canopy. However, it is known to tolerate light shade (Nshumbemuki, 1993).

In Kenya, *D. melanoxylon* naturally occurs in Machakos, Kitui and districts along the coast. Their natural populations are declining rapidly due to habitat loss and increased exploitation for carving, housing and other domestic uses. A recent survey conducted at selected sites in Kenya (Obunga and Sigu, 1996) to asses the status of the existing natural population as well as forms of human impact on the species has shown that the population of medium to large diameter individuals (above 20cm DBH) have severely been depleted in most of the accessible areas. An indication of extreme *D. melanoxylon* resource deficits in these areas was noted by the complete excavation of stumps and roots for carving use. This practice leaves no chances for resprouting and will lead to the ultimate extermination of *D. melanoxylon* from these areas with long-term consequenses for the woodcarving industry. However, in some parts of Kitui district, particularly in less accessible areas with poor road networks, commercially exploitable sizes still exist, with densities estimated at 1-5 trees per hectare. In the regions and habitats where *D. melanoxylon* is still found, introduction of

protection and substantial management intervention still offers an opportunity to use *D. melanoxylon* to improve both the rural and national economies.

### 4.2.4 Phenology and propagation

*Dalbergia melanoxylon* is a slow growing deciduous tree and grows up to 4-7 m high, occasionally reaching heights over 12m. The flowering and seeding periods vary from one region to another depending on the prevailing climatic conditions. In Kenya, it produces seeds from September to December (ICRAF, 1992).

Each pod contains 1-2 fragile seeds and the collection is done either by climbing the tree and shaking the branches with a hook or by shaking the branches from the ground in order to drop the pods. Seed collection should be done immediately after the colour of pods turns greyish. Usually, the pods tend to stay on the tree without releasing the seeds. However, heavy rains which displace the seeds from the trees and provide the necessary water for germination is believed to be the major dispersal method. Insects attack seeds within a short time of seed maturation, and this is one of the problems limiting to the species' natural recruitment potential.

The extraction of seeds from the pods is not recommended because of their fragility (Albrecht, 1993). The pods are dried in the sun to moisture content of between 9-12% prior to storage. The seeds can be stored in air-light containers at 3°C for several years in a seed store. If yellow or green pods are collected, they should be stored in ventilated containers and later dried in the sun. Ripe ones can be stored in sealed containers for one year without losing viability. Without proper storage, seeds can loose viability in a few months.

Pre-sowing treatment is not usually necessary. However, pods containing seeds can be broken into pieces and soaked in water for about 6 hours for better results. Under ideal conditions, seed germination trials in Kenya showed that the seeds can germinate within 8-20 days with an expected germination rate between 50-60%. Seedlings can be planted out after 5 months (Albrecht, 1993). Similar germination trials in Mozambique gave germination rates of between 39.5%-50%, while in Tanzania, germination percentage varied between 30-50% within 15-40 days (Nshubemuki,, 1993),

According to Maydell (1986), natural regeneration of *D. melanoxylon* seedlings is problematic associated with low survival rates, vulnerability to animal damage and fires. Propagation has been reported as successful from seeds, seedlings, wildings and cuttings. Unfortunately, there is no conclusive research to indicate the best planting material, as available published accounts are somewhat contradictory. For example, early results of an experiment in Kenya on cuttings showed very low survival rates (Sharman, 1995). In Tanzania, research trials indicated that *D. melanoxylon* can be grown from root cuttings or planted stumps, with the later exhibiting a more vigorous growth (Hall and Moore, 1987).

It has been hypothesized that a factor limiting *D. melanoxylon* seedling survival and growth is damage occurring to the tap root system during planting and this problem may be avoided by direct planting of root cuttings or stumps. According to Nshubemuki (1994), 2 years-old stumps about 14cm long comprising 12cm of root and 2cm shoot planted in early or mid rainy season followed by intensive weeding showed superior growth compared to seedlings. In Tanzania, regeneration has successfully been promoted through breaking roots by scratching with a hoe. On several roadsides in Tanzania, *D. melanoxylon* regeneration due to sprouting is frequently seen along roadsides where roots had been disturbed by grader blades (Hall and Moore, 1987).

Once established, experience has shown that the chances of survival and growth of *D. melanoxylon* can be dramatically increased by intensive weeding and management. In Tanzania, high survival rates were recorded in plantations, which were planted on white sandy loam soils, weeded and protected from fire.

Other trials at Kwanarukange and Korogwe in Tanzania showed that after 7½ years, trees planted early in the rainy season on thoroughly weedy plots were 30% taller than those planted at the same time but lightly weeded. Trees planted in the middle of the rainy season and thoroughly weeded were still about 45% taller than those planted at the onset of rains and lightly weeded (Mugasha, 1983).

Other studies have shown that *D. melanoxylon* can be successfully established under a plantation with an initial spacing of 2m×2m for good branching and stem form under medium shade provided by *Pinus caribaea*, and intensive weeding until the root collar diameter

measures about 5cm (Nshubemuki, 1993). However, in nature, (undisturbed natural environments as National Parks), mature trees are rarely found within 10m of each other. This suggests that *D. melanoxylon* is not a gregarious tree and may be difficult to establish in pure plantations unless heavily thinned. This is an area that needs research.

The growth of *D. melanoxylon* is reported to be slow during the first 8 years of its life. It has been hypothesized that during the early stages of growth of *D. melanoxylon*, the plant develops a good root system, which is crucial for its survival. Once this is established, the species is quite resilient, particularly to fire, browsing and physical damage (Sharman, 1995). If the root system is well established and damage occurs it is able to produce an alternative stem and continue with its development. It is also browsed by savanna animals and seedlings commonly are eaten by rodents.

Well-tended trees have been observed to increase in height by 0.6-0.7m annually and diameter by 1-1.5cm a year (Mugasha, 1983, Nshumbemuki, 1994) and reach carvable sizes in 40-60 years (Mugasha, 1983). In the wild, estimates indicate that *D. melanoxylon* matures after about 50-70 years in good quality sites and 100 years in poor sites (Nshumbemuki, 1993). Other estimates suggest this may take 70-200 years (UNEP, 1988).

## 4.3. *Brachylaena huillensis* O. Hoffm

### 4.3.1 Introduction

*Brachylaena huillensis* (muhugu) in the most important commercial tree in the upland dry forests in Kenya and elsewhere in East Africa (UNESCO, 1973). *Brachylaena huillensis* belongs to the family Compositae (=Asteraceae) and it is the only woody species in the family to develop to timber size (Lind and Morrison, 1974).

### 4.3.2 Utilization

*Brachylaena huillensis* produces durable timber of high value that is commonly used in furniture making, high class flooring, woodcarving, fuelwood, charcoal, railway sleepers, bridge making and girders. The wood is of high density and fairly uniform radially and transversely (Kigomo *et al.*, 1990). The wood is also aromatic and contains valuable oils used in perfumery (Bryce, 1966). *Brachylaena huillensis* sustains heat for long periods and is

consequently in high demand by charcoal burners in the lowlands of East Usambara for charcoal markets in the large port-town of Tanga (Norbert, 1997).

The carving qualities of *B. huillensis* include durability, beautiful finish, resistance to insect borers, and the ease with which logs are split prior to carving (Obunga, 1995). At present, wood carving remains the major consumer of *B. huillensis* (Kigomo, 1989). *Brachylaena huillensis* carving products are sold under the name mahogany.

It is believed that the use of *B. huillensis* for carving began in the 1940s, a period when the scarcity of *D. melanoxylon* in many parts of Machakos and Kitui districts in Kenya was felt. At that time, *B. huillensis* from the nearby Maavani Hills in Kitui district then provided a convenient and appropriate alternative. The population of *B. huillensis* at Maavani Hills is nearly decimated as shown by recent surveys (Obunga and Sigu, 1996).

### 4.3.3 Ecology and present conservation status

In Kenya *Brachylaena huillensis* naturally occurs in the following geographical regions:

- Lowland dry forests of the coastal belt (Arabuko-Sokoke, Boni, Hadu, Gonja, Maluganji and Shimba Hills Forest reserves) .
- Upland semi-deciduous dry forests (Karura, Ngong, Olulua forest reserves all near Nairobi and Maavani Hills near Kitui)
- Forests around Mt. Kenya (Kabaru, Kabirioni and Muringato Forests, all in Nyeri District, central Kenya.

In Kenya, *Brachylaena huillensis* is generally distributed at altitudes below 2 000m above sea level. It occurs in the dry *Cynometra* forests in the coastal belt and in the semi-evergreen *Croton-Brachylaena* forests of the highlands at altitudes between sea level and 2 000m (Albrecht, 1993), and in those areas where the mean annual rainfall is greater than 900mm (Kigomo *et al.*, 1990).

*Brachylaena huillensis* occurs on deep and well-developed red volcanic clay-loam soils of the elevated plateaus and red soils on the Kenyan coast. The species is closely associated with *Olea europaea* sub-species *africana, Croton megalocarpus, Calodendrum capense, Dovyalis abyssinica, Juniperus procera, and Teclea spp* amongst others. Above 2 000m altitude, the

associated species continue to strive suggesting that the distribution and growth of *Brachylaena huillesis* is generally influenced by temperature (Kigomo *et al.*, 1990).

In Tanzania, *B. huillensis* is found in lowland dry forests from Dar-es salaam and Pangani to the Usambaras, south of Mafi Hill in Longuera valley and south-east Umba steppe, (Norbert, 1997). Distribution of *B. huillensis* and other major carving tree species in Kenya are shown in Figure 4.1.

Most of the natural habitats for the species in Kenya have been converted to agriculture, human settlements and urban related development projects in areas such as Nairobi, settlements adjacent to Arabuko Sokoke Forest and Shimba Hills. Until 1980, the forests around Nairobi[1] were the best remaining areas of relatively undisturbed tropical semi-deciduous *B. huillensis* community in Kenya (Kigomo *et al.*, 1990) . However, recent surveys conducted at the forests near Nairobi (Obunga and Sigu, 1996) indicate that *B. huillensis* is among the most consistently commercially exploited indigenous hardwood in these forests and it is used mainly for carving particularly the case of medium and large diameter trees above 10cm at breast height. The trees of diameter classes below 10cm and branches left after harvesting for carving are utilized for poles, fuel wood and other commercial and subsistence needs of large urban slums and surrounding rural areas. Other threats are habitat loss through urban development, encroachment by settlements, grazing land and agriculture as well as mining of building stones. Recruitment in these forest blocks is generally good, with the exception of Olulua Forest where there is little or no regeneration owing to extensive grazing) (Obunga and Sigu, 1996).

Natural regeneration is typically associated with gaps created by harvesting mature *B. huillensis* trees. The remnant population of *B. huillensis* in these forests shows a significant decline in individuals above 30cm DBH owing to selective logging and indiscriminate extraction in the recent years. Most of the existing mature trees are generally of poor forms for carving such as being excessively fluted, hollowed by heart rot or with parasites. Others are located in inaccessible areas such as slopes and valley bottoms generally considered unprofitable to extract. Presence of large stumps at various stages of decomposition is

[1] Forests near Nairobi include Karura, Ngong and Olulua . All these forests harbour *Brachylaena huillensis* although they are now threatened in each of the forests.

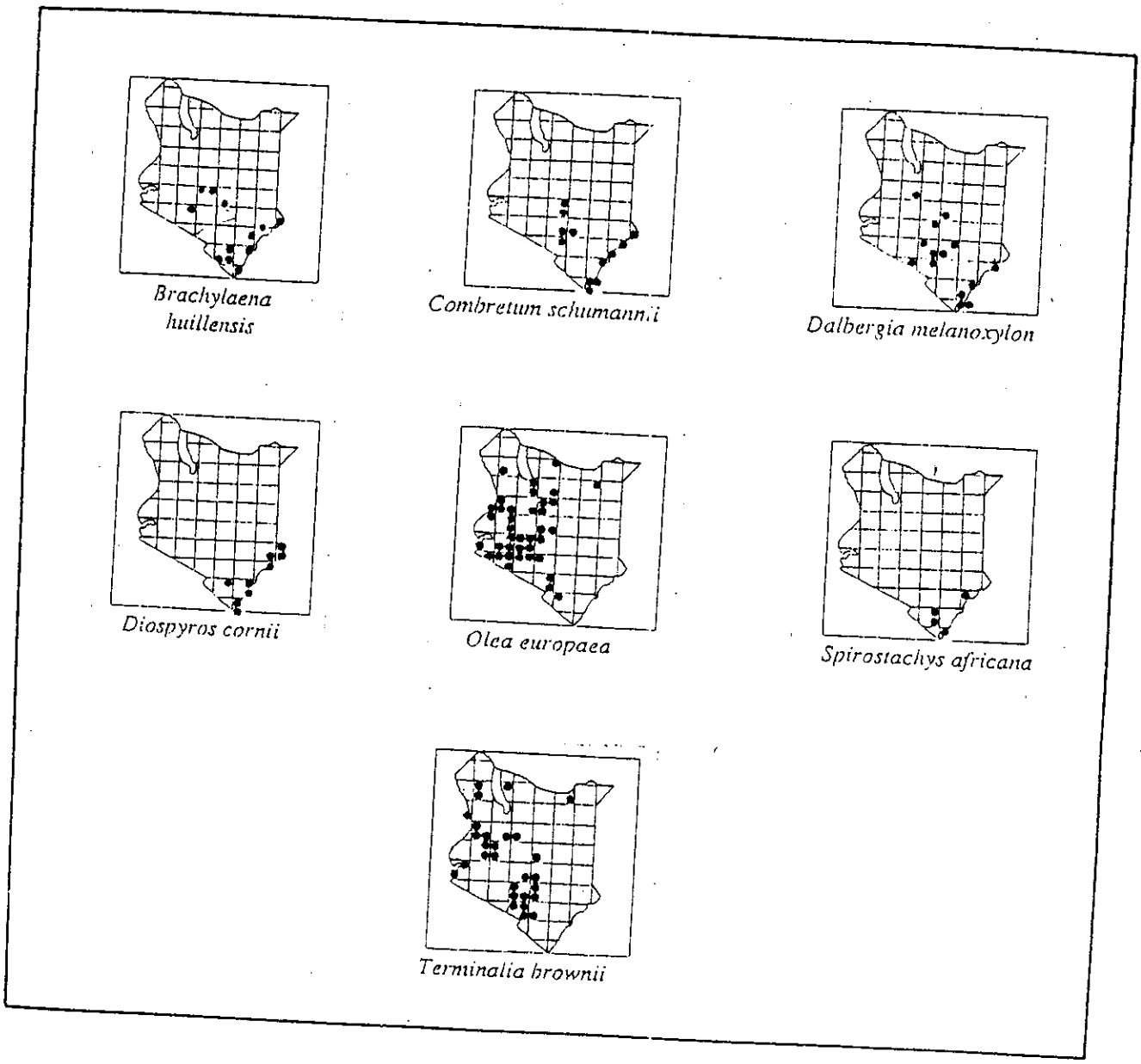



**Figure 4.1: Distribution of major woodcarving tree species in Kenya**

evidence of the past intensive selective logging of *B. huillensis* in these forests. Extensive gaps now dominated by weeds also attests to this.

The Arabuko-Sokoke Forest Reserve is the last remaining tract of lowland forests in Kenya, and covers 42 000 hectares (MENR, 1994). The rapid decline in numbers of mature *B. huillensis* through over-exploitation for carving at this forest is a most serious conservation threat. A recent inventory undertaken in Arabuko-Sokoke (KIFCON, 1991) indicates that *B. huillensis* occurs in two discrete populations within the forest. From the forest formations where the species occurs, the timber volume was estimated at 2.7$m^3$/ha in trees of sizes above 30cm DBH of which 50% is assumed to be usable for carving (KIFCON, 1991). The results also showed that an estimated 2 500$m^3$ of Brachylaena huillensis wood is in harvested from the forest per year at which rate the species may be exterminated in about 17 –25 years (KIFCON, 1991). This was confirmed by recent survey (Obunga and Sigu, 1996) of Arabuko-Sokoke Forest reserve where the current population structure of *B. huillensis* showed an extreme decline of individuals above 30cm DBH. They are sparsely distributed in the different vegetation types and there was widespread occurance of stumps greater than 9cm basal diameter as evidence of selective logging that has been sustained over the years. As a result, the issuing of permits for extraction of *B. huillensis* for fuel wood was suspended in 1990, with limited extraction for carving allowed until the mid 1990s when a complete ban was effected.

The recommended sustainable annual extractable volume is estimated at 47 $m^3$, but licenced extractors alone were actually harvesting over 400$m^3$ as estimated then (KIFCON, 1991). The cumulative volume including illegal harvesting was estimated at 2 510$m^3$ annually (KIFCON, 1991). The recruitment potential for the forest was also found to be healthy with over 2 300 seedlings/ha in most of the areas where the species occurs. Whereas populations of *B. huillensis* in Arabuko-Sokoke Forest Reserve are relatively stable, a recent survey on the impact of human use on the species carried out at Gonja, Shimba Hills and Mwaluganji Forest Reserves (Obunga and Sigu, 1996) shows that the *B. huillensis* population is declining owing to extensive human disturbance and intensive over exploitation. There is poor regeneration of these trees with few individuals below 10cm DBH and a lack of mature trees above 20cm DBH. In all the sampled plots in Mwaluganji Forest, there were no standing *B. huillensis* except for few stumps that signify past and fairly recent intensive harvesting.

Considerable damage by elephants has also been noted (Thomson and Ochieng, 1992). Given the small size of these forests and the patchy distribution of the species, there is concern that the remaining populations are threatened by the current harvesting practices for carving.

Earlier results (KIFCON, 1991) indicated less intensive illegal extraction of *B. huillensis* from the forest as compared to other forest areas where *B. huillensis* occured, probably due to a combination of the presence of elephants and protection of the forest by the Forest Department and the Kenya Wildlife Service. The estimated annual extraction from Mwaluganj Forest then stood at $225m^3$.

Forests around Mt. Kenya constitute one of the main current sources of *B. huillensis* alongside other commercial tree species such as Macaranga *(Macaranga capensis)*, Podo (*Podocarpus latifolius*), Camphor (*Ocotea usambarensis*) and others. In effect, Mt. Kenya is the largest single source of commercial indigenous timber in Kenya (Wass, 1995). It covers an area of 2 000 $km^2$. However, these forests have been over-exploited in the recent times leading to a Presidential ban in 1986 and total closure effective from 1987. Nevertheless illegal extraction of these valuable species is widespread. *Brachylaena huillensis* mainly occurs in the closed canopy forest within Mt. Kenya Forest, which covers about 31% of the vegetation types represented in the forest.

A recent vegetation survey (KIFCON, 1991) indicated that $0.5m^3$/ha of *B. huillensis* exist in the closed canopy forest and $0.25m^3$/ha in the areas covered by other forest associations respectively within Mt. Kenya Forest. Because of the rising preferential demand and off-take of *B. huillensis* from most of its natural habitats, concerns have been raised (Obunga and Sigu, 1996) that in order to attain sustainability, total control against further exploitation should be advocated while experimentation with alternative species more abundant and faster growing continue.

### 4.3.4 Phenology and germination

*Brachylaena huillensis* is a dioecious tree pollinated by insects. The male and female flowers occur in small white cylindrical panicles. The flowering period tends to follow the rainy seasons with rainfall quantity determining whether the tree will flower or abort the young developed flower buds (Albrecht, 1993).

In Kenya, the species produces flowers and seeds twice a year, between mid April-June and November-January (Albrecht, 1993; Kigomo, 1989). The massive and frequent flowering enhances the possibility of successful pollination and the likelihood of viable seeds. Seed viability is generally low even immediately after flowering, and it appears to decline rapidly thereafter, being completely lost after six months of storage at room temperature.

Development time of fruits is usually short and it is therefore necessary to conduct pre-collection surveys before harvesting seed. When fully mature, all the seeds are shed in a very short time, especially during heavy rains or strong winds. Shaking the tree branches with hooks is a common method used to collect seeds. The best time for collection is early in the morning when the seeds are still heavy with dew. Collection needs to be done early in the seeding season as seeds collected at the end of the seeding season are usually of poor quality.

The flowers and seeds of *Brachylaena huillensis* are subject to heavy pre-dispersal predation by insects. Dehydration and direct radiation also reduce viability such that only about 10-20% of the seeds are viable at the time of dispersal (Kigomo, 1989). There is no need for seed extraction, but debris should be removed from collected seeds and they should be dried under shade as well as protected from wind. Pre-sowing pre-treatment of seeds is not necessary. However, it is recommended to mix the seeds with moist sand before sowing in order to limit the seed dispersal by wind after sowing.

Under ideal conditions, the seeds germinate within 7-10 days with very low germination of 2-10%. Results of comprehensive studies of germination and establishment carried out by Kigomo (1989) at Ngong and Karura forests in Kenya showed that *Brachylaena huillensis* is extremely sensitive to the amount and timing of moisture availability. Generally, seedling germination is enhanced under conditions with little or no forest floor litter. However where there is substantial forest floor litter, unusually high amounts of rainfall are needed for successful germination. Further observations showed that the germinated seedlings need an initial continuous supply of moisture for a year or more in order to allow full root development In practice, such conditions are often difficult to find, particularly in the ecological ranges where *B. huillensis* naturally occurs. Natural regeneration often occurs under the female parent trees after seed dispersal mechanism have taken place.

Willan (1963) and Borota (1967) reported even lower stem increment growth rates of young plantations, ranging from 0.04cm-0.23cm over seven years., with the DBH of an average tree measuring 40cm at the age of 175 years. Willan (1963) estimated rotational age of 160 years needed to achieve an average tree of 75cm DBH.

To be able to direct management in order to balance its exploitation and conservation, further studies on reproduction and actual growth dynamics are recommended. Emphasis must be placed on silvilcultural management strategies that may lead to shorter rotation of the tree crop through tree husbandry practices such as weeding, stem singling out, fertilization by inorganic fertilizers, pruning, optimum spacing, use of mycorrhizae and rhizobial associations to enhance growth, use of growth hormones and proper provenance-site matching.

## 4.4 *Olea europaea* sub species *africana*

### 4.4.1 Introduction

*Olea europaea* is widely distributed in Kenya and is one of the most popular carving species in the country at present (see chapter 7). The species is commonly found in evergreen woodlands, woody grasslands and drier upland rain forests where it is associated with *Juniperus procera* as a co-dominant, and also found on lava flows (Dale and Greenway, 1961; Beentje, 1994). It occurs at an altitude between 1 300-3 150m above seas level in areas that have an annual rainfall between 600-2 000mm and mean annual temperatures between 15-26 degrees (°C). It grows best on well drained soils especially sandy loams (Albrecht, 1993).

### 4.4.2 Utilization

*Olea europaea* yields superlative firewood and very large quantities were used in Kenya for railway fuel at the turn of the century. The golden to pale brown wood with characteristic dark figuring is very hard, strong, durable and heavy. *Olea europaea* wood is recommended as timber for fine furniture, cabinet work, flooring, tool handles, construction poles, posts and wood carving. The wood is planed and polished to a beautiful finish. Other parts of the species finds a use as medicine (stem, bark and roots), food (fruit) and bee forage (Albretch, 1993). Round poles are extremely durable in the ground, hence they are suitable for building.

*Olea europaea* has gained prominence in the wood carving industry in recent decades following severe decline of *B. huillensis* and *D. melanoxylon*. The Kamba carvers have therefore moved closer to the source areas of *O. europaea*, and the location of Makindu and Nanyuki carving centres is largely attributed to the availability of the species from Kibwezi forest and Mt. Kenya Forests respectively. Substantial quantities of *O. europaea* are found at Mt. Kenya Forest and a recent survey (KIFCON, 1991) estimated a volume of $7.5m^3$/ha in the closed canopy forest areas where the species occurs.

The wide distribution and availability of *O. europaea* for carving still offers a chance for woodcarvers to make a living through it's utilization. However, the wood has to be obtained from long distances at increased costs or alternatively,carvers may have to keep shifting their carving bases to areas close to these resources. Kibwezi forest and Chyulu Hills are the closest sources of *Olea europaea* to the Kamba carving community. These forests are sorrounded by a marginal environment that is characterised by low rainfall. Thus these areas have low agricultural productivity and offer low incomes for alternative livelihoods. These forests therefore form important sources of a range of resources that support many economic activities in the region.

The greatest threats to *O. europaea* populations are intensive competitive extraction for charcoal burning and carving. Owing to this competition, local depletion of the species from the accessible areas has occurred, and carvers at Makindu have to undertake extended camping expeditions for several weeks, returning with semi-finished carvings. The indiscriminate harvesting of the large trees and the rising human disturbance associated with harvesting activities has contributed to the overall poor recruitment potential as evidenced in a recent survey at the two forests (Obunga and Sigu, 1996).

## 4.5 *Combretum schumannii.*

### 4.5.1 Introduction

*Combretum schumannii* occurs over a wide range of habitats from wet to dry forests to wooded grasslands and dense bushland (Beentje, 1994). In Kenya *C. schumannii* is found along the coastal districts as well as interior districts such as Machakos and Makueni (Dale

and Greenway, 1961). *Combretum schumannii* is characterised by white and narrow sapwood with a dark purble brown to black heartwood. It is straight grained, medium textured and hard, but it turns and takes polish well (Dale and Greenway, 1961). Despite the restricted distribution, the species is rapidly gaining prominence as a natural substitute for *D. melanoxylon* owing tothe dark heartwood and durability. On this basis it is locally referred to as 'ebony number 2' (Beentje, 1994).

### 4.5.2 Utilization

The scarcity and preference for *D. melanoxylon* has led to the widespread treatment of other woods to darken them such that to undiscerning eyes, carved items pass as true ebony. The use of *C. schumannii* for carving is common in Mombasa and Makindu carving centres where there is a marked shortage of carving raw materials and its use has continued to rise in the recent past. Currently, *C. schumannii* is found in relative abundance in Shimba Hills, Mkongani, Mrima Hill and Dzombo Forest Reserves (KIFCON, 1991) as well as Kibwezi and Chyulu Hills Forest Reserves (Obunga and Sigu, 1996). The increasing use of this species for carving, charcoal burning and other competitive uses has far reaching implications on existing natural populations unless urgent mitigation measures are put in place in good time.

## 4.6 *Azadirachta indica* A. Juss

### 4.6.1 Introduction

*Azadirachta indica* (neem) is a native of dry forests of India, Pakistan, Sri-lanka, Malaysia, Indonesia, Thailand and Myanmar (Tewari, 1992). It is grown around settlements, along roadsides and parks and is fast becoming the main alternative carving species in Kenya owing to abundance along the Kenyan coast and relative ease with which the wood is sourced by the carvers. The leaves and seeds of *A. indica* contain chemicals that have insecticidal effects, and with increasing interest in the production of pesticides from *A. indica*, plantations are being established throughout the world on a steadily rising scale (Tewari, 1992). In India where cultivation and utilization of *A. indica* has a long tradition, practically every part of the plant is used to extract the active ingredient.

### 4.6.2 Ecology

*Azadirachta indica* is a sturdy tree and can thrive over a wide climatic range with the exception that it is very susceptible to frost (Albrecht, 1993; Tewari, 1992). This species has a wide range of tolerance to environmental factors and is drought resistant (Albrecht, 1993). It strives in areas with sub-arid to sub-humid conditions with a mean annual rainfall between 400-1 200mm. It may occur in drier regions of less than 400mm mean annual rainfall where it's growth depends largely on the ground water availability (Schmutterer, 1995).

According to Albrecht (1993), it can grow with as little as 150mm annual rainfall. However, the optimum in Kenya is between 450-750mm at altitudes from sea level to 1 400m. Higher altitudes above 1 000m are less favourable to the species growth as fruit production is low. However, single trees have successfully been planted at altitudes up to 1 830m in India (Schmutterer, 1995). *Azadirachta indica* trees also exist in regions with up to 2 500mm annual rainfall provided the soil on which they grow is well drained.

*A.zadirachta indica* can grow in many different types of soil but it seems to grow best on well-drained deep sandy soils. Examples include soils with high clay content in Nigeria, lateritic soils in Benin, calcareous soils in the Caribbean (Haiti), saline or alkaline soils in Dominican Republic, Somalia and Saudi Arabia ( Fishwick, 1990, Radwiski, 1977). A soil pH value of between 6.2 and 7.0 seems to be most favuorable for *A. indica* but pH values of 5.9 and 10 may be tolerated under certain circumstances (Radwiski, 1977). The extensive roots of *A. indica* have the ability to extract nutrients and moisture from even highly leached sandy soils (Tewari, 1992).

*Azadirachta indica* can tolerate a very wide temperature range with maxima up to 50°C (north east and central Africa) and as low as 4°C. It is drought hardy and can withstand drought better than excessive moisture (Tewari, 1992). The tree can occasionally withstand temperature near or below 0 °C (northern Pakistan), especially during the seedling and sapling stages. The optimum mean annual temperatures are 21°C to 32°C.

*Azadirachta indica* requires high light intensity and needs sufficient space for growth and broad crown development (Tewari, 1992). It tolerates fairly heavy shade during early stages of growth, but this does retard growth of seedlings.

The species does not form pure stands under natural conditions. In Africa, it is associated with *Albizia amaru, Albizia lebbek* and *Tamarindus indica* in dry evergreen tropical forest. In dry deciduous forests and savannas, *A. indica* is associated with *Anogeissus latifolia Bosewellia serrata Tectonia grandis*, , and *Terminalia tomentosa*. In tropical thorn forests, neem grows with *Acacia nilotica, Acacia latifolia, Albizia amara, Bauhinia racemos, Capparis sp* and *Ziziphus sp*. It may also be associated in dry areas with *Acacia senegal, Balanites aegyptiaca, Leucaena leucocephala*, and other species, and under certain local conditions such as high precipitation. abundant birds, fruit bats and goats, neem may become invasive.(Schumuterer, 1995).

In Kenya, *A. indica* is planted principally in the drylands around Kibwezi and Voi and in coastal areas such as Gede, Kwale and Malindi. *Azadirachta indica* is therefore one of the best choices to improve the productivity of semi-arid lands or bare fallow farmlands which are either not put to any use or produce low economic returns.

### 4.6.3 Phenology and growth

*Azadirachta indica* is virtually evergreen and probably one of the only green trees around in desert areas (Tewari, 1992). In Kenya, flowering and seeding periods depend on the seed origin (provenance or region where it grows). Around Kibwezi, *A. indica* flowers from October-November whereas in other areas, it flowers from December (Albrecht, 1993). The tree starts fruiting at the age of five years but economic yield of fruits is at the age of 10-12 years. Fruit development takes about 6 months to mature from the onset of flowering. Usually after seed collection, fruit should be depulped and cleaned immediately to prevent rotting. Fruit may be sown fresh without necessarily undergoing any seed pre-treatment. Depulping and cleaning of seed improves the germination rate considerably (Tewari, 1992)

Seed can be stored for 4-6 weeks in well-ventilated containers at room temperature. However, the seed does not retain its viability for more than a few months. After sowing, seed germination has been observed to show a wide variation from 9-55 days depending on temperature and moisture (Albrecht, 1993; Tewari, 1992). Seedlings in the nursery bed can be transferred to individual tubes (pricked) at sizes of about 5cm (Tewari, 1992).and properly sheltered. They are ready for out planting when they are above 30 cm height and this needs to be done during the rainy season for early seedling establishment. *Azadirachta indica* can also

be propagated by use of wildings, through coppicing, direct sowing of seeds or through vegetative cuttings

### 4.6.4 Growth Statistics and Management

*Azadirachta indica* is a fast growing, small to medium sized tree. The rate of growth of *A. indica* varies depending on the quality of soil, rainfall and access to groundwater. In India, growth is usually rapid up to 5 years and then slows down thereafter (Tewari, 1992).

According to Radwiski (1977), 66% of the total growth of *A. indica* trees in northern Nigeria takes place during the first three years after which it reaches a height of 4 -7m. It and increases to 5-11m over the next 5 years. In Cameroon, 30 years-old trees reached a basal diameter of more than one metre. Very old trees on suitable locations can be 30-35m tall with a basal diameter of 2.5-3.5m. In Nicaragua, *A. indica* grown in plantations had a mean height of 7.7-9.6m and basal diameter of 0.54-0.76m at 8 years of age (Radwiski, 1977). In Dominican Republic, *A. indica* trees grew to a height of 6-7m within 2½ years in an area with low rainfall and on soil with high salinity (Radwiski, 1977). Trees planted in Cuba in 1964 attained a height of 14.2 m and diameter of 27 cm in 8 years (BetanCourt, 1978).

# CHAPTER FIVE

# THE STUDY AREAS

## 5.1 Introduction

Although woodcarving is practised widely in Kenya as a commercial pursuit, the industry is dominated by the Kamba tribe and essentially confined to the Coast, Central Kenya (Nairobi, Nyeri Districts) and the semi-arid areas of Machakos, Kitui, Mwingi and Makueni Districts (Marshall and Jenkins, 1994). The description of the study areas provided within this chapter is centred around information that is likely to have an effect on the access, control, availability and utilization of the carving raw materials. Relevant biophysical characteristics include those that touch on the productivity, ecological requirements and availability of the various core carving tree species as supplementary information to that which has already been given. In addition, the social characteristics of the areas that are presented are those which in one way or the other, compete for the access and utilization and control of the carving raw materials as well as comparative incomes which accrue from such competing uses. Although native communities in Central Kenya and at the Coast are not carvers, they act as resource facilitators and their contribution to the dynamics of the carving industry, directly or indirectly is significant.

## 5.2 Biophysical characteristics

### 5.2.1 Locality

The study area comprises all of districts which border the Indian Ocean (Lamu, Kilifi, Mombasa, Kwale) and the adjacent districts where woodcarving forms one of the important economic activities undertaken by rural and urban communities. Areas in the interior include Kitui, Makueni, Machakos, Nairobi and Nyeri. These districts are highlighted in Figure 5.1.

### 5.2.2 Topography, Geology and Soils

The study area by virtue of its large size cuts across a wide range of contrasting topographical features, vegetation types, soils, climate and human settlements. Generally, the land rises from sea level in a series of plateaux steps to the highest point in Kenya, Mount Kenya, which

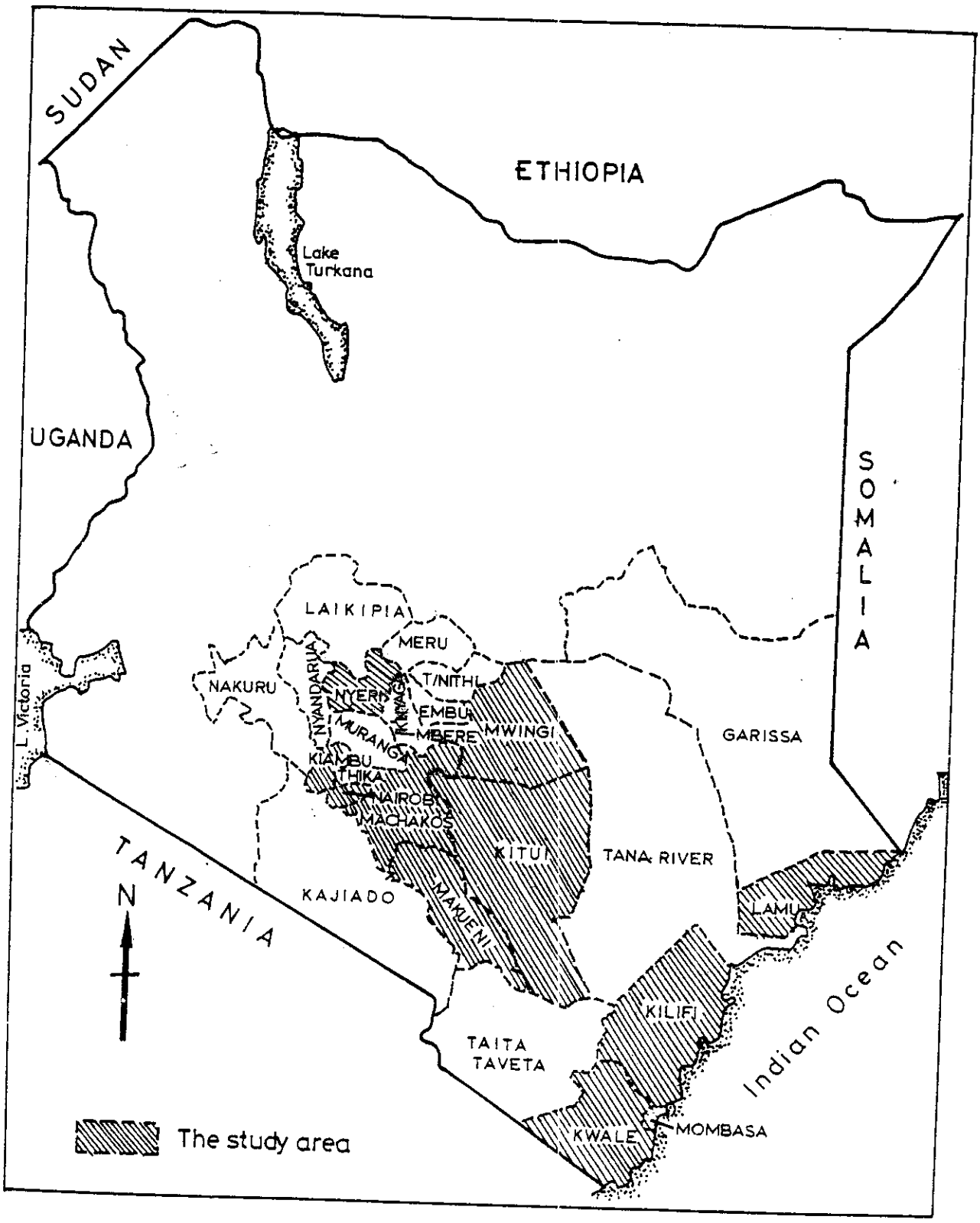
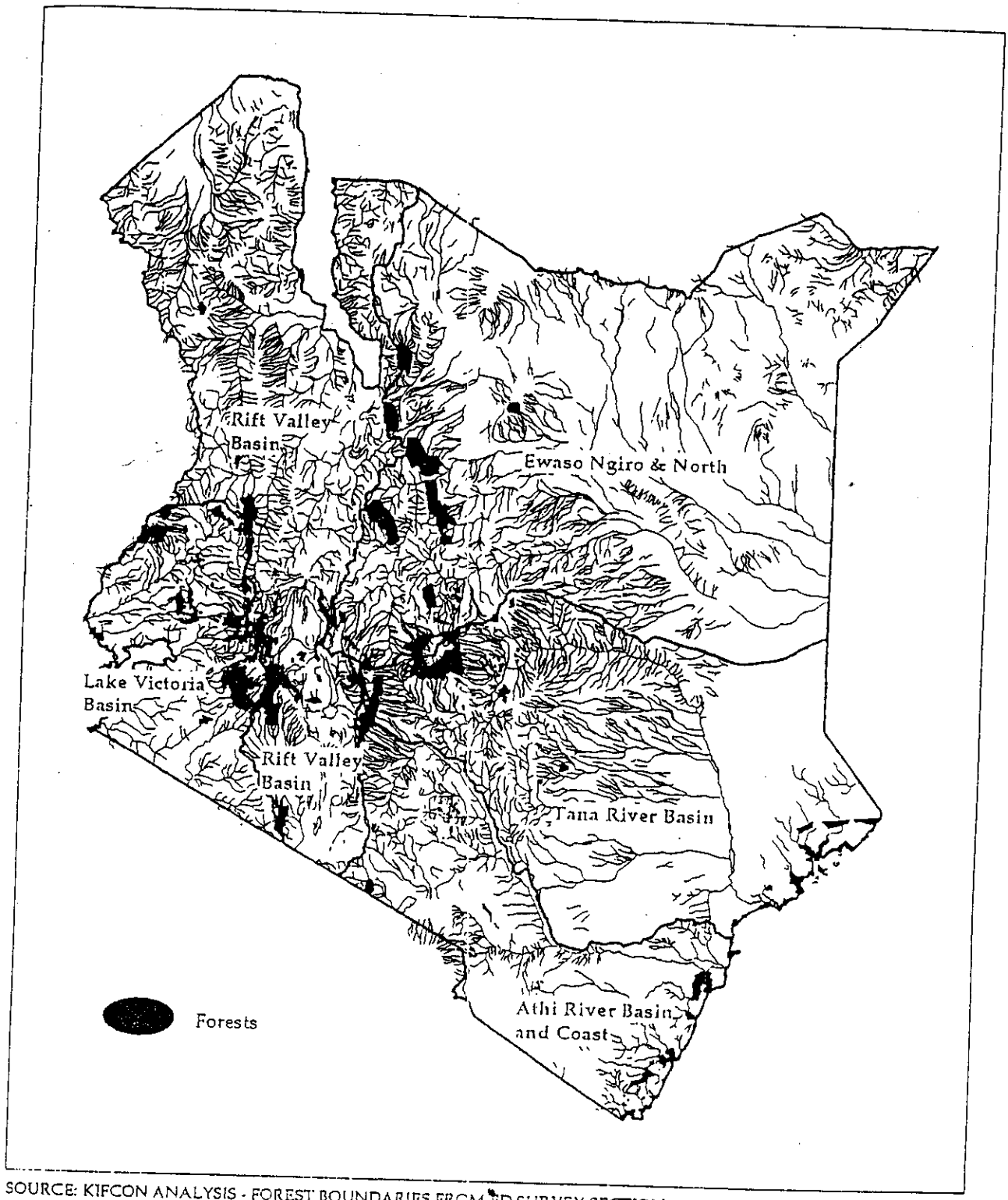



Figure 5.1 The study areas

reaches an altitude of 5 200m. The general altitude of the central highlands around Mt. Kenya ranges from 1 500m to 2 500m, with three major land masses rising above the plateaux: Mt. Kenya, the Abardare Range and the Kikuyu Escarpment. Similar elevated features, in many cases remnants of higher eroded surfaces, are found between the central highlands and the coast. This relatively simple land form has dictated the present drainage system with all major rivers flowing radially from the elevated interior. These include rivers Tana, Athi, Ewaso Ngiro, Sabaki and others, which form the main drainage basins in Kenya (Figure 5.2). Mt. Kenya forms the main source of these rivers, and therefore activities which destroy vegetation within this catchment affects the rest of the country. Other important forests and their importance in maintaining river flows in Kenya are shown in Figure 5.2. These rivers generally flow through the dry areas and the water is used for domestic, agricultural, energy and industrial purposes. The raised land forms are also associated with low temperatures owing to the high altitudes, and to high rainfall. The majority of forests and major vegetation formations are usually concentrated in the mountains. Indeed in Kenya, 70% of forests occur in mountains, hilly or footslope areas (Wass, 1995). The central highlands around Mt. Kenya, Chyulu Hills, Shimba Hills and others are presently some of the main sources of prime carving wood.

For the region around the central highlands, the economic potential is greatly influenced by the existing topographical features and rock formations. For example, soils have been well developed on higher altitudes where lava out pourings was common and poorly developed at low altitudes where lava flows are absent. According to KIFCON (1994), there are three broad categories of soils of the mountain depending on the altitude, ranging from below 2 400m, between 2 400-4 000m and above 4 000m. Although soils above 2400m are rich in organic matter and generally fertile, low temperatures is the limiting factor to their agricultural uses and they are now mainly used as National Parks. Below 2 400m dark reddish clay soils occur, which are well drained, deep, loamy and very fertile. Major forest formations and economic activities are found on this zone, and *Brachylaena huillensis* and *Olea europea* sub sp *africana* are found.

The greater part of Machakos, Kitui, Mwingi and the central part of Makueni districts consist of a basement complex of metamorphosed sedimentary rocks with some granite and basic igneous. Areas of high elevation have well developed and fertile soils characterized by




SOURCE: KIFCON ANALYSIS - FOREST BOUNDARIES FROM FD SURVEY SECTION
DRAINAGE BASIN BOUNDARIES FROM JICA / WATER MASTER PLAN

Figure 3.2: Drainage basins in Kenya

granitic and volcanic rocks and black cotton soils. These are the regions where *Olea europea* sub sp. *africana* and *Combretum schumanii* naturally occurs. Lowlands are characterized by red clay soils and sandy soils where *Dalbergia melanoxylon* is found.

Most districts at the Kenyan Coast, particularly those which border the ocean have four common topographical features with marked geological, soil and rainfall characteristics which dictate the resource use potential and land use patterns. These are the coastal plains (altitude below 60m) the foot plateau (60 - 135m altitude), coastal uplands range (150 - 420m) and Nyika Plateau (300 - 180m). The Arabuko Sokoke Forest Reserve and Shimba Hills are traditional sources of prime carving wood (*Brachylaena huillensis, Cobretum schumannii. Spirostachys africana*) to the carvers along the Coast and deserve a special mention here. The Eastern part of Arabuko Sokoke Forest Reserve lies on a flat coastal plain at an altitude of about 45m, comprising deep loose white sands with the remainder s on the foot plateau with red loam sands derived from tertiary sediments on higher ground (KIFCON, 1991; Mogaka, 1992). Shimba Hills rises upruptly from the coastal plain to form a plateau at an altitudes of 150 - 450m. Part of the reserve is composed of upper Duruma Sandstones covered with Magarini Sands while the rest is composed of Shimba Grit and Mazeras Sandstone (Davies, 1993). In general, most of these soils are of marginal quality for agriculture or plantation forestry (Thomson and Ochieng, 1992).

The Coastal Plains also have unique features that are a tourist attraction. These include attractive creeks, marine estuaries, estuarine swamps with mangrove forests and sandy beaches. In general, the Coastal Range has high rainfall and deep permeable soils. Hence, this area supports farming and tree growing activities in the region.

### 5.2.3 Climate

The contrasting topographical features of the entire study areas is associated with contrasting climatic conditions across the study area (Figure 5.3). The central highlands experiences an equatorial type of climate and gets rainfall throughout the year, particularly the high plateaus at altitudes of over 1 500m, where rainfall is typically between 1 500mm to 2 300mm during the main rain seasons.(March to June). These are represented by the humid to semi-humid zones in Figure 5.3, particularly areas around Mt. Kenya with highest altitudes. The low lying areas within the central highlands generally receive a bi-modal pattern with some rain

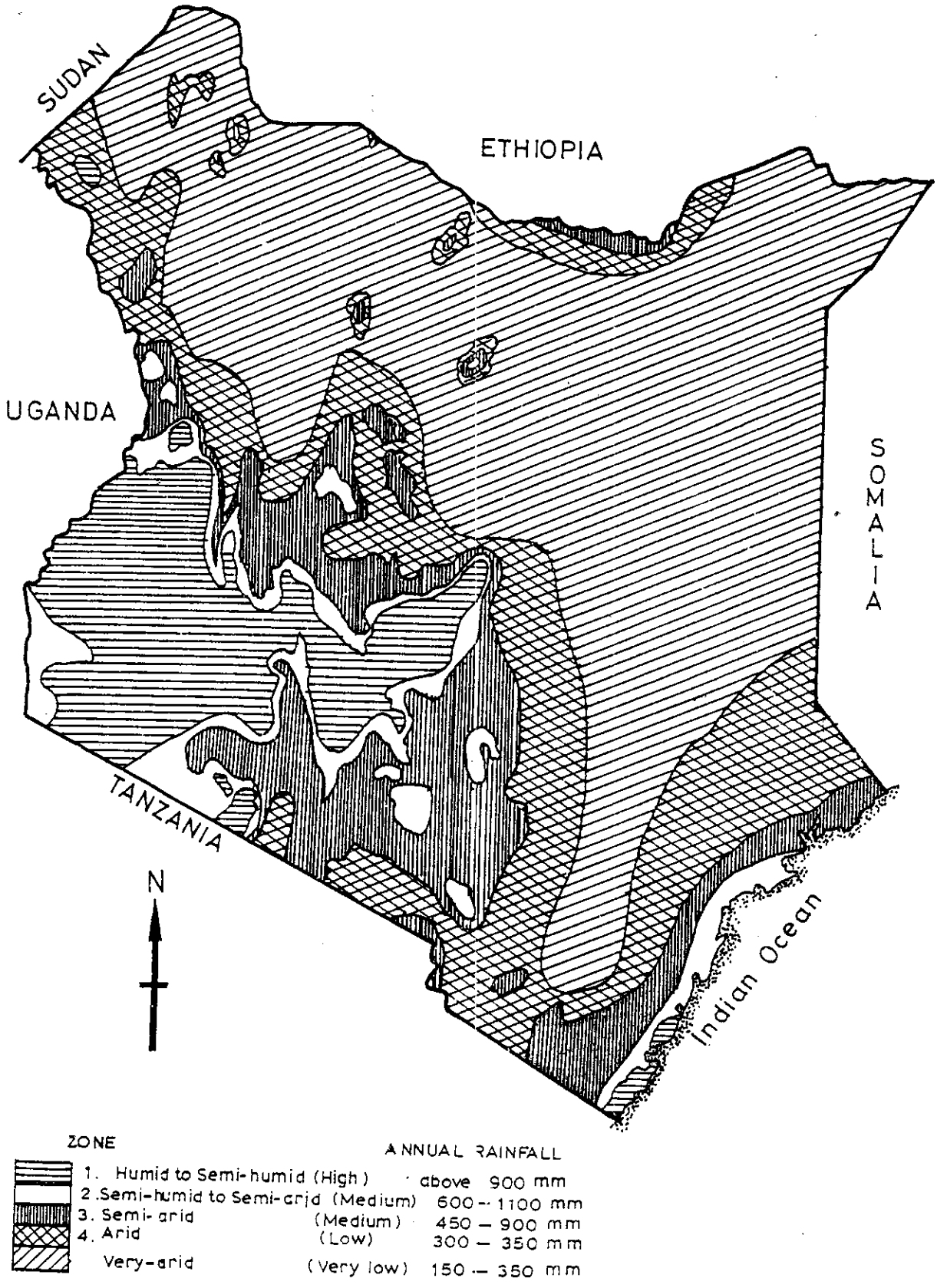



Figure 5.3: Agro-climatic zones of Kenya

falling in October to December. The total amount of precipitation decreases fairly regularly towards the top of the mountains and the lowlands.

Temperatures are generally inversely related to aspect and altitude, with the mean annual temperature being less than 13°C on the higher ground. Tables 5.1 and 5.2 show the mean monthly rainfall and mean monthly temperatures respectively, for selected locations within the study area.

**Table 5.1 Mean monthly rainfall of selected areas**

| 1 | Jan 1 | Feb 2 | Mar 3 | Apr 4 | May 5 | Jun 6 | Jul 7 | Aug 8 | Sept 9 | Oct 10 | Nov 11 | Dec 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nyeri | 45 | 40.8 | 106.9 | 230 | 207 | 34.3 | 36.3 | 37.0 | 34.1 | 109 | 149 | 117.2 |
| Machakos | 33 | 23.9 | 84.9 | 196 | 63 | 17.5 | 2.8 | 4.1 | 6.7 | 68 | 183 | 98.4 |
| Kitui | 34.7 | 34.9 | 91.8 | 155 | 45 | 3.4 | 1.7 | 2.3 | 4.1 | 47.4 | 247.5 | 114.1 |
| Makueni | 62 | 22 | 85 | 136.9 | 27 | 1.9 | 0.7 | 5.8 | 1 | 33.4 | 183.5 | 150.2 |
| Kilifi | 24 | 17.3 | 46 | 91.5 | 171.6 | 78.6 | 53 | 46.3 | 55.8 | 71.3 | 93.8 | 50 |
| Mombasa | 16 | 11 | 75 | 138 | 218 | 107 | 74 | 58 | 39 | 96 | 93 | 96.5 |
| Kwale | 61 | 51 | 104 | 110.4 | 139 | 76.8 | 65.6 | 64 | 34.6 | 59 | 68.4 | 82.6 |

**Table 5.2 Mean monthly temperature (degrees centigrade) of selected areas**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Machakos | 21.2 | 22 | 23.3 | 21.1 | 19.9 | 18.9 | 18.3 | 19.5 | 19.5 | 21 | 20.1 | 19.3 |
| Makueni | 24.6 | 25.8 | 25.8 | 24.4 | 23.9 | 22.2 | 21.5 | 21 | 21 | 23.9 | 23 | 22.7 |
| Mombasa | 23.3 | 23.4 | 24 | 23.6 | 22.1 | 21.2 | 20 | 20.2 | 20.7 | 21.7 | 22.8 | 23.4 |

Most of Machakos, Kitui, Mwingi and Makueni districts receive low rainfall. The climate is classified as hot and dry for most of the year, and regarded as arid and semi-arid with high temperatures, unreliable rainfall and high rates of evaporation. These are represented by semi-arid and arid zones in Figure 5.3. Historical data indicates that in four out of ten years, major droughts occur in the region usually resulting in devastating effects on crops, livestock and

people (Kaudia, 1996). On an average year, there are two rainy seasons with "long rains" from March to June and "short rains" in November and December.

Total annual rainfall ranges from slightly over 1 000mm in some of the highlands to less than 500mm in the low lying range lands which represent over 60% of the land area. Mean temperature patterns are closely linked to altitude. The highest mean temperatures are recorded in the eastern parts of Kitui and vary from 26°C to 34 °C and the minimum mean figures from 14 °C to 18 °C (GOK, 1998).

The coastal region has a monsoon type of climate which is hot and dry from December - May. The hottest months are December - February while the coolest months are June - August. The mean minimum temperature recorded rarely fall below 25°C at Mombasa but varies slightly within the coastal districts (KIFCON, 1995). Tourism has benefited from this type of climate as the coastal sunshine is a major attraction.

The region has a bi modal pattern of rainfall with its "long rains" during March - June and "short rains" in November - December. The amount of rainfall in the long rains decreases from a strip of about 10km wide from the coastline into the hinterland at a rate of about 100mm per 5km from over 1 200mm at the coastal bent /strip to 400mm in the hinterland (GOK and UNICEF, 1990) (Figure 5.3). The coastal belt falls under semi-humid to semi-arid with pockets of humid areas.

### 5.2.4 Broad scale vegetation distribution of Kenya

#### 5.2.4.1 General description

Using the broad vegetation classification and mapping units defined by White (1983) for the UNESCO Vegetation Atlas of Africa, four broad categories of natural wooded vegetation cover can be identified.in the study area. The central highlands, particularly Mt. Kenya forest, the Abardare ranges, Kikuyu escarpment, Arabuko Sokoke Forest Reserve among others are classified as forests, as they are characterized by a continuous stand of trees at least ten metres tall and with their canopies interlocking.(Figure 5.4). These forests constitute the main sources of *Brachylaena huillensis* and *Olea europaea* sub sp. *africana* as well as a range of other species now gaining popularity in the carving industry which occur in the closed

canopy forests. Pockets of gazetted natural forests and forested trust lands occuring in different parts of Machakos, Kitui, Mwingi, Taita Taveta, Lamu and Kilifi districts of the study area may at best be classified as woodlands and at worst as bushland, since they are characterized by open stands of trees at least 8m tall, with a canopy cover of 40% or more. As shown in Figure 5.4, most of these Districts are classified as bushland and woodlands with some areas being under wooded and bushed grasslands.

*Olea europaea* sub sp *africana*, *Combretum schumannii*, *Commiphora baluensis*, *Terminalia spp.*.may be sourced in these zones at appropriate ecological ranges in the entire study area(s). These are areas covered with grasses and other herbs with woody plants covering between 10% and 40% of the ground. These are also the main areas where *Dalbergia melanoxylon* is sourced, usually on private lands mainly in Kitui, Mwingi and some parts of Makueni Districts.

The most recent assessment of the vegetation cover of Kenya was carried out for the Water Master Plan (JICA, 1992). However, the classification is similar to that used by White (1983) with a few modifications. .

**5.2.4.2 Description of vegetation of selected Forest reserves**

As a basis for sound management and sustainable utilization of the prime carving species in Kenya, it is necessary to use vegetation descriptions that provide more detail than is provided by White (1983) and Water Master Plan (JICA, 1992), particularly for the Mt. Kenya Forest, Arabuko Sokoke and Shimba Hills where the bulk of wood carving timber have been sourced for many decades to date. Major forest reserves in Kenya are shown in Figure 5.5 and relevant forests to this study include Mt. Kenya, Arabuko Sokoke, Shimba Hills, Boni, Lungi and several pockets of forests within Kitui and Machakos Districts such as Mumoni, Gaikuyu,Nuu, Mutito, Endau amongst others. These forests form the main sources of carving wood, although major species for carving within these forests are widely depleted.

Description of Mt. Kenya forest has been made by several authors and several vegetation maps have been published. KIFCON (1994) identified three forest zones within the Mt. Kenya Forest depending on altitude; the sub-alpine zone occuring mainly between 2 800m - 3 400m

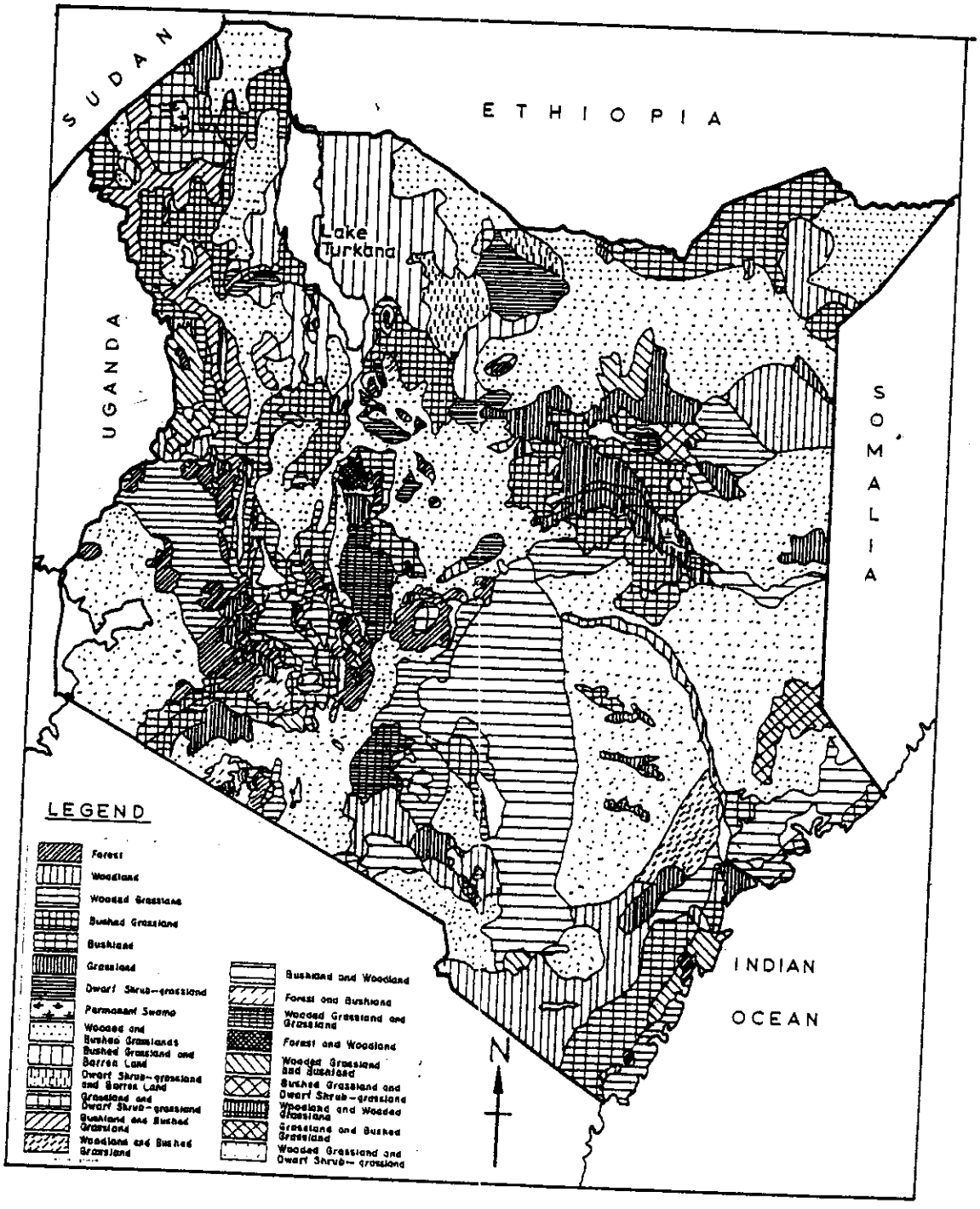



Figure 5.4: Vegetation of Kenya


Figure 5.5 Forest reserves in Kenya

altitude and characterized by *Hagenia abyssinica* and *Hypericum revoltum*; the montain forest found mainly between 2 400 - 2 900m which includes extensive stands of bamboo; and the sub-montaine forest below 2 400m and characterized by the occurance of *Macaraga capensis*, *Ocotea usambarensis, Neoboutonia macrocalyx* and other species including *Brachylaena huillensis* and *Olea europaea* sub sp *africana*. More detailed descriptions are given by Trapnell and Brunt (1987) and Beentje (1990) where seven forest types are distinguished, two of which are relevant to woodcarving. These are *Croton - Brachylaena - Calodendrum* forest at altitudes of 1 450 to 1 850m with rainfall of 750 - 950mm which occurs on the south-western slopes of Mt. Kenya. The other is the *Juniperus - Olea* forest formation which occurs on the Western and North Western slopes at altitudes of 1 800 -2 300m and rainfall of about 1 300 - 1 450mm.

Shimba Hills and the adjoining forests have been the subjects of many ecological and vegetation surveys in 1960s and 1970s (KIFCON, 1994). It has also been described by KIFCON (1994) and found to have a wide range of habitats, including four forest types (*Milicia, Afzelia, Paramacrolobium* and *Manilkara - Combretum*); two woodlands formations (*Combretum* and *Brachylaena)* and two kinds of thickets (*Cassipourea* and *Cynometra*), which make it one of the richest areas of plant species in the coastal zone. Of relevance to the study are the *Manilkara - Combretum* forest type and *Combretum* and *Brachylaena* woodland formation which have been the main sources of carving wood.

The Arabuko Sokoke forest is the largest remaining single block of closed forest reserve supporting indigenous hardwoods along Kenya's coast. The forest supports a dense evergreen and deciduous tropical vegetation composed of average size hardwood species forming storeys of closed canopies in some areas. Some large and fairly tall trees may be found along the Coastal Belt reducing in height to the inland.

There have been many descriptions and classifications of the vegetation of the East African Coast and Arabuko Sokoke (KIFCON, 1994). These include Dale (1939), Moomaw (1960), Beentje (1990), Hawthorne (1993) and more recently by Robertson and Luke (1993). According to Beentje (1990), three forest types characterize Arabuko Sokoke Forest which include *Afzelia - Hymenacea* Forest, *Brachylaena - Cynometra* Forest and *Brachystegia* woodland. Of relevance to the study is the *Brachylaena - Cynometra* Forest now dominated

by *Cynometra. Brachylaena* is not common because of past and present exploitation by the carving industry, and constitutes 3% of the growing stock (Beentje, 1990).

### 5.3 Socio-economic characteristics

To a large extent, Kenya's forest resources are found in areas of high agricultural potential where the human population explosion is generating an ever increasing demand for wood products and land for agriculture (Figure 5.6). For example, most forest areas and national parks as shown in Figure 5.6 are sorrounded by settlement schemes. Although the critical role played by forests in water catchment protection, prevention of soil erosion, floods, siltation of dams, and conservation of germplasm of flora and fauna is well known, the pressure on the forests continues to accumulate.

The Central Highlands for example, which experience an equatorial climate, sustain a high agricultural potential in the form of cash crops such as coffee, tea and other subsistence crops such as maize as well as supporting livestock. Most of the people living at the Central Highlands therefore make a living through intensive agriculture, and much of the potential forest area has been cleared and converted for agricultural use. A recent survey on household economy around Mt. Kenya forest (KIFCON, 1994) show that the average farm size for most households is 13 hectares and poor households use the forest intensively in order to supply most basic products. Forest plantations of exotic species have also been established in more productive areas and as a result, the prime carving species including commercial native tree species have suffered owing to the loss of habitat.

The picture is even more serious in the arid and semi-arid districts covered in the study. The fragile ecology and harsh environmental conditions which prevail in most areas cause severe limitations to intensive and meaningful land use and other related development activities, as many inhabitants are unable to plan their farming activities well. Rain-fed crop farming under existing technological conditions may not expand more than marginally and will remain low until innovative dry land farming systems are introduced. However, livestock rearing is the predominant land use. Overall, livestock incomes are more important than crop incomes in most areas. As shown in Figure 5.6, most of Kitui, Machakos and Mwingi Districts are still trust land where land resources are shared under communal systems. Similarly, areas near the

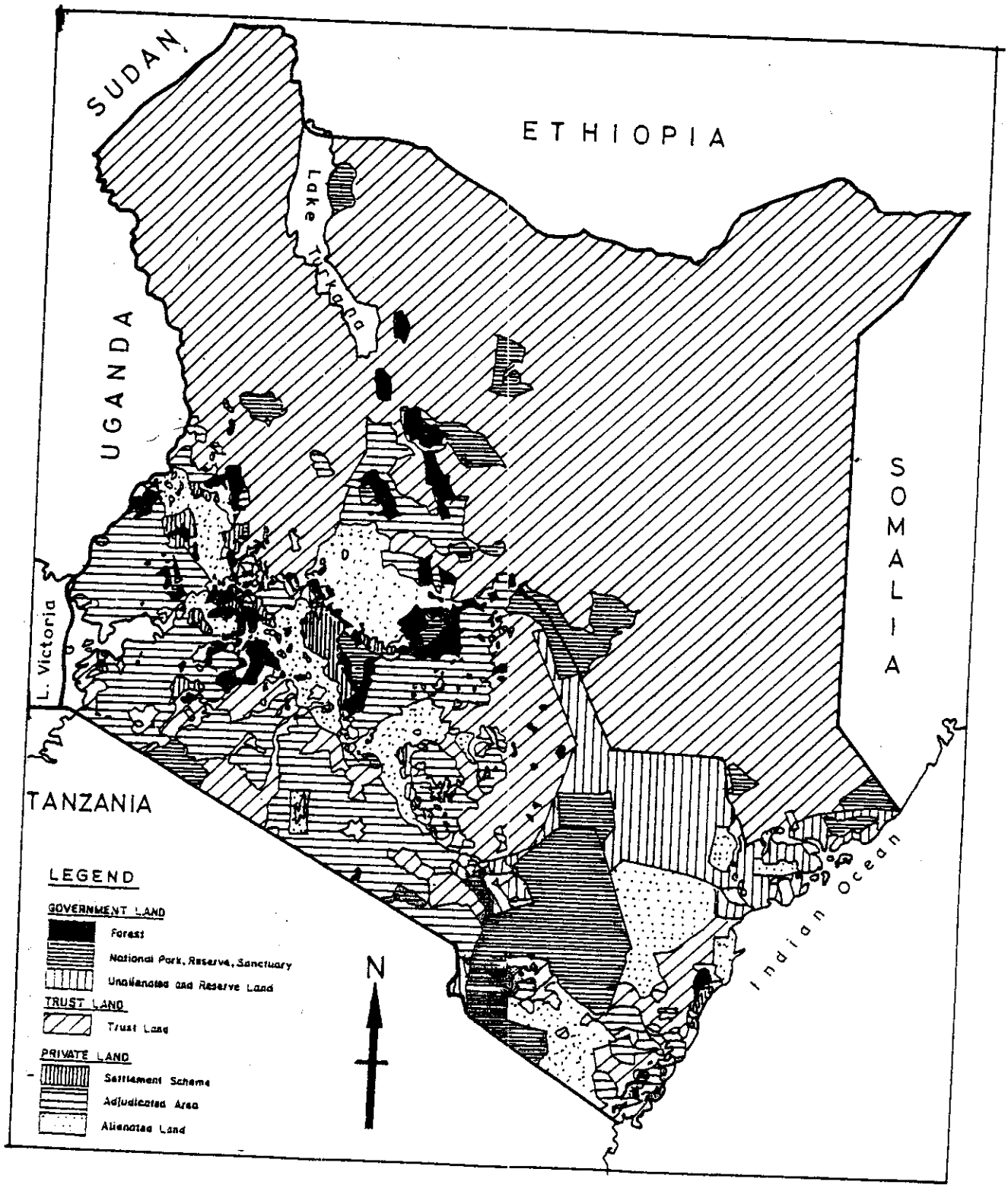



Figure 5.6: Land use in Kenya

coastal belt are also trustland, but more productive land along the ocean has mostly been alienated and adjudicated.

Generally, off-farming activities in most of the dry areas offer higher incomes, and woodcarving is one of the important economic activities undertaken by many people in the rural areas. Other than carving, the harsh environmental conditions has encouraged emigration of many people out of Kitui, some parts of Machakos and Makueni Districts in search of jobs and better lives, mainly in towns and trading centres (GOK, 1998).
Trading in charcoal, firewood and poles is a significant pre-occupation of many people. This is witnessed in markets widespread in the region, mainly around urban centres (principal markets) and rural service centres (rural markets) generally located at focal points along access roads. At present, wood is cut from private farms, range lands, communal lands and forests. It is increasingly clear that the demand will soon exceed sustainable supply. This is evidenced by the high price of charcoal, firewood, carving and construction wood, and a corresponding decline of the numbers of trees due to the expansion of markets. Energy needs from these dry areas are primarily met through the use of fuelwood and charcoal. Available estimates for rural firewood use per capita for Kitui district are 11 kg daily per capita consumption (UNICEF, 1990).

Like the upcountry forests, the forest at the coast have been subjected to increasing pressure for land for settlement and small holder cultivation, while their marketable timber has been removed systematically over the years for export because of ease of access to European and Arabian markets. Like all other Kenyan forests, they are sorrounded by a large population of subsistence small holdings who utilize them for traditional forest products such as building poles and fuel or even commercial products such as wood carving.

The most common sources of energy in most rural areas are fuelwood and charcoal. A survey of energy supply carried out in Kwale District showed that each household used an estimated 600 Kg of fuelwood annually.(UNICEF, 1990). Odera (1987) noted that over 90% of people in Kilifi District relied on woodfuel for cooking. It is evident that the demand for all types of utility wood outstrips the available supply in the entire region. Carving wood for example for the Akamba Co-operative Society at Changamwe (Mombasa) is sourced from Mt. Kenya,

Nairobi and parts of Kitui, Taita Taveta, Makueni districts and Lamu Districts as well as imports from Tanzania.

Unless adjustments are made now, the region will be forced to import wood fuel from vast distances, leading to considerable prices increases while on the other hand the forests will continue to experience mounting pressures, especially in the form of illegal removal of forest products. A recent survey (KIFCON, 1991) on household economy for the rural population around Arabuko Sokoke Forest shows that the sale of tree products, both timber and non-timber, was the most frequent source of income estimated at US$ 56 250 annually, excluding trade in carving wood sourced from the forest. Wage employment in the informal sector has also been noted as the major source of cash through economic activities which include tourism, fishing, small scale enterprises, cooperatives and self-employment, with monthly earnings ranging from US$ 25- 250 (GOK, 1999). The booming tourism and hotel industries have triggered rapid growth of smaller towns located within the coastal strip, and these are now becoming important commercial centres. Examples are Ukunda, Kwale, Gede, and Watamu among others.

## 5.4 Classification of the carving centres

All the carving centres in Kenya may be broadly classified into three categories based on their localities:

- along the major tourist circuits
- close to raw materials
- historical factors

***Tourist circuits (retail markets)***

Tourists travel to Kenya for many reasons and have found multiple attractions. Throughout the modern history of Kenyan tourism, major tourist attractions remain the captivating scenery and landscape, sunshine, wild flora and fauna, historical monuments and antiquities, business prospects and culture. In Kenya, these attractions are widespread all over the country. Tourist circuits are planned in such a way as to provide the greatest satisfaction for the least money and time to the tourists, and for the greatest financial profits to the country. The woodcarving, arts and curios industry is now a permanent element of Kenyan tourism and these products are made and sold at strategic places within the circuits. Figure 5.7 shows

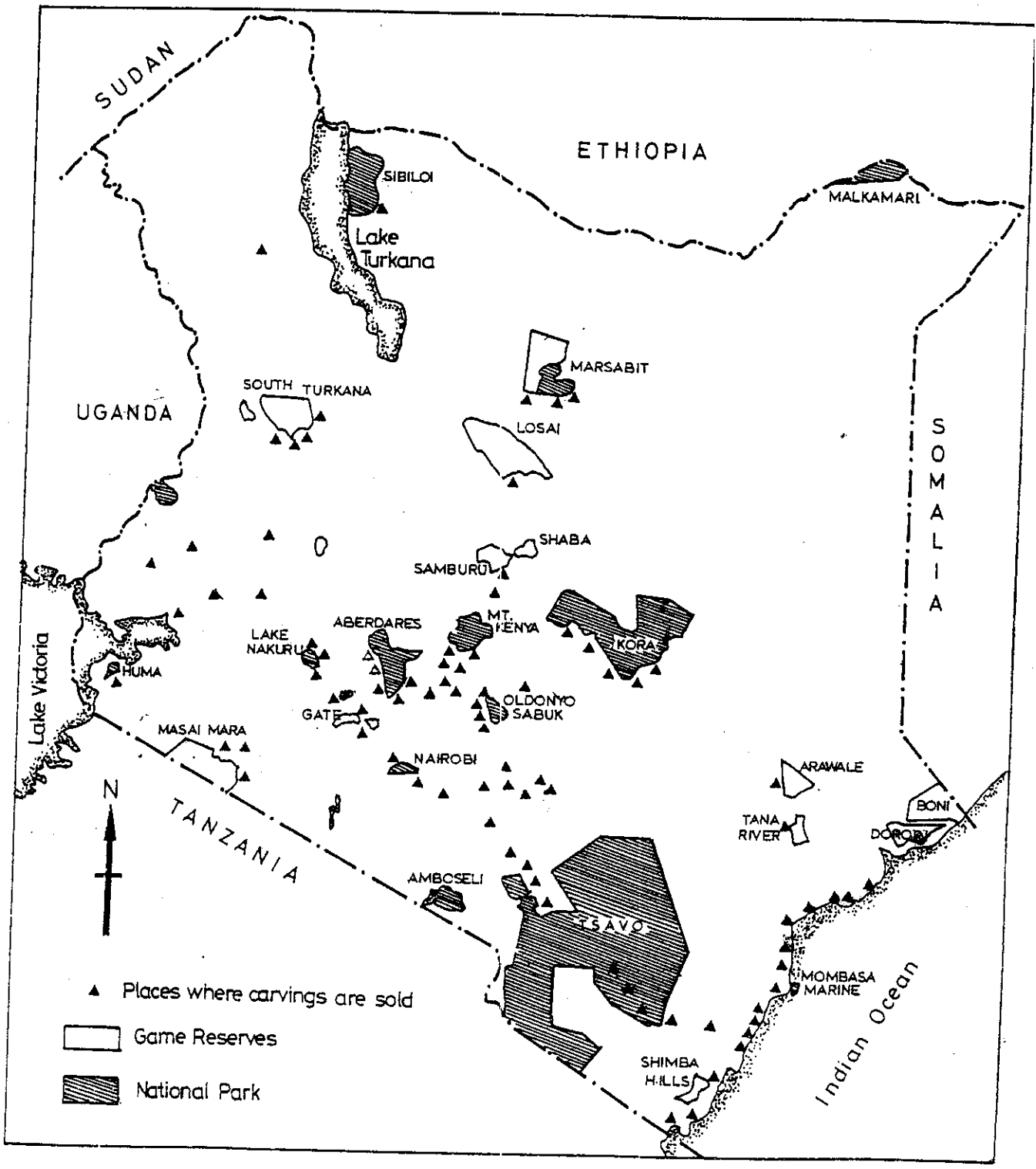



Figure 5.7: Tourists attraction areas in Kenya

the distribution of carvings sale outlets and the main tourist attractions in Kenya and where carvings are sold to tourists who visit these areas.

***Proximity to raw materials***

Carving centres are usually located in areas where raw materials are readily available in order to keep the production costs of carving to a minimum. Owing to the growing local depletion of preferred species at most of their traditional carving stations such as Wamunyu, Nairobi and Makindu, carvers are now relocating their carving bases to new resource rich frontiers. For example, in the recent past, carvers have started shifting to Naivasha and Nakuru Towns as supplies of *Olea europaea* from Nyahururu and other forests are close by. Those who do not carve on a full-time basis or for one reason or the other are not able to move to distant places have started to use alternative tree species more intensively. The use of *Terminalia brownii* at Wamunyu attests to this.

***Historical Considerations***

Nearly every woodcarver in Kenya has a traditional attachment to Wamunyu Village in Machakos District, the home of Mutisya Munge the founder of woodcarving industry early in the 20th century. Although the Wamunyu carving centre as it stands today is far removed from the main sources of carving raw materials, it is there by virtue of the honour and respect for Mutisya Munge.

# CHAPTER SIX

# METHODOLOGY AND TECHNIQUES USED IN THE STUDY

## 6.1 Introduction

The woodcarving industry in Kenya is complex but remarkably well organized. Each carving centre has three distinct 'departments' charged with specific duties and responsibilities to perform. These are the timber procurement and grading, carving and marketing departments each of which keeps accurate records of it's dealings.

Timber procurement and grading deals with sourcing of raw materials, delivery, grading, coding and pricing each round wood delivered. Grading, coding and pricing are done by 2 or 3 experienced persons at each centre, nominated by the co-operative management in consultation with the entire membership. The carving department constitutes the carvers who make over 95% of the centre membership. They make a selection of the size and species of the coded and priced logs at the log yard, pay for them in cash or through loaning[1] and carve. The carved products are then handed over to the marketing department and are then registered and tagged with the carver's membership number and selling price, and they are displayed at the showroom for sale. Carvings done for specific orders, usually for local or overseas customers, are packaged and send to final destinations. With this level of organization and co-ordination, the study was feasible. The rest of this chapter describes how information for the various components of this study were captured.

## 6.2 Description of the research process

### 6.2.1 The Preliminary research phase

The study was preceded by a reconnaissance trip to all the carving co-operative societies in the country. It is important to point out at this stage that I was not a new face to most of the carvers and co-operative officials. We had met several times before at different forums on related studies where most of them had actively participated. However, the aims of the explanatory trip were to introduce and explain the objectives of the study; to get acquainted

[1] Loaning entails the giving of a carving wood to a carver, who is often a member of the cooperative, without necessarily paying for it. This will be deducted from the sales of the finished carvings when they are sold much later.

with new officials and members; to identify the key informants and establish a rapport with the general woodcarving community and to gain an understanding of the local natural landscape, vegetation, local conditions and infrastructure. Informal conversations (and observations) with carvers were held in order to determine some of the tree species in trade at this stage, main source areas and the main carving wood suppliers. Visits were also made to rural markets on market days in order to gain an understanding on the dynamics of the trade, competition for carving resources with other users particularly on pole wood and charcoal traders. Private resource owners were also visited for information on the wood pricing and local rules of access to the resources.

During this phase, appropriate data collection sheets for each study component were developed and tested. Improvements and modifications were made where necessary. The preliminary research phase was done over a period of 2 months from December 1997 to January 1998.

### 6.2.2 The main research phase

Once the ground had been prepared during the pilot studies, the study commenced from February 1998 to June 2000, a period of almost 2.5 years. Whereas many of the carvers and co-operative officials and management were positive about the study, some of the members were sceptical and generally suspicious about the real intentions for the study. To this group, this research was seen as a way of reviewing the wood prices by the State as justification for increasing the prices due to the prevailing shortages of prime carving wood, or else as a means of identifying the main dealers of illegally sourced wood for prosecution. Unfortunately, there was little that could be done to alleviate these fears and perceptions.

## 6.3. Description of study techniques

The study objectives and the type of information required provided an important guide to selection of methods used in data collection, which were both qualitative and quantitative in nature. The techniques used are briefly described under broad categories below;

### 6.3.1 Direct participation and observation.

The understanding of workings of each of the above departments involved active participation and working very closely with them in order to gain first hand experience of the daily tasks as well as assisting in rapport building. For example, it is through observation and involvement that we got to know all the wood suppliers individually, build rapport with them and therefore we were able to know the sources and prices of wood consignments delivered. Suppliers often have traditional sources of wood. For this reason, we were able to know which suppliers source carving from Mt Kenya region, Karura and Ngong Forests or Kitui regions such that by knowing who supplied a particular consignment, it was possible to tell with some amount of certainty the source from which it originated. During the study, sources of each of the wood consignments delivered to each carving centre were identified and classified according to the ownership status of each source (whether private land, communal, under county councils or state owned).

The criteria used in grading of logs include size, form, defects and species. Large logs of good form (straight without nodes) and with minimum defects are highly graded irrespective of species. However, traditionally favoured species attract higher price premiums in each size class. The study therefore entailed classification of all the logs delivered according to sizes and to compare and contrast their variation with respect to centres, species and sources.

### 6.3.2 Interviews

Open-ended and semi-structured interviews were conducted with individuals , small groups, larger groups either on random basis or with key informants such as managers, chairmen, officials and amongst carvers. For sensitive issues such as sources of wood consignment and prices at source, private interviews were conducted.

Group interviews and discussions have advantages that much information is assessed and verified by all those present. The long duration of the study provided enough time to verify all information solicited from these interviews. It also provided the opportunity to tap into network of knowledgeable individuals for better understanding of some of the activities and observations made during the study period. Table 6.1 below shows the various categories of interviews carried out at each carving centre and the number of people interviewed in each category.

**Table 6.1: Categories of interviews carried out at woodcarving centres**

| Category of interview | Gikomba | Lungalunga | Malindi | Makindu | Mombasa | Nanyuki | Wamunyu |
|---|---|---|---|---|---|---|---|
| Wood suppliers | 15 | 30 | 20 | 10 | 50 | 8 | 15 |
| Cooperative officials | 10 | 9 | 6 | 9 | 15 | 8 | 10 |
| Individual carvers | 60 | 70 | 35 | 20 | 70 | 20 | 90 |
| Group of carvers | 3 | 8 | 4 | 5 | 4 | 2 | 6 |
| Wood retailers | 3 | 5 | 3 | 1 | 4 | 2 | 8 |
| Independent carvers | 10 | 25 | 20 | 10 | 15 | 20 | 40 |

The conduct of the study was aimed at interviewing at least 10% of members within each category, where the selection of those to be interviewed was done at random. However, where the members of the category were few especially in small centres such as Nanyuki, all the individuals were interviewed. Alternatively, in cases where the categories were represented by a large number of members (for example, individual carvers), the strategy adopted was to interview every 6$^{th}$ individual based on their sitting arrangement in the carving workshop.

## 6.4 The prices of materials along the market chain

Carving wood is obtained from a variety of sources, namely state forests reserves, private lands, county council forests, trust lands and communal areas. The task was to determine the wood prices from each of the sources, particularly the pricing criteria, harvesting costs, loading and transport costs, price changes along the chain usually through a series of middlemen and brokers, before finally being sold to the carver as the final user.

As explained in section 6.1 above, all the carving logs from all these sources are assembled at the log yard and appropriately coded and priced, where the price tag is conveniently placed on each log. This represents the final price of the log which will be paid by the carver as the final user. These final prices for all the wood consignments delivered over the study period were

therefore easily obtained by recording the price tags placed on the logs at the yards. The buying price (by the retail trader(s) from middlemen or any other supplier) is always negotiated on wholesale basis depending on the quality and sizes of the logs, and is done after unloading the logs from the delivery truck. These wholesale prices were obtained from the wood retail traders in confidence and from the wood suppliers themselves, who were also relied upon to provide the price(s) of wood from the source. However, this was counterchecked regularly (once every 2 months) at each of the main sources by posing as a potential buyer of the wood, particularly for wood sourced from state forests. On paper, no commercial exploitation of live wood (excludes dead or fallen indigenous trees) is permitted except from a number of selected forests in Kenya such as Arabuko Sokoke. The abuse of extraction of dead wood has been the most prevalent method through which carving wood from state forests are being sourced. Individuals who occasionally traded in carving wood sourced from their farms freely gave reliable prices of the wood sold. The costs of wood harvesting, loading and transportation was obtained by working alongside the workers where possible as well as through the interviews.

### 6.5 Determination of wood volumes

This was the most labour intensive stage of the research process as it involved categorizing all carving wood entering each carving centre by species and diameter classes. For *Brachylaena huillensis* (supplied to Gikomba, Malindi, Mombasa, Nanyuki and Wamunyu), and *Azadirachta indica* ( supplied to Malindi and Mombasa) and other species which were supplied in large numbers, complete enumeration of every 5$^{th}$ consignment delivered at each of the centres was made. This entailed measuring the dimensions of each log (diameters at both ends and the length) and recording it's price from which volume-price curves were generated from the enumerated logs. For the rest of the 4 out of 5 lorry loads of wood which were not enumerated, only the prices of all the logs were recorded and their respective volumes estimated from the volume-price curves developed for each of the species. For the carving species whose supply was generally erratic and low, and also brought as individual logs, dimensions of all the logs was made as practically as possible, and their volumes worked out.

Volume computations were carried out using Smallians formular (Philip, 1983) as follows:

$$\text{Volume of log} = \frac{(V_{g1} + V_{g2})}{2} * L$$

V = Volume of log

Vg1 = Cross-sectional area of end 1 of log

$V_{g2}$ = Cross-sectional area of end 2

L = Length of log

### 6.6 Competing uses for carving wood.

This entailed getting the market prices of the carving tree species as used for other purposes other than carving. These include such uses as firewood, sawn timber, charcoal burning and sale of poles. For example in Machakos, Kitui Districts, *Dalbergia melanoxylon* is sold and used in house construction, firewood and charcoal burning Visits were made to various markets in the country and dealers of each of these products were interviewed without necessarily following any selection criteria because their numbers were generally low. At each market visited, all the traders willing to provide the information required were interviewed, and their numbers are shown in Table 6.2. The information sought involved measuring the dimensions of the materials on sale and calculating unit prices in each case. Unit price of poles or firewood pieces were obtained by calculating the price per unit volume of wood as follows;

$$\text{Unit price (Ksh/m3)} = \frac{\text{Price of article (Kshs)}}{\text{Total volume of article } (m^3)}$$

**Table 6.2: Number of markets visited and traders of wood products interviewed**

| | | Number of traders interviewed for each competing use | | | |
|---|---|---|---|---|---|
| District | Number of markets visited | Charcoal | Firewood | Poles | Sawn timber |
| Kitui | 4 | 10 | 14 | 10 | 12 |
| Kwale | 5 | 14 | 12 | 16 | 14 |
| Makueni | 7 | 30 | 15 | 7 | 14 |
| Malindi/Kilifi | 10 | 26 | 17 | 30 | 29 |
| Machakos | 6 | 23 | 19 | 18 | 13 |
| Mombasa | 4 | 12 | 4 | 8 | 15 |
| Nyeri | 4 | 12 | 14 | 9 | 8 |
| Nairobi | 10 | 20 | 16 | 12 | 16 |

For irregular articles, volumes were obtained by the standard water displacement methods. In Makueni District, charcoal made from *Olea europaea* sub sp *africana* and *Combretum schumanii* are very popular. For purposes of this study, charcoal production unit costs and profits were determined by working alongside traditional charcoal burners at Makueni District. The dimensions of *Olea europaea* sub sp *africana* were accurately measured prior to entering the kiln, to the nearest centimetre and burnt using the traditional earth kiln method which is the commonest method used in charcoal production in most of the rural areas. Charcoal was harvested after one week and discrete charcoal volumes were determined by the standard water displacement method. Wood conversion efficiency was worked out thus;

$$\text{Wood conversion efficiency} = \frac{\text{Total volume of charcoal}}{\text{Total volume of input wood}} \times 100\%$$

The resultant charcoal volumes were packed in the standard trading bags weighing 25-30kg and their marked prices were recorded. It was necessary to determine the input and output

volumes, hence the corresponding cumulative output prices to make it possible to compare charcoal production with the woodcarving returns. Profits from charcoal production were calculated as follows;

Charcoal profits = (Total sales) - (Cost of materials and labour))

$$\text{Unit profits (Kshs/m3)} = \frac{\text{Total profits from cumulative sales (Ksh)}}{\text{Total input volume of wood } (m^3)}$$

## 6.7 Woodcarving returns per unit labour and profit margins

### 6.7.1 Cost in the carving stages.

In the light of competition for carving raw materials by carvers and other users, it is important to determine the relative profits accruing from woodcarving as an activity. The process of carving takes several stages as outlined in chapter 3, and each stage has a cost. These costs include the cost of wood, wood splitting costs, filing of carved products, sanding, polishing and painting. The actual carving was not costed because it is undertaken by the carvers themselves and is not contracted out.

In each case, dimensions of each log was accurately determined hence volume in cubic metres. Their codes and prices were recorded as well as names of individual carvers who were to carve them including their stall numbers. The splitting costs, number of products carved out of each log, costs incurred in filing, sanding, painting and polishing each product and the expected sales from all these products from one log, were recorded. The selling prices were based on the lowest product prices (sometimes referred to as 'factory prices') which are much lower than the cooperative wholesale price. Total time taken to complete all the products was also noted. The profits (revenue to carvers) were obtained by deducting all the costs from the expected sales of all products per log. All the costs and revenues were converted to per unit wood volume values. Random samples of carvers of different ages and experiences were selected at the carving centres where this component of the study was done (namely Gikomba, Mombasa, Nanyuki and Wamunyu). The mean value for all costs and revenues for the represented centres were calculated and analyzed.

### 6.7.2 Wood recovery during carving.

Wood recovery rates involves determination of wood volumes before carving and the volume of carved products from each log and expressing the ratio as a percentage, thus;

$$\text{Recovery rate}^2\ (\%) = \frac{\text{Volume of Products} * 100\%}{\text{Volume of wood}}$$

This component of the study was carried out at Gikomba where 20 carvers were chosen at random. However, some of those selected were not willing to take part and were replaced by their immediate neighbours. The measurement carried out in this component of the study were the dimensions of each log hence volume prior to carving, and accurate determination of volume of all the products carved out of it. Because most carved products are irregular, their volumes were determine by displacing them in water and measuring the volume of the displaced water. The volume of displaced water was taken as equivalent to that of the carved product. In order to take precautions of absorption of water by the products, a polythene paper was carefully wrapped around the surface of the product. Many carvers feared that immersing the carvings in water would make them crack as soon as they dried.

Profits = (cumulative sales of products from given log) - (cost of log + labour costs)

$$\text{Unit profits (Ksh/m}^3) = \frac{\text{Profits from cumulative sales (Ksh)}}{\text{Volume of log (m}^3)}$$

[2] Sometimes also referred to as 'wood utilization rate'

## 6.8 Investments in planting of *Brachylaena huillensis* and *Azadirachta indica*

### 6.8.1 Diameter, height and volume measurements.

In order to determine whether it is feasible to invest in the planting of these species with the aim of supplying the wood to the carving industry, the growth of each of the two species was modelled based on the available growth statistics from the existing plantations in the country. Individual trees within plantations of known ages of each of the species were measured for diameters at breast height (DBH) and heights using diameter tapes and Clinometer (Sunto) respectively. Volumes of 20 trees representative of the average sizes of the entire plantation were determined by climbing as high the crown as possible and measuring the stem diameters of standing trees at intervals of 1m including the sizes of large carvable tree branches. Tree climbing was done using seed collection tree climbing gear. Trained tree climbers from Kenya Forestry Seed Centre were very useful in this part of the study. Carvable tree volume was therefore obtained by adding volumes of each of the 1m stem segments as given in section 6.4 above. However, tree volumes determined through destructive sampling and taking measurements of stem and branch segments of fallen trees is recommended. We had a rare opportunity to take such measurements for *Brachylaena hullensis* in Karura Forest by working closely with one of the wood suppliers to Gikomba wood carving centre.

Using past records of individual tree performance (records of tree heights and DBH) and those recorded during the study, Age versus DBH, Age versus height and DBH versus volume curves were generated for each species. Age versus DBH gives an indication when the species attains a carvable size hence the time from which the tree owner expects returns from sales to woodcarvers. Similarly, Age versus Height gives an indication of the rate of growth and is important in characterization of the sites in silvicultural studies. Having generated each of the above models, simple economic models of each of the given species can then be developed.

This was began by drawing a simple table showing the ages of a planted tree from 1 to 50 years. From the Age-DBH curve, the DBH values for all the ages were generated. Similarly, from the DBH-Volume relationship, the tree volumes corresponding to each DBH were also generated. From the current wood market prices (Ksh/$m^3$), the potential values for each corresponding tree volume across the ages were generated (Gross value). From the age of 12

years, it is presumed that the tree is able to yield ¼ stack of firewood. This was valued using the current prices of firewood, and the total potential value of the tree was therefore obtained by adding the gross value of round wood and the firewood for all the ages and discounted at 10% as the Present Value of Benefits (PVB). Variable costs across the ages were also determined, and included the purchase of seedling, tending, fencing and watering. These were also discounted as Present Value of Costs (PVC).The difference between the PVB and PVC gives the Net Present Value (NPV). All these derivatives were represented in a diagram to show when tangible benefits would be realized and the levels of these benefits as a guide to investing in tree planting.

From the wood market prices for the year 2000 of each species, the value of each wood volume potentially available at various ages were generated, including other benefits such as sale of 1/4 stack of firewood each year per tree. Those costs and benefits that accrue as the tree matures over time beginning from the time of planting were discounted to the present (or to the year of planting). Present Value of Costs, Present Value of Benefits and Net Present Value will indicate the time in the tree rotation when the costs of tree maintenance are potentially off-set considering tree growth as an investment. The Net Present Value enables the tree owner to know when tangible benefits are expected and the optimum period when maximum benefits are expected beyond which clear felling may be carried out as the economic benefits (for woodcarving) of the tree will start declining.

# CHAPTER SEVEN

# SUPPLY DYNAMICS OF CARVING WOOD IN KENYA

## 7.1 Introduction.

*Brachylaena huillensis* trees are heavily used by the woodcarving industry in Kenya largely due to the shortage of other preferable species. Obunga and Sigu (1996) cites intense impact of over-harvesting of the species at Karura, Ngong and Olulua Forests near Nairobi as evidenced from the high number of both small and large diameters of stumps widespread within the forests. The same is probably true to all other habitats where *Brachylaena huillensis* can still be found in Kenya as this study was designed to establish, particularly the extend of the impacts of over-harvesting from the existing sources. Godoy and Bawa (1993) noted that future availability of specific tree specific tree species might be jeopardized by unsustainable harvesting practices now common in many parts of the tropics, and this remains true for the case of *Brachyleana huillensis* and other major carving species in Kenya.

This Chapter gives the diversity of the major woodcarving tree species in the trade. While it is known that a wide range of species have potential use in the industry, the intensity of utilization is expected to vary between species. The intensity of utilization is gauged from the volumes of each of the species utilized from 1998 to 2000. The ecological impact of this utilization intensity and hence the conservation status at the existing sources of the respective species is inferred from the diameter-frequency profiles for wood entering the carving markets in the country.

Market preferences or bias towards specific tree species is also established from the geographical extent over which the species is utilized at carving centres across the country. The overall impression obtained from these supply dynamics gives a useful background on the target species and sites where conservation efforts are required most.

## 7.2 Quantities of carving wood utilized in 1998-2000

### 7.2.1 Volume distribution by species.

A total of nine major carving species were identified and found to dominate the Kenyan woodcarving industry during the study period, and the proportion of their respective quantities utilized are given in Figure 7.1. Table 7.1 gives the summary of the species volumes in each of the years 1998-2000. *Brachylaena huillensis* constitutes the highest annual mean volume over each of the years 1998-2000 (proportion of 57.4%) with the mean volume over this period estimated at 5 602.6 $m^3$. However, there was a wide variation

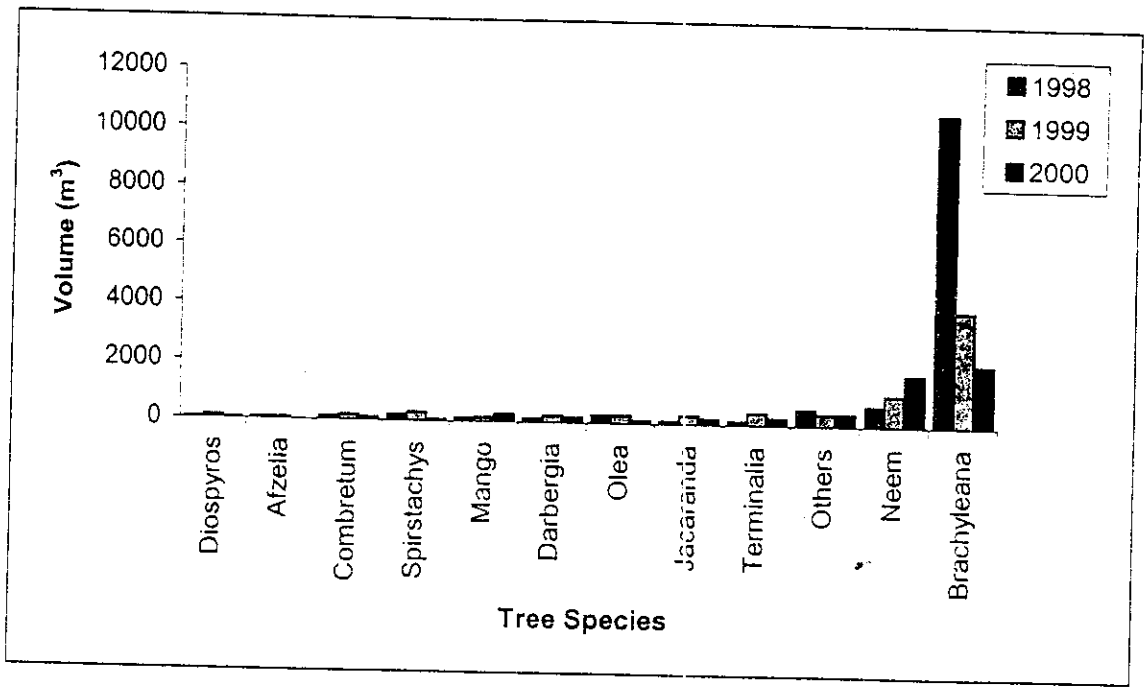



Figure 7.1: Distribution of wood volumes according to tree species in the years 1998-2000

**Tabel 7.1: Distribution of wood volumes ($m^3$) according to tree species in the years 1998 - 2000**

| Year | Afzelia | A. indica | Brachylaena | Combretum | Dalbergia | Diospyros | Jacaranda | Mango | Olea | Others | Spirostachys | Terminalia | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 55.0 | 691.0 | 10718.2 | 108.0 | 137.4 | 17.0 | 106.2 | 126.6 | 288.0 | 557.3 | 201.8 | 136.9 | 13 143.2 |
| | *0.4* | *5.4* | *81.5* | *0.8* | *1.0* | *0.1* | *0.8* | *0.8* | *2.2* | *4.3* | *1.5* | *1.0* | |
| 1999 | 61.4 | 1 073.3 | 3 964.8 | 172 0 | 248 0 | 96.0 | 308.6 | 155.8 | 286.2 | 420.3 | 294.3 | 427.4 | 7 508.1 |
| | *0.8* | *48.3* | *52.8* | *2.3* | *3.3* | *1.3* | *4.1* | *2.0* | *3.8* | *5.7* | *3.9* | *5.7* | |
| 2000 | 0 | 1 776.8 | 2 124.8 | 97.0 | 187.6 | 63.7 | 209.2 | 273.2 | 123.89 | 420.4 | 58.0 | 252.6 | 5 583.4 |
| | *0* | *31.7* | *38.2* | *1.7* | *3.4* | *0.7* | *3.8* | *4.9* | *2.5* | *7.9* | *1.0* | *4.5* | |
| Total | 116 4 | 3 540.8 | 16 806.8 | 377.8 | 573.4 | 176.8 | 624.0 | 555.6 | 698.7 | 1 398.0 | 554.1 | 816.9 | 26 246.9 |
| **Mean** | 58.2 | **1 180.3** | **5 602.6** | **125.7** | **191.2** | **58.9** | **208.0** | **185.2** | **232.9** | **468.1** | **184.7** | **272.3** | **8 748.1** |
| | *0.6* | *17.2* | *57.5* | *1.6* | *2.6* | *0.7* | *2.9* | *2.6* | *2.7* | *5.8* | *2.1* | *3.7* | |

Italized values represents respective proportions (%) of volumes utilized for each species

between each of the years with a declining trend where the highest volumes were received in 1998 and lowest in 2000 (Figure 7.1).

This was followed by *Azadirachta indica* (neem) with 1 180.3 $m^3$ or 17.2% of the total volume, where unlike *Brachylaena huillensis*, the quantities received showed an increasing trend with the lowest volume recorded in 1998 and the highest in 2000 (Figure 7.1). These two species alone constituted the bulk of the volumes utilised over the study period as they jointly accounted for 74.6 % of the total volume entering the industry in the country.

The traditional carving species noted besides *Brachylaena huillensis* were *Olea europaea* subsp. *africana*[1], *Dalbergia melanoxylon*, *Combretum schumannii* and *Spirostachys africana*. Like *Brachylaena huillensis*, their supplies over the study period showed a general decline in the years 1998-2000 (Figure 7.1) as they are generally sourced from state forests during which time the forest administration in the country was being changed and restrictions on illegal harvesting was unusually highest. Some of the alternative carving species whose utilization for carving has gained prominence in recent times and were recorded over the study period include *Terminalia spp, Jacaranda mimosifolia*, *Mangifera indica* (mango), *Afzelia quanzensis* and *Diospyros cornii* (mkulu) (Figure 7.1). Other alternative species utilized in much smaller quantities during the study period were *Commiphora baluensis, Newtonia buchananii, Terminalia prunoides, Terminalia spinosa, Manilkara zansibarica, Erythrina abbysinnica, Cordia sinensis, Grevillea robusta, Melia volkensii*, and *Brachystegia spiciformis*. These alternative species were generally grouped together under 'others' in Figure 7.1 because their supply was low, erratic and unpredictable.

As shown in Figure 7.1, total wood supply was characterised by a sharp decline in volume from 1998-2000 particularly for the traditional prime carving species which ordinarily constitutes the main volumes of carving wood in the country. The reverse was true for the alternative species whose volumes increased over this period as they are sourced mainly from private farms and were not adversely affected by the changes in the forest administration. These administrative changes in the Forest Department were triggered by a sustained publicity campaign and outcry by environmentalists in Kenya in 1998 against encroachment, illegal allocation of forest land and illegal harvesting of commercial hardwood wood, including *Brachylaena huillensis*, from state forests in the country. Among the changes in the Forest administration in Kenya were, for example, the changing of custody of Kenya's indigenous forests from the Forest Department to Kenya Wildlife Service (KWS). As a result of the change, carvers have found it increasingly difficult to source the prime carving wood

[1] The use of *Olea europaea* in the text will always refer to *Olea europaea* sub species *africana*

from state forests. During this period, utilization of alternative carving wood sourced from private sources other than state forests has increased.

### 7.2.2. Volume distribution by centres

Of the total carving wood volume entering the market in 1998-2000, 19 154.3 $m^3$ (72.6%) was utilized on the Kenyan coast where most carvers are concentrated. Volumes were distributed between Malindi cooperative Society (Malindi), the Akamba cooperative society (Mombasa) and Lungalunga cooperative society (Lungalunga) ( Figure 7.2). Table 7.2 shows the variation of these quantities over this period.

As expected by reason of sizes of the carving centres, the volume of the carving species utilized at Akamba Cooperative Society was the highest being 36.8 % of total national volume, followed closely by Lungalunga, which receives its supply from Tanzania. The rest of the wood volumes were used at Nanyuki, Wamunyu and Gikomba cooperative centres (Figure 7.2)

Although Nanyuki cooperative society is strategically located close to the source areas for prime carving wood species, namely *Brachylaena huillensis* and *Olea europaea*, the cumulative volumes utilized were lower than expected for two reasons. Firstly, owing to the ban on the utilization of indigenous hardwoods from state forests in Kenya, carvers at Nanyuki are constantly under surveillance and often harassed by various government officials from time to time, making their working environment rather hostile. Mt. Kenya Forest Reserve is arguably the most valuable and vital natural resource and heritage per square kilometre in the whole of Kenya (Shaw, 2000). Whenever media reports highlight the on going rampant destruction of the forest, government officers make frequent raids at the carving centre and in the process consficate whatever wood is in the yard, and sometimes they even consficate carved products. The number of carvers who work at this cooperative centre is therefore low. Secondly, the wood suppliers find it safer and more profitable to deliver carving wood to distant markets such as Wamunyu, Gikomba or even Mombasa where better prices are on offer due to the high demand (chapter 8).

Gikomba cooperative society located at the outskirts of Nairobi city shares similar problems as Nanyuki. Although the carving centre is close to the sources of *Brachylaena huillensis* at Karura, Ngong and Olulua forests near Nairobi, the volumes utilized were found to be generally lower than expected. Media reports alluding to these forests in the recent past have largely been due to the anticipated excision and allocation of the forests to private developers (Karura and Ngong Forests) and mining (Olulua Forests) as well as to the illegal harvesting of

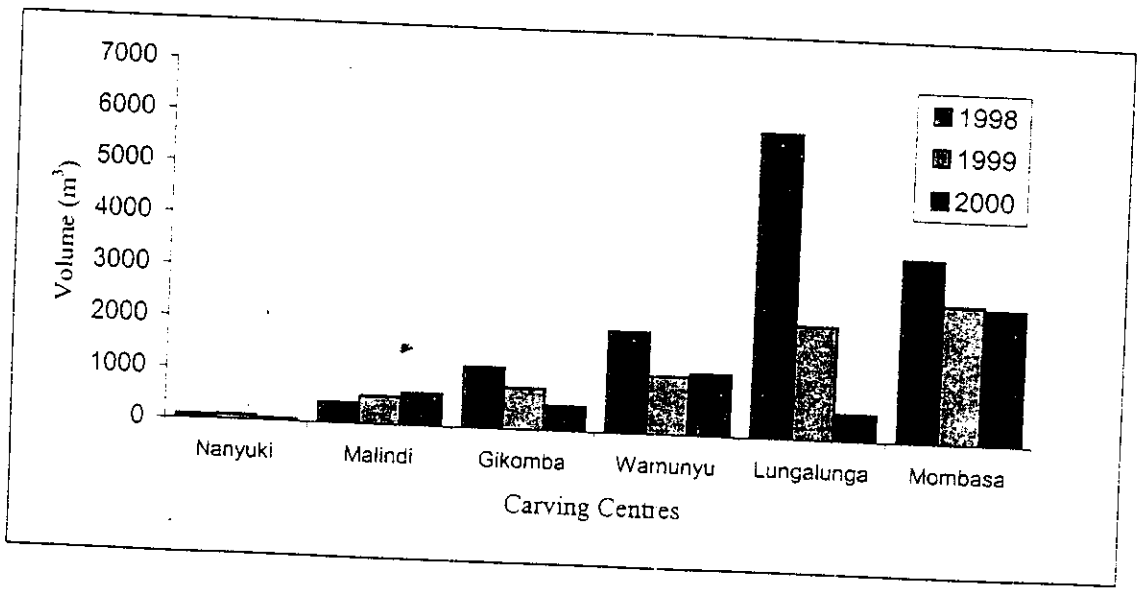



**Figure 7.2: Distribution of wood volumes according to carving centres in the years 1998-2000**

**Table 7.2: Distribution of wood volumes ($m^3$) according to carving centres in the years 1998 - 2000**

| Year | Gikomba | Lungalunga | Malindi | Mombasa | Nanyuki | Wamunyu | Total |
|---|---|---|---|---|---|---|---|
| 1998 | 1 149.3 | 5 913.9 | 410.3 | 3 551.0 | 86.4 | 2 033.3 | 13 144.2 |
| | *9.0* | *45.0* | *3.3* | *27.0* | *0.7* | *15.0* | |
| 1999 | 750.2 | 2 207.3 | 553.1 | 2 688.0 | 100.9 | 1 209.8 | 7 509.3 |
| | *10.8* | *29.1* | *7.7* | *35.8* | *1.3* | *15.3* | |
| 2000 | 481.6 | 528.6 | 670.5 | 2 631.6 | 51.9 | 1 229.8 | 5 594.0 |
| | *8.8* | *9.7* | *11.6* | *47.3* | *0.9* | *21.9* | |
| Total | 2 381.1 | 8 649.8 | 1 633.9 | 8 870.6 | 239.2 | 4 472.9 | 26 247.6 |
| **Mean** | **793.7** | **2 883.3** | **544.6** | **2 956.9** | **79.7** | **1 490.9** | **8 740** |
| | *9.5* | *27.9* | *7.9* | *36.8* | *0.9* | *17.0* | |

Italized values represents respective proportions (%) of volumes utilized at each centre

*Brachylaena* from these forests. The extremely low volume of *Brachylaena* entering Gikomba in the last two years may be understood in the light of this publicity.

Wood supplies from Mt. Kenya destined to Gikomba often go through various police roadblocks on the highways unlike the supplies to Wamunyu where numerous unguarded feeder roads are used. Policemen have been reported to demand heavy bribes in place of punishment. However, suppliers sometimes risk being jailed for handling the banned indigenous hardwoods.

### 7.2.3 Species diversity across carving centres

The highest number of the major carving species in trade were utilized at the Akamba Cooperative Society in Mombasa, where a total of 8 species were used in significant quantities accounting for 93.1% of the total volume utilized at the centre. These are *B. huillensis, A. indica, M. indica, D. melanoxylon, C. schumannii, O. europaea, S. africana,* and *D. cornii*. A wide range of other species used in minor quantities constituted a proportion of the total at 6.9%, including *Newtonia buchananii, Terminalia prunoides, Terminalia spinosa, Manilkara zansibarica* among others.

The Akamba society is essentially the largest carving market in Kenya by virtue of its strategic location near an international airport. Mombasa town is a hub of tourist activities and probably the most popular in Eastern and Central Africa. The high demand for carvings has ensured an equally high demand for wood supplies which come from as far as Mt. Kenya regions in Central Kenya and includes imports from Tanzania.

Malindi is a much smaller town and the volume of carving trade is relatively modest. It has benefited from tourist spill-overs from Mombasa and is famous for sport fishing. Carving species diversity is similar to that of the Akamba centre at Mombasa, but the quantities are much lower. The demand for wood is therefore easily satisfied by the local wood sources from Kilifi, Lamu and occasionally from Kwale and other adjoining districts. The lowest diversity of species utilized for carving was noted at the Equator cooperative society in Nanyuki where the use of *Olea europaea* and *B. huillensis* command 89.2% of the total entering the centre. Other species used (10.8%) were *Dalbergia melanoxylon, Grevillea robusta* and *Cupressus lusitanica* among others.

Wamunyu cooperative centre located at Wamunyu and Gikomba cooperative society (Nairobi) share the same sources of the carving wood which are essentially Mt. Kenya, Nyeri District, Kitui, Machakos, Makueni Districts and to a lesser extend, Karura, Ngong and Olulua forests near Nairobi. For this reason the species diversity at the two centres is also

similar, but the quantities differ where the volume utilized at Wamunyu is about twice that of Gikomba for all the species. Species utilized are *Brachylaena huillensis, Olea europaea, Terminalia brownii* and *Dalbergia melanoxylon* among others.

*Brachylaena huillensis*, *Dalbergia melanoxylon* and *Olea europaea* are the most widely used across all the carving centres in Kenya and the volumes utilized were limited by the supply. For most of the other species, utilization was localized and mostly confined to the regions of their origin.

### 7.3 Seasonality in supply of carving wood

The supply of carving wood in Kenya was found to have an appreciable seasonal component with two distinct peaks each year. In order to illustrate this further and to link this variability with the wider income-earning activities of carvers other than carving, *Brachylaena huillensis* was used. Variability of supply of *B. huillensis* to Akamba carving centre ( as a representative to all the other centres) is shown (Figure 7.3). Two peaks are distinctive; one from February - April and August - October. In a market context, these variability may be explained by:

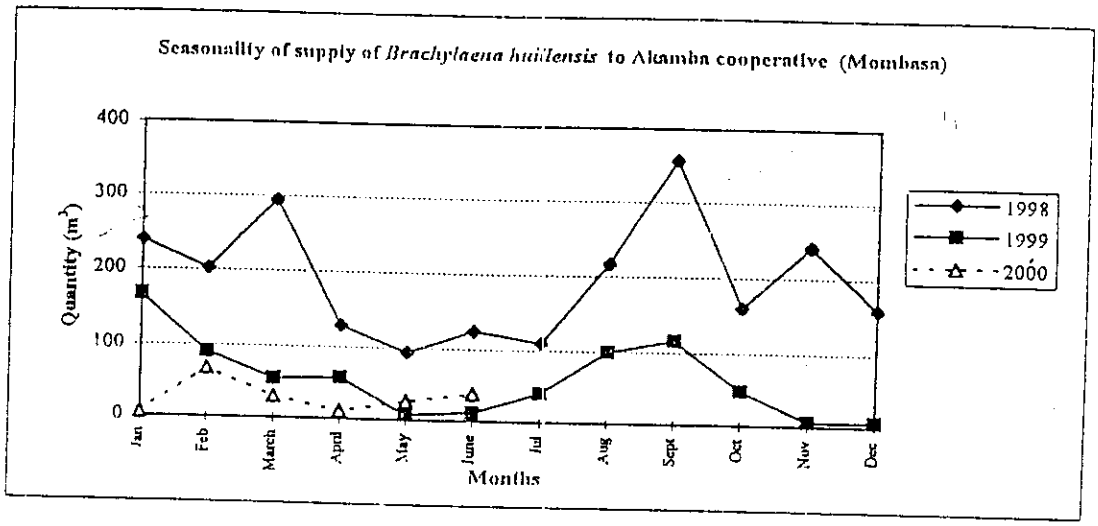
- variation in the number of tourist consumers and
- variation in the number of producers

#### Variation in tourist consumers

The main consumers of carvings in Kenya are tourists whose arrival is characterized by high and low tourist seasons. The tourist high seasons in Kenya are Jan-April and July-November, and is reflected by the seasonality in sales of carvings at Malindi (Figure 7.3). The tourist high seasons are therefore the busiest times for carvers and is reflected in the high wood volumes utilized at the respective periods of each year.

#### Variation in the number of producers

During the tourist low season in April - July of each year particularly in the Kenyan Coast, this period coincides with the long rains when many forests in the region are usually largely inaccessible. This off-peak season therefore provides an opportunity for carvers to engage in other income generating activities such as farming.



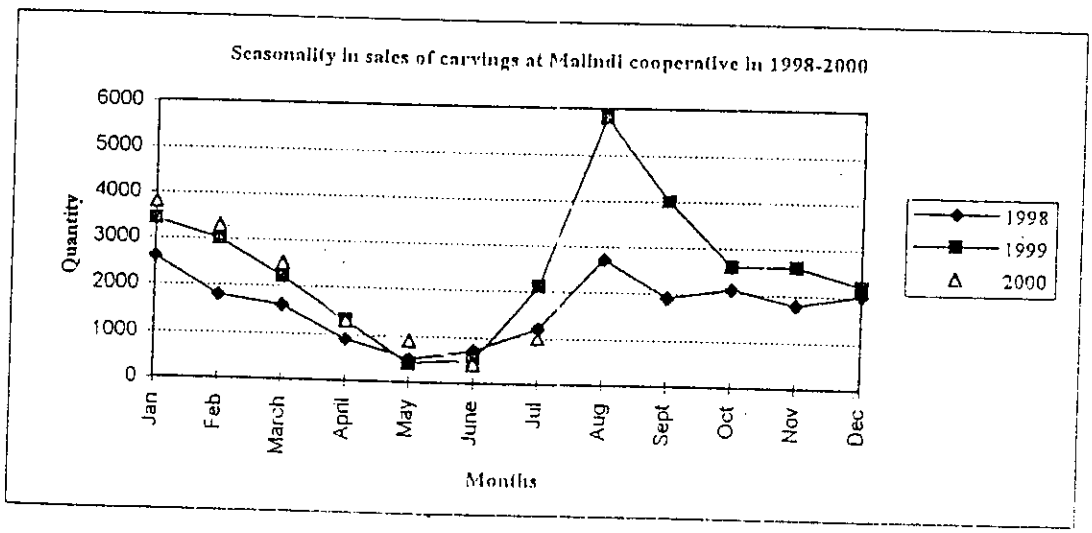




Figure 7.3: Seasonality in (a) supply of *Brachylaena huillensis* to Akamba cooperative in Mombasa and (b) sales of carvings at Malindi cooperative centre in the years 1998-2000

## 7.4 Variation in wood sizes and the link to scarcity

The targeting of the juvenile prime carving wood as an indicator of wood scarcity in Kenya is well documented (Kigomo *et al.*, 1990; Obunga and Sigu 1996). This study was designed to capture the diameter size variation of the wood entering the carving markets in order to provide some insight into the extent of the ecological impacts the carving industry has had on the existing resources. In addition, with proper documentation and identity of the sources of the specific wood species and their respective quantities, the study was able to link and compare the relative vulnerability of each species at the existing sources. The study confirmed an increased intensity of utilization of juvenile sizes over time across all the species, but the extent tended to vary with species.

### *Brachylaena huillensis*

With the distinction of being the most intensively utilized woodcarving tree species in Kenya at this stage, *Brachylaena huillensis* is also the most geographically widespread. Four main sources of *B. huillensis* were recognised as Mt. Kenya, Nyeri, Nairobi, Kilifi (Arabuko Sokoke Forest, parts of Lamu and outlying areas) and Usambara Region in coastal Tanzania. The population structure of *B. huillensis* in Mt. Kenya and Nyeri Forests may best be inferred from the wood supplied to Nanyuki and Wamunyu. Similarly, the *Brachylaena huillensis* population in Karura, Ngong and Olulua forests are known from the sizes of carving logs entering Gikomba Market. Malindi and Mombasa give the impression for Kilifi and the outlying areas. Lungalunga receives 95% of *Brachylaena huillensis* from Tanzania and therefore provides a good indication of the resource status in Tanzania.

Wamunyu is the main recipient of *B. huillensis* from the Mt. Kenya region. The diameter ranges of *Brachylaena* logs received at Wamunyu ranged from 6.8cm to 45 cm with a high concentration of logs of sizes 20cm (1998), 13cm (1999) and 12cm (2000) respectively, (Figure 7.4 d). This agrees with the findings of a recent survey (KIFCON, 1991) where the population structure of *Brachylaena huillensis* is dominated by individuals of less than 20cm DBH.

The overall diameter range of timber entering Gikomba are similar to those of Wamunyu although the values for the most intensively utilized wood sizes are much smaller for the corresponding years; 12cm in 1998 and 1999 and 8cm in 2000 (Figure 7.4 c).

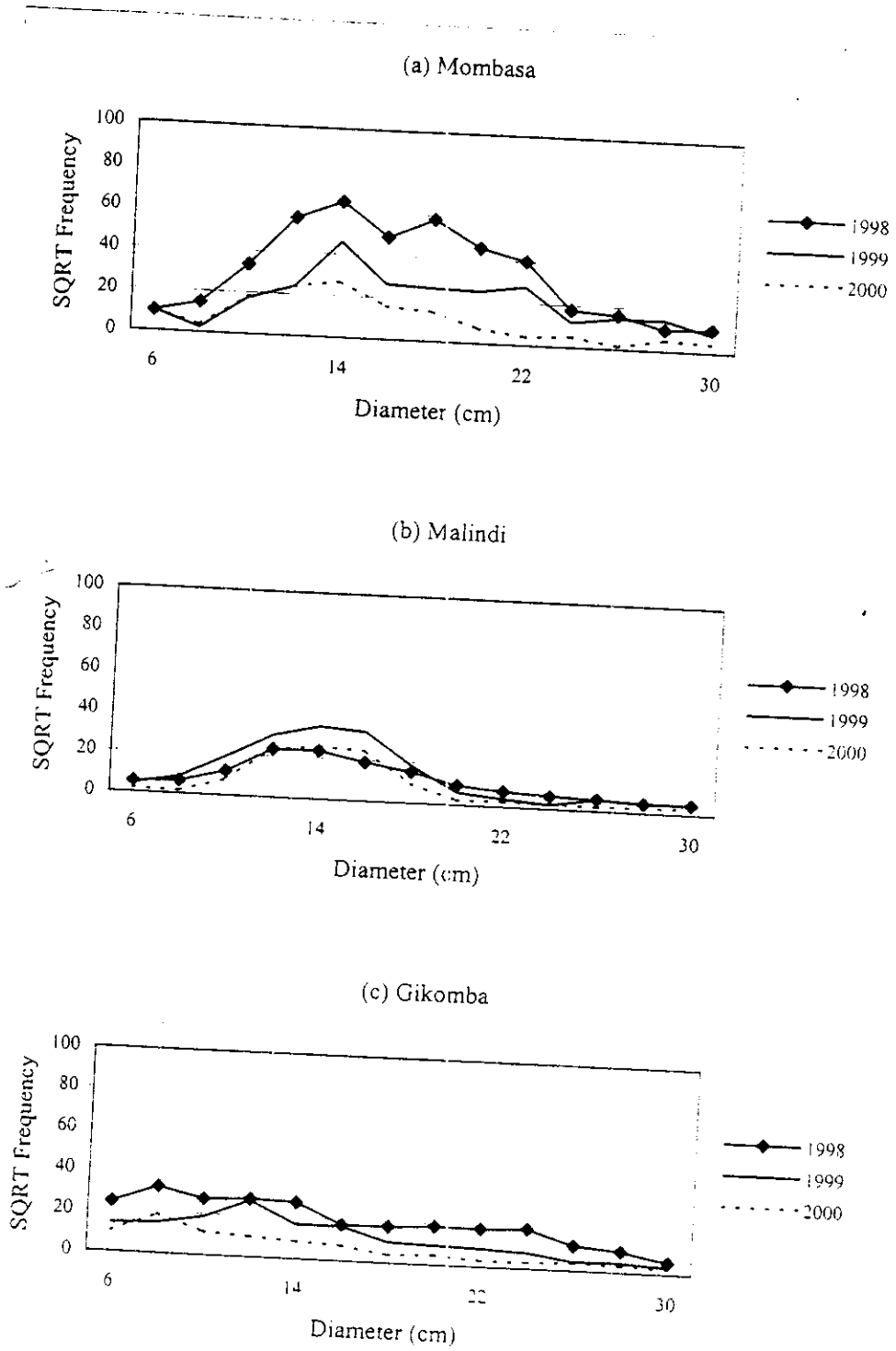
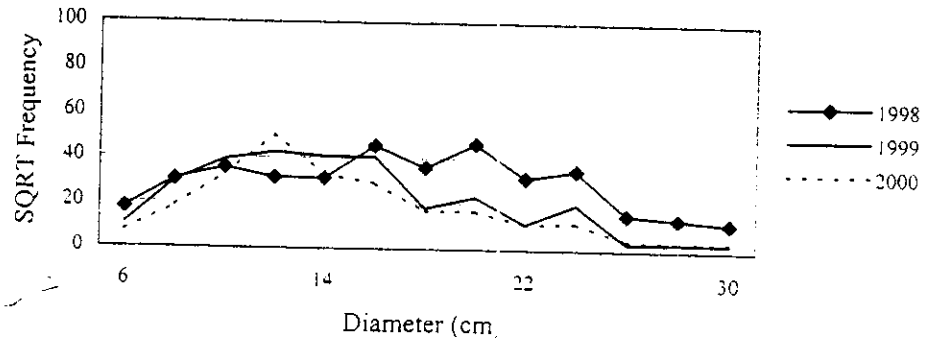



Figure 7.4 : Frequency variation for various size classes of *Brachylaena huillensis* in the years 1998-2000 for (a) Mombasa (b) Malindi (c ) Gikomba (d)Wamunyu and (e) Lungalunga

(d) Wamunyu




(e) Lungalunga

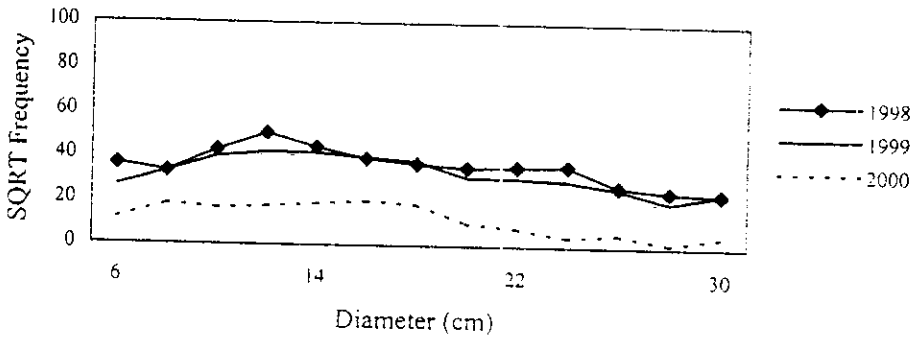



Figure 7.4 (cont.) : Frequency variation for various size classes of *Brachylaena huillensis* in the years 1998-2000 for (a) Mombasa (b) Malindi (c ) Gikomba (d)Wamunyu and (e) Lungalunga

These observations confirm the findings of a recent resource survey (Obunga and Sigu, 1996) on the population structure of *B. huillensis* at Karura, Ngong and Olulua Forests with the optimum DBH found to range from 8-25cm (Karura), 15cm-25cm (Ngong) and 10-15cm (Olulua). These forests are the main sources of *Brachylaena huillensis* carving wood, particularly to the Gikomba market.

The wood diameter frequency profiles for *Brachylaena huillensis* recorded at Mombasa and Malindi show similarities because they both share common wood sources. At both centres, the optimum diameter is estimated at 16cm (1998), 14cm (1999) and 13cm (2000) with a sharp decline above a diameter of 21 cm (Figure 7.4a and 7.4b ). Lack of large diameter logs suggests long-term removal of valuable stems from existing sources.

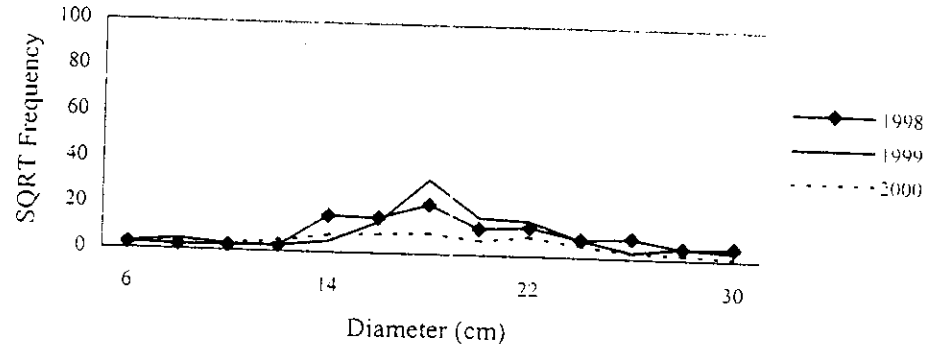
The status of *B. huillensis* at Usambara region in Tanzania may not be any better as confirmed by the diameter profiles ofwood recorded at Lungalunga, with high concentrations of wood sizes ranging between 12cm-16cm as shown in Figure 7.4e.

***Olea europaea*** sub species ***africana***

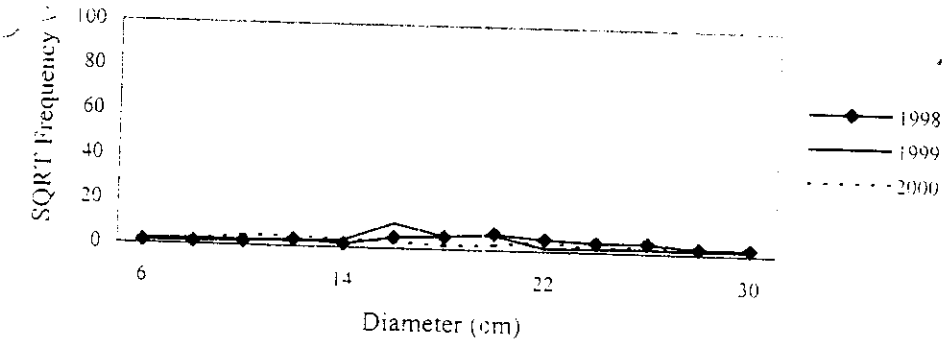
The geographical distribution of *Olea europaea* is probably the widest of the prime carving species used currently in Kenya. The natural range for the species extends as far as the western areas of Kenya and it forms important components in major forests such as Kagamega Forest, Nandi Forest and Mau Forests among others. Although localised depletions have occurred, particularly in areas close to the carving centres such as Kibwezi, parts of Mt. Kenya and Nyeri Forests, considerable quantities of *Olea europaea* still exist. Accessibility to wider sources of *Olea europaea* other than these mentioned is reflected in the high optimum[2] diameter figures across the carving centres in Kenya. In addition, the ecological impact by the woodcarving on the species seems relatively low. The low utilisation intensity is indicated by the low volumes supplied to the carving centres. Figure 7.5 shows the diameter frequency distribution profiles of *Olea europaea* round wood received at various centres in Kenya in 1998-2000. Mombasa received the highest volumes of *Olea europaea* due to the high demand hence competitive prices on offer at the centre. In all the centers, the most frequent diameter classes were observed for 14 cm to 24 cm where the quantities received at each of the centers generally low (Figure 7.5).

[2] Optimum is used here to indicate the highest recorded concentration or frequency of given sizes of carving wood.

(a) Mombasa




(b) Gikomba




(c ) Wamunyu

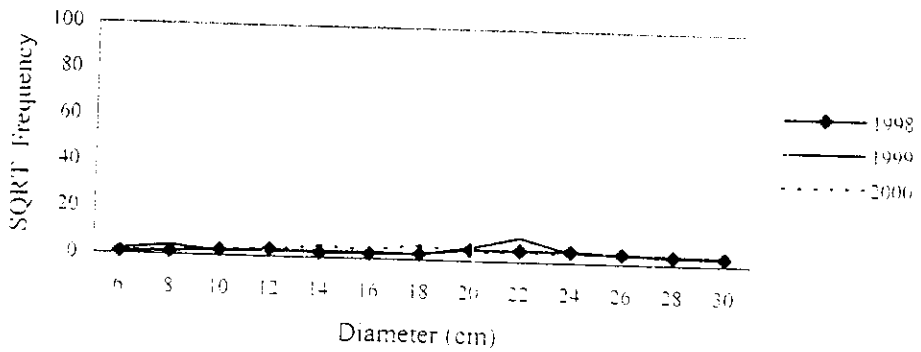



Figure 7.5: Frequency variation for various size classes of *Olea europaea* in the years 1998-2000 for (a) Mombasa (b) Gikomba (c ) Wamunyu and (d) Nanyuki

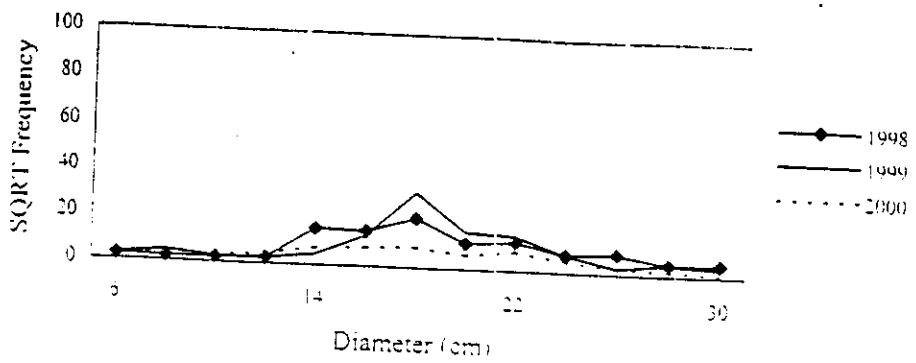



**Figure 7.5 (cont.): Frequency variation for various size classes of *Olea europaea* in the years 1998-2000 for (d) Nanyuki**

***Dalbergia melanoxylon***

The woodcarving industry in Kenya started off with the carving of *D. melanoxylon* in the Wamunyu area, making it one of the oldest consistently utilised species for carving in Kenya and the rest of Africa where it occurs. The depletion of *D. melanoxylon* around Wamunyu region over the decades had largely been attributed to the lack of collective control of resources on communal lands. Land adjudication in many parts of Machakos and Kitui is a fairly recent undertaking long after extirpations of *D. melanoxylon* had occurred in many areas.

Currently, the bulk of *D. melanoxylon* utilised is sourced from private lands with harvesting rights vested in individual land owners. Owing to the high value attached to the species in the carving industry, resource owners have been noted to use *D. melanoxylon* for speculative purposes. This has helped to regulate the off-take volumes from most of these areas as

indicated by the low volumes supplied to the carving centres in Kenya. However, these low intake volumes need to be treated with caution because a high proportion of *D. melanoxylon* carvings in the market are made outside the cooperatives. For example, carvings made by independent carvers in many parts of Kitui and sold at local markets are largely made out of *Dalbergia melanoxylon*. The volumes captured by the study therefore represent a fraction of the actual volumes of *D. melanoxylon* used.

As the case of *B. huillensis*, the similarities of the diameter profile curves for *D. melanoxylon* for wood recorded at all the carving centres suggest a common source of the resource or a similar resource status across diverse sites. Figure 7.6 show the *D. melanoxylon* diameter profiles for various carving centres in 1998-2000. Generally, there was a shift to the use of smaller wood diameters, but this was more marked at Wamunyu as carvers harvest whatever is available from areas previously harvested, particularly from the nearby rangelands.

***Terminalia brownii***

*Terminalia brownii* is one of the fairly recent alternative carving species whose popularity in the industry has gained prominence in the last three years. However, its utilization is more intensive at Wamunyu and Gikomba carving centres. The species is widely spread in rangelands of Machakos, Kitui and Makueni Districts. Owing to the prevalence of large diameter individuals, the species is popular in the carving of large carvings such as giraffes and other large sized animal figures. Whereas *T brownii* wood of large diameters dominated the two carving markets in 1998-1999, the diameter profiles indicate a general shift from the use of large diameters to small ones, particularly for Gikomba center (Figure 7.7b), unlike Wamunyu where consistent use of large diameters was observed (Figure 7.7a). This significant change is probably an early warning sign of over-exploitation of this species from the current source areas. In this regard, further investigation on the species population structure at their current sites is highly recommended.

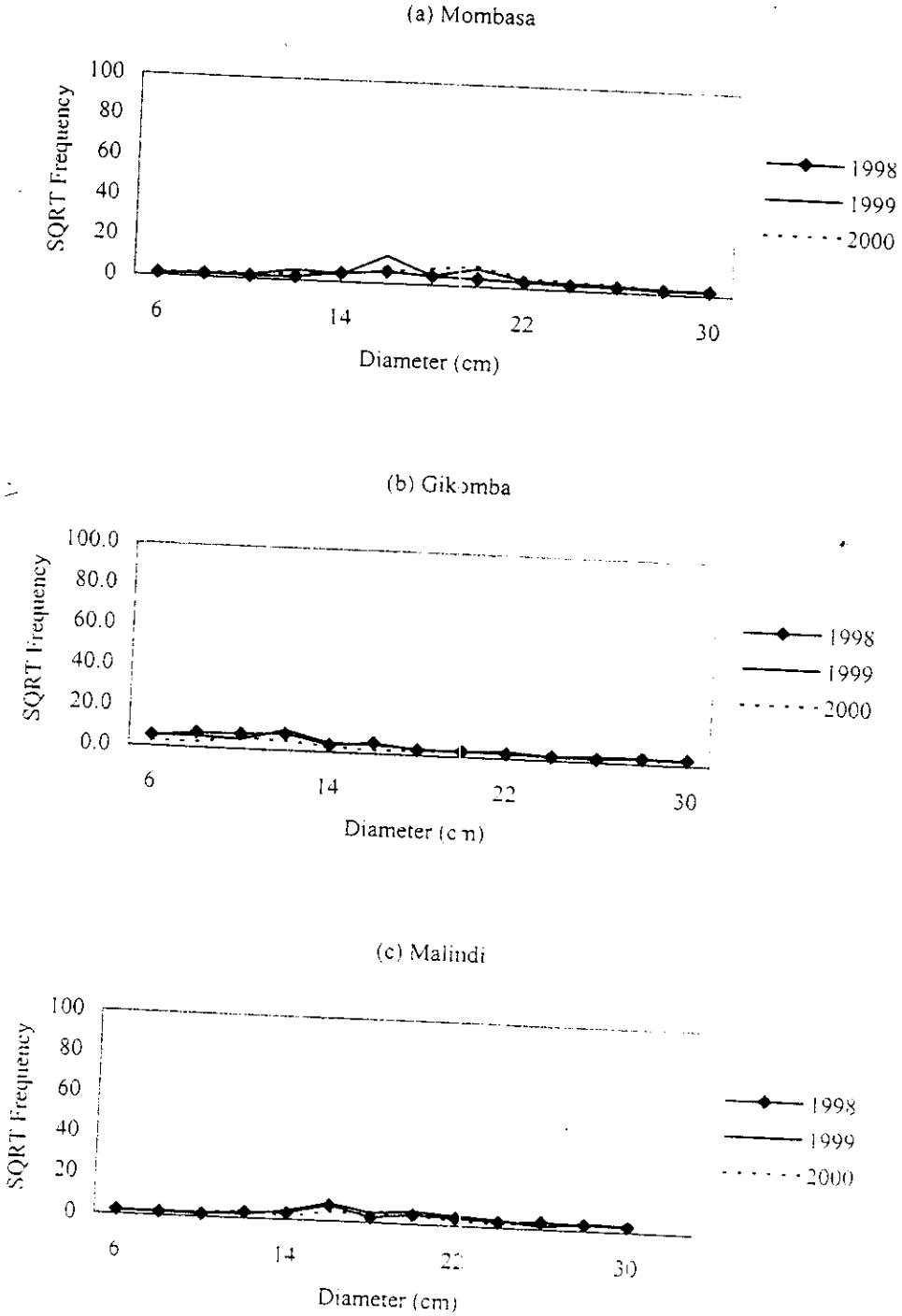



Figure 7.6: Frequency variation for various size classes of *Dalbergia melanoxylon* in the years 1998-2000 for (a) ) Mombasa (b) Gikomba (c) Malindi and (d) Wamunyu.

(d) Wamunyu

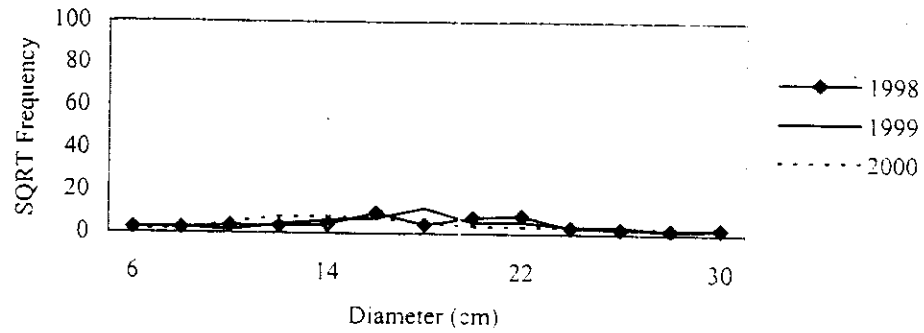
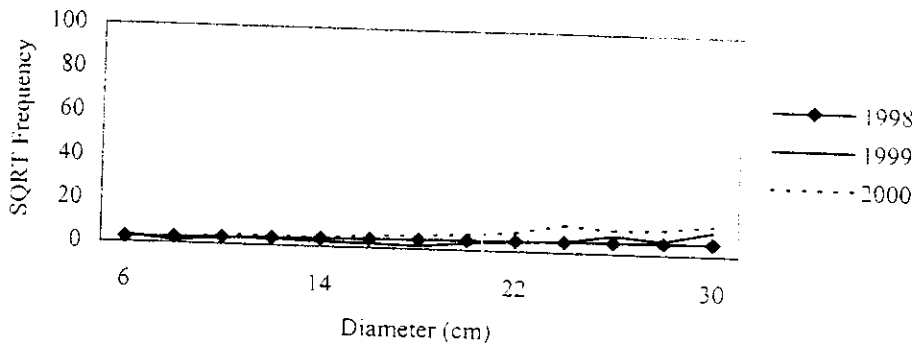



**Figure 7.6 (cont.): Frequency variation for various size classes of *Dalbergia melanoxylon* in the years 1998-2000 for (a) ) Mombasa (b) Gikomba (c) Malindi and (d) Wamunyu.**

(a) Wamunyu




(b) Gikomba

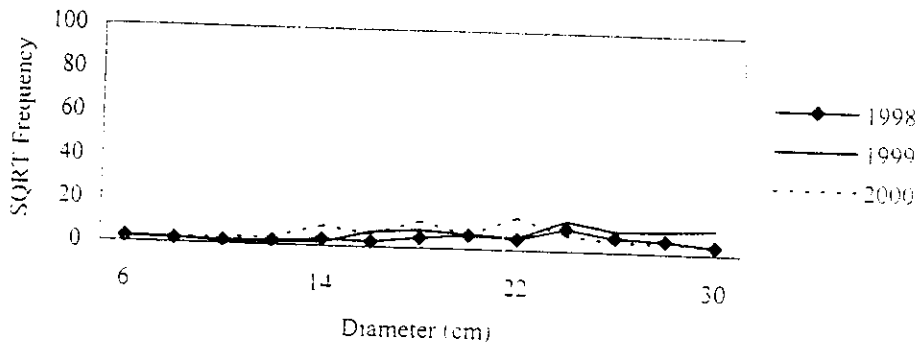



**Figure 7.7: Frequency variation for various size classes of *Terminalia brownii* in the years 1998-2000 for (a) Gikomba and (b) Wamunyu**

***Azadirachta indica*** (neem)

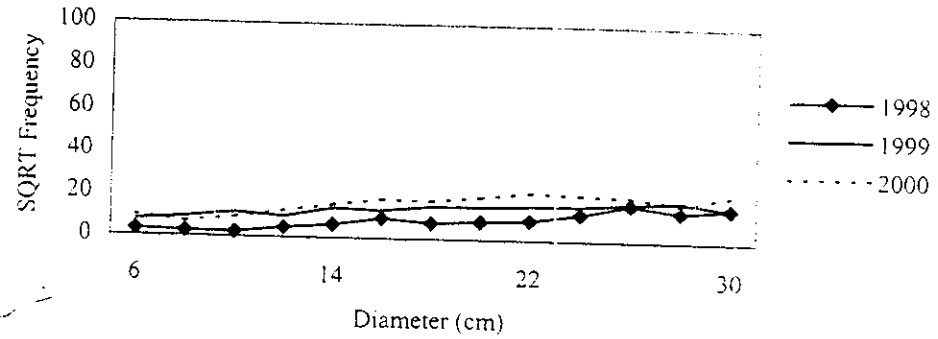
Like *Terminalia brownii*, *Azadiracta indica* (neem) is a recent discovery in the carving industry and its carving qualities are similar to those of *Brachylaena huillensis*. The use of *Azadiracta indica* (neem) as an alternative of *Brachylaena huillensis* has been successfully achieved at the Akamba cooperative society (Mombasa). Substantial amounts of *A. indica* are also utilised for carving at Malindi. The largest wood diameters on record for logs entering the carving markets in the country are those of *A.. indica* which in some cases reach close to 1m.

The diameter profiles of *A.. indica* received at Mombasa and Malindi show a relatively stable resource population with very little variation in the dominant diameters utilized for three years estimated at 27cm in Mombasa and 28cm in Malindi (Figure 7.8). Carvers seem to prefer fresh *A.. indica* wood, and considerable volumes of dry unutilized *A. indica* logs is a familiar sight at these two carving centres. The need to regulate the *Azadiracta indica* supplies in order to minimize such wastage and to ensure sustainability is strongly recommended.

***Combretum schumannii***

Intensive use of *Combretum schumannii* was observed mainly along the Kenyan coast where quantities received at Akamba (Mombasa) were relatively higher than those entering Malindi centres respectively. Although large sized *C. schumannii* wood were received over this period, smaller diameter logs, particularly at Akamba (Mombasa) centre where 10 cm to 25 cm individuals seemed to dominate the supply. Supply of *C. schumannii* to Malindi was found to be erratic and the wood of all diameter classes were represented (Figure 7.9).

(a) Mombasa




(b) Malindi

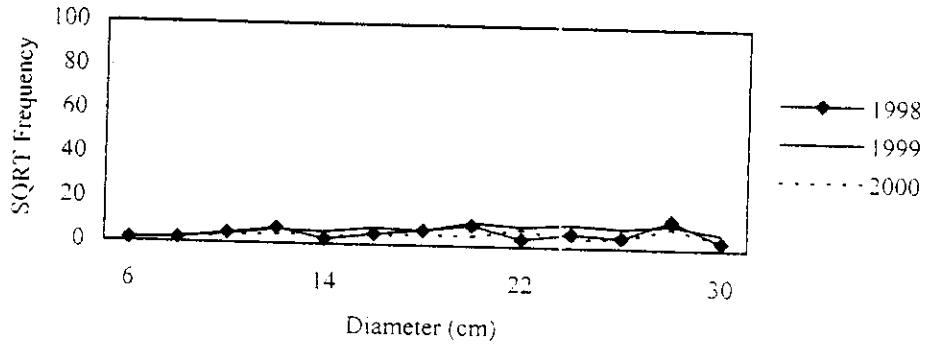
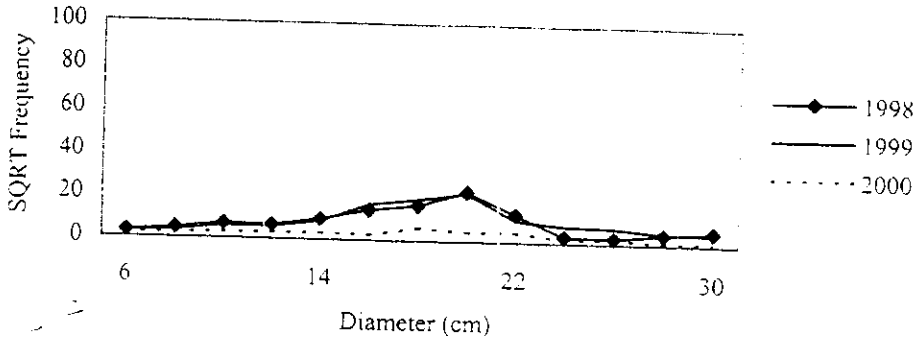



Figure 7.8: Frequency variation for various size classes of *Azadirachta indica* (neem) in the years 1998-2000 for (a) Mombasa and (b) Malindi

(a) Mombasa




(b) Malindi

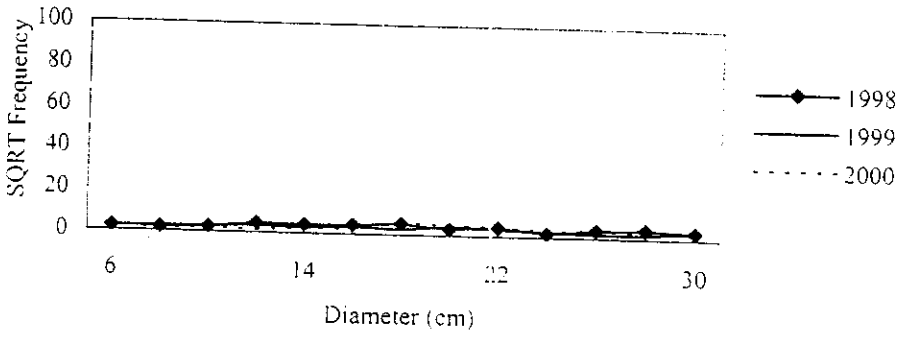



Figure 7.9: Frequency variation for various size classes of *Combretum schumannii* in the years 1998-2000 for (a) Malindi and (b) Mombasa

***Mangifera indica*** (Mango)

Significant quantities of *Mangifera indica* were supplied to Akamba (Mombasa0 and Malindi centres over the study period dominated by large diameter logs of 17 cm to over 30 cm at both centres. Quantities received at Mombasa were nearly the same for the three years with the dominant diameters of between 15 cm and 25 cm for the entire period (Figure7.10a)

***Jacaranda mimosifolia.***

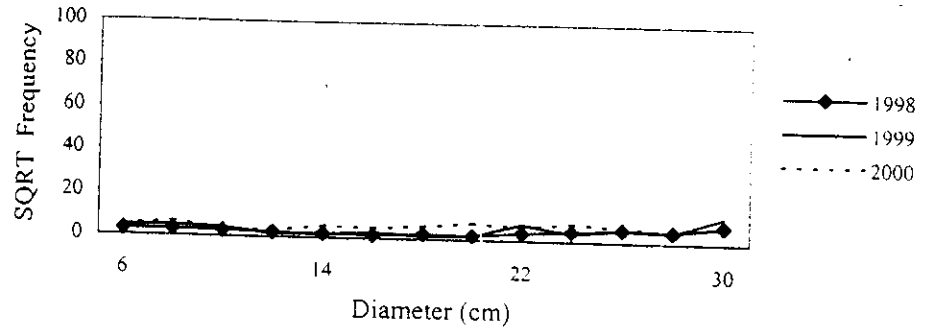
Utilisation of *Jacaranda mimosifolia* for carving is confined to the Gikomba Cooperative centre where supplies are obtained from the city of Nairobi and its environs, mainly from private premises. The shortages of the supplies of *Brachylaena huillensis* and other prime carving species in the recent times has led to an inreasingly intensive use of *Jacaranda mimosifolia.* Intensive use of *Jacaranda mimosifolia* is likely to be sustained on a short-term basis only because the existing *Jacaranda mimosifolia* resource base is limited. Indeed, early signs of resource shortage may be inferred from a sharp shift of the dominant wood diameters from 20 cm to 25 cm in 1998/99 to less than 20cm in 2000 (Figure 7.10c).

## 7.5 Discussion

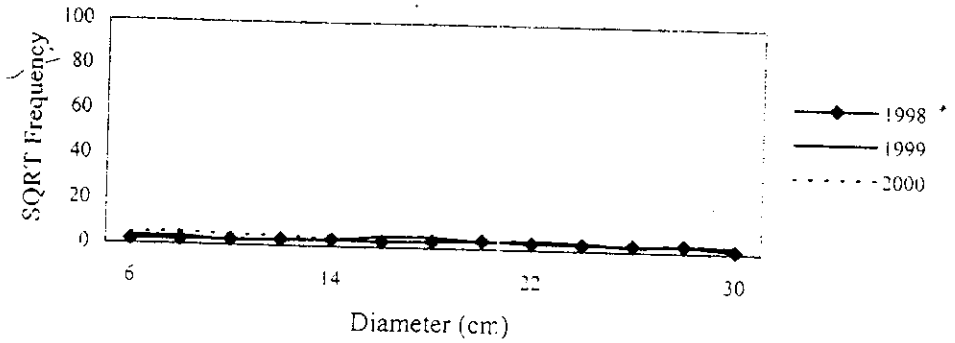
It is widely accepted that the Kenyan woodcarving industry is a rural development success facing an uncertain future. This uncertainty is largely due to its dependence on declining stocks of over-exploited, slow growing hardwoods, mainly sourced from state forests in the cases of *Brachylaena huillensis, Combretum schumanii, Olea europaea* sub sp. *africana and Spirostachys africana* and private lands in the case of *Dalbergia melanoxylon.*

This study has established that about 60% of the volume requirement in the entire industry is met by *Brachylaena huillensis* alone. This confirms the extent at which the industry is vulnerable owing to an over dependence on one species. For example, when restrictions on the sourcing of *Brachylaena huillensis* from state forests were enforced more strictly in late 1998, carvers in Kenya were momentarily placed at a state of helplessness. The ecological impacts brought about by this massive utilization on the existing populations of the species are significant as infered by the dominance of small diameter carving logs entering the markets. If this rate of exploitation is not checked, *Brachylaena huillensis* is then headed for extinction.

(a) Mombasa (Mango)




(b) Malindi (Mango)




(c) Gikomba (Jacaranda)

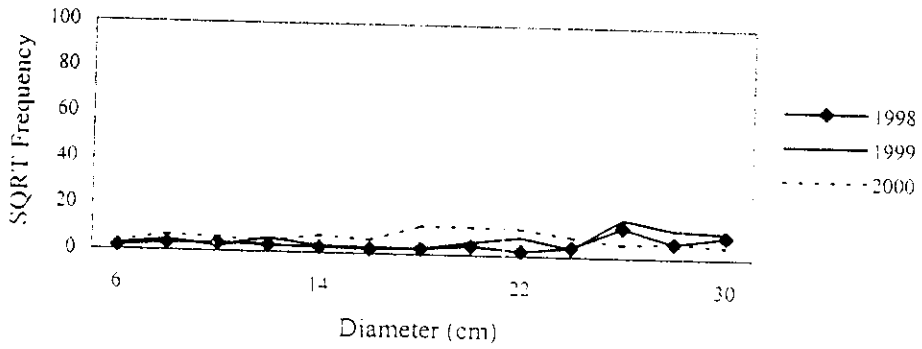



**Figure 7.10: Frequency variation for various size classes of *Mangifera indica* (Mango) in the years 1998-2000 for (a) Malindi (b) Mombasa and *Jacaranda mimosifolia* for (c ) Gikomba**

The carvers are aware of the wood shortages and are way head in carving trees of unknown carving qualities or incurring higher costs to source wood from distant sources. At the same time, they are learning to be more economical in the use of the the little that is available to them whose supply is increasingly becoming erratic and unreliable.

Beale (1995) observed that the reason why a resource is depleted and potentially threatened with extinction is because of the issues of externalities, ill informed resource rights, imperfect information and discounting, which cause a difference between the social optimum rate of exploitation and the optimum private rate of the exploiter.

According to Ciriacy-Wantrup (1952), renewable biolcgical resources could be exploited within limits beyond which further depletion would have irreversible and uncertain effects in the future. He went further to state that the presence of such irreversible, uncertain and thus possibly large effects meant that there should be an emphasis on safe minimum standards (SMS) being adopted which would prevent the loss of unique natural resouces.

Similar approaches on decisions about depleted biological resources were further developed by Bishop (1978) and Krutilla (1969) by advocating the use of a minimax strategy which minimises the maximum amount of loss that would occur due to a specific decision. As to how to determine the rights of future generations to unique resources from the viewpoint of the present, Bishop concludes that like all choices relatec to distribution, these choices must ultimately rest with society and the institutions it has created to deal with such issues.

The main sources of *Brachylaena huillesis* in Kenya are forests around Mt. Kenya. Supplies from this location were transported as far as Mombasa, particularly in 1998 and 1999. These forests have been under siege and threat from extensive tree logging, charcoal production, *Cannibalis sativa* (bhang) growing, livestock grazing and various forms of cultivation and illegal allocation of forest land (land grabbing). Mt. Kenya is Kenya's prime water catchment area and it is estimated that half of Kenya's population rely on it for water. Much of the country's hydro-electric power generation depends on water from this catchment as do the livelihoods of millions of agriculturalists and other users of land. The hydro-power shortfalls and the current water rationing programme in Nairobi and other cities in Kenya are pertinent

reminders of the country's dependence on Mt. Kenya Forests and the consequences of the ongoing destruction, which unfortunately includes woodcarving. In an effort to contain this crisis which has all the makings of developing into a major environmental disaster in Kenya, the government (1999-2000) made far reaching changes in the stewardship of Mt. Kenya Forests from Forest Department to the Kenya Wildlife Service. This is the main reason for a reduction in supply of the species for carving in the last two years.

Similar accounts of increased logging and related destruction activities have appeared concerning Karura, Ngong, Olulua, and Arabuko Sokoke Forests which constitute the existing sources of *Brachylaena huillensis*. They all need increased conservation attention as indicated by the dominance of small diameter logs from these sources. The high concentration of carvers at Wamunyu and therefore the high demand for wood needs to be addressed in order to ensure sustainable sourcing for carving wood in the region. With the current establishment of a large tree nursery, efforts to encourage extensive tree planting in the region to satisfy demand for carving wood is probably the best available option.

The status of *B. huillensis* at Usambara region in Tanzania may not be any better as confirmed by the diameter profiles of wood recorded at Lungalunga. The *B. huillesis* habitats in East Usambara (Tanzania) have been a subject of a recent study (Sheil, 1992; Burgess *et al.*, 1992; Norbert, 1997). The study noted the rapid destruction of the key habitats largely through human related activities. Of major concern was the inceasing destruction of *Brachylaena huillensis* woodlands north of East Usambara by the charcoal industry. Woodcarving is a rising additional human activity as we know it today. The Usambara region has been proposed as a forest reserve as a measure to reverse the adverse trend (Johanson and Sandy, 1996).

The increased utilization of *Terminalia brownii* sourced from private farmlands is encouraged. However, care needs to be taken to ensure that the available stocks are not excessively harvested from one area.

With a 72% of carving wood volume entering the industry being concentrated along the Kenyan coast, greater efforts to ensure resource sustainability needs to be made in order to

satisfy the high demand made by the carvers in this area. Private investments in the planting of *Azaditachta indica, Brachylaena huillensis* and other species should be promoted particularly among the resident population in the region. *Azadirachta indica* (neem) has shown the potential to substitute the utilization of *Brachylaena huillensis*. However, the extent at which this can meet the rising demand is not known. In this regard, inventories on *A.. indica* (neem) populations along the entire coastline are recommended

### 7.6 Summary

The study has established that of all the species used in the woodcarving industry in Kenya, *Brachylaena huillensis* has had the greatest conservation impacts. Unless urgent mitigation measures against further intensive utilization in the industry are put in place without delay, the species is headed for extinction.

Efficacy of the existing government policies on harvesting of indigenous trees has been a complete failure and needs to be reviewed in order to solve the problem of illegal sourcing. Although more restrictions on access to *Brachylaena huillensis* was enforced more strictly in the last two years, sustainability in enforcement of this restriction may not be possible on long term basis as much of this will depend on political changes in the country. On the interim, the international carvings market may have to intervene in efforts to restrict the use of *Brachylaena huillensis* in carving as part of the efforts to help in conservation of this and other threatened prime carving species.

# CHAPTER EIGHT

# MARKETING OF CARVING WOOD IN KENYA

## 8.1 Introduction

In the face of increasing human populations and poverty, commercial use of tree resources forms one of the core economic activities of many people. The woodcarving industry in Kenya has been a major consumer of specific hardwoods and has created viable markets for these woods whose sources are either the state forests or private farmlands. Arnold and Perez (1996) have argued that trees of commercial importance may be included in farming systems as commercialization has often led to scarcity, domestication and privatization of such resources as observed in many parts of the world. Trees of commercial value and economic importance, like the non-timber forest products (NTFPs) often provide economic buffers in crops failure as well as a source of additional incomes when benefits of other economic activities are temporarily reduced (Chambers and Leach, 1987). The harsh environmental conditions which prevail in Kitui, Machakos and other Districts in Kenya where woodcarving forms one of the main economic activities is probably one of the reasons which has made the industry a full time economic activity, hence a huge market for carving wood.

Marketing is the performance of all the activities necessary to transform a raw product from its point of production, harvest or gathering to the point of final consumption (Veeman, 1999). This Chapter explores the marketing chain for carving wood in Kenya from the point of harvesting to the final user (carver). The purpose for this was to attempt to identify the stages of this chain that have contributed to the depletion of the scarce resource. Once this is done, it may be possible to suggest appropriate intervention measures in the form of policies that may save the industry from collapse. The chapter also gives a wider overview of the round wood trade in Kenya, it's pricing, and how carving wood trade relates to it in terms of size, round wood market share, participants, revenues and range of species in use.

## 8.2 Round wood trade in Kenya

### 8.2.1 Structure of the domestic round wood trade

Wood is of critical importance for both subsistence and commercial purposes in Kenya, being one of the most important products derived from forests in the country. The trade network for wood and wood products within the country is complex and is presented in Figure 8.1. Round wood comes from three main sources; commercial plantations of alien species, natural forests and woodlands of native hardwood species, and importation. Ownership of these resources

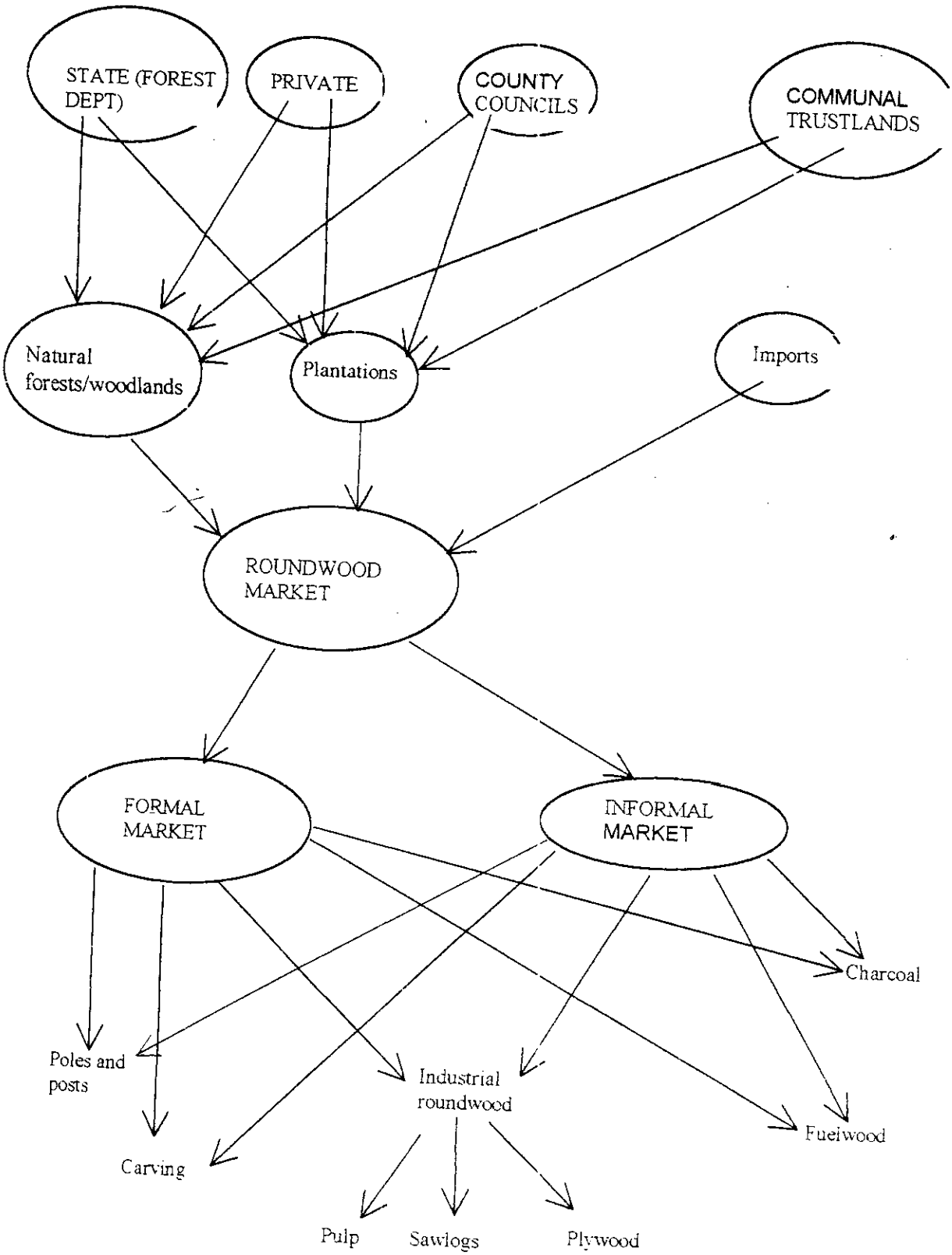



**Figure 8.1 : Structure of round wood trade in Kenya**

is varied and includes the state, county councils or even private ownership. Major closed canopy natural forests and plantations in Kenya are owned and managed by the state through the Forest Department. The Department is in charge of developing, managing and controlling the utilization of the forests by local people for subsistence purposes and the commercial industrial sector.

Forest plantations largely produce fast growing exotic softwoods such as pine and cypress, which meet the vast majority of basic building and carpentry requirements in the country. They were developed as a response to the very low capacity of indigenous forests to supply wood on a sustainable basis because of slow growth rates. The area under state forest plantations in Kenya is estimated at 170 000 hectares, while the area covered by private plantations is estimated at 70 000 hectares. The main species grown include *Eucalyptus spp.* (gum), *Acacia mearnsii* (wattle) and others. Owing to the intensive management of these plantations, the growing stock of wood biomass is estimated at 347$m^3$/ha (KIFCON, 1994). These softwood plantations provide for approximately 80-90 % of Kenya's industrial timber needs with an annual sustainable supply volume estimated at 2 494 000 $m^3$ (KIFCON, 1994).

None of the major softwoods in plantations has been significantly utilised in the woodcarving industry except for the limited use of *Cupressus lusitanica* in the carving of utilitarian articles such as spoons, salad servers and stools, observed at Nanyuki and Gikomba carving centers. However, from a broader perspective, the softwood plantations have helped to reduce the potential utilization pressures on the woodcarving hardwoods, which would have otherwise been long exterminated.

Attempts have been made to diversify the choice of plantations using a variety of tree species, in order to address the changing end use objectives, relative susceptibility to insects and diseases and effectiveness of regeneration among other reasons. In this respect, *Brachylaena huillensis*, *Olea europaea, Azadirachta indica* and a wide range of other indigenous species have been tried in plantations, but on a limited scale such that their contribution to the round wood market in Kenya is considered insignificant. Much of it has largely been for purposes of research or to promote conservation.

Although the natural indigenous forest resources cover a large land area (1.22 million ha), their low growth rate, hence low growing stock (176$m^3$/ha) is a limitation to their large-scale intensive utilization. The lack of proper co-ordination of their utilization together with the high off-take volumes over and above what appeared to be sustainable led to a Presidential ban on their continued use.

This national ban on felling of live indigenous hardwood trees except for fallen or dead trees was effected in the mid-1980s and still stands to this day. Other than the high off-take volumes as a reason for the ban, it was felt that the environmental services provided by the indigenous forests through their protective role of watersheds, as well as other non-extractive uses had a priority over all other uses. Despite the ban, illegal extraction of round wood from these forests has been rife and is estimated at over 50 000$m^3$ annually (Marshall *et al.*, 1994). These indigenous forests are the major sources of the most desirable and expensive hardwoods that are in high demand mainly for high-class construction, furniture making, charcoal production and woodcarving. Overall, annual sustainable accessible round wood production from Kenya's indigenous forests is estimated at between 1 620 000$m^3$ (Wass, 1995) and 1 905 000$m^3$ (KIFCON, 1994).

Trees planted on private farmlands, in settlements and in urban areas, form an important source of round wood in Kenya. Tree planting on farmlands and settlements in Kenya has a long history. The practice was intensified as early as the 1970s through popular promotion by the statutory organs and various volunteer groups and organizations. The domestic and rural round wood demand in many parts of Kenya today are being satisfied through this scheme. The supply of *Jacaranda mimosifolia*, and *Grevillea robusta* to Gikomba (Nairobi) carving centers is largely through these farmland and urban tree planting efforts that were initiated three or so decades ago. If efforts to plant some of the prime carving species were started then, the industry would no doubt be more secure than it is today. Survey on wood resources in Kenya (JICA, 1992) showed a high land area covered by farmland and urban tree resources (9.5 million ha) and a high volume of wood biomass (9.3$m^3$/ha) that was estimated as exceeding that of closed canopy forests and plantations combined. The total annual accessible sustainable round wood supply from farmlands and settlements is estimated at 9 373 000$m^3$ (KIFCON, 1994).

The importation of wood is not new in Kenya as specialized hardwoods from many countries find their way into the country. These include Australia (*Eucalyptus marginata*), Tanzania (*Pterocarpus angolensis*, *Milicia excelsa*, *Brachylaena huillensis*), Uganda (*Pterocarpus angolensis*), Zaire, Zambia and UK. Recent studies on wood imports to Kenya (Marshall and Jenkins, 1994) reported an annual fluctuation of imports of 7 062 $m^3$ (1984), 7 128 $m^3$ (1990) 3 926 $m^3$ (1991) and 2 297 $m^3$ (1992).

Woodlands and bushland are also important sources of round wood in Kenya. By virtue of the extensive area covered, the potential sustainable wood supplied from this source is estimated at 11 157 000 $m^3$ annually (KIFCON, 1994).

### 8.2.2 Sources of carving wood by ownership category

On the basis of the structure of the domestic trade of round wood in Kenya, the wood volumes entering the carving market were classified according to the respective sources as shown on Table 8.1. These figures are averages for the round wood of all species supplied to the carving markets from 1998 to 2000. It was found that the carving wood originating from the state forests during this period accounted for 35% of the total volume, followed closely by imports from Tanzania, which accounted for 34.2%. A significant quantity of the carving wood was also sourced from private lands estimated to constitute 25% of the total volume. The lowest quantities accounting for 0.7% of total volume originated from communal lands largely because of the past intensive utilization of the marketable wood to the extent that accessible areas are now severely depleted. Gikomba, Malindi, and Akamba (Mombasa) carving centers received almost equal proportions of carving wood from the state and private land respectively while the bulk of carving wood entering Wamunyu originated from state forests. In the event of more restricted access to wood resources in the state forests in future, carvers at Wamunyu are therefore likely to be the hardest hit.

**Table 8.1: Sources of carving timber by ownership category**

| Carving center | State forest | Private land | County council | Imports | Communal lands | Totals |
|---|---|---|---|---|---|---|
| Nanyuki | 220.0 | 11.9 | 7.3 | - | - | 239.2 |
| Gikomba | 1109.4 | 1390.2 | - | - | 9.7 | 2509.3 |
| Wamunyu | 3459.5 | 884.6 | | | | 4344.1 |
| Malindi | 621.2 | 804.6 | 70.3 | - | 137.8 | 1633.9 |
| Mombasa | 3553.2 | 3403.5 | 1269.6 | 644.2 | - | 8870.6 |
| Lungalunga | 242.7 | 39.4 | - | 8367.6 | - | 8649.8 |
| Makindu | 25.0 | 30.0 | 15.0 | - | | 70.1 |
| Total | 9230.9 | 6564.2 | 1362.4 | 9011.8 | 147.5 | 26,317 |
| Annual mean | 3076.9 | 2188.0 | 454.0 | 3003.9 | 49.2 | 8772.3 |
| % | 35% | 25% | 5.1% | 34.2% | 0.7% | 100% |

The general movement of woodcarving raw materials in Kenya is shown in Figure 8.2. The most important source areas constitute Mt. Kenya Forest Reserve, which supplies raw materials to nearly all woodcarving centers except Malindi and Lungalunga. The source areas of the 6 largest wood carving market centers are provided for the interior (Figure 8.3) and coastal region (Figure 8.4) of Kenya. The carving centers in the interior are Gikomba, Nanyuki and Wamunyu where carving wood resources used at each of these centers originate from common sources, namely Mt. Kenya region, Kitui, Machakos, Makueni, Mwingi, Kiambu and Nairobi Districts. Carving wood from the same sources were also supplied to the Akamba (Mombasa) carving market being the largest carving market in the country with

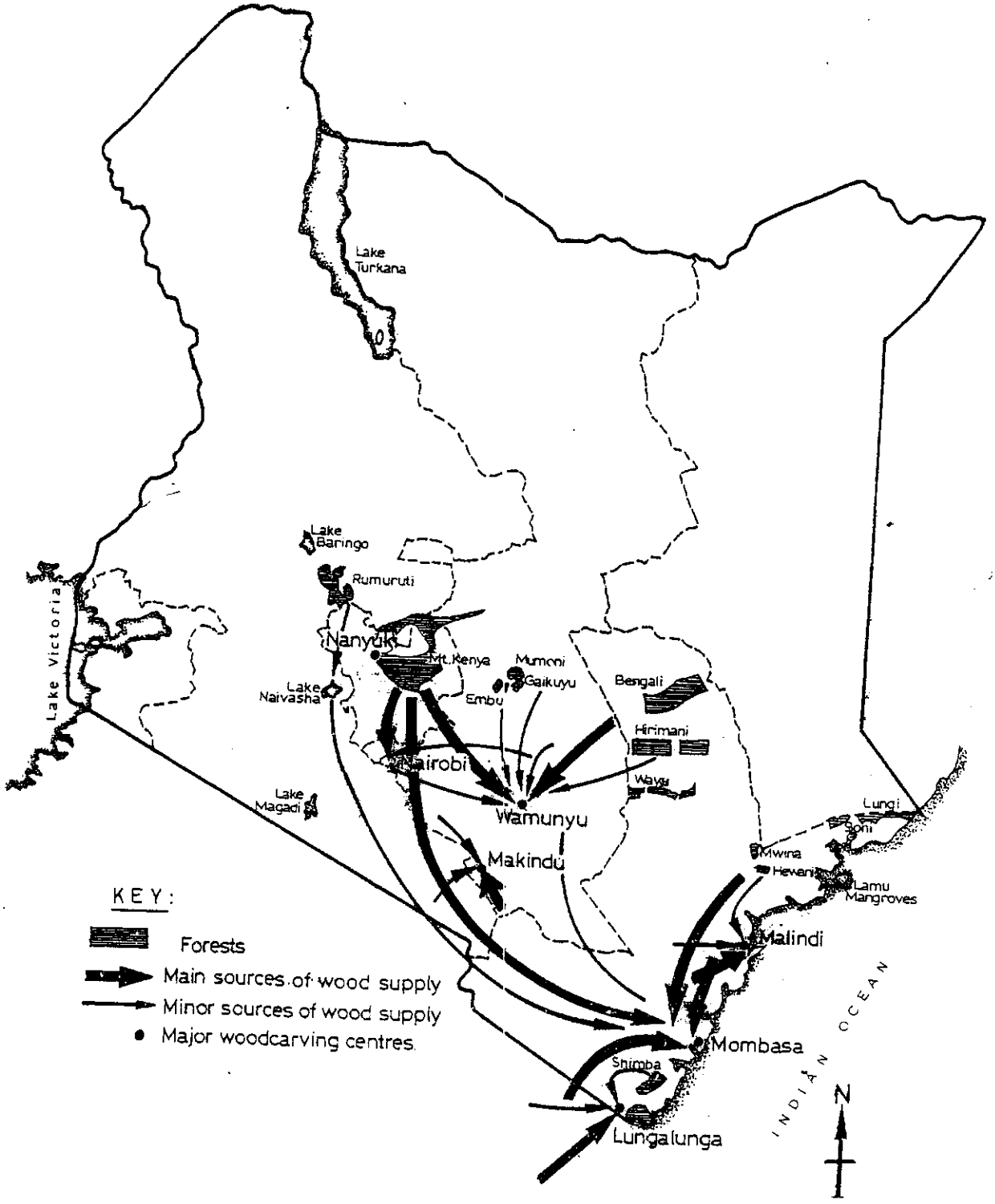



Figure 8.2: Main sources and destinations of woodcarving raw materials in Kenya

**Movement of Woodcarving Timber in Central Parts of Kenya**
(Annual volumes in cubic metres)

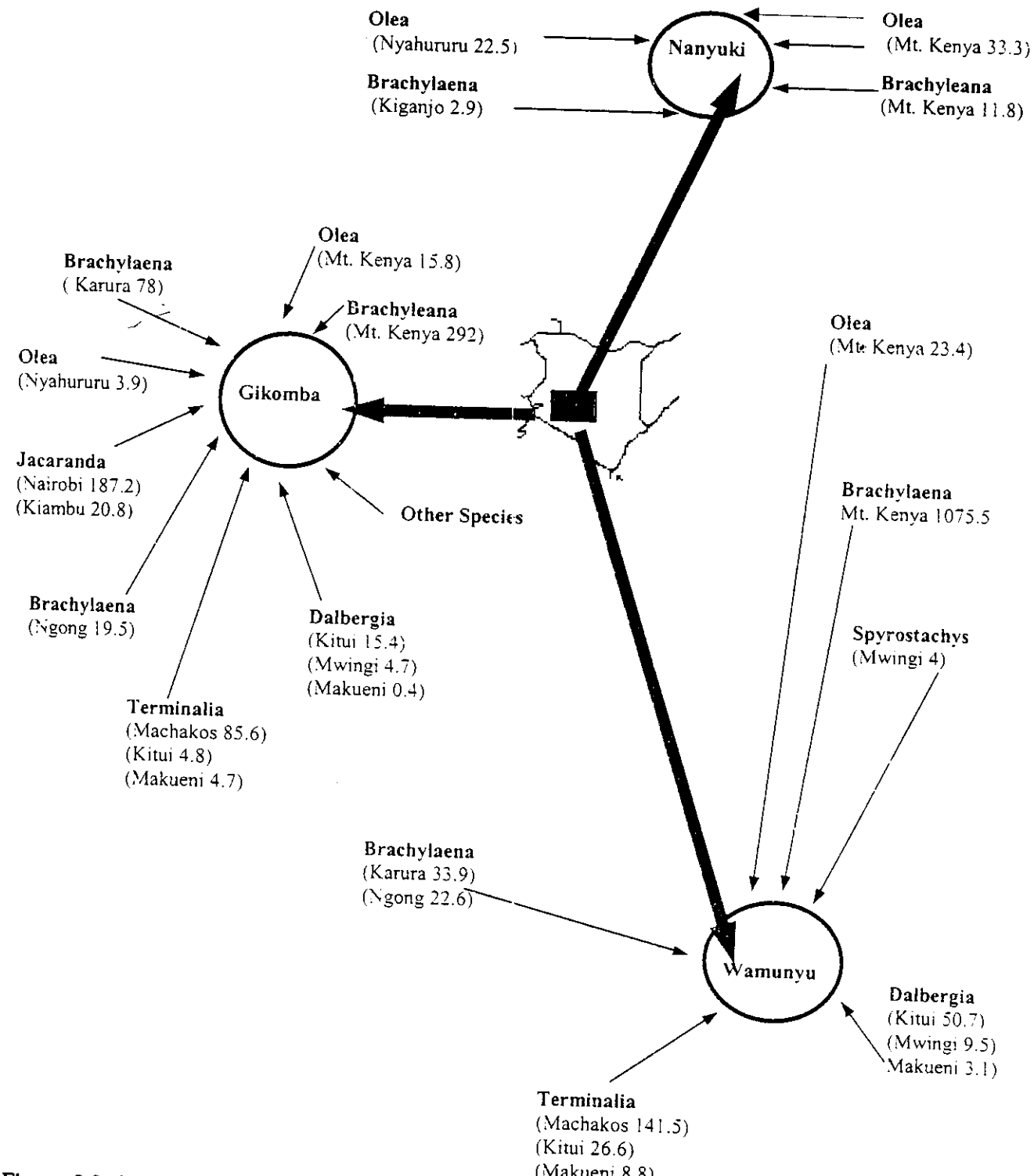



**Figure 8.3: Movement of carving wood supplies to Gikomba, Nanyuki and Wamunyu carving centers in the years 1998-2000**

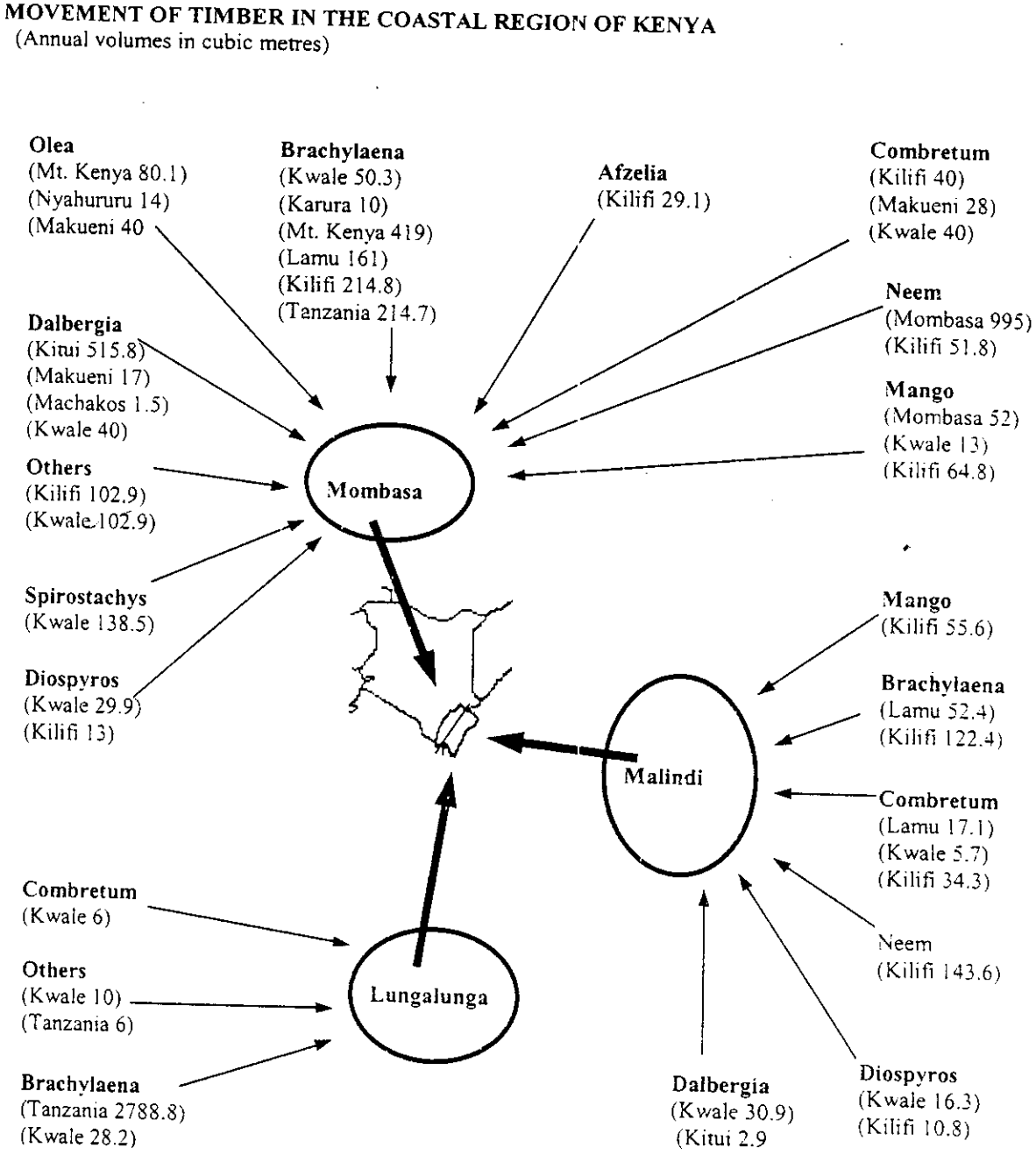



**Figure 8.4: Movement of carving wood supplies to Lungalunga, Malindi and Mombasa carving centers in the years 1998-2009.**

the highest number of carvers and a corresponding demand for carving wood. The center also received wood supplies from the surrounding coastal Districts such as Kilifi, Kwale and Lamu, as well as imports from Tanzania.

## 8.3 Wood pricing in Kenya.

### 8.3.1 Government pricing system

The evolution of round wood pricing in Kenya is well documented (Maingi, 1989; Solberg, 1975; GOK, 1982), dating back to 1900. According to Maingi (1989), the round wood pricing system has undergone four recognized stages. These are the payment of a fixed fee for unlimited extraction (1900s), fee payment for stacked wood irrespective of species (up to 1925), linking of fees to species characteristics where similar species attract equal fees, and finally payment of fees where each species fetched it's own price (1960s). All these methods had shortcomings and resulted in low revenues to the state leading to unsustainable forest plantations development. The rising demand for sawn wood in the face of declining supplies prompted the government of Kenya to seek a World Bank loan in 1975 to finance a plantation development programme. The loan was approved but with certain conditions, including a requirement to link value of standing round wood (stumpage price) to annual inflation, to improve round wood measurement, and price formulation, and to promote marketing such that all costs incurred the in the rotation period be recovered. The rates to be charged on standing round wood (stumpage[2] price) are supposed to be determined by the cost of replacement of the capital costs already incurred during plantation development. This is also known as replacement cost method. This method guarantees recovery of all costs of production regardless how efficiently or inefficiently they were incurred. However, the stumpage price being based on historical/past costs that has no relevance in the present forming the main limitation to the continued use. This is probably one of the reasons why its use was stopped in Kenya recently. Although the past records can be subjected to statistical econometric concepts using the current supply and demand functions, this method needs a competitive market with many round wood suppliers on which to base the current prices, which is lacking in Kenya. Instead, the round wood supply in the country is dominated by the State (Maingi, 1989).

The method of round wood pricing now in use is based on the market price of sawn wood of a given species (Marshall *et al.*, 1994), and the prices of some of the indigenous and products are shown in Table 8.2. The stumpage price is determined by deducting from the price of processed wood products (sawn wood) the costs of sawn wood production, transportation,

[2] Stumpage price is the price of wood at the source before harvesting, handling and transportation charges are included. This is the price often paid to the government by wood dealers as they source the wood from state forests.

logging, and allowing a normal return on investment. This is also known as the residual method or derived demand stumpage value (FAO, 1983) or value based method (Davis *et al.*, 1987).

**Table 8.2: Wood stumpage prices in Ksh/m$^3$ (unless otherwise specified) for selected wood carving species and products from 1992-2000**

| Species | 92/93 | 93/94 | 94/95 | 95/96 | 96/97 | 97/98 | 98/99 |
|---|---|---|---|---|---|---|---|
| *Afzelia quazensis* | 574 | 725 | 3626 | 3684 | 3684 | 4015 | 4417 |
| *Brachylaena huillensis* | 364 | 628 | 3139 | 3184 | 3184 | 3476 | 3824 |
| *Combretum schumanii* | 364 | 725 | 3626 | 3626 | 3184 | 4015 | 4417 |
| *Dalbergia melanoxylon* | 574 | 725 | 3626 | 3626 | 3684 | 4015 | 4417 |
| *Olea europaea* | 574 | 460 | 3626 | 3626 | 3684 | 4015 | 4417 |
| *Terminalia brownii* | 166 | 210 | 2299 | 2299 | 2336 | 2546 | 2801 |
| Other species (indigenous) | 166 | 166 | 273 | 273 | 277 | 302 | 332 |
| Hardwood poles < 10cm diameter 10-15cm diameter | 1.50/m | 2/m | 2/m | 2/m | 4/m | 4/m | 4/m |
| Firewood Natural forest | 1.80/m | 2.5/m | 2.5/m | 2.5/m | 5/m | 5/m | 6/m |
| per stack | 96/stack[3] | 120/stack | 120/stack | 135/stack | 200/stack | 200/stack | 220/stack |
| per m$^3$ | 32/m$^3$ | 40/m$^3$ | 40m$^3$ | 45/m$^3$ | 70/m$^3$ | 70/m$^3$ | 77/m$^3$ |
| Exotic forest per stack | 78/stack | 105/stack | 105/stack | 120/stack | 180/stack | 180/stack | 198/stack |
| per m$^3$ | 28/m3 | 35/m$^3$ | 35m$^3$ | 40 m$^3$ | 60/m$^3$ | 60/m$^3$ | 66/m$^3$ |

The procedure for the stumpage price determination in Kenya depends on whether the species is plantation (softwood) or non-plantation (indigenous hardwoods). Although the stumpage price determination for hardwoods (known as ground scaling) is fairly easy, that for the soft woods depends on whether the standing wood is being thinned or clear felled, and whether the stems were pruned as well as their diameters at the time of felling where large diameter individuals attract high prices. This is also known as sliding scaling method.

There has been a marked increase in the prices of wood products in Kenya, where for example, the sharpest increase was recorded in 1994/95 when the Kenyan Shilling was devalued owing to inflationary pressures.

[3] One stack weighs about 20 kg

### 8.3.2. Other methods of pricing with potential uses in Kenya

#### 8.3.2.1 Negotiation method.

Negotiation of forest charges is not widely used. where it is used it is generally applied in special circumstances. For example, it was used in Liberia until 1973 and in Ghana until early 1960s (FAO, 1983). In spite of its simplicity, the government requires knowledge of the industry, the value of logs, products and costs of logging and processing, without which it is likely to remain in a weak bargaining position. It is difficult to imagine how practical this method can be if applied to the woodcarving industry, particularly for species extracted from state forests. However, this method now applies for the wood sourced from private farmlands where dealers often negotiate with the landowners. Landowners in the interior regions of Kitui District were observed to continue to still accept low prices offered by timber dealers. By reason of the harsh climatic conditions of some of these regions and high poverty levels, selling a *Dalbergia melanoxylon* tree at a throwaway price can make a difference between having a day's meal or none at all. It is therefore important to advocate for the formation of *Dalbergia melanoxylon* producer associations in the interest of regulating the prices and long term conservation of remaining stocks of this species.

#### 8.3.2.2 Open bid and sealed bid auctions

According to Sharman (1994), the World Bank has put forward the idea of letting forest concessions through tender or auction procedures with a view to finding a price that reflects real market conditions and is compatible with operations' actual capacities. In open bid auctions, commonly termed oral auctions, bidders gather at one place at the same time in presence of the auctioneer at the log yard. Bids are then signaled orally or visually to the auctioneer until the highest bid is achieved.

Sealed bid auctions involve submission of tenders in writing and in sealed envelopes, which are opened later, and the highest bidder is offered the wood. Various experiences and studies (Johnson, 1979; Mead, 1966) have shown that sealed bid auctions will generate slightly higher prices than open bid auctions because collusion or tacit cooperation among bidders is facilitated by open bidding.

Karsenty (2000) observes that bidding allows market mechanisms to set the price of the resource and the cost burden of assessments is also transferred to the operators. He goes further to indicate the criticisms leveled at this system, one of which is the fact that it ignores investments already made, particularly if new operators have entered the market. This has

been reported in Cameroon where operators who have made investments have to make offers equal to those who have not made investments (FAO, 1983; Karsenty, 2000). This method could be used in Kenya if illegal sourcing was controlled more strictly. The woodcarver cooperatives, including a wide range of independent carvers could compete for these resources.

#### 8.3.2.3 Public log market

The basic structure of a public log market consists of a log assembly yard to which logs would be delivered. Grading and sorting facilities and procedures for sale of the logs either by periodic auction or on a regular basis at established prices then takes place. The markets are located at convenient assembly points accessible to processing plants and/or transport modes.

Log markets avoid the problems of timber appraisal prior to setting forest charges and surveying costs prior to its sale (FAO, 1983). For this to work effectively, the market must be competitive and log transportation must be efficiently organized and carried out at low cost. Public log markets offer distinct advantages, not only in establishing the level of forest charges, but also in forest management, in allocating wood among users and in encouraging economic development. They have been proposed for sale of public wood in USA (Mead, 1976; Clawson, 1978) and are used in Thailand (FAO, 1983).

The system is already in operation in the woodcarving industry between the wood dealers, cooperatives and the carvers where carving logs are sold at the yards close to woodcarving centers. If this system could be used by the government, it would probably involve the harvesting of round wood by the forest officials themselves, and having them stocked at convenient points, preferably close to their offices, where carvers could purchase them periodically, say, on a weekly or fortnight by basis.

#### 8.3.2.4 Expert judgment

This method applies to the application of human judgment to set prices for round wood or other products. It is subjective and depends on experience (Davis *et al.*, 1987). The woodcarving cooperatives and other retail traders of carving wood use expert judgment to fix the wood price already. The basis for the pricing depends on wood species, sizes, deformities such as heart rot, nodes, straightness and costs incurred in purchasing among others. The difference in prices for a given species across markets, as observed during this study is

accounted for by the varied experiences and value systems of individual experts, and the circumstances under which they made them.

### 8.3.3 Round wood extraction procedures from state forests and their limitations

The process of round wood extraction from state forests starts with an application for harvesting license by a prospective licensee (applicant). This is done at the nearest convenient Forest Department Office or at the District Forest Office within which the management area for the round wood source falls. The application documents undergoes a series of vetting stages which include District, Provincial and National or Ministerial Licensing Committee as final stage where the powers to issue licenses is vested on it. At each of the stages, the availability of the desired wood resources, capability of the applicant, past records of conduct, and outstanding debts from any previous licenses among others, are scrutinized.. A successful applicant may be allocated an appropriate area to harvest after valuation of the standing wood within the allocated area has been made by the Forest Department and the licensee (applicant) having made full payment of this value.

Wood carvers, through their cooperatives are usually licensed to extract the carving wood (fallen or dry wood) from state forests at specified forests such as Arabuko Sokoke Forest. For such permitted extraction of the indigenous wood from these selected forests, the stages such as inventories of the existing volumes for the desired species and determination of payment to be made by the applicant are subject to serious abuses by forest administration staff largely owing to poor skills, lack of motivation, poor attitudes, limited budgetary allocation and lack of political support to Forest Department in Kenya. The most common is deliberate under estimation of existing volumes of the wood during the inventory sessions largely due to poor record keeping on the quantities of existing standing trees. For example, when inventory records are received from the field, there may not be an updated reference to counter check their accuracy and validity. Reports of some forests existing only on paper but not on the ground are largely attributed to poor record keeping and lack of regular updating of records as required.

In most of the forests where carving wood is obtained, no pre-determined allowable off take is known, and there is little effort to regulate the wood yields. In most cases, off take volumes are based on the impressions of local forest officers who may lack the experience or the necessary background information on the dynamics of the specific forests.

The type of license given depends on the annual intake of volumes applied for. Table 8.3 shows the range of licenses issued by the Forest Department to applications based on 1993/94 financial years. License fees are reviewed annually.

In general, licenses for extraction of indigenous wood from state forests seldom follows all the steps as described above particularly after the ban in their commercial utilization was effected, except from selected forests where limited extraction of such wood is permitted, such as Arabuko Sokoke Forest. Instead, licenses (or tickets) for extraction of fuel wood, poles, medicine, and other minor forest produce are issued through the District Forest Office after payment of minimal monthly fee. Carving wood is mainly extracted under the guise of fuel wood or pole wood through the use of the monthly tickets. The use of these tickets has been greatly abused and it is the principal means through which carving wood and other commercial indigenous woods find their way to the round wood market illegally. Unnecessary bureaucracy brought about by the lengthy and frustrating licensing procedure has helped to stimulate illegal wood extraction from some of the existing source areas of carving species.

**Table 8.3: Range of licenses issued for extraction of wood from State Forests**

| Type of license | Annual intake Capacity ($m^3$) | Fees (Ksh) |
|---|---|---|
| Special license | Over 20 000 | 100 000 |
| Large scale sawmill | 10 000 -20 000 | 30 000 |
| Medium sized sawmill | 4 000-10 000 | 10 000 |
| Small scale sawmill | up to 4 000 | 6 000 |
| Minor licenses | - | 3 000 |
| Stone quarrying | | 6 000 |
| Application fee | | 1 000 |

Source: MENR, (1995). Socio-economic and participatory aspects of Forestry Development

## 8.4 Wood pricing chain in woodcarving industry in Kenya

In principle, most of the carving wood entering the wood carving industry in Kenya sourced from state forests is illegal because the ban on their utilization is still in force. With the porous management of these forests by the Forest Department officials, the present trade in carving wood can best be described as black marketeering. The relative ease of sourcing the wood mainly through illegal mechanisms may seriously undermine efforts by other wood producers to sell their wood to carvers at better prices in future if the present trends are allowed to continue. However, with the growing scarcity of prime carving wood from state

forests, particularly during the last two years, considerable attention has been given to obtaining it from private sources.

With cheap wood being obtained from existing sources on one hand, and a high wood demand on the other, excessive profiteering in the carving round wood trade has been very common. For this reason, a considerable number of middlemen have been attracted to the round wood trade and they now control the round wood supply to carvers. The laxity on the part of forest officers in regulating off take has made the state forests resemble an open access resource. In some cases, the forest officials illegally harvest the wood and transport it to the markets, thereby taking the wood rent for themselves. The existing round wood pricing chain that operates in parallel to that of the State is described below in the following sections.

### 8.4.1 Prices of wood at the source.

In most cases, the pricing of carving wood originating from state forests is similar to that of an open access resource. Wood prices are usually negotiated and have been found to cost about Ksh. 15 000 per lorry load or less. This translates to Ksh. 1 000/$m^3$ for prime carving such as *Brachylaena huillensis*, *Olea europaea*, *Combretum schumanii* and *Spirostachys africana*. Other lesser known species attract similar but lower prices at source.

Species from private farms in rural or urban areas have varied prices. For example, prices of *Jacaranda mimosifolia* and *Azadirachta indica* may range from Ksh. 0-1 500/$m^3$. In some cases, constructors would wish to have a site cleared of vegetation and carvers are called upon to harvest the trees from such sites. In such a case, the cost of purchasing the wood is considered to be zero. This can also apply to situations where forest officials harvest the timber themselves and sell it to carvers. For individuals who own carving trees on their farmlands, and who wish to sell some of the trees, prices are negotiated and have been found to cost approximately Ksh. 500 per standing tree. Typical wood prices at source are given for all the species entering the carving industry in Table 8.4.

#### 8.4.1.1 Harvesting costs

Harvesting is nearly always done using a power saw, particularly for wood harvested from state forests. The case may be different for trees sourced from private farmlands in the rural areas where the use of machinery is rare, and instead, local tools are used. With the use of a power saw, a lorry load of 15$m^3$ of wood would cost approximately Ksh. 3 000. This translates to about Ksh. 200/$m^3$ of wood harvested. Harvesting charges are determined by

## Table 8.4 Pricing chain for carving wood

| Carving species | Carving Station | Price at source[4] | Gate price at carving center | Actual price to carver | Overall price to carver[5,6] | Stumpage price [7] | Species access [8] index |
|---|---|---|---|---|---|---|---|
| *Brachylaena huillensis* | Nanyuki | 1000-1500 | - | 3180.5 | 2950.4 | 4053 | 1.07 |
| | Wamunyu | - | 4064.8 | 6912.2 | 6214 | 4053 | 1.11 |
| | Gikomba | - | 3492.5 | 5777.8 | 5107.6 | 4053 | 1.13 |
| | Malindi | - | 2844.4 | 5305.3 | 4230.1 | 4053 | 1.25 |
| | Mombasa | - | 3757.9 | 5788.1 | 5314.7 | 4053 | 1.08 |
| | Lungalunga | - | 1153.4 | 4059.5 | 2345.6 | 4053 | 1.73 |
| Mean | | | 3062.6 | 5170.6 | 4360.4 | | 1.22 |
| *Olea europaea* | Nanyuki | 1000-1500 | - | 5538.9 | 4615.4 | 4681 | 1.2 |
| | Wamunyu | - | - | 6842.7 | 6842.7 | 4681 | 1 |
| | Gikomba | - | 3602 | 8675.5 | 6296 | 4681 | 1.38 |
| | Mombasa | - | 3004.6 | 5305 | 4737.3 | 4681 | 1.12 |
| Mean | | | 3301.3 | 6590.5 | 5622.9 | | 1.18 |
| *Dalbergia melanoxylon* | Gikomba | 1000-3,000 | - | 14,558.8 | 13,902 | 4681 | 1.05 |
| | Wamunyu | 1000-3,000 | - | 14,362.2 | 3083.4 | 4681 | 4.66 |
| | Malindi | - | - | 12,540 | 5558.1 | 4681 | 2.26 |
| | Mombasa | - | - | 12,507.4 | 7000.6 | 4681 | 1.8 |
| Mean | | | | 13,517.1 | 7386.0 | | 2.44 |
| *Terminalia brownii* | Wamunyu | 1000-2000 | - | 3316.6 | 1684.3 | 2969 | 1.96 |
| | Gikomba | - | - | 4035.7 | 3994.6 | 2969 | 1.01 |
| Mean | | | | 3676.2 | 2839.5 | | 1.49 |
| *Jacaranda mimosifolia* | Gikomba | 0-1500 | - | 3815.2 | 3178.8 | 352 | 1.2 |
| Mean | | | | 3815.2 | 3178.8 | | 1.2 |
| *Combretum schumanii* | Mombasa | 1000-3000 | 4325 | 7495.6 | 6660.6 | 2969 | 1.13 |
| | Malindi | 1000-3000 | - | 6715 | 3864 | | 1.73 |
| Mean | | | | 7105.3 | 5262.3 | 2969 | 1.43 |
| *Azadirachta indica* | Malindi | 0-1000 | - | 2438.5 | 2111.3 | 352 | 1.15 |
| | Mombasa | - | - | 2997.1 | 2910.2 | 352 | 1.03 |
| Mean | | | | 2717.8 | 2510.8 | | 1.09 |
| *Mangifera indica* | Malindi | 0-1000 | - | 2420 | 2017 | 352 | 1.19 |
| | Mombasa | - | - | 3138.7 | 2780.3 | 352 | 1.13 |
| Mean | | | | 2784.4 | 2398.7 | 1.16 | 1.16 |
| *Sprostachys africana* | Mombasa | 1000-1500 | 3085.2 | 4760.8 | 4639.7 | 352 | 1.03 |
| Mean | | | 3085.2 | 4760.8 | 4639.7 | | 1.03 |
| *Afzelia quanzensis* | Malindi | 500-1000 | - | 1705.4 | 995 | 4681 | 1.17 |
| Mean | | | | 1705.4 | 995 | 1.11 | 1.17 |

[4] All prices at source, at carving centers and to carvers are given in Ksh/m3, and represent the annual mean values for the years 1998-2000 from all the individual logs delivered to each carving during this time, excluding the logs brought by individual carvers from own farms.

[5] Overall price includes the logs brought by individual carvers from own farms whose prices are not captured as part of trading.

[7] Represents the current Government stumpage chargeable rates for each given species

[8] Obtained by the ratio of actual price and overall price as a measure of the incidences of own sourcing of raw materials

the amount of fuel used in operating the power saw. The use of a full tank for example, would cost Ksh. 300

#### 8.4.1.2 Loading costs

Loading costs are negotiated and have been found to range from Ksh. 2 000-3 000 per lorry load amounting to an average of Ksh. 150/$m^3$. Some of the factors considered in determining the loading costs are the terrain, accessibility of the harvested wood, loading distance and size of the truck among other factors.

#### 8.4.1.3 Transportation costs

Transportation is probably the most expensive stage in the timber marketing chain. The transportation costs are not pegged on mileage but on a general consensus. In the last three years, the average charges based on a 15-20$m^3$ lorry capacity have been found to lie between Ksh. 100/km - 200/km. This translates to about Ksh. 8/km/$m^3$ of wood for relatively short distances and Ksh 4/km/$m^3$ for distances above 200 km.

### 8.4.2 Prices at the carving center gate (gate price)

On arrival at a carving center, the wood is off-loaded at any one of these three points: a cooperative wood yard, a private wood yard or at the transporters own wood yard, all of which are located at convenient points of access to the carvers.

For the cooperative and private yards, the prices offered by the buyer is a result of extensive negotiations depending on the species and the sizes of wood delivered. In most cases, the logs are counted and an average price per piece (wholesale price) is what is usually negotiated. During these negotiations, the buyers have generally been observed to have an upper hand, particularly when there are many suppliers or when the two parties have no previous acquaintance. The added fact that most of the prime carving wood is illegally sourced is enough reason to make many suppliers sell the wood consignment hastily.

Some established cooperatives such as the Akamba cooperative in Mombasa, Malindi and others, have a number of traditional wood suppliers who even enjoy some amount of overdraft facility through advance payments before delivery of wood. In some cases, the roundwood may be bought on a sight-unseen basis as a result of mutual trust developed over long-term association. In some cases, some of the cooperative officials themselves may be involved in the wood trade.

The gate prices offered for all the carving logs entering cooperatives over a period of three years are shown in column 4 of Table 8.4. Where the gate price is not shown, the wood is solely sold by independent traders other than the cooperative, on retail basis to the carvers. These include *Azadirachta indica, Afzelia quanzensis, Dalbergia melanoxylon, Jacaranda mimosifolia, Mangifera indica* and *Terminalia brownii.* Although *Brachylaena huillensis, Combretum schumannii, Olea europaea* and *Spirostachys africana* may be sold on retail as well, most of it is sold through the cooperative.

### 8.4.3 Prices to carvers.

Sale of wood to carvers involves retail trading by all dealers who own wood yards near the carving centers including the cooperative management. The wood is sold at competitive prices and carvers have the freedom of choice of the yard. The wood at each yard is coded and price tags are placed on them. The study captured these prices through the price tags on each log as indicated in column 5 of Table 8.4 as actual price to carver. Apart from the logs of a given species supplied by the dealers, some carvers make an effort to source their own wood. In general, carver's preference to source own wood may be seen as part of normal price adjustments in the light of wood scarcity and accessibility. The study captured these volumes for each species. Because the price of wood obtained by carvers on their own is not considered at the retail end of the marketing chain, their inclusion in the overall volume consumption lowers the overall price as indicated in column 6 of Table 8.4. The comparison of these two prices (ratio of actual price and overall price to carver) gives an indication of the degree of independence by carvers to source their own wood for carving, which has been regarded as the species accessibility index and is shown in column 8 of Table 8.4. The index values range from 1 to 4.66 where the values rise with degree of 'own sourcing' suggesting that either the wood prices of a given species offered at the market are too high, or that the species is easily accessible to carvers and may be readily obtained when it becomes necessary to do so.

The highest price indices of all species are for *D. melanoxylon* with decreasing prices from Wamunyu, Malindi and Mombasa respectively. Wamunyu is probably the closest center to the larger *Dalbergia melanoxylon* rich frontier in Ktui and Mwingi Districts and therefore carvers easily source own wood from these nearby sources.

The highest price index for *Brachylaena huillensis* is found at Lungalunga and Malindi carving centers. At Lungalunga center for example, *Brachylaena huillensis* logs are freely supplied across the border by many suppliers who can either sell them to the cooperative or to individual members of the cooperative. Malindi generally lies within a *Brachylaena*

*huillensis* belt (Arabuko Sokoke and outlying areas) where the species is largely accessible to members who are even able to source them on their own.

Carvers at Nanyuki and Gikomba have access to considerable quantities of *Olea europaea* through own sourcing. In Karura and Ngong forests for example, carvable sizes of the species are found both in plantations and at the natural forests areas. The wide distribution of *Terminalia brownii* around Wamunyu means that the species is more accessible to carvers there than it is to those at Gikomba (Nairobi).

The price of standing wood (stumpage price) of each species according to the government rates are given in column 7 of Table 8.4 and indicates the price which should be paid at the wood source (column 3). The wide differences in the two prices shows that the government structure is inefficient and does not apply to the wood carving industry at this point in time largely due to poor implementation of existing regulations.

### 8.4.4 The overall marketing chain for carving wood in Kenya

From the descriptions given so far on the prices of the wood from the various stages, an overall marketing chain is presented in Figure 8.5.

## 8.5 Variation in carving round wood unit prices

### 8.5.1 Unit price variation by species and time

As expected, the prices of the woodcarving round wood show a general upward trend from 1998 to 2000 for each species as indicated in Figure 8.6. In this figure, the criteria for choice of species order has been the ascending order in unit prices to make these unit price comparisons in categories much easier unlike that of alphabetical order adopted in most descriptions in this thesis. In most of the species, the rise in wood prices was more marked in the year 2000 brought about by wood scarcity. The highest rise was observed for *Azadirachta indica*, which has continued to be utilized more intensively, particularly along the coast in place of *Brachylaena huillensis*, whose supply has drastically reduced over time. Other alternative woods such as *Terminalia brownii* and *Jacaranda mimosifolia* have gained prominence and their prices have also showed a significant rise over this period. Generally, the variation in mean unit prices of the carving wood species can be broadly categorized into three classes, namely: low prices (Ksh/$m^3$ at 1 000 to 4 000 for *Afzelia quanzensis, Jacaranda mimosifolia, Mangifera indica, Terminalia brownii*); medium prices (Ksh/$m^3$ 4 000 to 8 000 for *Azadirachta indica, Brachylaena huillensis, Combretum schumannii,*

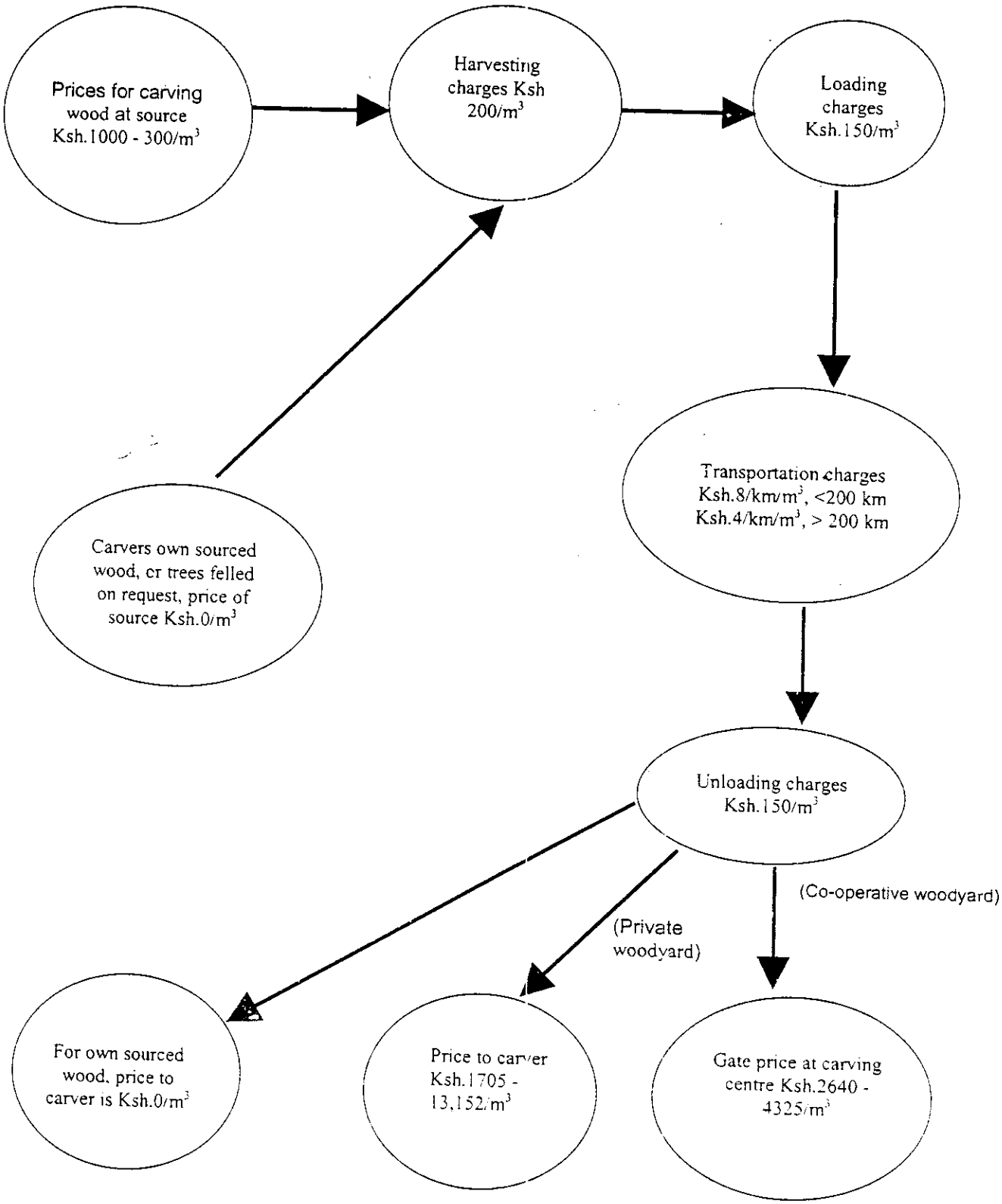



Figure 8.5: Overall marketing chain for carving wood in Kenya

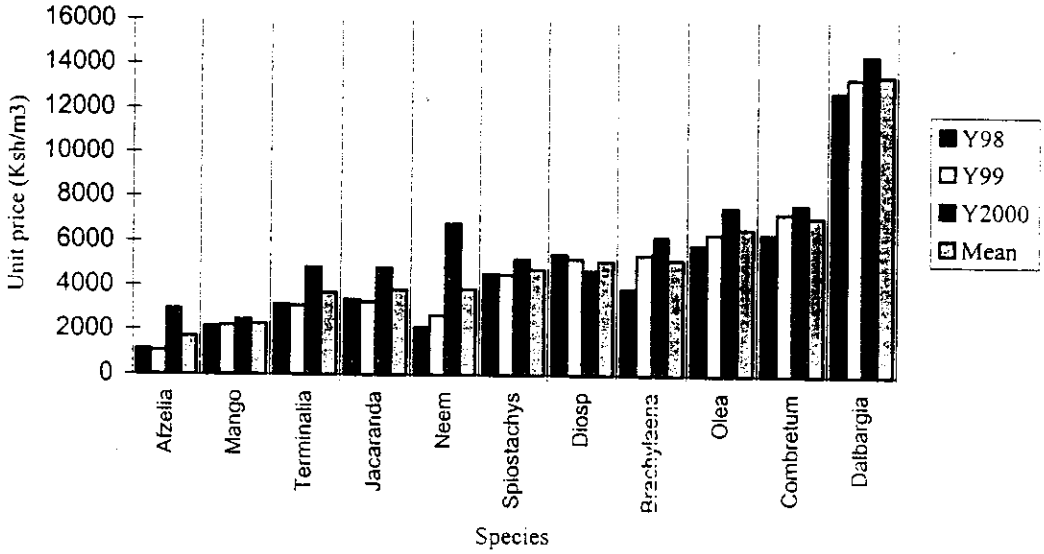



**Figure 8.6: Unit price variation between woodcarving species in 1998 - 2000**

*Diospyros cornii, Spirostachys africana, Olea europaea,*), and high prices (Ksh/$m^3$ above 8 000 for *Dalbergia melanoxylon)* The extremely high market prices for *Dalbergia melanoxylon* with a record mean of Ksh. 13 517.7/$m^3$ for three years probably contributes to the high index where carvers opt to source their own materials at more affordable prices from private farmlands.

The low market prices for *Brachylaena huillensis* (Ksh 5 170/$m^3$) are influenced by the extremely low prices at the source as discussed earlier. If the level of stumpage was strictly adhered to as required, carvers could have to pay more for the wood. This could lead to higher recovery rates and generally more efficient utilization of the species and probably to long-term sustainable off take volumes. This applies equally to all the other species.

### 8.5.2 Unit Price Variation by geographical location

There was a wide variation in prices of carving wood of the same species across different sites as determined by the market forces. Figure 8.7 shows the variation in unit prices of major carving species traded at various carving centers in Kenya in the year 2000. The blank spaces in each figure at a given center are an indication that the species is not traded there.

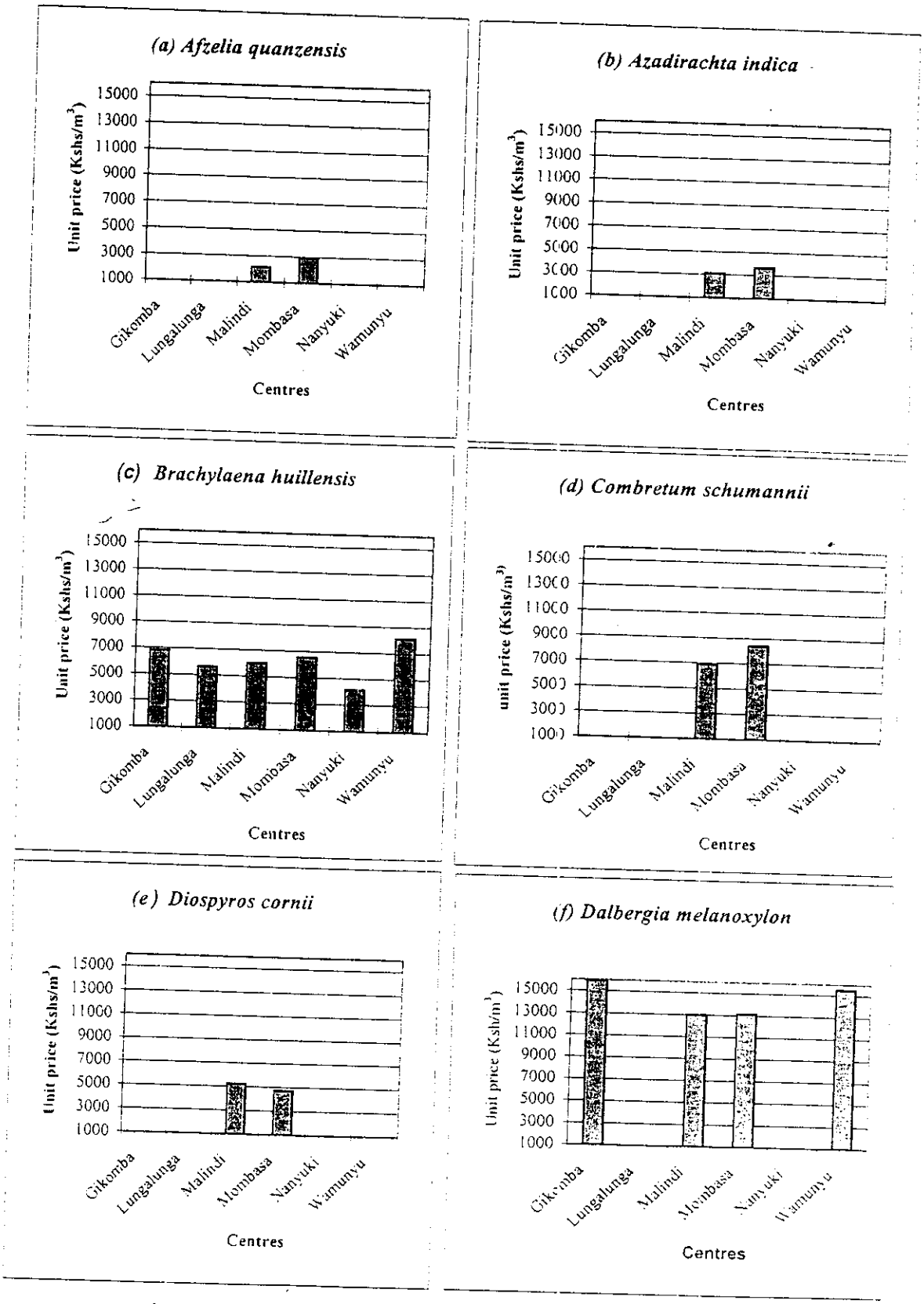



Figure 8.7 : Unit price variation in the year 2000 of carving round wood to carvers for (a) *Afzelia quanzensis* (b) *Azadirachta indica* (c) *Brachylaena huillensis* (d) *Combretum schumannii* (e) *Dalbergia melanoxylon* (f) *Diospyros cornii* and (g) *Jacaranda mimosifolia*

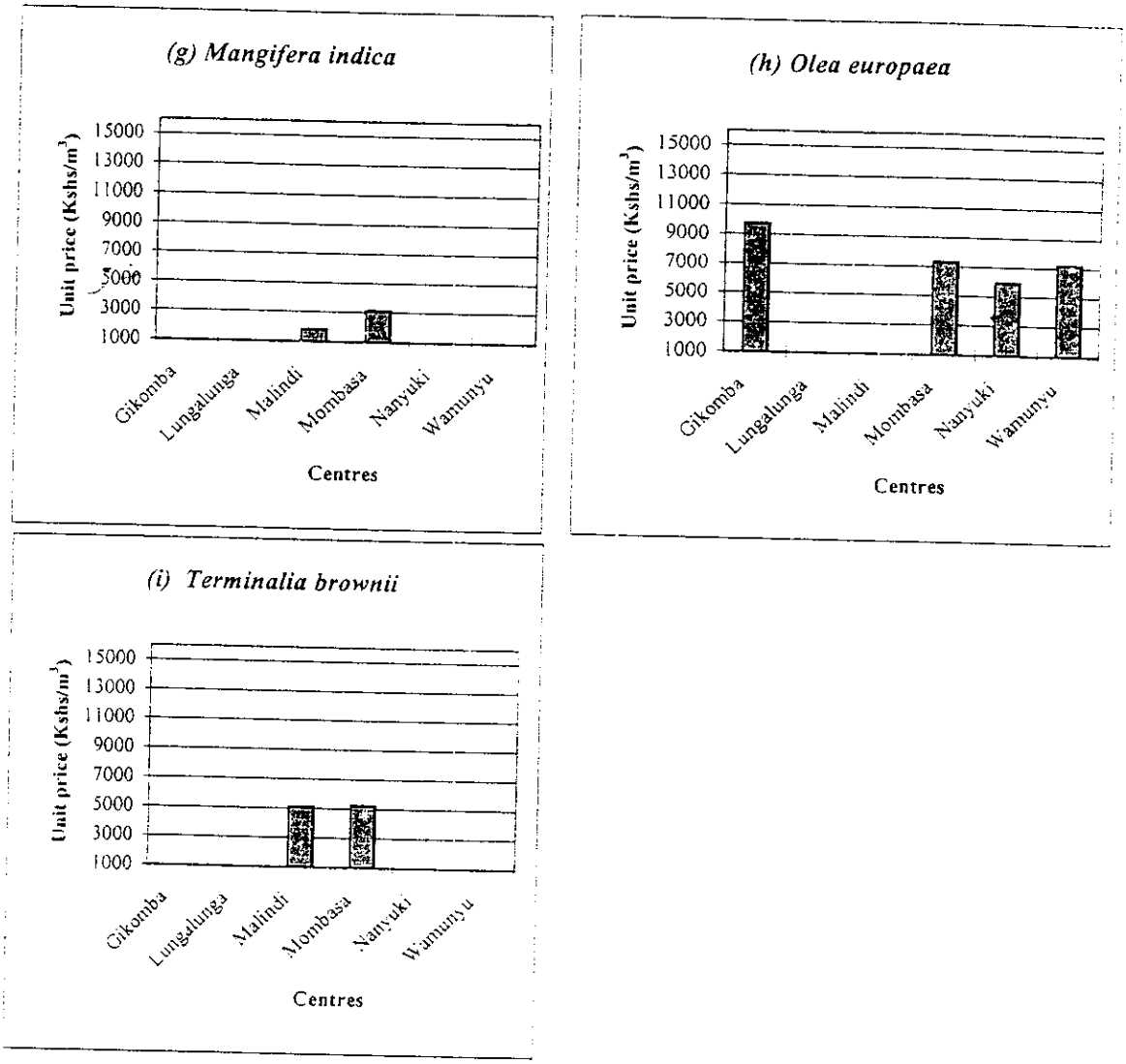



Figure 8.7 (cont): Unit price variation in the year 2000 of carving round wood to carvers for (a) *Mangifera indica* (b) *Olea europaea* (c) *Spirostachys africana* and (d) *Terminalia brownii*

The highest unit prices for *Brachylaena huillensis* wood were recorded at Wamunyu carving center followed by Gikomba and Mombasa. As pointed out earlier, the high concentration of carvers coupled with a narrow range of accessible species to carvers at these centers together with and restrictions placed on the sourcing of *Brachylaena huillensis* in this period is the reason for this observation. Lower unit prices were noted at Nanyuki and to a lesser extent, at Lunga Lunga centers. This is largely due to easy access to sufficient *Brachylaena huillensis* resources at these points.

The highest unit prices for *Olea europaea* were recorded at Gikomba and the lowest at Nanyuki. The constraints and risks associated with supply of wood to Nairobi City, particularly handling of banned hardwoods limits wood supply leading to wood shortages. These high prices are slightly above what an average carver can afford, they obtain their own supply of wood from this species.

The unit prices for *Dalbergia melanoxylon* were generally lower in the coastal carving centers (Mombasa and Malindi) than it was in interior centers (Wamunyu and Gikomba). This is probably due to more restricted distribution, longer periods of utilization hence generally more depleted *Dalbergia melanoxylon* resource base in the interior areas as opposed to the coast where intensive utilization is fairly recent and is more widely distributed.
The demand for *Azadirachta indica* is higher at Mombasa than Malindi as inferred from the consumption volumes received at both centers. The prices at Mombasa are higher than those of Malindi suggesting that market forces are determining the *Azadirachta indica* wood prices. However, the reverse was true for *Diospyros cornii* (mkulu) and *Afzelia quanzensis*. These are explained by the supply limitation due to scarcity at the respective centers

### 8.5.3 Unit price variation by size class (diameter)

The diameter-frequency profiles of the various species of carving wood (chapter 7) gave an indication of the most intensively utilized size classes. The diameter-unit price curves are intended to show the timber sizes at which the market prices are the highest under the existing pricing system. Further, the curves are likely to show the degree of price uniformity relative to size, or better still, the efficiency of the price allocation for a given species and market relative to other markets for the same species, keeping other market factors constant. It also indicates the limitation of the present pricing systems of logs by the cooperatives.

Various unit price-diameter profiles are discussed below.

***Brachylaena huillensis***

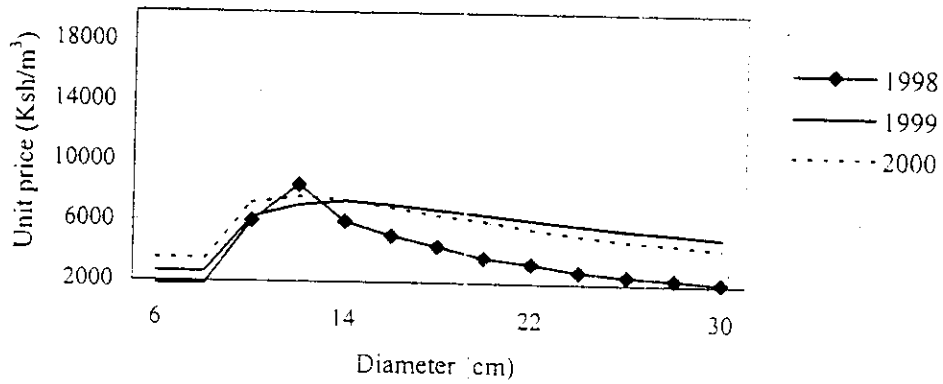
The highest diameter-unit price value for *Brachylaena huillensis* showed a slight variation across markets (Figure 8.8). The highest prices were recorded for the diameters 14cm (Wamunyu), 16cm (Gikomba), 14cm (Malindi) and 13cm (Mombasa). These values are nearly the same as those obtained from the diameter-frequency profiles for the respective markets (see Figure 7.4, chapter 7). The narrow range of diameter-unit price values show that although the unit price values themselves vary as influenced by market factors and externalities, the criteria for determining the price is uniform across markets.

Although the highest diameter -unit price values for *Brachylaena huillensis* wood entering all these carving centers were generally close, and that the unit prices for large diameter wood showed a declining trend, the rate of decline across the centers varied considerably (Figure 8.8). For example, the least steady decline in diameter-unit price was observed for the wood entering Mombasa carving center (Figure 8.8 a), particularly for wood of diameter above 16 cm with unit price values in the year 1998 almost doubling in 1999 / 2000 for the same size of wood. The same observation of doubling in unit prices was made at Gikomba center but the unit price decline was steady (Figure 8.8c). The steadiest variation in diameter-unit price was observed in Malindi carving center and the wood unit prices across the years and wood diameters were also noted to differ only slightly (Figure 8.8b). Generally, the highest prices for *Brachylaena huillensis* were recorded at Wamunyu where the differences between the years are distinctive (Figure 8.8d). Nanyuki and Lungalunga recorded the lowest unit values owing to the availability of the raw materials near the respective centers (Figure 8.8 e and Figure 8.8f).

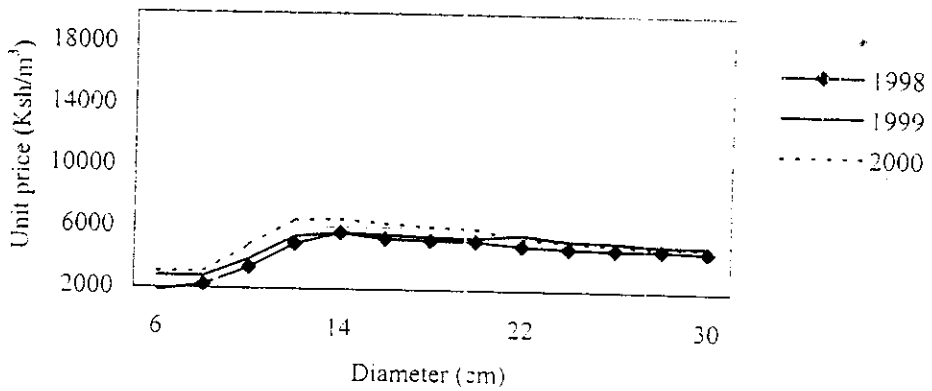
***Dalbergia melanoxylon***

The highest diameter-unit price for *Dalbergia melanoxylon* as established by the study varies from 16cm (Wamunyu), 16cm (Gikomba) and 20cm (Mombasa) as shown in Figure 8.9 and are generally higher than the optimum values for *Brachylaena huillensis*. Generally, high unit values for *Dalbergia melanoxylon* were recorded above 20cm diameter classes in all centers except Wamunyu where logs of 15cm to 18 cm were highly priced (Figure 8.9 d).

(a) Mombasa




(b) Malindi




(c ) Gikomba

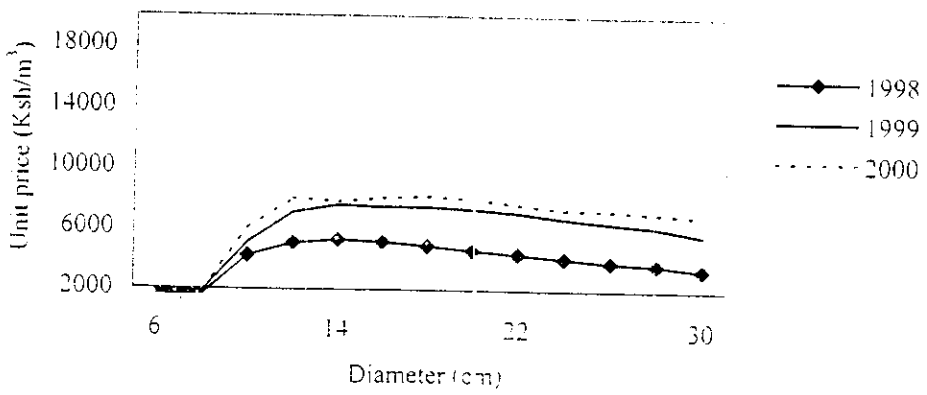
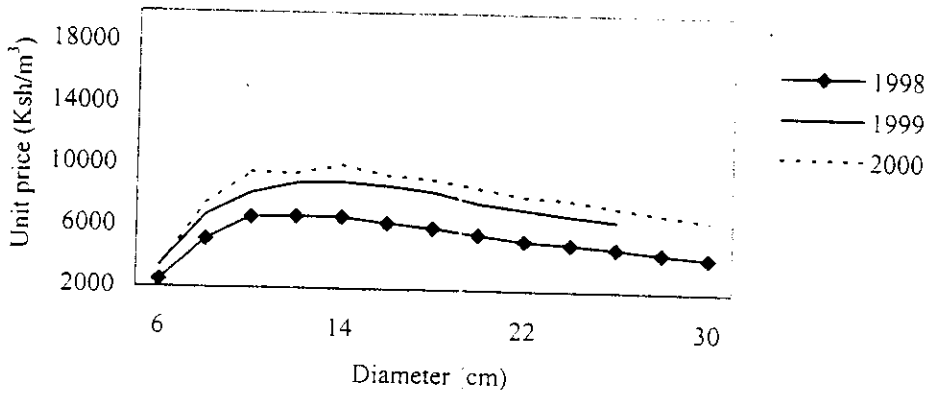
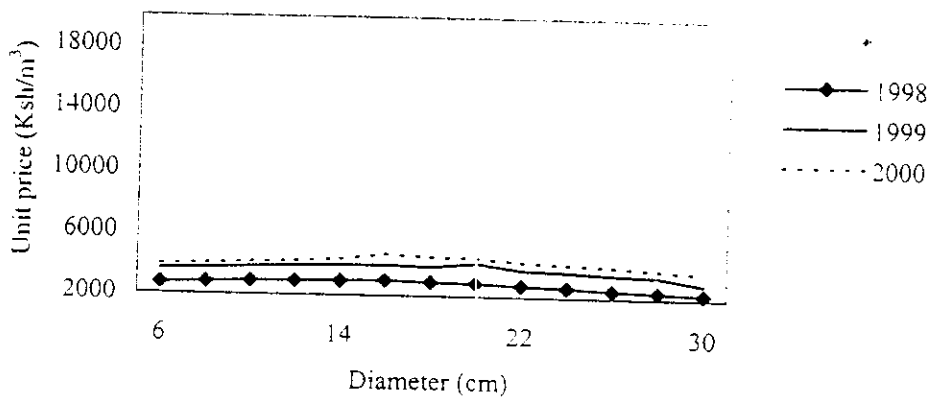



Figure 8.8: Unit price (Ksh/$m^3$) variation for various size classes of *Brachylaena huillensis* in the years 1998-2000 at (a) Mombasa (b) Malindi and (c) Gikomba carving centers.

(d) Wamunyu




(e) Naryuki




(f) Lungalunga

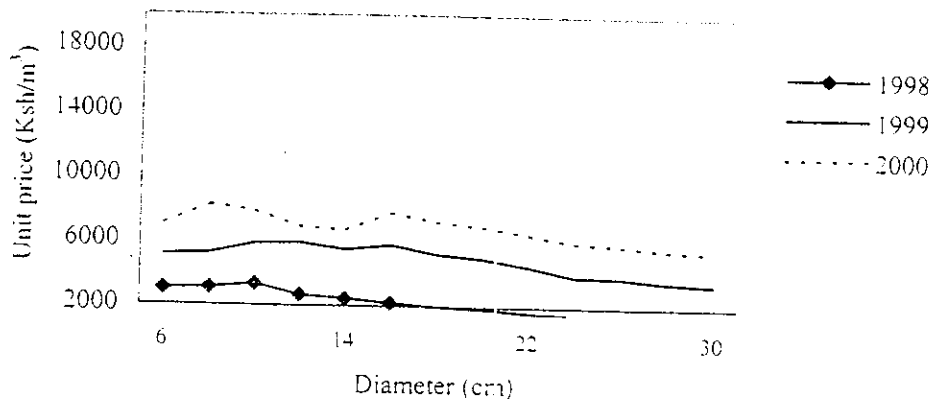
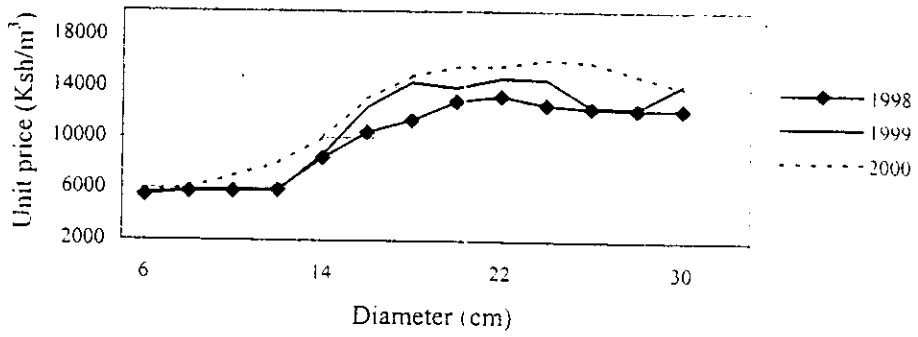
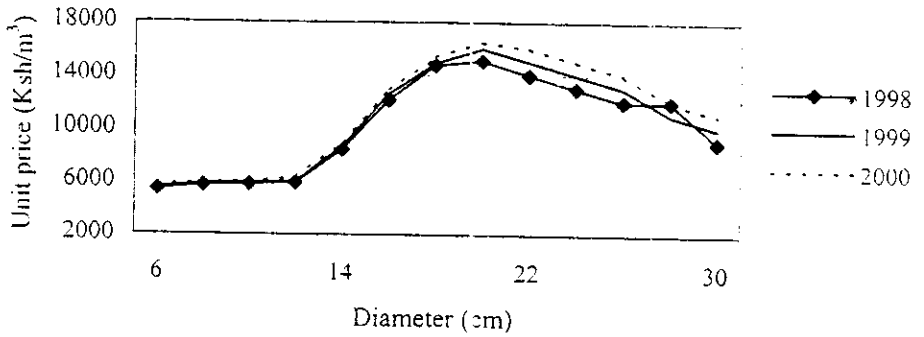



Figure 8.8 (cont.): Unit price (Ksh/m$^3$) variation for various size classes of *Brachylaena huillensis* in the years 1998-2000 at (d) Wamunyu (e) Nanyuki and (f) Lungalunga carving centers.

(a) Mombasa




(b) Malindi




(c) Gikomba

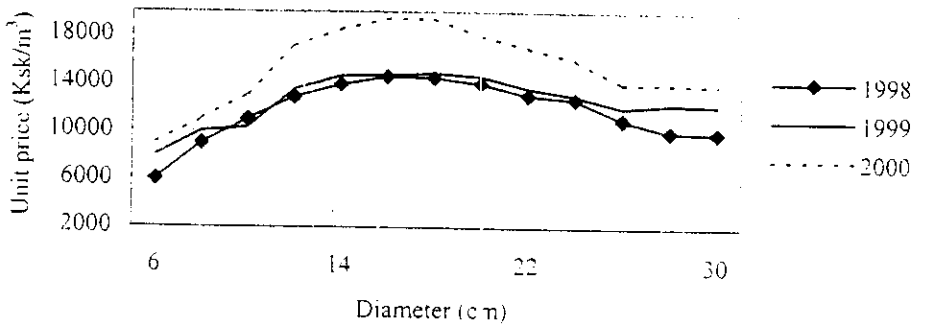



Figure 8.9: Unit price variation for various size classes for *Dalbergia melanoxylon* in the years 1998-2000 at (a) Mombasa (b) Malindi and (c) Gikomba and (d) Wamunyu carving centers

(d) Wamunyu

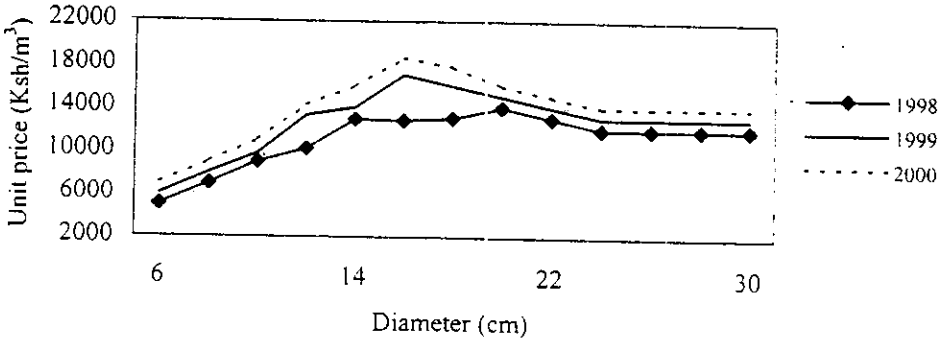



**Figure 8.9 (cont.): Unit price variation for various size classes for *Dalbergia melanoxylon* in the years 1998-2000 at (d) Wamunyu carving center.**

### *Olea europeae*

*Olea europeae* showed similar trends to that of *Dalbergia melanoxylon* where large diameter classes of above 20 cm were highly priced (Figure 8.10). However, the prices recorded at Gikomba were the highest (Figure 8.10b), while those recorded at Mombasa, Wamunyu and Nanyuki were fairly uniform (Figure 8.10 a, c and d).

### *Azadirachta indica*

*Azadirachta indica* unit prices were relatively low and uniform for both Mombasa and Malindi centers (Figure 8.11a, b), with slightly higher values recorded in Mombasa. Smaller logs were generally priced higher, particularly for diarneters between 10 and 14cm.

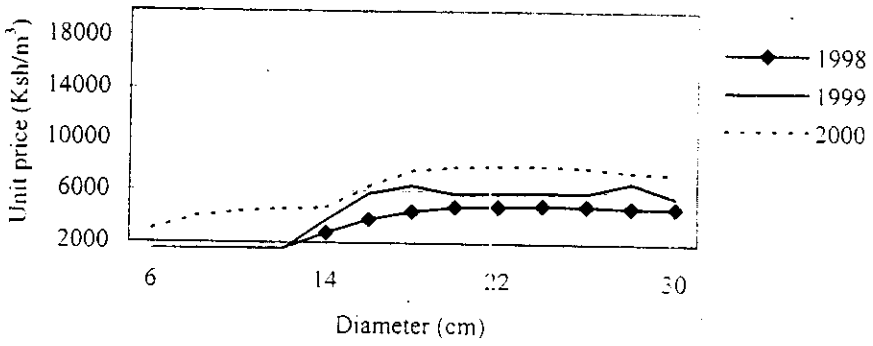
### *Terminalia brownii*

*Terminalia brownii* shows a general increase in unit price with an increase in diameter for both Gikomba and Wamunyu centers (Figure 8.12a, b). There has been a general increase in unit price over the period from 1998 to 2000 over all size classes.

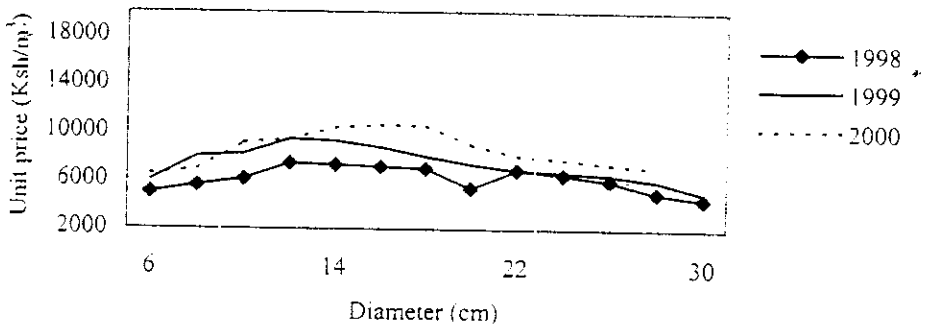
### *Combretum schumannii*

The unit prices for *Combretum schumannii* increased with increasing diameter in both Mombasa and Malindi centers (Figure 8.13a, b).

(a) Mombasa




(b) Gikomba




(c) Wamunyu

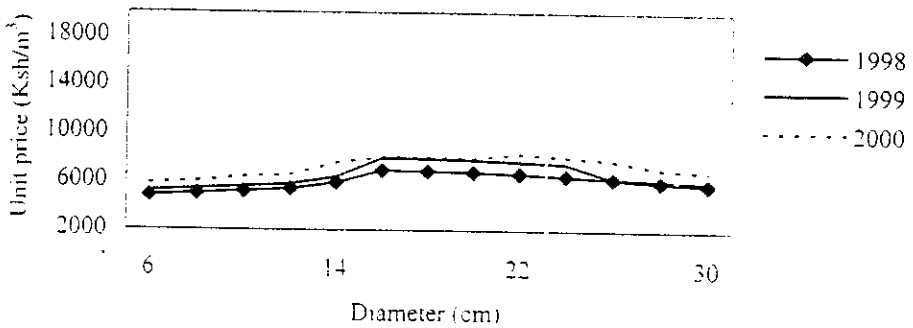



Figure 8.10: Unit price variation for various size classes for *Olea europaea* in the years 1998-2000 at (a) Mombasa (b) Gikomba and (c) Wamunyu carving centers

(d) Nanyuki

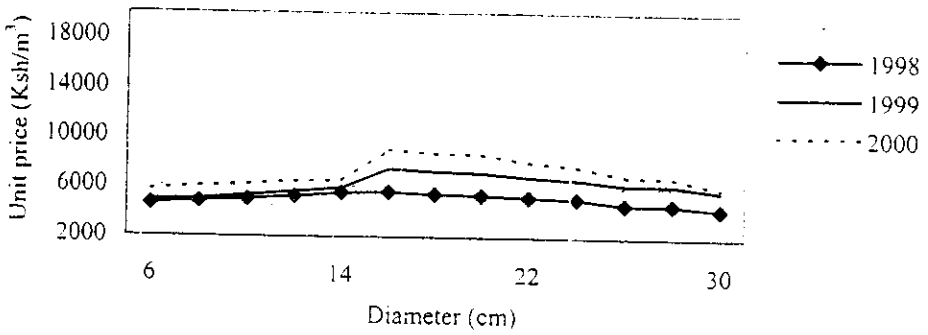
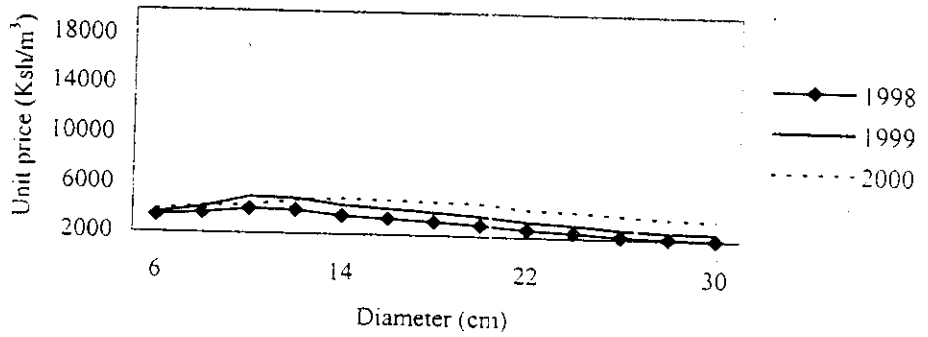



Figure 8.10 (cont.): Unit price variation for various size classes for *Olea europaea* in the years 1998-2000 at (d) Nanyuki carving center

(a) Mombasa




(b) Malindi

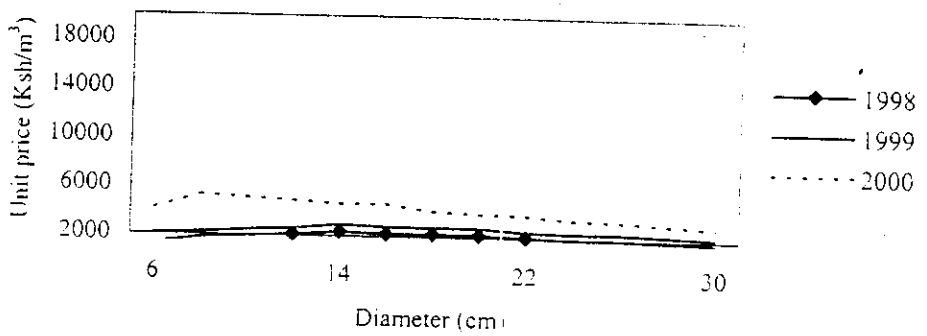
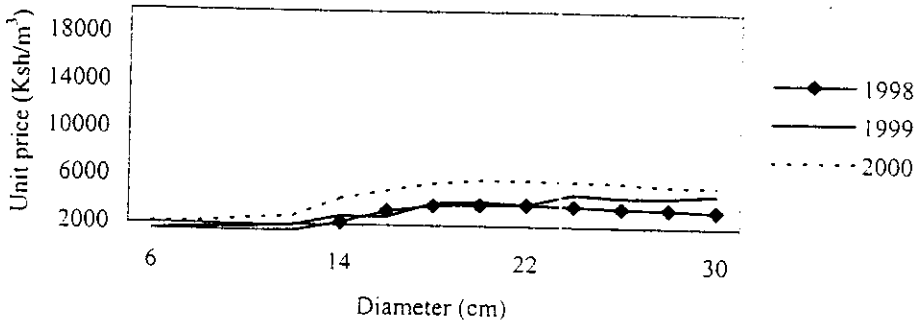



Figure 8.11: Unit price variation for various size classes for *Azadirachta indica* in the years 1998-2000 at (a) Mombasa (b) and Malindi carving centers

(a) Gikomba




(b) Wamunyu

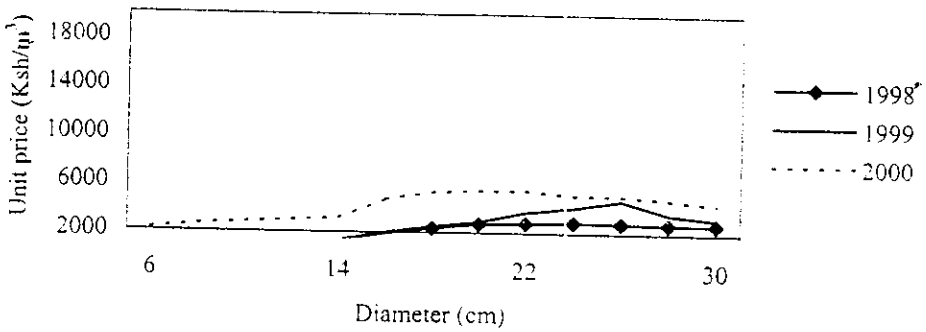
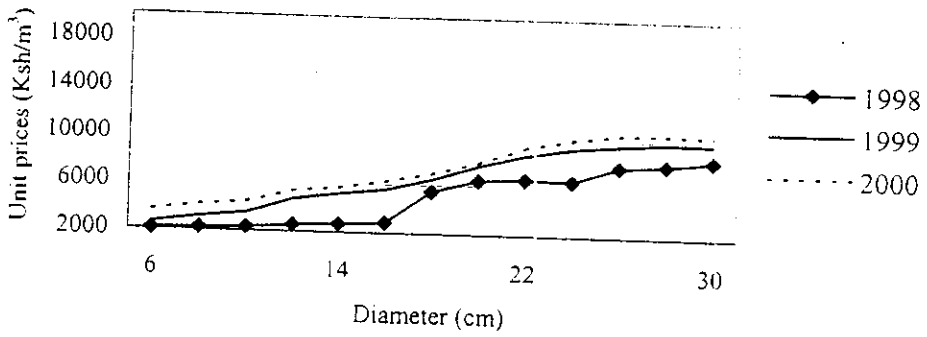



Figure 8.12: Unit price variation for various size classes for *Terminalia brownii* in the years 1998-2000 at (a) Gikomba (b) and Wamunyu carving centers

(a) Mombasa




(b) Malindi

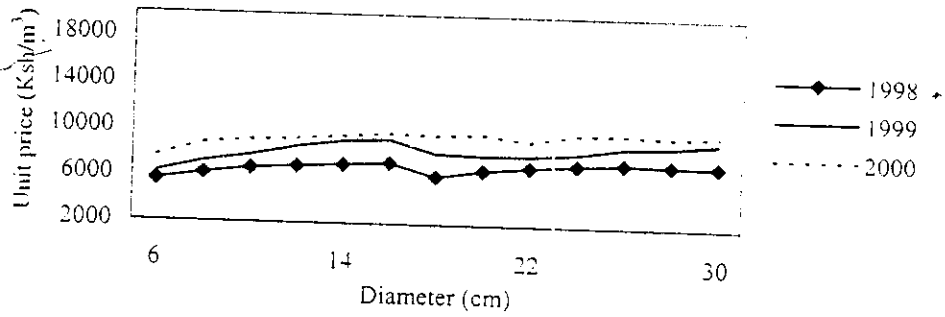



**Figure 8.13: Unit price variation for various size classes for *Combretum schumanii* in the years 1998-2000 at (a) Mombasa (b) and Malindi carving centers**

### *Mangifera indica*

*Mangifera indica* generally has a low unit price, with prices being highest in small diameter logs. Unit prices were lower in Malindi than in Mombasa (Figure 8.14a, b). The unit price has remained relatively constant over the period from 1998 to 2000 over all size classes.

### *Jacaranda mimosifolia*

The unit prices for *Jacaranda mimosifolia* increased with increasing diameter at the Gikomba center (Figure 8.14c).

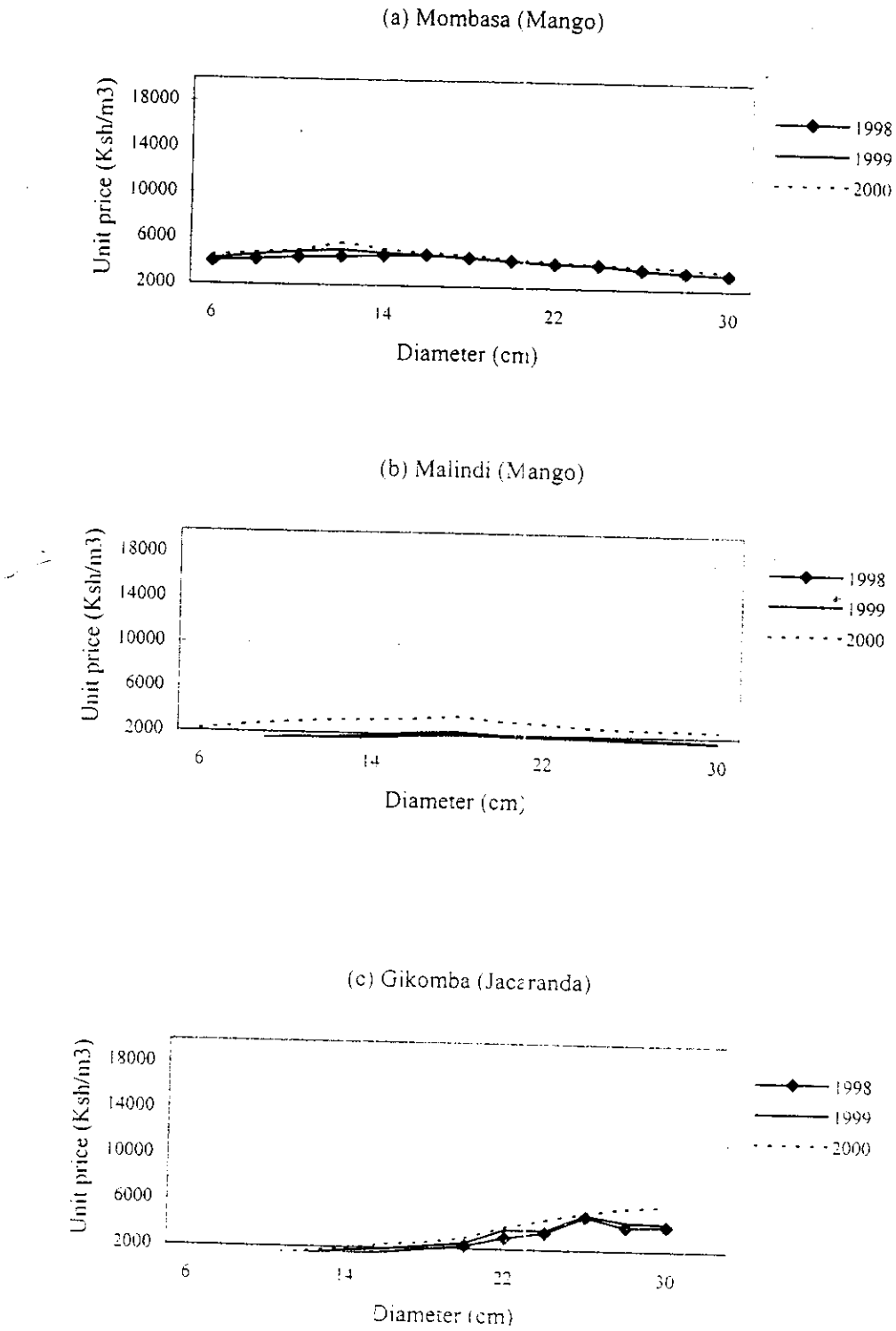



Figure 8.13: Unit price variation for various size classes for *Mangifera indica* in the years 1998-2000 at (a) Mombasa and (b) Malindi, and of *Jacaranda mimosifolia* at (c) Gikomba carving centers.

### 8.5.4 Some general observations on unit price variation by size class (diameter)

*Terminalia brownii* sold at Gikomba and Wamunyu attracted similar prices for the respective sizes (Figure 8.12 a and b), and in each case, large diameters of above 20 cm were highly priced with fewer declines in unit price for diameters above 25 cm as observed for other species. A similar observation was made for *Combretum schumannii* sold at Mombasa and Malindi (Figure 8.13 a and b) as well as price trends for Mangifera indica at Mombasa (Figure 8.14 a). The unit prices of Mango at Malindi were the lowest particularly for the years 1998 to 1999 (Figure 8.14 b). The reverse is true for the case of *Azadirachta indica* entering Mombasa and Malindi (Figure 8.11 a and b). In this particular case, highest unit prices were recorded for relatively small diameter logs of between 12 cm to 15 cm. The unit prices of Jacaranda mimosifolia sold at Gikomba were also found to be low, but logs of above 25 cm attracted high prices (Figure 8.14 c). Similar trends of decline in unit prices with increasing wood diameter were noted for *Azadirachta indica* (Figure 8.11) and *Terminalia brownii.* (Figure 8.12).

The decline in the unit prices of carving wood with increase in wood diameter is probably an indication of a weakness in the carving wood pricing system, particularly for the large diameter wood, which fails to attract a price equivalent to its volume. This problem is more marked at the Akamba carving center (Mombasa) than at the other carving centers for most of the species. The reasons for the least steady decline in prices at the Akamba (Mombasa) is probably explained this way; Mombasa carving center being the largest draws its carving wood from varied sources all over the country. Unfortunately, an estimated 40% of the accessible large diameter wood from the existing sources has a number of deformities mostly in the form of hollowness and heart rot (personal observation). The high wood demand at this center is an assurance that any wood delivered, including the deformed ones, would sell more favourably than it would at the other centers. On the other hand, the trading of a large number of logs at Mombasa may partly contribute to the observed price trends with respect to the poor prices of large diameter logs as brought about the high wood turnover, hence the likely effect of a resultant bulk discount. Generally, the reduced unit prices of large diameter wood is an anomaly which probably calls for a more scientific way of determining the wood prices as opposed to the expert judgment method now used.

## 8.6 Discussion

### 8.6.1. Comparison of the woodcarving industry to the wider wood market in Kenya

From the findings of this study, a comparison of the woodcarving industry with the entire timber industry in Kenya was made using a set of criteria as presented in Table 8.5. Although woodcarving has not received the attention given to the larger timber industry in Kenya probably due to the low comparative annual volume intake, (0.7% of total supply), the annual revenues which accrue from woodcarving represents about 25% of total revenues from entire timber industry in the country. This underlines the importance of 'value adding' of products, and carvings in this case seems to surpass the rest of wood products in the market by a wide margin. Woodcarving, as established in this study is an extremely labour intensive activity where despite the low wood intake, total number of carvers almost equal the number of people employed in the rest of the timber industry in the country. These observations justify the need for government to re-orient its focus to the woodcarving industry and to support policies and efforts geared towards sustaining it. In addition, efforts by the international community to understand the dynamics and importance of the industry which have been in place for the last five years and where this study is part, are not in vain.

**Table 8.5 Comparison of the carving industry with the wider wood market in Kenya**

| Aspect of comparison | Timber industry | Woodcarving industry | Comments |
|---|---|---|---|
| 1 Annual round wood market share (supply) | Volume of accessible roundwood supply estimated at 24,929,000m$^3$ (KIFCON, 1994, Wass, 1994) | Wood intake estimated at 17,544.4m$^3$ or 0.70% of market share. (present study) | The woodcarving cooperatives assumed to constitute 50% of total volume of wood utilized for carving or 8,772.4m$^3$ |
| 2 Direct employment | 100,000 employed in timber industry (Juma *et al.*, 1996) | 60,000 full time carvers and 350,000 dependants (Obunga, 1995) | Carving considered as an informal source of employment |
| 3. National value of the industry based on worth of traded products annually | Total domestic production of wood and paper estimated at US$ 100 million (Juma et al. 1996) | Total potential output based on wood volumes consumed per year estimated at US$ 25 million (present study) | Total output estimates based on export sales statistics of carvings is over US$ 20 million (Obunga, 1995) |
| 4. Range of species | >60 species | 8 major species and 43 minor species (present study, Obunga, 1995) | |

### 8.6.2. Limitations of current round wood pricing policies

If forestry is to be made a profitable enterprise, the stumpage values must be made to be realistic and sustainable and should reflect expected scarcity of a given species not only now but also in future. The implications of the low stumpage prices of the carving wood on carving industry are discussed in this section.

Having captured the carving wood market mechanisms and the cost centers including their monetary values, the task is to use this information to identify the points in the chain that have given rise to fundamental flaws leading to increased threat to the integrity of the prime carving species in Kenya.

Extensive studies by Repetto (1987), Repetto and Gillis (1988) and Barbier *et al.*, (1994) have shown that if government leaves all the profits of a resource harvest to those involved in its exploitation, without seeking appropriate returns, this will act as a powerful incentive for the exploiter to mine the resource. Further, Vincent and Binkley (1991) observed that the price paid by the exploiter for the logs harvested in the forest (stumpage price) has a role to play in determining forest depletion and the sawmill capacity to process cut logs.

From the description of carving round wood marketing chain from the round wood source to the carver as the final round wood user, it was found that government intervention is minimal and that existing carving round wood prices are largely determined by forces in an open or free round wood market. As carving wood becomes scarce, the forces in the free round wood market are expected to read these scarcity signals and an upward round wood price adjustment is naturally expected as forces of demand and supply are at play. The study has attempted to answer three questions regarding the carving round wood prices as follows:

(a) are the present carving round wood prices as set by free market realistic?

(b) are the government carving round wood prices realistic if they were more strictly enforced?

(c) What is the appropriate price for a carving round wood?

In order to respond to these questions, illustrations using *Brachylaena huillensis* sourced from Mt. Kenya and supplied to Gikomba, Mombasa, Nanyuki and Wamunyu carving centers is used. Before this is done, it is important to understand how the value of standing wood is determined (known as the stumpage price or price of wood at source) and the linkage of this value and the market price of wood (the price of round wood paid by a carver to secure the wood from wood dealer prior to carving). The price of wood at the source (forest) is a function of the wood free market price. It is residual value determined by deducting from the

wood free market price the costs incurred in the market chain such as logging, hauling, transport and labour. All these costs in the carving wood marketing chain have already been determined such as cost of wood at source, harvesting costs, loading costs, transportation costs and the price of wood as bought by a carver prior to carving. Using these values determined by the study, the stumpage price that should be paid for wood at the source was derived using a standard procedure (FAO, 1983). This residual value (stumpage) can be compared to the actual amount paid by the wood harvester at the source, and the difference between these values and the government values indicates discrepancy in the carving round wood market. Stumpage price of carving logs can be derived using this simple formula:

**Stumpage price** (derived) = **Price of carving log paid by carver** *less* **unloading charges** *less* **transport charges** *less* **value of log at forest roadside** (before it is transported) *less* **harvesting costs.** Table 8.6 shows how these values were determined as an illustration:

**Table 8.6: Derived stumpage price for *Brachylaena huillensis* . All prices are given in Ksh/m$^3$ assuming the volume prior to carving.**

| | Nanyuki | Wamunyu | Gikomba | Mombasa |
|---|---|---|---|---|
| Price to carver/m$^3$ (market price) | 3180.5 | 6912.2 | 5777.8 | 5788.1 |
| Unloading | 150 | 150 | 150 | 150 |
| Transport | 320 | 1600 | 1600 | 2400 |
| Profit on capital | 318 | 690 | 578 | 579 |
| Overheads | 160 | 345 | 288 | 189 |
| Value of log at Roadside/m$^3$ | 2232.5 | 4127.2 | 3162 | 2370.1 |
| Log production costs/m$^3$ | | | | |
| Harvesting | 200 | 200 | 200 | 200 |
| Loading | 150 | 150 | 150 | 150 |
| Profit on capital | 220 | 413 | 316 | 237 |
| Overheads | 110 | 206 | 158 | 119 |
| Derived stumpage value/m$^3$ | 1552.5 | 3158.2 | 2338 | 1664.1 |
| Actual payment/m$^3$ | 1500 | 1500 | 1500 | 1500 |
| Government stumpage/m$^3$ | 4053 | 4053 | 4053 | 4053 |

Results show that the stumpage values calculated as the residual prices along the roundwood market chain and the actual amount paid at source are nearly the same, but they amount to about half of that required by the government. Given this discrepancy, it is clear that the present low carving round wood market price is largely determined by the low wood prices at the source. In addition, it is clear that the governments' stumpage structure in operation is irrelevant as far as the woodcarving industry is concerned. Since the market is unable to register the signals of resource scarcity as it currently operates, the market values are surprisingly low, partly explaining the observed depletion of *Brachylaena huillensis* and other prime carving species from the existing habitats. This inability of the market to capture these signals is an example of market failure. Beale (1995) states that market failures exist when markets within which the resource is traded fails to reflect the full implications of resource use, and this seems to apply to the present study. Tisdell (1997) adds that while the market system is theoretically a powerful, relatively inexpensive and responsive mechanism for allocating resources, in practice, it is less than perfect. He goes on to say that market failure occurs when the price mechanisms or the market, fails to bring social optimum. This is when private decisions of individuals or firms about resource use results in benefits that do not pay the full costs. Michael (1994) acknowledged that market prices are often distorted as a result of market imperfections and policies, and do not always take account of social or environment costs or benefits which are external to the private market.

Looking at these market failures more closely to see why the market is not responsive to scarcity, we find that the carvers are generally removed from the market chain of round wood since they only appear at the end of the chain. Between the source and the carvers are a series of middlemen who supply carvers with the carving wood. Several authors have argued and advanced some possible theories, which have attempted to explain the dynamics of market forces and their effects on the prices of products and in situations similar to those of the present study. For example, Karsenty (2000) contends that if resources are of higher quality (obtain a high market price) and their acquisition cost is low, there will be a rental created by the sale of different products along the market chain. This opens the possibility that some operators (middlemen) may be content to act as rent takers with no incentive to upgrade the resource. Gillis (1992) observers that rent seeking operators have a short-term focus that is incompatible with the long-term horizon essential in the forestry industry. In the interests of conserving the heavily depleted prime carving species and the carving industry, carvers should therefore source the wood directly from harvesters based on the conviction that they will be more inclined to manage the resource properly because they have a longer-term investment in it.

The question about the amount levied by the government on stumpage now becomes relevant, assuming that enforcement against illegal sourcing of round wood was strictly enforced. Starting with the existing government stumpage for *Brachylaena huillensis*, and using the same values in Table 8.6, and considering the process in reverse by asking what the round wood market price should be, derived market prices were obtained as shown in the Table 8.7 below:

**Table 8.7 Derived wood market price (Ksh/m$^3$) for *Brachylaena huillensis* paid by carvers**

| | Nanyuki | Wamunyu | Gikomba | Mombasa |
|---|---|---|---|---|
| Actual price paid by carver/m3 | 3180.5 | 6912.2 | 5777.8 | 5788.1 |
| **Derived price paid by carvers/m3** | **5681** | **7984** | **7493** | **8177** |
| Unloading | 150 | 150 | 150 | 150 |
| Transport | 320 | 1600 | 1600 | 2400 |
| Profit on capital | 318 | 690 | 578 | 579 |
| Overheads | 160 | 345 | 288 | 289 |
| Value of log at Roadside/m3 | 4733 | 5022 | 4877 | 4759 |
| Log production costs/m3 | | | | |
| Harvesting | 200 | 200 | 200 | 200 |
| Loading | 150 | 150 | 150 | 150 |
| Profit on capital | 220 | 413 | 316 | 237 |
| Overheads | 110 | 1206 | 158 | 119 |
| Stumpage value/m$^3$ (government) | 4053 | 4053 | 4053 | 4053 |

The values paid by the carvers as derived from the stumpage values now in operation do not differ significantly with the actual price paid by carvers in the present markets for *Brachylaena* huillensis, and other species as well. This confirms that generally, the stumpage values set by government are too low to reflect the relative scarcity of these prime species, strict enforcement notwithstanding. Karsenty (2000) observes that forest policies adopted by countries in Central Africa (and probably Kenya as well) rely primarily on government regulation and technical precepts, and have made little attempt to use the range of economic instruments, which are often based on market mechanisms, to put a price on forest resources, regulate access to forest concessions or make trade-offs between log exports and local processing. He goes further to state that the signals sent out by the tax structure results in forest resources being under valued, and this discourages operators from investing in practices which would reduce wood losses or adopting innovative processing and marketing strategies.

Reasons for the market failure to capture the scarcity signals of *Brachylaena* have been given. However, market forces do not always fail. Karsenty (2000) recommends the use of market mechanisms as a guide to management in the forestry sector. Market systems can provide the information that deficient government statistics systems are unable to offer.

In order to determine the level at which stumpage price should be levied to reflect the wood scarcity in the carving industry, the expected level can be derived based on the prices of carvings in the market. Using standard procedures of stumpage determination (FAO, 1983) and cost figures established as part of this study, the appropriate derived value was obtained as shown in Table 8.8. From this example, the expected level of the stumpage value, which should be levied by the government, should be about 3 times the present value. Only that way can the market capture the scarcity signals of these prime species and appropriate adjustments brought about by the market forces to help in regulating their uses. In practice, this should mean that each standard sized log at the market should not cost below Ksh 800 as bought by a carver. At present, the mean value is about Ksh 275 for an average *Brachylaena huillensis* log. However, there are many reasons why it may be difficult to implement this recommendation in practice. Firstly, carvers are aiming at increasing their incomes, and higher wood prices would drive many of them to poach the wood. Secondly, the market share for high quality items in Kenya is generally a small one, and does not provide an assurance that if many carvers made products of exceptionally high quality would receive instant market response of high prices. Whichever way it takes, investing in the planting of fast growing species by individual carvers, the state and individuals seems to be the best option at this point in time in an effort to sustain the industry.

**Table 8.8: Derived stumpage price (Ksh/m$^3$) for *Brachylaena huillensis* based on prices of carvings**

| | Nanyuki | Wamunyu | Gikomba | Mombasa |
|---|---|---|---|---|
| Selling price of carvings × recovery factor (600× 300 ×0.35) | 63,000 | 63,00 | 63,000 | 63,000 |
| Value of products recovered from 1m$^3$ wood | 63,000 | 63,000 | 63,000 | 63,000 |
| Marketing | 12,600 | 12,600 | 12,600 | 12,600 |
| - Transport | | | | |
| - Rents | | | | |
| - Miscellaneous | | | | |
| Carvings production costs/m$^3$ | 20,000 | 20,000 | 20,000 | 20,000 |
| Overheads × Recovery % | 3150 | 3 50 | 3150 | 3150 |
| Depreciation × Recovery % | 630 | 630 | 630 | 630 |
| Material × Recovery % | 1260 | 1260 | 1260 | 1260 |
| Profits on capital × Recovery | 6300 | 6300 | 6360 | 6300 |
| Value of logs entering cooperative/m$^3$ (price to carver) | 19,060 | 19,060 | 19,060 | 19,060 |
| Unloading costs | 150 | 150 | 150 | 150 |
| Transport costs | 150 | 150 | 150 | 150 |
| Profit on capital | 1906 | 1906 | 1906 | 1906 |
| Value of logs at Roadside/m$^3$ | | | | |
| Loading | 150 | 150 | 150 | 150 |
| Transport | 320 | 1600 | 1600 | 2400 |
| Harvesting | 200 | 200 | 200 | 200 |
| Overheads | 953 | 953 | 953 | 953 |
| Derived stumpage value/m$^3$ | 15,231 | 13,951 | 13,951 | 13,151 |
| Government stumpage value/m$^3$ | 4053 | 4053 | 4053 | 4053 |

**Summary**

As the Kenya government made efforts to meet the industrial wood requirements through intensive cultivation of fast growing softwood plantations, little or no attention was paid to the woodcarving industry, hence a general lack of understanding on the specific wood requirements, dynamics of the industry and its strategic importance as source of employment and foreign exchange. These mistakes are now being paid for at a very high price since a source of livelihood to thousands of carvers and their families is at stake. The wood demands for the growing industry has outstripped the supply by a very wide margin. The growing imbalance in supply and demand in the industry is made worse by the lack of appropriate adjustments in wood prices in the free market to reflect scarcity as well as poor implementation of the existing levels of stumpage structures albeit lower than expected. The methods used in fixing the levels of stumpage need to be appraised.

All these shortcomings have led to further depletion of most of the valued carving species from state forests. Carvers are now increasingly turning to private sources of wood other than state forests, and there is also more use of alternative species.

As scarcity of the prime species grows, distances covered in supplying the little available wood is increasing, sometimes getting to as far as 700 km and obtained at higher costs. In the final analysis, urgent efforts towards planting of fast growing alternative trees offers the best option through which the woodcarving industry in Kenya may be sustained.

# CHAPTER NINE

# THE ECONOMIC RETURNS OF CARVING TO WOODCARVERS IN KENYA

## 9.1 Introduction

Mogaka *et al.*, (2001) observe that one of the reasons why people carry out economic activities in ways and at levels that degrade forests is because they can gain high economic benefits from doing so. Indeed, thousands of people directly depend on the woodcarving industry as a source of employment (Obunga, 1995). The employment creation and hence economic support to many of these people can continue indefinitely if the approach to management policies is thoughtful. However, in absence of alternative sources of income, forest degradation will continue to be an unavoidable outcome as extraction of forest products forms one of the main economic activities under such circumstances. Woodcarving is one such activity and has made a difference to lives of many people in many rural and urban areas of Kenya.

This chapter examines woodcarving as an economic activity, which has continued to remain as the main source of livelihood to thousands of clans, families and individuals among the Kamba tribe spread over many Districts in Kenya. Efforts are made to quantify all costs incurred during carving and how these costs could be reduced in order to maximize profits from the sale of finished carvings. Still on revenue maximization, the rate of production of carvings is linked to carvings quality and wood consumption and appropriate recommendations are given. The existing woodcarving ccoperatives set-up in production and marketing of carvings is also examined in necessary detail and some of the main factors which have contributed to their instability and poor marketing of carvings are discussed. Appropriate policy recommendations are also sought.

The economic value of woodcarving industry in Kenya is also estimated based on annual wood volume consumed. This provides an opportunity to determine its contribution to the national economy and to justify the need for urgent national and international efforts to sustain it.

## 9.2 Amount spent by carvers to secure materials

### 9.2.1 Spending by species

Wood carvers in Kenya spend large sums of money on *Brachylaena huillensis* wood, estimated at over Ksh 22 million annually, or 67.5% of the total expenditure on carving raw materials for the last three years (Table 9.1). During this period, over Ksh 101 million has been spend on procuring raw materials for carving in the entire industry in the country. Owing to the scarcity of *Brachylaena huillensis*, the amount spent on it has declined from 81.4%, 67% and 50.1% from 1998, 1999 and 2000 respectively. The reverse is true for *Azadirachta indica* (neem), which has been on the rise from 3.4%, 7.4% and 20.5% in the same period.

### 9.2.2 Amount spent according to centers.

The Akamba cooperative center (Mombasa) by virtue of its large size compared to the other centers, received the highest volume of wood. The amount spent on procurement of materials was 35.8% of the national average (or over Ksh 12 million annually). Wamunyu and Lungalunga followed closely with their mean averages standing at 24.9% and 20.4% respectively (Table 9.2)

## 9.3 Costs incurred and revenues in carving

### 9.3.1 Comparative costs in carving stages

This study was undertaken to see which operations in the process of carving are the most expensive such that these costs may be reduced by some form of training in order to maximize the cost-effectiveness of the operation and to use the scarce wood resources more effectively.

The stages followed in carving were outlined in Chapter 3. For a carved article to be considered complete, it goes through different stages. The process starts by a choice of wood by a carver and handing it over to those who specialize in crosscutting and splitting it to the desired sizes. Once the carving has been done, all the finishing stages are contracted to those specialized in the finishing process. The stages of finishing lines involve filing, sanding,

## Table 9.1: Procurement costs of carving wood according to tree species in the years 1998 - 2000 (Ksh)

| Year | Afzelia | A. indica | Brachylaena | Combretum | Dalbergia | Diospyros | Jacaranda | Mango | Olea | Others | Spirostachys | Terminalia | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1998 | 55 920.0 | 1 402 840.0 | 30 997 420.0 | 409 440.0 | 613 060.0 | 0 | 388 060.0 | 295 820.0 | 1 437 860.0 | 1 179 615.0 | 922 240.0 | 415 540.0 | 38 117 815.0 |
| | *0.15* | *3.7* | *81.4* | *0.9* | *1.6* | *0* | *1* | *0.8* | *3.7* | *3.2* | *2.4* | *1.1* | |
| 1999 | 59 900.0 | 2 520 260.0 | 22 695 020.0 | 944 000.0 | 1 042 900.0 | 0 | 848 980.0 | 373 500.0 | 1 374 760.0 | 1 425 870.0 | 1 331 520.0 | 1 269 240.0 | 33 885 950.0 |
| | *0.2* | *7.4* | *67.0* | *2.6* | *3.1* | *0* | *2.5* | *1.1* | *4.1* | *4.4* | *3.9* | *3.7* | |
| 2000 | 0 | 6 081 320.0 | 14 900 600.0 | 679 320.0 | 1 896 600.0 | 322 442.0 | 746 520 0 | 748 120.0 | 978 280.0 | 1 702 910 0 | 317 120.0 | 1 246 240 0 | 29 619 472.0 |
| | *0* | *20.5* | *50.1* | *2.2* | *6.4* | *1.1* | *2.5* | *2.5* | *3.3* | *6.1* | *1.1* | *4.2* | |
| Total | 115 820.0 | 10 004 420.0 | 68 593 040.0 | 2 032 760.0 | 3 552 560.0 | 322 442.0 | 1 983 560.0 | 1 417 440.0 | 3 790 900.0 | 4 308 395.0 | 2 570 880.0 | 2 931 020 | 101 921 760.0 |
| **Mean** | **57 910.0** | **3 334 806.0** | **22 864 347.0** | **677 586.7** | **1 984 186.0** | **322 442.0** | **661 186.0** | **472 480.0** | **1 263 633.0** | **1 436 132.0** | **856 960.0** | **977 006.0** | **33 973 919.0** |
| | *0.2* | *9.9* | *67.5* | *1.9* | *3.5* | *0.9* | *1.9* | *1.4* | *3.7* | *3.8* | *2.5* | *2.8* | |

Italized values represents respective proportions (%) of costs for each species

## Table 9.2 Procurement costs of carving wood according to carving centres in the years 1998 - 2000

| Year | Gikomba | Lungalunga | Malindi | Mombasa | Nanyuki | Wamunyu | Total |
|---|---|---|---|---|---|---|---|
| 1998 | 5 169 390.0 | 8 369 371.0 | 1 292 583.0 | 14 570 314.0 | 342 383.0 | 8 441 381.0 | 38 117 815.0 |
| | *13.5* | *22.0* | *3.2* | *38.3* | *0.9* | *22.1* | |
| 1999 | 3 285 761.0 | 9 337 635.0 | 3 741 629.0 | 10 623 251.0 | 372 152.0 | 6 668 962.0 | 33 885 950.0 |
| | *9.5* | *27.6* | *10.9* | *31.4* | *1.1* | *19.5* | |
| 2000 | 2 532 718.0 | 2 932 327.0 | 2 843 469.0 | 11 196 160.0 | 236 956.0 | 10 204 161.0 | 29 619 472.0 |
| | *8.6* | *9.9* | *9.6* | *37.6* | *0.8* | *33.9* | |
| Total | 10 987 869.0 | 19 822 620.0 | 7 877 681.0 | 34 831 560.0 | 910 540.0 | 25 314 504.0 | 101 921 760.0 |
| **Mean** | **3 662 623.0** | **6 901 597.0** | **2 469 689.0** | **12 111 627.0** | **338 314.0** | **8 438 168.0** | **33 973 919.0** |
| | *10.6* | *20.4* | *7.3* | *35.8* | *1* | *24.9* | |

Italized values represents respective proportions (%) of costs for each centre

painting and polishing, in that order. Operations other than carving are generally time-consuming. Although some carvers may decide to undertake all these stages on their own without necessarily contracting them out, the majority of them do not. The costs incurred at each of these stages were determined (Table 9.3) and the procedures followed were outlined in chapter 6. It is important at this stage to explain in detail the significance of Table 9.3. Carving logs are usually delivered in standard sizes of 1.5 m long with varying diameters where the optimum values range from 12 cm to 25 cm (chapter 7).

On average, the number of products carved out of one log depends on the sizes of the products. Most carvers produce medium sized products measuring about 4 inches[1] high, such that on average, one log can produce about 30 such carvings. When all the costs of carving production are considered, which include cost of the log, splitting, filing of 30 carvings and other subsequent costs for additional operations on carvings such as sanding, painting and time taken to produce these 30 products, the total costs as well as the number of products per log were converted to per unit wood volume values by dividing the number of products by the wood volume. For example, products per unit volume ranged from 423 to 799 with an average of 588. Each finished product has a marked price that it attracts on retail or wholesale trading. Cumulative marked prices (using wholesale prices) of all products made from unit wood volume gives the total per unit sales or total value of products. Per unit sale figures ranged from Ksh 47 075/$m^3$ to Ksh 88 142/$m^3$. Per unit profits (or revenue), which accrue to the carver, are the difference between the total per unit sales and total per unit costs of products made from the unit wood volume. These varied from Ksh 30 626 to Ksh 67 234/ $m^3$, depending on the species and products carved. Products made from *Dalbergia melanoxylon* attract high prices, and closely followed by other prime species such as *Brachylaena huillensis*, *Combretum schumanii*, *Olea europaea* and *Spirostachys africana*.

Other factors that affect pricing include the level of detail input carved into each product, which must be reflected in the amount of time invested by a carver.

[1] Carvers use inches as standard measurements for sizes of carvings and have been used here for convenience.

## Table 9.3: Cost incurred for different stages of carving

| Centre | species | Costs of log | Spliting | Sanding | Painting | Polishing | Total Costs | Articles | Time (days) | Sales | Profits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mombasa | Spirostachys | 5 531.0 | 716.0 | 5 197.0 | 3 607.0 | 5 263.0 | 21 317.0 | 423.0 | 160.0 | 77 754.0 | 56 438.0 |
| | | *25.9* | *3.4* | *24.4* | *16.9* | *24.7* | | | | | |
| Nanyuki | Olea | 5 051.0 | 1 453.0 | 7 334.0 | 2 340 0 | 2 617.0 | 20 907.0 | 549.0 | 134.0 | 88 142.0 | 67 234.0 |
| | | *24 0* | *6.9* | *35.0* | *11.2* | *12.5* | | | | | |
| Wamunyu | Brachylaena | 7 431.0 | 464 0 | 5 271.0 | 1 098.0 | 797.0 | 16 449 0 | 799.0 | 150.0 | 47 075 | 30 626.0 |
| | | *45.2* | *2.8* | *32.0* | *6.7* | *4.8* | | | | | |
| Total | | 17 977.6 | 2 632.6 | 17 801.2 | 7 044.8 | 8 676.2 | 58 672.6 | 1 762.0 | 443.7 | 212 971.0 | 154 298.0 |
| Mean | | **5 992.0** | **878.0** | **5 934.0** | **2 348.0** | **2 892.0** | **19 558.0** | **588.0** | **148.0** | **70 990.0** | **51 432.0** |
| | | ***30.6*** | ***4.5*** | ***30.3*** | ***12.0*** | ***14.8*** | | | | | |

Italized values represents respective proportions (%) of costs for each operation

When the process of carving is complete, in principle, carvers are supposed to sell the products through the cooperative at standardized prices set by the cooperative management. Given that each carver keeps a fixed number of carvings at the cooperative warehouse which have to be replenished each time a product is sold, they are at liberty to sell any excess products on their own, usually at 'factory' prices which are much lower than those set by the cooperatives. The per unit revenues (profits) used in this study are based on the prices of products as sold by the carvers themselves ('factory" prices) before they are handed over to the cooperative for final marketing where the prices set by the cooperative for the same product may even be five times as much.

The choice of the 'factory' prices in determining the revenue levels to carvers is more realistic because most of the carved products are increasingly being sold outside the cooperatives. These revenue values (profits), which accrue to carvers, therefore represent the very minimum profits, which can be obtained from carving because very low product prices were used. The profit margins (revenues to carvers) would obviously be much higher if the cooperative standard prices for products were used. The level of per unit profits from carving will be compared with per unit profits from other competing uses for carving wood in order to identify the areas which require policy intervention towards better allocation of scarce wood resources.

The results of these studies show that sanding constitutes the highest proportion of costs as shown in Figure 9.1. This is the most labor-intensive stage in the process of carving and requires some considerable amount of concentration, which most carvers would like to avoid and instead pay others to carry on. At the same time, this is also the stage that will have an influence on the price of the product. A well-sanded carving is very smooth and very attractive, appealing to the eyes and generally deserves a second look. The carvings sold at high quality art galleries often undergo additional sanding stages, which an average carver may not be patient enough to undertake. As carving woods become scarce, it would be appropriate to encourage carvers to undertake the sanding process themselves so as to ensure that carvings of high quality are produced which will in turn attract high prices and in the process, the rates of timber consumption are likely to be reduced significantly.

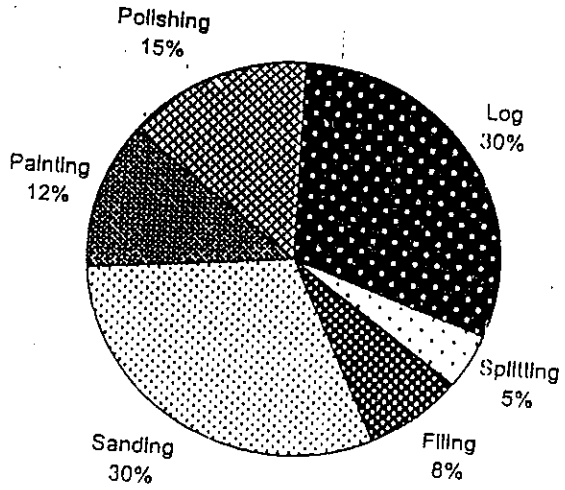



**Figure 9.1: Comparison of costs incurred at different stages of carving**

### 9.3.2 Comparison of costs and profits obtained based on carving experience

There is wide variation in the level of skill and experiences among carvers. Since the art of carving is mainly acquired through informal training that is learnt during an apprenticeship, the learning period depends on an individuals efforts. It is generally agreed in the carving fraternity that experience is linked to productivity. This was examined using 3 groups of carvers whose experiences varied from 0-5 years, 6-10 years and greater than 10 years (Table 9.4). The procedure is outlined in chapter 6.

The findings of this study show that profit margins are inversely proportional to carving experience as per the age ranges considered in this sample (Table 9.5). This observation could be explained by the fact that young people who generally constitute the bulk of carvers in the industry are energetic and more active and therefore more productive. Older members have a tendency to allocate their carving time to other duties and engagements related to the welfare of their families and other activities. However, the advantage of experience, as established in this study is a better recovery of wood in terms of carved articles per unit volume of wood. This was attributed to the fact that older carvers tend to work more slowly and were found to be more precise in their carving methods. Most of the older carvers also owned a wider range of carving tools, which were essential at critical stages of the carving process.

## Table 9.4 : Comparison of mean costs and revenue based on years of experience

| Category of Carvers | Unit Cost of Log | Spliting | Filing | Sanding | Painting | Polishing | Total Costs | Articles/m³ | Time (days) | Sales | Profits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 -5 years | 7 288.0 | 448.5 | 1 420.3 | 5 626.2 | 2 174.6 | 1 094.9 | 18 052.5 | 724.0 | 120.0 | 55 680.0 | 37 628.0 |
| | *40.4* | *2.4* | *7.8* | *31.2* | *12.0* | *6.0* | | | | | |
| 6 -10 years | 7 174.0 | 586.0 | 1 398.7 | 5 280.7 | 1 118.6 | 831.0 | 16 389.9 | 807.0 | 132.0 | 52 117.5 | 35 727.0 |
| | *43.8* | *3.6* | *8.5* | *32.2* | *6.8* | *5.0* | | | | | |
| >10 | 7 046.0 | 445.0 | 1 462.2 | 5 587.0 | 655.5 | 1 245.0 | 16 440.7 | 997.0 | 115.0 | 52 095.0 | 35 654.3 |
| | *42.9* | *2.7* | *8.9* | *33.9* | *3.9* | *7.6* | | | | | |

Italized values represents respective proportions (%) of costs for each activity

**Descriptive Statistics**

Dependent Variable: profit/day/m3

| Category of carvers | Mean | Std. Deviation | N |
|---|---|---|---|
| 0-5 years | 12598.31 | 7167.7030 | 34 |
| 6-10 years | 12042.12 | 8315.9519 | 79 |
| >10 years | 9142.104 | 6629.1306 | 19 |
| Total | 11767.95 | 7834.6000 | 132 |

**Tests of Between-Subjects Effects**

Dependent Variable: profit/day/m3

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 160387390[a] | 2 | 80193694.78 | 1.313 | .273 |
| Intercept | 1.205E+10 | 1 | 1.205E+10 | 197.270 | .000 |
| CARVERS | 160387390 | 2 | 80193694.78 | 1.313 | .273 |
| Error | 7.881E+09 | 129 | 61089286.49 | | |
| Total | 2.632E+10 | 132 | | | |
| Corrected Total | 8.041E+09 | 131 | | | |

a. R Squared = .020 (Adjusted R Squared = .005)

**Table 9.5: Analysis of variance for profits based on carving experience (years)**

### 9.3.3 Wood recovery during carving

In the light of the growing scarcity of carving resources, efforts directed towards increased wood recovery during the carving process need to be increased. As indicated in chapter 8 in this thesis, the relative ease at which carving wood is sourced from the state forests is reflected in the low market prices and this goes a long way to undermine the incentives for improved wood recovery during carving. The low stumpage means that carvers can make profits at any level of efficiency, and for this reason, they may not be inclined to be more economical in the use of available resources.

This study was carried out by determining the volume of carving logs through measurement of log dimensions, and those of the finished products by use of standard water displacement methods as provided in chapter 6. During carving, a wide range of products, which differ in size and type, are usually made from one piece of timber This is largely due to the wood taper and form defects, which necessitates the change of product size, type or design. Recovery is therefore obtained as the average value of all the products carved out of a given timber. The main finding of the study shows that. the average for a range of products made from one carving wood is estimated at 35% (Figure 9.2).

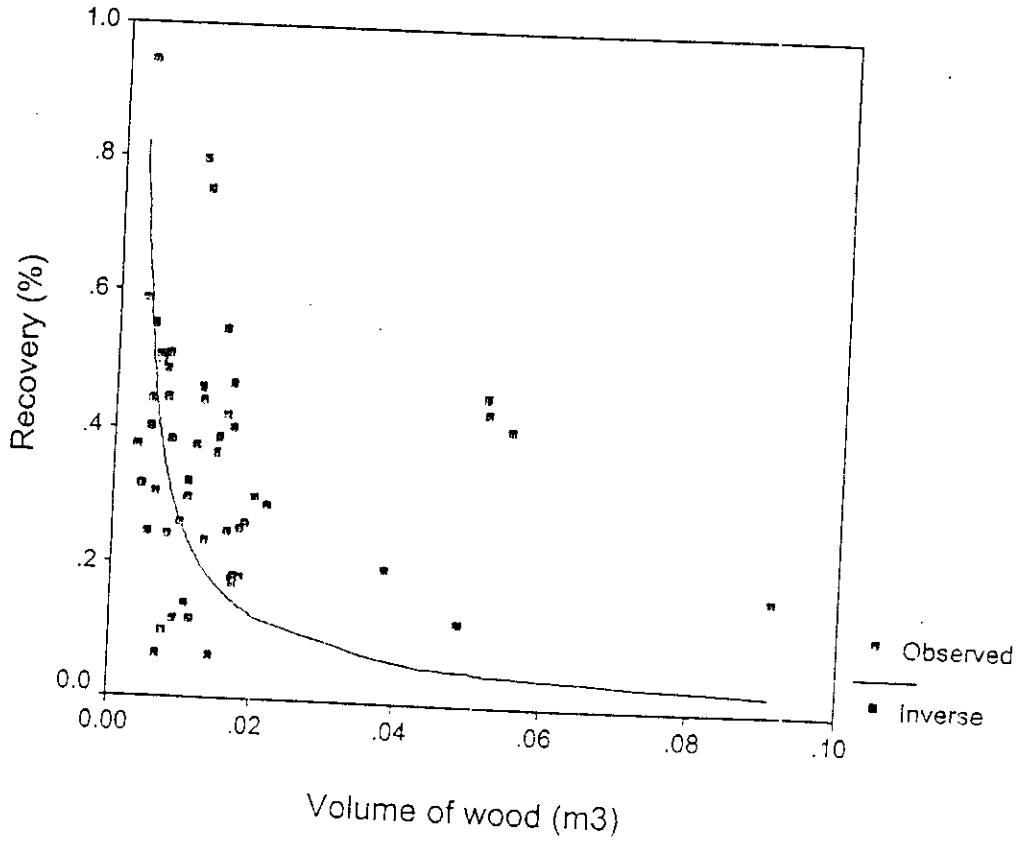



Figure 9.2: Wood recovery during carving

The possibilities of increasing the recovery rates in carving are many and some have already been covered in the preceding sections of this chapter, which include the deliberate stressing of the supply of wood to carvers so that they may use whatever is available more economically. Other more friendly methods include training in design cutting of wood, carving of more innovative carving designs, use of appropriate tools for all the varied stages of carving, diversification of carvings such as the carving of miniature articles as gift packs among others. Efforts to address some of these needs have already started in Kenya and led by the 'Ten Thousand Villages Program' of the Mennonite Brethren Churches in North America.

## 9.4 Wood volume and value of carvings in Kenya

The studies undertaken on the number of carvings produced per unit volume of wood and the associated costs, wood volumes and other derivatives from the above sections are applied in this section to provide some information on the size of the wood carving market in Kenya, and its potential economic benefits, not only to the carvers, but to the nation as a whole. Estimates of the export values of the carving industry in Kenya were made from the export statistics records kept by the Ministry of Commerce and Industry. These figures exclude the carvings bought and carried as personal effects by tourists visiting Kenya.

With knowledge of the quantities of timber used in the industry annually and the recovery rates of carving products made from a unit volume of wood, it is possible to estimate the size of the carving market in the country. This information will also be used to provide insight into the nature, extent of current weaknesses and strengths in the marketing of carvings in Kenya. This component of the study has also attempted to estimate the optimum allocation of wood resources to carvers in the light of present resource scarcity. Further, this information will be used to estimate the annual wood consumption for Makindu cooperative center from the carvings sales information obtained from this center. Makindu is situated some 200 km south of Nairobi along the Nairobi-Mombasa Highway and lies within Makueni District. Carvers at this center usually undertake long camping expeditions in the distant Chyulu, Kibwezi Forests and the surrounding bushland within the District to carve and return with finished carvings. For a long time, it has been difficult to estimate their volume requirements due to their migratory carving strategies.

### 9.4.1 Size of woodcarving market and potential benefits.

#### 9.4.1.1 Determination of number of articles per unit wood volume and mean price per article

From the preceding sections of this chapter, the number of carved articles produced from a unit volume of wood ($1m^3$) was found to vary depending on the sizes of carvings, nature of the carved log, and recovery among a range of carvers amongst other reasons. In order to find a working figure for the number of articles per unit volume of wood, an average of all the article size categories was used (Table 9.6).

**Table 9.6: Carvings made from unit wood volume ($m^3$)**

| Carving center | Articles per unit wood volume | Sizes of carvings | Species used |
|---|---|---|---|
| Mombasa (Akamba) | 423 | Medium (4-5 inches) | *Spirostachys africana* |
| Nanyuki | 162 | large (6-8 inches) | *Olea europaea* |
| | 549 | medium (4-5 inches) | |
| | 684 | medium(4-5 inches) | |
| | 1287 | small (3 inches) | |
| Wamunyu | 233 | large (6-8 inches) | *Brachylaena* |
| | 790 | medium (4-5 inches) | *huillensis* |
| | 830 | medium (4-5 inches) | |
| | 1758 | small (3 inches) | |
| Total | 6716 | | |
| **Mean** | **746** | | |
| Standard deviation | 480 | | |

Values from different carving centers, species and sizes of carvings were used in order to obtain an average working figure, which can be applied, across the country.

For purposes of this study, a working figure of 600 instead of 746 carvings per unit wood volume is used in order to give allowance for wastage, low recovery rates and defects on logs. In addition, the prevalence of deformed logs by reason of wood scarcity has often increased

the incidences of wastage, and therefore the choice of a lower number (600) is presumed to give a more practical scenario.

A working figure for the price per article was obtained from detailed sales information gathered at Malindi for sales of carvings from 1995-2000 (Table 9.7). The price per article reached its highest value over the period from 1996-1998, following which it seems to be declining. Nevertheless, the mean unit price is estimated at Ksh 450 per article. Given that prices of carvings within cooperatives are fairly standardized, the value of Ksh 450 per article is adopted for all other calculations that follow.

**Table 9.7 :Sales of carvings at Malindi Cooperative Society from 1995-2000**

| Year | Number of articles sold | Revenue (Ksh) | Price per article (Ksh) |
|---|---|---|---|
| 1995 | 29 179 | 12 121 940 | 415 |
| 1996 | 25 935 | 13 842 140 | 513 |
| 1997 | 37 704 | 18 663 075 | 494 |
| 1998 | 18 724 | 9 770 260 | 521 |
| 1999 | 29 529 | 12 019 158 | 407 |
| 2000 | 12 261 | 4 161 640 | 339 |
| **Total** | 152 432 | 69 578 213 | 2 689 |
| **Mean** | 25 405 | 11 596 369 | 448 |

### 9.4.1.2 Determination of carvings not sold through the cooperatives.

In the existing woodcarving cooperative system, carvers sell their carvings through the cooperative and also to independent dealers in the larger carvings market. In principle, all carvings should be sold through the cooperative. However, due to the marketing problems experienced by the cooperatives, a high proportion of carvings made by the members are now increasingly being sold outside the cooperatives. As already pointed out, carvings sold outside the cooperative are cheaper. This is because most carvings sold this way are in a less

finished state. Another reason is that many carvers are poor in bargaining for prices of their products. Lack of elementary education is seen as major limitation for most of them to determine what constitutes a proper price of a product using basic economic principles of costing. Independent dealers have taken full advantage of these knowledge gaps and are always seen around these cooperative centers with tempting ready cash to pay for products. Observations made during the study indicate that the price of a product sold outside the cooperative is about four times cheaper than what it would fetch through the cooperative. Therefore, in an effort to estimate revenues, which accrue to carvers from carvings sold outside the cooperatives, the price of a product has been reduced by 75% of the value of the same product when sold through the cooperative. The extend of carving sales outside the cooperative is an indication of the seriousness of marketing problems within the cooperatives. Two case studies are used in order to develop an appreciation of the proportion of the carving sales outside the cooperative system throughout Kenya.

#### 9.4.1.2.1 Malindi cooperative carving center

Of the carving wood entering the industry at Malindi about 50% goes to the cooperative carving workshop. The rest is bought and used by other carvers around Malindi who are not members of the cooperative. The wood volumes used in the estimation of the level of carving at Malindi are based on what enters the cooperative. From experience and data collected in this study, of the wood entering the trade, about 40% of the wood volume is wasted due to defects such as heart rot, presence of nodes, wood decay, other infections and insect attacks, the use of poor tools, and inexperience of carvers to list the most important factors amongst a range of other reasons. Using the working figures obtained previously in this study, such as articles per unit wood volume and price per article, it is possible to estimate overall production and sales of carvings at Malindi (Table 9.8).

The wood volume shown in Table 9.8 can be linked to those shown in Table 7.2 (chapter 7). However, as explained above, two deductions on volume values have been made to reflect the 50% exclusive use of total volume entering Malindi at the cooperative workshop, including a further 40% of the remainder due to wood defects. These deductions are made in order to arrive at a more realistic number of articles carved at each of these centers and to avoid over estimation in articles actually made. The same procedure is followed in obtaining the discrete

volumes of wood used in each of the years. Derived articles per year were arrived at using the rate already established above. These values showed a rise across the years, from 73 800 in 1998, 99 600 in 1999, and 120 600 in 2000 with an annual mean of 98 000 articles made based on the wood volumes received. The actual articles sold were obtained from sales records at Malindi cooperative, and were found to be 24 171, or 24.6% of total articles. The difference between these two figures gives the number of articles sold outside Malindi cooperative, and are estimated at 73 828, or 75.4%. The revenue values, which accrue to carvers from these sales, are proportional to the articles made, and were found to be Ksh 10 876 950 and Ksh 33 222 600 from cooperative and outside sales respectively. However, since articles sold outside the cooperative are 75 % cheaper, the actual revenue realized from outside sales is estimated at Ksh. 8 305 650, and represents a significant loss.

**Table 9.8 :Annual input of wood at Malindi, estimated production of carved items, sales through the cooperative and estimated sales that do not pass through the cooperative over the period 1998-2000.**

| Year | wood volume[2] (cubic meters) | Derived articles | Actual articles sold through cooperative | Articles not sold through cooperative |
|---|---|---|---|---|
| 1998 | 123 | 73 800 | 18 724 | 55 076 |
| 1999 | 166 | 99 600 | 29 529 | 70 071 |
| 2000 | 201 | 120 600 | 24 261 | 96 339 |
| Total | 490 | 294 000 | 72 514 | 221 486 |
| Annual Mean | 163 | 98 000 | 24 171 | 73 828 |
| % | | | **24.6%** | **75.4%** |
| **Potential annual revenue (Ksh/yr)** | | | **10 876 950** | **33 222 600** (or 8 305 650 after 75% reduction in prices of each article) |

#### 9.4.1.2.2 Akamba cooperative society (Mombasa)

All the wood entering the Akamba (Mombasa) center is used at the cooperative workshop. In this case, only the 40% reduction in total wood volume due to wood defects is made, aimed at obtaining a realistic number of articles carved. All other computations were done in the same

[2] The wood volumes shown in this column do not represent the total real wood volumes received at Malindi. These are residual volumes after real volumes were subjected to 50% deduction and a further 40% deduction of the remainder. See section 9.4.1.2.1 of text for explanation of these deductions.

way as that of Malindi center in the previous section. The wood volumes show a declining trend over the three years, from 2 130.1 $m^3$ in 1998, 1 612.8 $m^3$ in 1999, and 1 579 $m^3$ in 2000 (Table 9.9), with an annual mean of 1 774.1 $m^3$. This center has been the most affected by the recent changes in the administration of Kenyan forests where access to carving wood was more restricted over this period as explained in chapter 7. From these wood volumes, mean annual number of articles made at this center is estimated at 1 064 360 with 33% and 67% of these articles being sold through the cooperative and outside respectively. The annual revenue figures realised from these sales are as high as Ksh. 160 783 200 and Ksh. 954 536 400 respectively. However, the actual revenue from out side sales is 75% less. Considering the proportions of the cooperative and outside sales at the two centers, mean values are estimated at 30% and 70% respectively.

Determination of volumes of wood utilized at Makindu center was made possible using principles developed in this study as used in the two case studies above, and annual volume was estimated at 71.3 $m^3$

**Table 9.9. :Annual input of wood at Akamba (Mombasa), estimated production of carved items, sales through the cooperative and estimated sales that do not pass through the cooperative over the period 1998-2000.**

| Year | Wood volume used (cubic meters) | Derived number of articles | Actual articles sold through cooperative | Articles not sold through cooperative |
|---|---|---|---|---|
| 1998 | 2 131 | 1 278 000 | 422 496 | 855 504 |
| 1999 | 1 613 | 967 680 | 332 688 | 634 992 |
| 2000 | 1 579 | 947 400 | 316 704 | 630 690 |
| Total | 5 322 | 3 193 080 | 1 071 888 | 2 121 192 |
| Mean | 1774 | 1 064 360 | 357 296 | 707 064 |
| % | | | 33% | 67% |
| **Potential revenue (Ksh/yr)** | | | 160 783 200 | 954 536 400 (or 238 634 410 after 75% price reduction per article) |

### 9.4.2 Potential size of woodcarving industry in Kenya

Using the working figures developed thus far and the volumes of wood received, the volume of the woodcarving trade in Kenya can be estimated (Table 9.10). Before these computations are done, it is important to take note that the carving cooperatives represent a proportion of 50% of the entire carving market share in Kenya. The rest represents independent carvers and private carving groups (Obunga, 1995). Following this, it is assumed that wood volume consumed by the cooperatives is about 50% of the total volume used in the industry in the country annually and therefore revenues of similar proportions are made annually. This is taken into account in the calculations that follow as shown in Table 9.10.

Annual volumes utilized within the cooperatives including 40% deduction made as before, are shown. The trend shows a drastic reduction in volume over the years as captured in chapter 7 with an annual mean of 5 279.4 $m^3$. Derived articles from this volume are estimated at 3 167 620. Although sales outside of the cooperative markets are sold cheaply to dealers, these dealers make huge profits in the next stage of the marketing chain. Therefore, the price per article is taken as the same or about the same as the cooperative level of Ksh. 450.

When these figures are used, the overall annual revenue value from cooperatives of Ksh 1.4 billion is obtained as potential sales per year or Ksh. 2.8 billion for the entire industry annually. A reduction of 30% due to overheads, taxes and other costs gives a net value of Ksh 1.9 billion for the entire industry or an equivalent of US$ 24.9 million. This figure compares very well with the findings from one of the component studies (Obunga, 1995) where the export value of carvings from Kenya based on export records was estimated at US$ 20 million annually.

**Table 9.10: Estimated size of the woodcarving industry in Kenya**

| Year | Total wood volume (cubic meters) | Derived articles | Potential revenue (Ksh) |
|---|---|---|---|
| 1998 | 7 917 | 4 749 900 | 2 137 455 000 |
| 1999 | 4 536 | 2 721 360 | 1 224 612 000 |
| 2000 | 3 386 | 2 031 600 | 914 220 000 |
| Total | 15 838 | 9 502 860 | 4 251 997 800 |
| Mean/yr | 5 279 | 3 167 620 | **1 425 429 000** |
| Total revenue/yr (Ksh/yr) | | | **2 850 858 000** (assuming cooperatives have 50% of market |
| Total Net revenue in US$ assuming 30% overhead costs | | | **24 945 008** |

### 9.4.3 Current weakness in marketing of carvings

The high number of carvings sold cheaply outside the cooperative markets (about 70% of products made by members) reveals a glaring weakness in the cooperative market system and the presence of serious marketing problems within the existing structure. Strategies used by independent dealers, who have increasingly benefited from sales outside of the cooperative system, have been given and revolves around prompt payment for products albeit at cheaper prices. Although the choice of how and where to sell products lies with individual carvers, the concern here is product under-pricing in sales made outside of the cooperatives, and therefore a loss of the opportunity to allow the market forces to operate freely in the light of prevailing wood scarcity. The prices of carvings, as for the stumpage prices of carving wood, should reflect the relative scarcity of wood and may need to be revised from time to time in response to these changes. There is need to re-structure the existing cooperatives in order to make them more efficient in marketing the products, and government intervention may be required as well as the international carving market.

### 9.4.4 Optimum allocation of wood resources to carvers

In the carving industry, the price of a finished product is a function of artistic workmanship where the greater the skill employed, the higher the price. Great artistic workmanship on the other hand requires a considerable time investment. The production rates of carvings as captured from across the spectrum of carvers in Kenya are high and there is rising concern about the high volume and poor quality of the Kenyan carvings. At present production rates of 600 carvings per unit volume of wood (1 $m^3$) are produced in 120 days, (Table 9.6). In reality, this is an equivalent of using 20 average sized logs of 1.5m long and 20cm diameter in 4 months, per carver. If the rate of production of carvings was reduced, the volume of consumption would reduce by the same proportion, and presumably the quality and price per item would increase. The prices for carvings sold in high quality art galleries in Nairobi and other cities, which largely originate from cooperative members, are many times higher than those offered by the cooperatives for the same products.

Carvers in the cooperatives therefore have the opportunity and potential to produce equally high quality products with corresponding reduction in quantities of wood used. Since the wood is usually brought in standard sizes of 1.5m long, allocation can be made much more easier if proper registers of membership are kept. The actual process of planning and implementing the allocation scheme of these resources is beyond the scope of the present study but warrants further investigation.

### 9.4.5 Pricing of carvings

As already established, the price of a finished carving is derived from the economic principles of costing where the cost of wood, labour, marketing and other overheads are taken into consideration. However, much more important factors which determine the price are the species used and the time taken to carve. Time is a reflection of the level of skill and labour input and the opportunities for excellent workmanship are high. For example, woodcarvers in Indonesia have been noted to carve one product (usually extra large carvings of 3m high and 1.5-2m diameter) for up to a period of *five years!* (Personal observation).

In many places in Kenya and elsewhere, it is common knowledge that the genus *Dalbergia* is associated with good sculptures. With its characteristic dark colour, many buyers have a tendency to buy dark coloured carvings. Carvers are aware of this preference and often use black shoe polish to darken alternative woods in order to give the appearance of being a *Dalbergia* carving. Other than *Dalbergia* carvings, which command the highest prices in the market, most of the other species used, particularly the prime carving species, fetch similar prices depending on the quality of the carving. However, other light woods, particularly those that do not absorb polish or paint well, sell at lower prices. Carvings sold through the KCCU chain of cooperatives have relatively standardized prices. Variation is brought about by the quality of the respective products from the impression of the cooperative officers at a given market.

## 9.5 Discussion

### 9.5.1 How to limit the use of scarce wood resources

Generally, the most obvious policy to reduce resource degradation is to limit activities that make use of the resources concerned, and in this case is to limit the use of prime carving species. However, such a policy would naturally be expected to affect the people who rely on the resource, and whose benefit the policy was designed to help.

Although the design of policies to both manage natural resource in a sustainable manner and reduce poverty is difficult or even unrealistic in certain cases, this study has established that in woodcarving, if carvers were impressed to make fewer products of high quality and price, more carvers would derive benefit from prime carving wood but smaller destructive effect on these species would be expected because less wood would be required in a given time.
In the same way, if such prime carving species were restricted for other uses other than carving and such restrictions were fully institutionalized nationally, this would ensure that other competing uses for the resources (which contribute to resource degradation) are reduced significantly so that resource qualities can be improved without reductions in use for carving.

The economic returns from woodcarving as an alternative economic activity has been demonstrated and found to be potentially high. Despite these high returns, the standard of living of most of the woodcarvers does not seem to reflect the high returns, as many of them appear desperately poor. However, some of them are known to have made substantial savings. Such members should be encouraged to find alternative occupations where possible, so that wood resource use can be reduced without necessarily affecting their standards of living.

### 9.5.2 Limitations of the existing woodcarving cooperatives in marketing of carvings

It is now recognized that the volume of carvings being handled by the existing woodcarving cooperatives is very high, and billions of shillings change hands. Despite the size and organization, they are unable to cope with the large number of carvings from the members and, as now established, loose about 70% of the carved products to independent dealers. Cooperative members are increasingly tempted to sell carvings outside of cooperatives because of cash payments which are made on delivery of carvings unlike the cooperatives where members get paid at the end of the month, or even longer. These are some of the problems that should be addressed as part of a national effort to limit wood consumption in the industry in the light of hardwood scarcity.

It is true that cooperative business, as like any other business organizations, succeed to the extent that they are well managed. The woodcarving trade in Kenya has a strong component of family or clan involvement within a recognized social hierarchy. The respected clan elders are given leadership roles by virtue of their social standing irrespective of the level of education that the trade demands. In all woodcarving cooperatives in Kenya therefore, respected chairmen who represent the interests of clans or families hold top positions. Although lower administrative positions have been created to accommodate commercial managers, clerks and accountants in accordance with the laws governing cooperative movement in Kenya, real powers of managing the cooperatives are vested with the chairmen who make all the important decisions. Problems of marketing in woodcarver cooperatives are not new, having been reported as early as 1951 (Elkan, 1958).

Woodcarving trade is mainly tourist oriented and other than the direct sales to tourists who come to Kenya, a substantial quantity of carvings is shipped to satisfy demand from dealers abroad. It therefore demands a great deal of offshore promotional activity through exhibitions and trade fairs, and a high level international market surveys and networking. Generally, Kenyan managers are not geared to this sort of high business profile or high level of networking.

One of the constraints in the woodcarver cooperatives is the fact that membership is uninformed. Many members barely have elementary education and they thus have limited capacity to read and interpret accounts of the society whenever the need arises. Though the lack of education does not necessarily cripple the development of these cooperatives directly, the few educated members, particularly in the leadership roles may take advantage of members ignorance by manipulating them and even exploiting them. Although this has not been reported, the frequent elections held, sometimes as frequently as twice a year in some cooperatives, are an indicator of dissatisfaction on the part of members. This was observed in Nanyuki (1998), Mombasa (1999/2000) and Lungalunga (1999/2000)

Development and growth of many cooperatives in Kenya have been hindered by varied malpractices such as misappropriation of funds, misuse of assets and general corruption. In woodcarving cooperatives, some members have raised some concerns about a lack of transparency on the part of the leadership. This is common particularly when foreign orders for carvings are received where each item is priced individually. Some committee members have been reported to alter these figures deliberately or keep the original price list as a closely guarded secret. This has led to dissatisfaction of many members who have instead opted to be independent. The cooperatives have therefore lost fine carvers who have felt cheated and disenfranchised. In future, particularly when carvers will be required to fully develop an environmental policy within their cooperatives, some percentage of their income might be required to finance such needs. This will call for honesty and transparency in so far as handling of business practices and finances is concerned.

Owing to poor marketing by the cooperatives, it has been difficult to confine members to trade all their carvings through the cooperatives. It has thus been difficult to adopt a tough position in respect of members who trade outside of the cooperative system due to a lack of

transparency and dishonesty by management. Furthermore, even if members were expelled for violating some of the statutes, they are easily able to join other independent groups with more flexible rules. For example, the Malindi cooperative society lost a number of members in 1999 to an independent dealer who has since remained a threat to the society.

The weakness in the management of woodcarver cooperatives can be seen in the increased number of independent carvers in many parts of the country. These marketing weaknesses and consequent increase in independent carvers have a direct bearing on the quantity of wood resources utilized, and these issues need further investigation.

## 9.6 Summary

This study has established that wood value adding through woodcarving provides one of the highest per unit returns. The high labour intensity demands has ensured the economic survival of thousands of people and therefore, there is every reason to support this industry in the light of the growing number of carvers. Practical methods of limiting the wood consumption without adversely affecting the incomes of carvers exist. These have been discussed and are encouraged.

The existing woodcarver cooperatives do not seem to be effectively meeting the objectives for which they were established as most of the products made by members are sold cheaply to middlemen and dealers largely due to poor marketing, incompetence and mismanagement of these cooperatives. Lack of standardization of product prices brought about by too many independent carvers is a recipe for exploitation by dealers and middlemen particularly for sales made outside of cooperatives. The low prices of such products are obviously a loss of the opportunity to allow the free market to adjust to reflect the growing wood scarcity. It is therefore in the interest of every carver to join cooperatives or to work in groups. As far as possible, such independent groups should advocate for standard prices for products as a way of guarding against exploitation by dealers and middlemen as well as encouraging a level playing ground in the industry.

# CHAPTER TEN

# MODELING THE GROWTH OF *AZADIRACHTA INDICA* (NEEM) AND *BRACHYLAENA HUILLENSIS* (MUHUGU)

## 10.1 Introduction

Knowledge about rates of change biological variables in response to a given set of conditions forms the basis for producing tools to predict yields, performance and silvicultural treatments (Pukkala and Kalle, 1998). Further, growth data are required to model and forecast the development of a forest (Gadow and Hui, 1998), for mathematical models function as simplified representations of reality (Starfield *et al.*, 1990) and in certain conditions, they may have limitations (Starfield, 1991). Models assist resource managers in decision-making and can also be used to disclose characteristics or dynamics of an existing population, or predict the future dynamics of population under various conditions (McKenzie, 1997).

According to Muir (1990), three major approaches to forest modeling include tree, gap and forest models where each of them are used as basic units in developing the respective models. They may be classified further based on population structure, diversity and spatial variables that they describe. The present study aims at developing growth models of *Brachylaena huillensis* and Azadirachta indica from which to estimate their wood yields and potential benefits at different ages in their lifecycle, and to determine the profitability of investing in their planting.

As indicated in Chapter 8, trial plantations of *Brachylaena huillensis* and *Azadirachta indica* exist in Kenya and have been used in this study to model the growth superficially. The underlying task was to look into the feasibility of investing in the planting of these species in the medium term in order to sustain the woodcarving industry. The parameters used in this study to model growth and the procedures used are outlined in chapter 6. Using the year 2000 round wood market prices (see Chapter 8) the value equivalent of each volume was computed and discounted at 10% in order to determine the Net Present Values and hence the financial rotation for each species. Financial rotation is the time when the potential value of a standing

tree exceeds the costs of maintenance. In determining the financial rotation age, it is assumed that the tree is planted on the farmer's own land and the value for the land is not considered as a cost. Variable costs per tree incurred therefore will only be through purchase of seedlings (Ksh 15) in addition to the following costs per seedling; fencing (Ksh 20), watering (Ksh 120 in year 1, Ksh 60 in year 2 and Ksh 45 in year 3) and tending (Ksh 30 per year for all years).

## 10.2 Discussion

### 10.2.1 *Azadirachta indica*

The *Azadirachta indica* (neem) plantation used in this study is located at Gede near Malindi. This is probably one of the only old *Azadirachta indica* plantations with records of performance, and was therefore the most appropriate one to use for purpose of this study. It is a small plantation within an arboretum, which was established in 1976, with individuals at a spacing of 3x3 meters. The records of growth were not undertaken until 1980 when the first assessment was done on DBH and height. No other assessment was carried out until 1998 and 2002 when it was done as part of this study. The results for these two assessments have therefore been used to develop a growth model, which will be used for the purpose of this study to demonstrate the viability of planting this species for the woodcarving industry. Other plantations of *Azadirachta indica* exist elsewhere but no records of performances are available.

#### 10.2.1.1. Diameter and height as a function of age

Measurements of DBH and tree height were undertaken at various ages (Figures 10.1 and 10.2). The results show that *Azadirachta indica* attains a DBH of 14 cm in 16 years. A diameter of 14 cm is a threshold diameter as it is suitable for carving as indicated by the diameter profiles of carving wood given in Chapter 7.

At age 16 and DBH 14 cm, the first thinnings could be harvested and carved, or sold as pole wood for house construction, firewood[1] and other potential sales. A diameter of 76.3 cm is predicted at the age of 50 years under the conditions at Gede, (with mean annual rainfall of 1019 mm and altitude of 0-150 m), a situation that probably occurs on other areas along the Kenyan Coast.

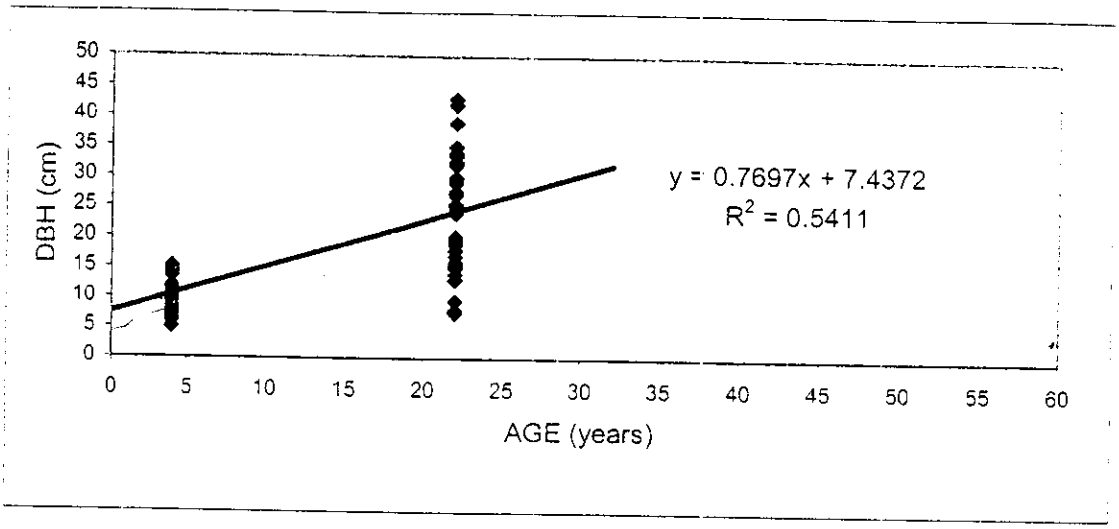



Figure 10.1: Age-DBH model for *Azadirachta indica*

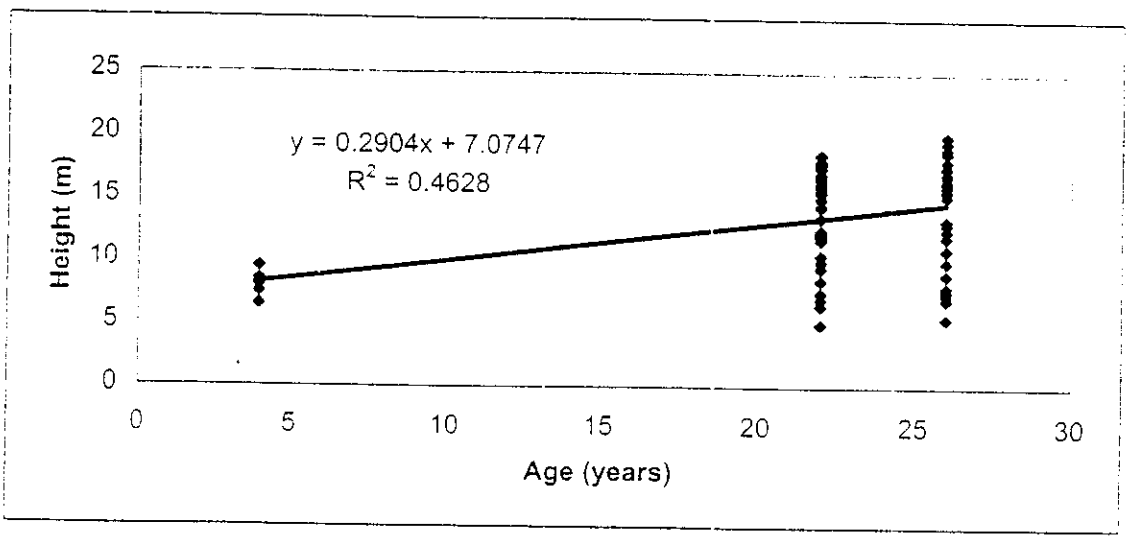



Figure 10.2: Age-height model for *Azadirachta indica*

[1] Firewood and fuelwood has been used interchangeably to mean twigs harvested from a tree and can be used in cooking.

### 10.2.1.2 The relationship between DBH and Volume

The volume of standing *Azadirachta indica* was determined using the standard procedure given in chapter 6, and is presented in Figure 10.3. *Azadirachta indica* is a fast growing tree as evidenced from field observations in Kenya and other countries (see chapter 4), and this has now been established through growth models in this study.

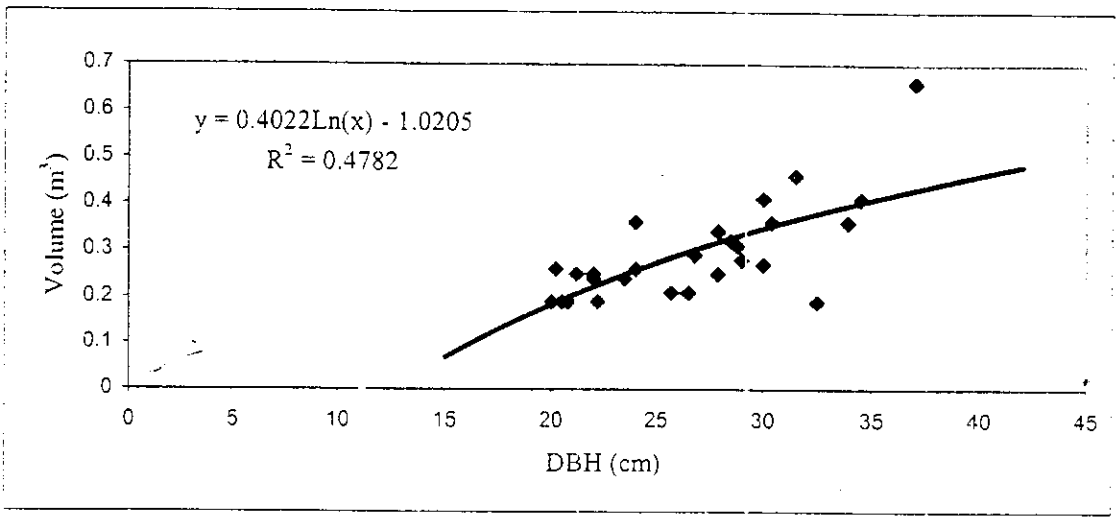



**Figure 10.3: DBH-Volume model for *Azadirachta indica***

### 10.2.1.3 Simple economic model for *Azadirachta indica*

The cost estimates and gross margin per tree for on-farm production of *Azadirachta indica* are given in Table10.1. Sales for firewood can begin at the age of 12 years from the prunings (branches) with the production of ¼ stack annually with a market value of Ksh 50. This could continue for the rest of the life of the plantation until clear felling. Sales of poles could begin from the age about 8 years when the DBH is about 8.5cm. At the age of 17 years, these trees produce stems of sufficient size to carve, with a diameter of approximately 14 cm. The current wood price for *Azadirachta indica* was Ksh. 3 662/m$^3$

The results show that significant potential financial gains from *Azadirachta indica* tree can start accruing at the age of 14 years when the Present Value of Benefits (PVB) on fuel wood and round wood sales exceed the PVC (Figure 10.4). This agrees with the observations made in chapter 8 where the highest wood unit values *for Azadirachta indica* were found to be

about 13 cm. However, tangible benefits will be realized when the Net Present Value (NPV) exceeds the Net Present Costs, and this occurs at the age of 28 years) (Figure 10.4). The Figure also shows that the highest NPV for *Azadirachta indica* occurs at the age of 44 years when benefits are steady and the DBH is about 62 cm. Clear felling of *Azadirachta indica* plantation after this age can be done at the discretion of the owner.

These results show that over the short and medium term, *Azadirachta indica* has a very high potential for production from on-farm systems with high returns to the farmers due to high volume increments over time. This species therefore offers great potential in the woodcarving industry in future.

**Table 10.1: Cost estimates (Ksh) for on-farm production for *Azadirachta indica* (Neem) tree**

| Age | DBH (cm) | Height (m) | Gross value Roundwood [2] | Fuelwood (Value) | Total value | Discounting factor (10%) | Variable Costs | Gross margin [3] |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.60 | (19.00) | -.00 | 19.00 | 0.909 | 165.00 | (146.00) |
| 2 | 3.20 | 1.40 | (27.17) | -.00 | 27.17 | 0.826 | 245.00 | (217.80) |
| 4 | 5.70 | 2.60 | (81.53) | -.00 | 81.53 | 0.683 | 290.00 | (208.47) |
| 6 | 7.30 | 3.70 | 135.80 | -.00 | 135.80 | 0.564 | 320.00 | (185.05) |
| 8 | 8.50 | 4.60 | 163.10 | -.00 | 163.10 | 0.467 | 350.00 | (186.90) |
| 10 | 9.20 | 5.70 | 190.20 | -.00 | 190.20 | 0.386 | 380.00 | (189.8) |
| 12 | 10.20 | 6.50 | 298.90 | 50.00 | 348.90 | 0.319 | 410.00 | (61.10) |
| 14 | 12.00 | 8.20 | 407.70 | 50.00 | 457.70 | 0.263 | 440.00 | 17.70 |
| 16 | 13.90 | 9.80 | 489.20 | 50.00 | 539.20 | 0.218 | 470.00 | 69.20 |
| 18 | 17.40 | 11.60 | 543.60 | 50.00 | 593.60 | 0.180 | 500.00 | 93.60 |
| 20 | 20.90 | 13.30 | 625.10 | 50.00 | 675.10 | 0.149 | 530.00 | 145.10 |
| 22 | 24.40 | 14.90 | 679.50 | 50.00 | 729.50 | 0.123 | 560.00 | 169.50 |
| 24 | 27.80 | 16.60 | 815.30 | 50.00 | 865.30 | 0.102 | 590.00 | 275.3 |
| 26 | 31.30 | 18.30 | 1059.90 | 50.00 | 1109.90 | 0.084 | 620.00 | 489.909 |
| 28 | 34.80 | 19.90 | 1386.10 | 50.00 | 1436.00 | 0.069 | 650.00 | 786.00 |
| 30 | 38.30 | 21.680 | 1793.70 | 50.00 | 1843.70 | 0.057 | 680.00 | 1163.70 |
| 32 | 41.700 | 23.40 | 2310.10 | 50.00 | 2360.00 | 0.047 | 710.00 | 1650.00 |
| 34 | 45.20 | 25.00 | 2908.00 | 50.00 | 2958.00 | 0.039 | 740.00 | 2218.00 |
| 36 | 48.00 | 26.00 | 3587.50 | 50.00 | 3637.50 | 0.032 | 770.00 | 2867.50 |
| 38 | 52.00 | 28.00 | 4375.70 | 50.00 | 4425.00 | 0.026 | 800.00 | 3625.00 |
| 40 | 55.05 | 30.00 | 5190.90 | 50.00 | 5240.90 | 0.022 | 830.00 | 4410.90 |
| 42 | 59.00 | 31.00 | 6223.80 | 50.00 | 6273.80 | 0.018 | 860.00 | 5413.80 |
| 44 | 62.50 | 33.00 | 7283.70 | 50.00 | 7333.70 | 0.015 | 890.00 | 6443.70 |
| 46 | 65.90 | 35.00 | 8425.20 | 50.00 | 8475.20 | 0.012 | 920.00 | 7555.2 |
| 48 | 69.40 | 36.00 | 9512.30 | 50.00 | 9562.30 | 0.01 | 950.00 | 8612.30 |
| 50 | 72.90 | 38.00 | 11007.10 | 50.00 | 11057.10 | 0.0085 | 980.00 | 10077.00 |
| 52 | 76.30 | 40.10 | 12,230.10 | 50.00 | 12280.00 | | 1010.00 | 11270.00 |

[2] Roundwood here signifies the total possible usable wood harvestable other than branches.

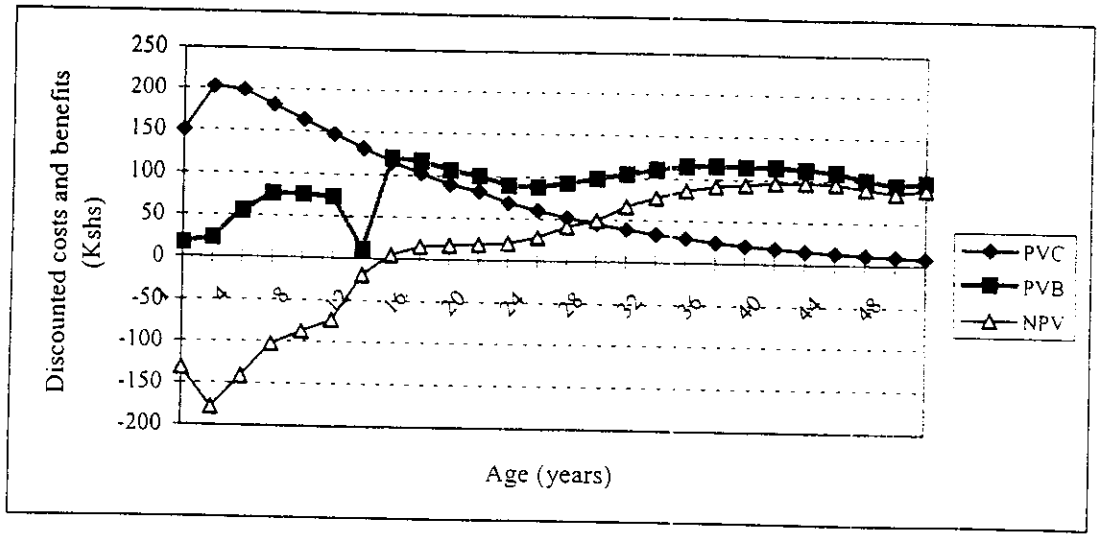



**Figure 10.4 Financial rotation for *Azadirachta indica* at Gede**

### 10.2.2 *Brachylaena huillensis*

Various plantations of *Brachylaena huillensis* in Nyeri, Ngong and Gede were assessed. The ages of these plantations varied from 22 years to 77 years. These sites were chosen, as other existing plantations for *Brachylaena huillensis* have no assessment records. These plantations have been subjected to a wide range of non-uniform management regimes at different stages including stem singling out (pruning/thinning) and fertilizer application. These interventions have made the existing assessment results somewhat unreliable.

The measurement of plantations across many sites is permissible in order to provide rapid solutions where little is known (Gadow and Hui, 1998). Pukkala and Kalle, 1998).

#### 10.2.2.1 Growth models for *Brachylaena huillensis*

The same procedure described above was followed in determining the growth patterns of *Brachylaena huillensis*. The growth rate for *Brachylaena huillensis* confirms the findings of Kigomo (1989) and research results from Tanzania (see chapter 4). Overall age versus DBH and age versus height relationships for the plantations measured are given in Figures 10.5 and 10.6 respectively. Relationships between volume and DBH were generated from the Nyeri plantations of *Brachylaena huillensis* as shown in Figure 10.7.

[3] The values given in brackets denotes negative or negligible values

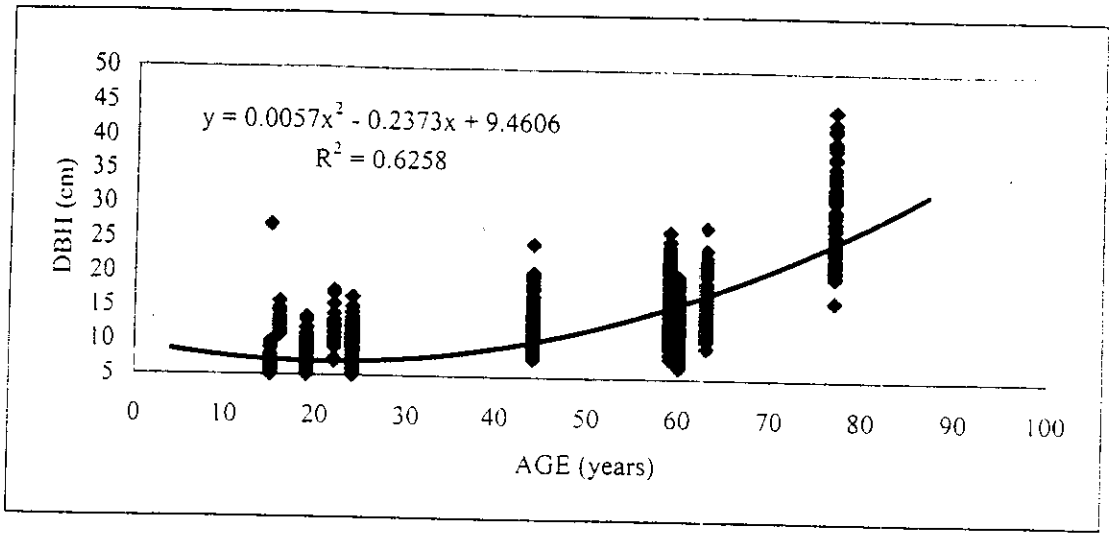



Figure 10.5: Age-DBH model for *Brachylaena huillensis*

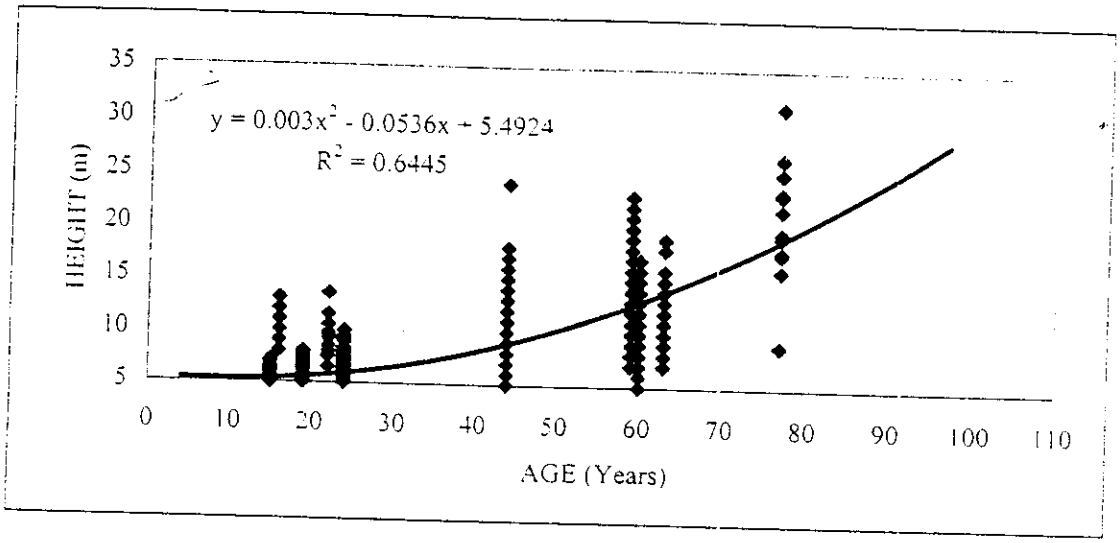



Figure 10.6: Age-Height model for *Brachylaena huillensis*

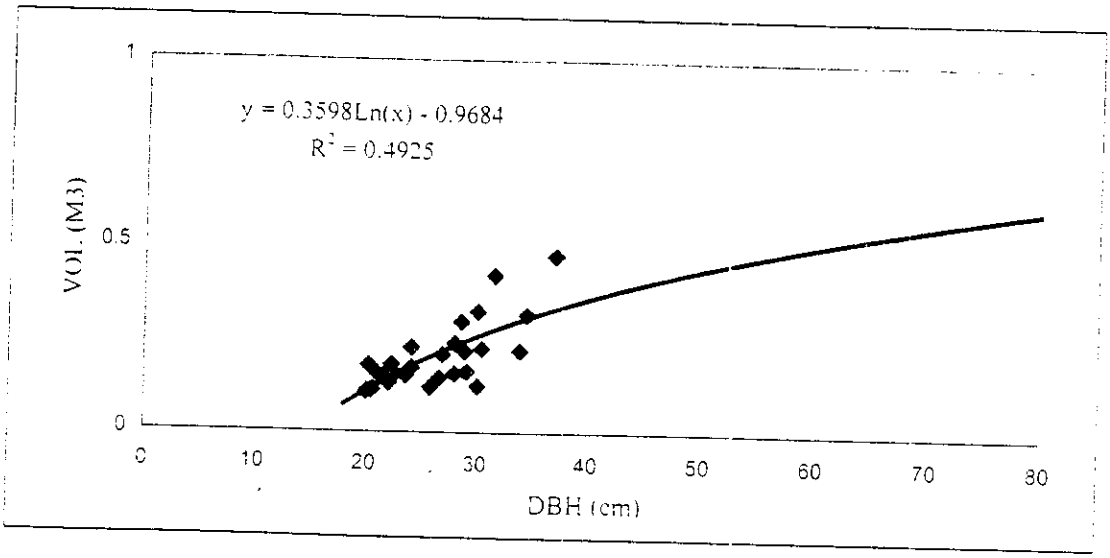



Figure 10.7: DBH-Volume model for *Brachylaena huillensis*

Carvable volumes of *Brachylaena huillensis* are attained at the age of 44 years when the DBH is expected to be about 11.8 cm (Table 10.3). The results show that *Brachylaena huillensis* is much more slowly growing than *Azadirachta indica* particularly during the first 50 years of its life.

The costs associated with maintenance of *Brachylaena huillensis* are potentially offset at the age of 26 years when the Present Value of Benefits (PVB) exceeds the Present Value of Costs (PVC) as shown in Figure 10.8. However, one interesting observation established in this study is that levels of costs and benefits remain the same after this age of 26 such that Net Present Value (NPV) remains below zero until this age, and is maintained at zero value for the rest of the time (Figure 10.5). This is an indication that investments in the planting of *Brachylaena huillensis* do not appear feasible in practice. Unlike *Azadirachta indica* whose establishment and maintenance costs are offset at the age of 14 years, the corresponding age for *Brachylaena huillensis*, as established in this study, is about twice this age, at 26 years.

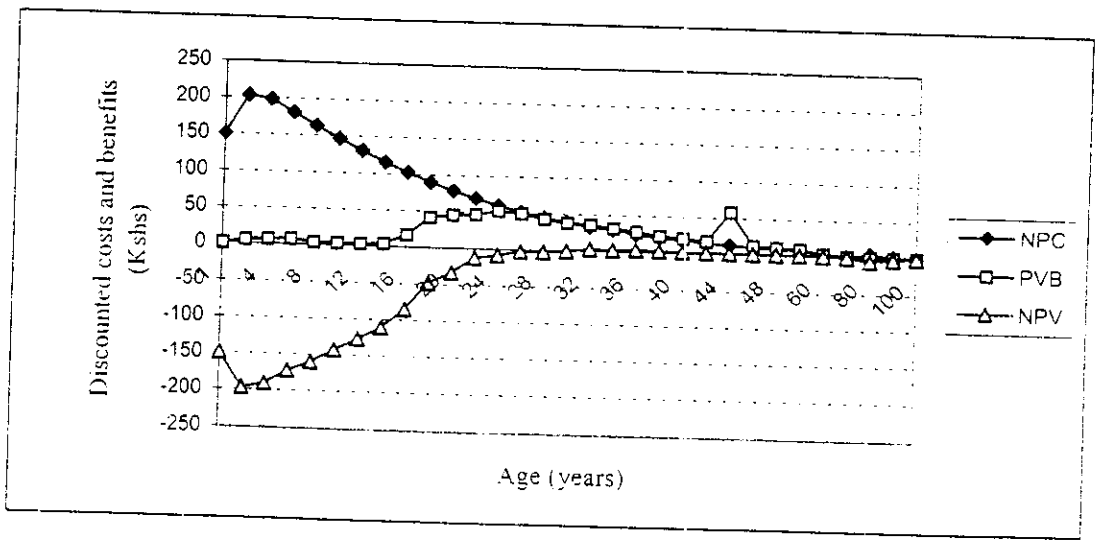



Figure 10.8: Financial rotation for *Brachylaena huillensis*

**Table 10.2: Cost estimates (Ksh) for on-farm production of *Brachylaena huillensis* tree**

| Age | DBH | Height (m) | Gross Value (Roundwood) | Fuelwood | Total wood value | Variable Costs | Discounting factor | Gross margin |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 0.50 | 0.50 | | 0.50 | 165.00 | 0.909 | (164.50) |
| 2 | 2.50 | 0.90 | 6.20 | | 6.20 | 245.00 | 0.826 | (238.80) |
| 4 | 3.30 | 1.80 | 9.80 | | 9.80 | 290.00 | 0.683 | (280.20) |
| 6 | 3.90 | 2.60 | 12.90 | | 12.90 | 320.00 | 0.564 | (307.10) |
| 8 | 4.90 | 3.80 | 7.20 | | 7.20 | 350.00 | 0.467 | (342.80) |
| 10 | 6.50 | 5.00 | 7.76 | | 7.76 | 380.00 | 0.386 | (372.24) |
| 12 | 7.50 | 5.80 | 10.30 | | 10.30 | 410.00 | 0.319 | (399.70) |
| 14 | 7.90 | 6.00 | 12.90 | | 12.90 | 440.00 | 0.263 | (427.10) |
| 16 | 7.80 | 6.20 | 77.60 | | 77.60 | 470.00 | 0.218 | (392.40) |
| 18 | 7.90 | 6.40 | 232.70 | | 232.70 | 500.00 | 0.180 | (267.30) |
| 20 | 8.00 | 6.60 | 258.50 | 50.00 | 308.50 | 530.00 | 0.149 | (221.50) |
| 22 | 8.20 | 6.80 | 413.60 | 50.00 | 463.60 | 560.00 | 0.123 | (96.40) |
| 24 | 8.30 | 7.10 | 465.40 | 50.00 | 515.40 | 590.00 | 0.102 | (74.60) |
| 26 | 8.50 | 7.40 | 542.90 | 50.00 | 592.90 | 620.00 | 0.084 | (27.10) |
| 28 | 8.80 | 7.10 | 568.80 | 50.00 | 618.80 | 650.00 | 0.069 | (31.20) |
| 30 | 9.10 | 8.10 | 620.50 | 50.00 | 670.50 | 680.00 | 0.057 | (9.50) |
| 32 | 9.40 | 8.50 | 723.90 | 50.00 | 773.90 | 710.00 | 0.047 | 63.90 |
| 34 | 9.70 | 8.90 | 775.60 | 50.00 | 825.60 | 740.00 | 0.039 | 85.60 |
| 36 | 10.00 | 9.30 | 827.30 | 50.00 | 877.30 | 770.00 | 0.032 | 107.30 |
| 38 | 10.50 | 9.70 | 853.20 | 50.00 | 903.20 | 800.00 | 0.026 | 103.20 |
| 40 | 10.80 | 10.20 | 879.00 | 50.00 | 929.00 | 830.00 | 0.022 | 99.00 |
| 42 | 11.30 | 10.70 | 930.70 | 50.00 | 980.70 | 860.00 | 0.018 | 120.70 |
| 44 | 11.80 | 11.20 | 982.40 | 50.00 | 1032.40 | 890.00 | 0.015 | 142.40 |
| 46 | 12.30 | 11.70 | 1034.10 | 50.00 | 1084.10 | 890.00 | 0.012 | 194.10 |
| 48 | 12.70 | 12.40 | 1085.80 | 50.00 | 1135.00 | 920.00 | 0.01 | 215.00 |
| 50 | 13.30 | 12.90 | 1111.60 | 50.00 | 1161.60 | 950.00 | 0.0085 | 211.60 |
| 60 | 16.50 | 16.00 | 1318.50 | 50.00 | 1368.50 | 980.00 | 0.0032 | 388.50 |
| 70 | 20.40 | 20.00 | 1447.70 | 50.00 | 1497.70 | 1010.00 | 0.0012 | 487.70 |
| 80 | 24.90 | 24.00 | 1571.80 | 50.00 | 1621.80 | 1070.00 | 0.0049 | 551.80 |
| 90 | 300 | 29.00 | 1654.50 | 50.00 | 1704.50 | 1200.00 | 0.0019 | 504.50 |
| 100 | 36.10 | 35.00 | 1758.00 | 50.00 | 1808.00 | 1230.00 | 0.00073 | 578.00 |

## 10.3 Conclusion

These simple models developed in this study have provided some useful information on the way forward in formulating practical methods through which the woodcarving industry may be salvaged. One of the methods is by planting fast growing alternative tree species and this study has demonstrated that *Azadirachta indica* is one of the most promising candidate

species for such a programme. Although the study has found that investments in planting of slow growing *Brachylaena huillensis* on short to medium terms appears unrealistic in practice, efforts towards its planting need to be enhanced by government and individuals alike so that future generations of carvers may have an opportunity to use it.

One of the main problems encountered in developing these growth models was lack of well-kept records on tree performance, particularly for *Brachylaena huillensis* and other indigenous trees represented in some of the existing plantations in Kenya. It is important to initiate efforts towards an establishment of a tree performance database in the region so that investment decisions may be made based on more reliable sets of data taken over long periods.

# CHAPTER ELEVEN

# WOOD USE AND FOREST POLICY IMPLICATIONS

## 11.1 Introduction

This chapter reviews the Kenyan policies and legislation affecting the management of forest resources and points out major weakness and failures have led to uncontrolled access to the woodcarving resources. Informal rules of access to the carving species are also covered with case studies from Kitui and Machakos districts, which is where the trade originated. The failure of these policies has led to irreparable degradation of the natural environment and ultimately represents a significant threat to the people who depend on natural resources for their survival. As remedial measures are being discussed, depletion is expected to get worse and other options have to be formulated. The feasibility of on-farm production of carving trees as an option to the current unsustainable sourcing from state forests is discussed and demonstrated.

## 11.2 Rules of access to carving wood

One of most important outputs in this study has been to identify easy access to carving wood as one of the main causes of the observed continued unsustainable utilization of prime carving wood in Kenya, and failure of market mechanisms to operate efficiently. The present high levels of resource utilization and depletion points to some of the threats to the resource base which may undermine the nation's economic growth and stability in the long run.

The resource base can be damaged as a direct result of heightened demand, and an indirect result of the breakdown of local institutional arrangements governing resource use (Dove, 1993; Mombery *et al.*, 1997; Peters 1994; Sithole, 1999)

### 11.2.1 Informal Rules

The origins of the woodcarving industry and the historical trends in growth have been examined in the early chapters of this thesis. The industry grew with the dubious distinction of over harvesting the available carvable wood stocks in one area and progressively moving to the next resource rich frontiers, a practice which has persisted until today. The study has captured a responsive market to the scarcity of *Dalbergia melanoxylon* (mainly sourced from private farms) through high prices leading to a measure of self - regulation through low utilization volumes entering the market. The reverse is true for *Brachylaena huillensis* and a wide range of others, which originate form state forests. A pertinent question that arises is why the market is responsive to *Dalbergia melanoxylon* and not so much to the other equally popular traditional carving species. The answer probably lies in accessibility to and control of the existing resources. In order to address this problem, the study here attempts to document some of the institutional arrangements associated with the control of wood use in general and of carving resources in particular, and to establish the level of enforcement of these rules.

This part of the study was carried our mainly in Machakos and Kitui districts where the woodcarving industry originated, and also where depletion of *Brachylaena huillensis* (Yatta Plateau) and *Dalbergia melanoxylon* (Wamunyu) have been most devastating. The areas rich in *Dalbergia melanoxylon* stock were also considered for comparative purposes. The study also intended to link commercialization of carving to resource depletion in these areas and investigate why utilization and depletion of *Dalbergia melanoxylon* appears to have slowed down in the recent decades.

Resource studies in Zimbabwe show that in areas undergoing massive commercialization, there is a tendency for rules governing use to break down or to lack applicability (Campbell and Byron, 1996). This is probably what happened when commercialization of woodcarving reached its peak in Kenya in the 1960's, particularly in the Wamunyu region. In order to link resource depletion and commercialization, information on the history of land tenure for the region was solicited from old resident members of the community.

Land tenure defines the methods by which individuals or groups acquire, hold, transfer or transmit property rights on land (Juma and Ojwang, 1996). Formal rules of tenure therefore, define the nature and content of property rights and determine how society allows individuals or groups to hold property rights of land or other resources, and the conditions under which those rights are to be held and enjoyed. In Africa there are many instances where the system of rights of access has slowly broken down as a consequence of the emergence of modernizing centralized states, population pressure on limited available land, and development of new land use patterns (Juma and Ojwang, 1996). The rules governing access to land resources and the manner of their current use will affect not only the welfare needs of present and future generations, but also the ecological status of the natural systems of which land is part. The Kamba customary rights distinguished between a cleared and cultivated family land (*ng'undu*) and the larger unsettled land available for communal use (*weu*). The family land (*ng'undu*) is akin to private ownership and customary tenure recognized these private rights on the *ng'undu*.

Tree resources within the communal areas (*weu*) were accessible to any user. Otieno (1984) alluded to increased wood cutting and overgrazing in Machakos as early as 1930s and 1940s.

In contrast, within the *ng'undu*, members of the family had guaranteed rights of access to the natural resources. It was controlled, well regulated and defended against utilization by outsiders. Resources in the outer area did not need extensive investments of labour because by nature they had to be shared with equal rights of access by all members of the community. Open access is characterized by an absence of regulatory mechanisms regarding resource use and in the context of resource scarcity and competition, resource degradation is likely to result.

The thrust of official policy in Kenya since the middle 1950s has been to systematically replace customary or traditional systems with modern tenure system though the process of adjudication. This process was very slow and costly (Juma and Ojwang, 1996). The breakdown of traditional authority undermined the capacity of local communities to effectively fulfill their regulatory functions, and was accompanied by increased competition for access to land and other natural resources. These changes have, in many instances,

transformed the common property ownership into situations of common access, with resultant adverse impacts on land care and conservation of natural resources.

At present, most areas in Machakos and Kitui Districts have been adjudicated and owners are exercising better protection, particularly with respect to tree resources (Tiffen, 1994). Thus, despite increased levels of cultivation, tree density on farms has increased (Brandley, 1991). The natural woodland is managed for grazing, controlled wood cutting, bee keeping and collection of wild produce (Brandley, 1991).

The composition of indigenous woody vegetation in Machakos and Kitui today show the extent to which natural conditions have been modified by management, which includes selective control, protection and planting (Gielen, 1982; Neunhauser *et al.*, 1983; Rocheleau and Van de Hoek, 1984). Trees are now considered as investments of capital and labour, and this has implications for management of smallholdings. The decisions involved in planting trees reflect a division of responsibility between men and women. Men plant trees for timber and building poles, fuel, windbreaks and hedgerows, shade and ornamental purposes (Mbithi, 1978; Gielen, 1982) while women favour fruit trees (Hayes, 1986; Rocheleau, 1989). Overall, tree planting is now seen as a means of income diversification.

The most common restrictions in harvesting trees limit the collection of green wood. When outsiders request access to living trees, the costs of such rights of access are various forms of informal payment such as farm labour and water carrying (Hayes, 1986). As *Dalbergia melanoxylon* becomes increasingly scarce, efforts to replace them have not been done, but instead, intensification of farm forests is on the rise in which fruit trees and fast growing exotics are increasingly being planted. The security of individual titles has had a profound impact by strengthening the incentives to manage the land wisely.

Most residents agree that the observed depletions of *Dalbergia melanoxylon* (around Wamunyu) and *Brachylaena huillensis* (Yatta plateau) occurred during the transition period between the change from customary systems of land tenure to the modern system, which unfortunately coincided with the period when woodcarving gained popularity and prominence.

### 11.2.2 Formal Rules

The presence of state land has provided an important opportunity for conservation of the country's biodiversity. The vesting of monopoly rights in the state has been justified on a number of grounds, one of which is the understanding that biological resources serve important functions and posses values that transcend the scope of individuals. Other reasons concern the outlay of human, financial and technical resources far beyond the capabilities of individuals or communities, as well as ensuring an effective and sustainable framework for long-term planning and implementation. Formal rules for state land generally restrict the use of resources by protecting and regulating their management (Scoones and Matose, 1993; Dewees 1994). Such rules have been known to have limited impact at local levels (Brigham *et al.*, 1996).

Land in Kenya is subject to various state laws and policies, which have a direct impact on the conservation, alteration or removal of forests. This Forestry legislation in Kenya is fairly comprehensive but spread over various acts, which are administered without coordination by a wide range of public bodies and individuals (MENR, 1995). The lack of coordination in their enforcement has given rise to serious loopholes which various individuals have taken full advantage of to misuse forest products, mainly through timber harvesting. The policies and laws relevant to the woodcarving industry are discussed below.

#### 11.2.2.1 National Forest Policy: Sessional Paper No. 1 of 1968

Kenya's forest policy sets out ten basic principles under which forests will be managed for the greatest common good and on a sustained yield basis. The first official policy was formulated in 1957 and subsequently restated by the government of Kenya in 1968. However, it has been revised to address new concerns and realities some of which envisages privatization of management activities in forest plantations and greater involvement of local communities and non-governmental organizations (NGOs) in management decisions related to indigenous forests. It is yet to be adopted.

### 11.2.2.2. Forest Act, Cap 385 of 1962

This is the main legislation, which addresses reservation, protection, management, enforcement and utilization of forests and forest resources on Government Land. It was originally drafted to support the 1957 Forest Policy. The act specifically covers:

- gazettement, alteration of boundaries and de-gazettement of Forest Reserves,
- declaration of Nature Reserves within Forest Reserves, and regulation of activities within such Reserves
- issuance of licenses for activities within Forest Reserves,
- prohibition of certain activities in Forest Reserves or unalienated Government Land (not a Forest Reserve, not set a side for public use, not leased or licensed for occupation by the Government) except under license,
- enforcement of provisions of the Act, including penalties and powers to enforcing officers,
- power of the minister to make rules with respect to the sale or disposal of forest products, occupation of forests, licensing and entry into forests. This prerogative has been taken with the Forests (General) Rules, which sets rules for sale of forest products and specifies royalty rates for these products.

Although the Act provides a sound basic structure for forest management, it has a number of deficiencies. For example it only covers gazetted forests and does not cover the needs of local communities, leading to conflict between local communities and the state and is contributing to forest degradation. Furthermore, it does not allow multiple use of forest reserves and does not recognize the importance of environmental protection.

In practice it is evident that Kenya is losing its best nature forest in a rapid rate and woodcarving has partly contributed to this. However, the forests loss is not attributed to the illegal removal of timber but to excisions as provided for in the Act. For excisions to occur (or additions) the provisions in the Act do not require parliamentary discussions and approval, a procedure which applies to most of the other Acts. This lack of checks and balances and of means to object, have been used, for example, to allocate Karura and Ngong Forests (near Nairobi) to private developers. When the public knew that this had been done silently, an outcry ensued in late 1998, which culminated in the removal of the head of Forestry

Department in Kenya just a year later. Since then, public sensitivity to encroachment of forests has been high, and this has affected the wood supply to carvers as attested by the volumes over the past 2-3 years.

#### 11.2.2.3 Presidential Ban on Logging of Indigenous Timber of 1986

A Presidential Decree of uncertain date (usually dated 1986) bans felling of indigenous trees. This was mentioned in Chapter 5. The decree is problematic because there is no legislation to support it. Other policies are supported by legislation such as the Forest Policy that is supported by the Forest Act. As such, implementation can be carried out under the power afforded to the minister by the Forest Act or by other laws for cases outside the forest reserves. However, poor implementation has led to the illegal sourcing of woodcarving timber from state forests to this day and clarification on implementation is needed urgently.

#### 11.2.2.4 Wildlife Policy

Conservation and management of the country's wildlife resources have recently (1990) been articulated within National Parks. The policy specifies non-consumptive use of forest resources with emphasis on recreation and tourism as the main sources of revenue. The main thrust of this policy is to promote benefit sharing between tourists and the adjacent local communities so as to reduce the removal of natural resources directly from the parks. More recently (1991), Kenya Wildlife Service and the Forest Department implemented a Memorandum of Understanding (MOU), which stipulates joint management of some forests rich in biodiversity, such as Shimba Hills, Arabuko Sokoke and others. The Forest Department collects revenue from forest products while the Kenya Wildlife Service is responsible for collection of tourism revenue. This joint management has helped to reduce the level of illegal activities in some of the forest areas, particularly the removal of *Brachylaena huillensis* and *Combretum schumanii* from Shimba Hills and Arabuko Sokoke Forests as well as *Olea europaea* and *Combretum schumanii* from Kibwezi and Chyulu Forests.

### 11.2.2.5 The Wildlife Act, Cap. 376 of 1976

The Wildlife Act closely interacts with the Forest Act. It includes the conservation of forests within National Parks, National Reserves and Sanctuaries. More recently (2000), major changes in the management of Kenya's indigenous forests has been made. Owing to the rising level of illegal activities in Kenya's forests largely due to poor management by the Forest Department, custody of all indigenous forests has been transferred to the Kenya Wildlife Service. This implies that less wood will be available to carvers, which has been confirmed in this study. Generally, the Kenya Wildlife Service has a strong infrastructure and committed staff and has received a high national and international profile in the recent years through activities such as promoting the ban on trade in ivory.

These factors were considered in the recent changes affecting custody of indigenous forests. However, while this development is encouraging, several practical and institutional issues need to be addressed. Firstly, the ability of the Kenya Wildlife Service in terms of personnel and financial resources is limited, particularly in the light of the new additional duties, and needs to be strengthened. Secondly, the Forest Department rangers who are now idle could impede the current initiatives of the Kenya Wildlife Service, as most of them are party to irregular activities. Thirdly, arguments have been advanced as to whether this recent decision is within the mandate of the Kenya Wildlife Service. However, the majority maintain that Kenya Wildlife Service custodianship of public resources goes beyond the narrow confines of wildlife to include other components of rich biological biodiversity, and that its involvement is one of the few practical options available to save forests. In he face of this debate, it is clear that in order to protect indigenous forests, amendments to the existing Policies and Acts have to be affected soon.

### 11.2.2.6 National Food Policy: Sessional Paper No. 4 of 1981

Although the policy targets activities of the agricultural sector, it states that no further destruction of forests should occur in the light of their ecological importance and role in climate stabilization. However, while the national Food Policy stipulates that forests should

not be destroyed, there is a certain amount of conflict in that many current forest excisions are carried out specifically for settlements and conversion to agriculture. The loss of habitats for most of the carving species, particularly *Dalbergia melanoxylon* and in many cases, *Olea europaea* is largely attributed to this.

#### 11.2.2.7 Agriculture Act, Cap. 318 of 1980 (revised in 1986)

The Act has provisions concerned with promoting soil conservation and preventing the destruction of natural vegetation. The Act gives authority to Provincial Agricultural Boards and District Agricultural Committees and sub-committees to enforce land preservation rules, which protect soil, including the control of land clearing for cultivation. It covers for example, prevention of harvesting of *Dalbergia melanoxylon* from private farms if this is deemed destructive. However, this Act is generally unclear and rarely put into practice.

#### 11.2.2.8 The Trustland Act, Cap. 288 of 1962 (revised in 1970)

The Trustland Act is connected with the Land Adjudication Act and Land (Group Representatives) Act. The Trustland Act makes provision for rights in trustland (land held by local authorities on behalf of the people resident in that area) and controls unauthorized occupation, the utilization of trees and other produce on land other than forest areas covered by the Forest Act. It is implemented by the Minister for Local Government and stipulates that the minister can make rules for the protection, felling or removal of trees or forest produce in trustland.

The Trustland Act is supplemented by extensive subsidiary legislation, which may be specific to certain locations or situations. For example, the Trustland (Removal of Forest Produce) Rules set rules for granting of licenses to any one by the District Commissioner or other person designated by the council. Licenses are valid for one year and may include extraction for timber, posts, poles, bamboo, withies, firewood and other products.

This Act would for example apply to the interior regions of Kitui District where considerable quantities of *Dalbergia melanoxylon* can still be found. However, there was no evidence to

show that this Act is now being implemented particularly in areas covered by the study. A major weakness in the Act is the limited recourse given to the occupant should the Government require the land for a specific purpose.

Forests and biodiversity in general could certainly be affected in cases where the Government would wish to use the land for a purpose unfavorable to conservation.

#### 11.2.2.9 Chief's Authority Act, Cap. 128 of 1970 (revised in 1988)

This Act empowers chiefs to enforce various environmental conservation provisions within the limits of their jurisdiction, including control of the use of tree resources on private land. These include prohibiting destruction of vegetation, regulating cutting of timber and wasteful destruction of trees amongst others. This is probably the most widely applicable Act known to resource owners. Each time a tree is to be removed (usually more than three or four trees), permission has to be sought from the local chief. However due to presence of low penalties, violation of this Act is very common.

### 11.2.3 Efficacy of formal rules

Despite the consistency with which all these policies and Acts focus on forest conservation, there is very little to show for them on the ground. Forest lands and biodiversity are disappearing rapidly. This study has confirmed that biodiversity loss is largely a result of government actions and it is becoming clear that there is much to do to meet the objectives of the existing policies. Unfortunately, there are many excellent recommendations, which have been put forward by many individuals and organizations, which address these issues, but the government is taking time to act on them.

Fortunately, carvers have demonstrated that they are very responsive to trends, as shown by the rise in the use of alternative tree species from private sources. The possibility of investing in the planting of *Azadirachta indica* (neem) and *Brachylaena huillensis* through on-farm and plantation production are explored in the next section.

## 11.3 Discussion

In order to sustain the woodcarving industry in Kenya on a long-term basis, the following responses are suggested alongside those already suggested in this study. These approaches generally cut across disciplines, sectors and interest groups, whose contributions, though diverse in nature, will no doubt go a long way towards ensuring the sustainability of the industry.

### 11.3.1 Community led responses

The role of communities living adjacent forests in the conservation of biodiversity is increasingly becoming clear, and their cooperation in conservation efforts has been found to be vital (Tisdell, 1995). Local people have little incentive to support the conservation of resources unless they gain from it, or at least they are not deprived of potential benefits. In certain cases, it may be possible to permit limited use and still retain biodiversity (Godoy and Bawa, 1993), but extraction may be viable only in areas of low population densities (Homana, 1993; Godoy and Bawa, 1993).

This study established that a significant proportion of the carving timber, which enters the carving markets in Kenya, is poached by members of the communities living adjacent to forests. A considerable portion of the current policy discussion concentrates on methods and mechanisms to ensure that local communities benefit from non-consumptive use of forests and that they play an active role in conservation efforts. Such mechanisms have worked in many countries such as Cameroon (Ruitenbeek, 1992), China (Tisdell, 1994; Dixon and Sherman, 1990). Such benefits come in different forms including subsidies for retention and conservation, nature based tourism or eco-tourism, permitting the use of forests for economic activities that do not threaten biodiversity, income transfers so as to reduce their need to exploit natural areas and identify income generation projects in which they can become involved and hence reduce their economic dependence on exploitation of forests.

Therefore, to ensure sustainability of our prime carving wood, it is necessary to develop successful programs to address the economic needs of the communities living adjacent to forests such that the conservation goals of forested areas are still fulfilled. At the same time,

the direct contribution of these communities living adjacent to forests to the management of these resources is advocated while other appropriate incentives are planned.

### 11.3.2 Government led responses

The State is able to initiate changes aimed at promoting the sustainable use of natural resources such as hardwoods. A number of options may be considered in such an event.

#### 11.3.2.1 Allocation of resources

The rapidly escalating demand and utilization of wood resources in Kenya calls for major efforts in revision of the existing wood use policies if the serious consequences of resource shortfalls are to be avoided. This becomes important particularly when different sectors compete for the same resources whose viability is construed as under threat. For example, *Brachylaena huillensis* and *Dalbergia melanoxylon*, as well as a range of other prime carving species are also sold for fuelwood, building poles and charcoal burning. Within each of these sectors, these hardwoods attract different royalties.

While many factors are considered in licensing the harvesting of any given tree species, this study has demonstrated that in cases where choices have to be made between competing uses for a rare resource, priority should be given to the use which gives the greatest returns to users in the interests of conservation. In order to illustrate this argument, a survey on the market prices for prime woodcarving tree species in alternative uses was made around the country. Details of the procedure of determining their unit prices are given in Chapter 8. Table 11.1 gives the unit price comparisons for a range of competing uses for carving wood at various markets in Kenya.

The use of *Brachylaena huillensis, Combretum schumannii, Dalbergia melanoxylon* and *Olea europaea,* for carving is probably the best utilization option available in terms of unit returns from the sales of traded products. The high output of up to Ksh 280 000 per cubic meter is considerably higher than the market price for prime sawn wood in Kenya today. The reverse

is true for charcoal burning where, for example, the burning of $4m^3$ of *Olea europaea* using the traditional systems results in an output of 11 bags with a cumulative market value of Ksh 2 750 or Ksh $687.50/m^3$.

In this regard, product prices of alternative uses for tree species are required as a guide to fixing the levels of stumpage prices to be levied. This study has established that even if the government was strict in enforcing the rules of access to the carving wood, the present stumpage levels are far below the market prices that reflect resource scarcity, which is thus contributing to further depletion and resource mining due to abnormal profits which accrue to the carvers and middlemen involved in the trade. Finding an appropriate and realistic level of stumpage combined with strict enforcement of access rules is viewed as the most effective means of conserving already depleted stocks. Furthermore, only very high quality art that gives credibility and integrity to the industry should be encouraged.

**Table 11.1: Comparison of the unit price of wood in alternative uses in Kenya. ($Ksh/m^3$)**

| | Charcoal | Poles | Firewood | Sawn timber | Woodcarving |
|---|---|---|---|---|---|
| *Olea europaea* | 250-400 | 3490-8500 | 3050-8,000 | 17,700-42,000 | 40,000-280,000 |
| *Brachylaena huillensis* | 250-400 | 3580-8500 | 4,000-8,000 | 17,700-42,000 | 40,000-280,000 |
| *Dalbergia melanoxylon* | 250-400 | 4000-9000 | 2500-8,000 | 38,700-77,000 | 40,000-300,000 |
| *Azadirachta indica* | 250-400 | 3450-8,000 | 2500-6,000 | 17,700-42,000 | 20,000-280,000 |
| *Ecalyptus spp* | 250-400 | 3500-10,000 | 6,600-10,000 | 16,700-27,400 | - |

### 11.3.2.2 Privatization of forests

There is a strong feeling within the Kenya's Forest administration, the public domain and in other organizations that the virtual state monopoly of forest management will have to end. The prevalence of numerous illegal activities within the state forests is contributing to massive destruction of wood resources, and this is being cited as a justifiable reason for such a move.

The proposed Forestry Policy in Kenya underscores the need for the state to shed its role as a manager of forest estates. However, it should remain the forest authority concerned with policy making, legislation and law enforcement, education and training, and regulation and support of forestry related commerce and industry (MENR, 1995). The merit of privatization lies in its ability to act as an investment incentive and to effectively control resources (Mugabe *et al.*, 1997). Its rewards ensure the satisfactory enforcement of rights and controls otherwise absent under the state (Commander, 1986). However, shortcomings of privatization exist. It has been argued (Mugabe *et al.*, 1997) that it introduces a profit interest, which may conflict with the management and conservation of natural resources. While it may cure some of the weaknesses inherent in a system of state ownership, it has the potential to compound the problems of impoverished local communities adjacent to forests who depend on forest resource for their livelihood. Further, the success of privatization in Europe and other developed countries may have succeeded because their economies have an industrial base rather than an agricultural one, hence there are reduced local demands for forest products such as fuel wood, and food amongst others.

One feasible option is a gradual move towards privatization of forestry in Kenya through the plantation development sector, which is mainly geared to meeting industrial needs. However, with the findings of this study which has confirmed that unrestricted access to the resources is the main reason for depletion of the prime carving species at this stage, privatization appears to be the best available option for now until such time that enforcement of access to these resources is improved. Overall, given the country's limited forest resource base, it is crucial that the remaining state forests are managed in society's best interests

### 11.3.3 Market led responses

#### 11.3.3.1 Eco-labeling of carvings and certification

Many buyers of carvings in Kenya and abroad are not aware of the adverse ecological impacts that the woodcarving trade has had on the trees and the ecosystems from which they are sourced. With knowledge that many consumers in developed countries tend to select

products from ethical sources or that are produced with minimal negative impacts on the environment, pressure on consumer demand can have far reaching implications on the conduct of the wood carving trade in Kenya, particularly in switching to the use of more sustainable alternative species. A number of organizations in the world have introduced systems through which they inform their clients whether products have been produced in an environmentally sound manner by placing labels on the products (eco-labels). The plans to introduce eco-labels for carvings made in Kenya are now underway and it is believed that it should relieve some pressure on the scarce prime carving trees. The Forest Stewardship Council (FSC) eco-labels are fast becoming the most widely respected labels for wood products from well-managed sources, and this organization has been involved in developing practical methods of introducing eco-labels into the carving industry in Kenya. It is endorsed by major conservation organizations and donors, and it gives an independently verified guarantee to the consumer that the wood from which the product is made comes from well managed source areas according to strict environmental, social and economic standards.

As indicated above, substantial progress has been made in Kenya towards labeling of carvings carved from sustainably produced trees mainly sourced from private farmlands and other areas outside the threatened forests in the country. These have been termed 'good wood' trees, and those in the market at this stage include *Azadirachta indica, Jacaranda mimosifolia* and a range of others given in Chapter 7. The increased utilization of these alternative species in Kenya is largely a result of these efforts. With financial assistance from WWF/UNESCO/People and Plants Initiative, the first meeting was held in Kenya in 1997. It was attended by representatives from the wood carvers, carving exporters and other stakeholders in order to map out appropriate methods of working towards a common goal in the interest of sustaining the industry. A 20-year vision for the woodcarving industry was developed where a 'good wood' group was formed. The group comprised representatives from woodcarvers, forestry officials, exporters, importers, and other conservation groups, and was to oversee the method through which carving wood would be responsibly sourced, and the gradual move towards wood certification.

A second meeting was held in 1999, attended by a wide range of interest groups linked to the East African Woodcarving industry with the hope of developing an appropriate system of 'good wood' labeling in the short-term and a longer term plan for certification of wood for

the woodcarving industry in the whole of East Africa. Several other meetings have been held since then and arrangements for instituting pilot eco-labeling of carvings made from *Azadirachta indica* (neem) are now at an advanced stage in Kenya.

### 11.3.4 The International community

This study has established that the stakes in the woodcarving industry in Kenya are very high. The livelihoods of thousands of people are at stake and it is important to realize that the solution will not be found in relying on the government to act. The government has limited capacity for implementing the necessary policies both in terms of the management capability and the necessary room to maneuver. Economic and cultural pressures now experienced may demand short-term responses in order to save the industry even where these are clearly not sustainable in the long run.

In the medium-term, there is a clear need for a global response to save the woodcarving industry in Kenya. According to Robin (1992), no one country can halt climatic change, protect endangered species or provide all the necessary technical solutions. The efforts by WWF/UNESCO/Kew People and Plants Initiative have provided an excellent base on which to start the long process geared to sustain the wood carving industry. The agenda at the Rio Heads of States Meeting under the auspices of the United Nations (June 1992) provided a framework within which rich nations could help to reduce the pressure on the natural resource base. Since then, the Bio diversity Convention has come into force, widening the policy relevance for conservation policies and funding for biodiversity conservation through the Global Environmental Facility (GEF). The opportunity to save the woodcarving industry exists and the strategies to do this should be discussed and implemented sooner rather than later based on the initiatives that have already been started.

# CHAPTER TWELVE

## RECOMMENDATIONS AND CONCLUSIONS

### 12.0 Introduction

This chapter provides the interests of wide range of recommendations based on the findings of this study. Some of the recommendations may be difficult to achieve as it is likely to be difficult to reach a balance between carvers, commerce and conservation without painful sacrifices and choices being made. A journey of a thousand miles begins with one step.

### 12.1 Recommendations

The recommendations listed below relate to all the areas covered by the study.

#### 12.1.1 Supply dynamics of carving wood

1. Inventories to estimate the existing stocks of the major woodcarving species in trade are required. This is important particularly in the light of the certification progammes now being discussed. One of the pre-conditions for certification is the requirement that management plans are developed for areas where harvesting takes place such that good record keeping must be in place. An updated inventory for the species covered in previous studies should also be considered.

2 Natural forests, which have been heavily over-exploited, should be closed to further extraction until stocks of the carving species recover. Although the ban on their utilization is in force, more strict enforcement is needed.

3. Construction of wood treatment plants at the cooperative centers is urgently required. As the stocks of mature wood are depleted, juvenile stems are now increasingly being used leading to warping and cracking of carvings.

4. Carvers should be given access to a range of alternative species with potential carving qualities and still in abundant stocks in natural forests. However, where this is possible, government officials should harvest the wood themselves and stored at central places easily accessible to carvers and sold by tenders.

5. Investment in planting of *Azadirachta indica* is feasible and should be encouraged in Kenya on a short and medium term basis (15-30 years). For research purposes, permanent sample plots for all the carving trees should be established and records of their performances regularly updated. KEFRI should provide a lead in this.

### 12.1.2 Marketing of carving wood

6. The stumpage prices of the carving tree species should be derived from the market prices of the carved products and not the sawn wood, as is the presently done. This will increase the royalty rates and, hence revenue to the Forest Department. More efficient use of the resource should be encouraged. In addition, the system of allocation of revenue derived from harvest of timber should be reviewed to determine whether it is possible to channel more funds directly into maintenance of natural forests.

7. The possibility of charging stumpage per tree cut needs to be explored rather than using wood volumes. This is because volume measurement is often impractical and rarely used.

8. The carvers through their cooperatives should be licensed to extract the wood themselves, rather than through middlemen. Middlemen contribute to price distortions of the carving wood and have reaped excessive benefits from the trade. .

9. In areas where the prime carving wood exists, particularly on private farms, the resource owners should form resource owner associations for better bargaining of the prices. Wood obtained cheaply has encouraged wastage and low recovery during carving.

10. There is need for transparency in the running of all affairs of the woodcarving cooperatives. The possibility of involving them in the environmental policies, eco-labeling and other future programmes geared towards sustaining the industry calls for a

high degree of integrity and transparency in running all the affairs of the trade. Methods of solving the marketing problems for carvings should also be explored. The low prices of 70% of total articles made by cooperative members as they are largely sold outside of cooperative to middlemen is a huge loss to carvers themselves, and the wood which is increasingly becoming scarce is being indiscriminately exploited.

### 12.1.3 Economic returns of carving

11. The wood recovery in the carving process needs to be improved through proper designing of carvings, use of appropriate tools and training. All carvers trained informally, and therefore the need to arrange for short term training programmes for appropriate areas of need should be investigated.

12. Carvers should be advised to make fewer products that each require a greater investment of time than is presently done. Taking more time to produce few products of higher quality will ensure higher sale prices and less wood use.

13. All carvers should be encouraged to join cooperatives in order to increase the prices of carvings. They should be taught simple costing procedures in carving process and how to price the finished carvings. A big number of carvings are under priced for lack of pricing techniques by many carvers. They should also be taught how to save their incomes and to invest them in other income generating ventures.

### 12.1.4 Wood use and policy aspects

14. Many policies and laws developed to counteract the loss of biodiversity are conflicting in many ways. There is clearly an urgent need to harmonize them all. The power of all those concerned with their implementation need to be activated from time to time because many of them do not know their responsibilities.

15. Penalties for illegal extraction of the resources from forests should be reviewed and brought more in line with the value of the resource. At present, these penalties are too low to act as a deterrent to illegal activities.

16. Forgery of licenses is very common, and therefore the system of issue should be improved

17. More effective monitoring and control of illegal sourced wood from the forests is needed. It is easy for example, to conduct market inspections from time to time, including setting up of roadblocks for timber consignments.

18. For forests where extraction of carving wood is permitted (e.g. Arabuko Sokoke), extraction should be supervised or better still, the extraction should be done by the Forest Department and brought to their forest stations for sale. The sales can then be carried out through auction using the sealed or open bidding systems.

19. The local communities should be given an important role in the management of the forests for they are often more familiar with the forest area and the resources it can provide. A low cost is also likely to be incurred in providing enforcement and harvesting activities under such arrangements.

20. Privatization of forestry in Kenya should be viewed as a long-term solution to the management problems being experienced at the moment. This should be encouraged as a way of reducing the financial liability of the Forest Department and of promoting active management of the existing forests.

21. The international community should intervene in the efforts already in place, to save the woodcarving industry in Kenya and therefore provide assurance to thousands of carvers who depend on this trade for a living.

### 12.2 Sustainability indicators in the woodcarving industry

This study has attempted to contextualise the woodcarving industry within the ambit of sustainability and sustainable development by focusing on actions that may reduce the demand for carving wood from increasingly threatened habitats. The need for policy re-

orientation to steer the efforts towards sustainable woodcarving industry in Kenya cannot be over emphasized, and has formed the thrust of this study.

The outputs of this study and those of the component studies all funded by WWF/UNESCO/Kew 'People and Plants Initiative', have created a considerable amount of awareness on the adverse impacts of wood over-exploitation on forest habitat and the potential threat to the sustainability of the woodcarving industry. More importantly is the fact that woodcarvers themselves and other stakeholders have been actively involved in formulating and developing the ideas and pathways aimed at reversing these adverse trends in the industry. A summary of quantifiable indices by which progress in sustainable woodcarving industry in Kenya could be gauged is shown below (Table 12.1).

## 12.3 Conclusion

The Kenyan woodcarving industry is a highly visible and important sector of the Kenyan economy, but is facing an uncertain future. The only feasible option available to change the destiny of this important industry is through changing the buyer and carved wood sourcing behaviour from unsustainable felling of slow growing hardwoods to sustainable sourcing from alternative on-farm cultivation of fast growing species. The efforts to do this have already begun and should be encouraged and supported. This study has demonstrated that investments in the planting of *Azadirachta indica* are feasible, particularly along the Kenyan Coast. The next move besides others is towards the campaign to grow these fast growing species, and to consolidate the certification programme, which is still in its infancy. Meanwhile, the Kenya Government should do all within its power to regulate access and the extraction of available prime carving tree species, which has been found through this study, to be the main reason for ongoing depletion and the present (and probably the future) vulnerable state of the woodcarving industry.

## Table 12.1: Indicators for sustainability of woodcarving industry in Kenya

| Recommendation category | Indicators | Means of verification | Comments |
|---|---|---|---|
| Supply dynamics of carving wood<br>• Less use of severely depleted species | • More supply of alternative species<br>• Widespread planting of fast growing alternative carving trees | • Surveys of woodcarving centers<br>• Surveys of showrooms on carving stocks<br>• Interviews with carvers, management, wood suppliers, transporters<br>• Management plans by resource owners<br>• Increased area under plantations of woodcarving trees | Risks in changing the species carved may adversely affect the international market share for Kenyan carvings. Buyers must therefore be informed on the change of species used |
| Marketing of woodcarving wood<br>• Sustainable wood supply<br>• Improved wood pricing<br>• Improved licensing of wood extraction from state forests | • Quantities of wood received in a given time at carving centers<br>• Sizes and prices of delivered wood<br>• Sources of wood<br>• Formation of resource owner associations<br>• Improved methods of charging stumpage fees<br>• Cooperatives involvement in carving wood sourcing | • Surveys of wood yards<br>• Records of wood deliveries from dealers and cooperatives<br>• Surveys across major wood sources<br>• Unit wood prices<br>• Interviews with officials, dealers, owners, and observation | Awareness creation among resource owners and users have to be made |
| Improved economic returns of woodcarving | • More economical use of wood, improved recovery<br>• More high quality carvings made<br>• Better designs<br>• Better bargaining power for product prices | Training of carvers on designs<br>• Surveys across carving centers<br>• Formation of cooperatives among independent carvers<br>• Training in simple costing procedures on costs and profits in carving | |
| Improved wood use policies | • Enforce restrictions on access to wood from state forests<br>• Penalties for illegal wood extraction be raised to more realistic level<br>• Improved licensing of wood extraction<br>• Certification of carvings from sustainably sourced alternative wood<br>• Increased awareness by woodcarvers in wood production, utilization and conservation<br>• Market awareness on need for sustainable woodcarving industry and conservation. | • Surveys on Government forests, interviews with wood suppliers, dealers, Government officials and observation<br>• Monitoring of carvings and wood markets in the country<br>• Training schedules and programmes of carvers, resource owners<br>• Information availed to buyers of carving from Kenya on the need to buy carvings from sustainably sourced wood | |

In that the subject of this study is an examination of sustainable development of the woodcarving industry, it is fitting to close with the words of the report of the Brundland Commission (WCED, 1987):

*'In the end, sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional changes are made consistent with future as well as present needs. We do not pretend that the process is easy or straightforward, painful choices have to be made. In the final analysis, sustainable development must rest on political will'.*

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