KENYA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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CHAPTER 1
Introduction to Kenya and its Agricultural Sector

1.1 LOCATION

Kenya is located in the Eastern part of Africa. It lies between 34º and 42º East and latitudes 5º North and 5º South. It borders the Republics of Somalia on the east, Sudan and Ethiopia on the north, Uganda on the west, Tanzania on the south and the Indian Ocean on the south east (see Appendix III).

The country covers an area of about 582,646 km^2 (58,264,600 hectares) out of which only about 5.2 million hectares of land is devoted to crop and milk production. About 80% of the country is semi-arid or arid. Kenya has a total of 44,751.3 km^2 of protected areas, with varying degrees of legal protection and land uses.

Kenya has one of the highest population densities in sub-Saharan Africa, with around 230 persons km^2 of agricultural land. Four fifths of the population is estimated at close to 25 million and still growing at around 3.6% p.a., and estimated to rise to 37 million by the year 2000.

1.2 AGRICULTURAL SECTOR

The agricultural sector is the hub of Kenya's economy and this will be the likely trend in the foreseeable future. The sector contributes 28% of the Gross Domestic Product (GDP), generates over 60% of the foreign exchange earnings and employs 70% of the population. Perhaps the most important aspect of the sector is that it provides food to the ever increasing population, and also provides raw materials to the agro-based industries which account for 70% of all the industries in the country. The sector is characterized by smallholder farmers, 80% of whom own and utilize less than 2 hectares of land but account for 75% of the marketed surplus in both crop and livestock products.

The main farming system is maize based owing to the fact that maize is the staple food of the majority of Kenyans. The other important food crops grown are millet, wheat, barley, cassava and beans, horticultural crops, coffee, pyrethrum and tea are the main crops grown mainly for export.

The trend in agricultural production has been characterized by rapid growth in the last three decades except for the last three years owing to vagaries of nature and the world economic recession. However, the agricultural production is currently improving.

Agriculture being the mainstay of the Kenyan economy, national development policy guidelines tie up closely with the rural economy. This is clearly seen in the development trends in post independence economy. Key issues are highlighted below:

- From the outset, rapid economic growth was seen as the solution to Kenya's quest for development. First enshrined in the Sessional Paper No. 10 of 1965 (page 18), this theme formed the basis of the first three National Development Plans (NDP). In the immediate decade, agricultural production grew at a reasonable, high rate supporting the growth in the other sectors and resulting in an average GDP of 6.5% p.a.
- By the end of the third plan period, that is 1978/79, it was realized that poverty persisted particularly in the rural areas in spite of the economic growth without redistribution and helped to change national policy focus more towards NDP and subsequent NDPs have maintained the focus on greater socioeconomic involvement of the rural population in development as crucial in up-grading their standard of living and supporting the other productive systems.
- A land tenure policy that encouraged land subdivision, registration and privatization gave farmers the security, confidence and incentive to devote their time, labour and capital to agriculture expecting to reap the benefits there-off. This worked well while population pressure was still low but now this is leading to land fragmentation below economically viable units. This calls for further policy intervention on land issues.
- The policy has rightly supported cash crop production for export and subsistence production for broad self sufficiency in basic foodstuffs. To this end, agricultural research for instance had been biased towards:
    - cash crops and a few selected food crops,
    - high yielding crops,
    - technical and/or agronomy based research rather than economic/social research,

- development and management of the high potential areas rather than the marginal lands,
- high annual returns rather than long term sustainability.

1.3 FOREST RESOURCES

The forests in Kenya are highly fragmented occurring in 273 forest areas of which 43% (118) are only 100 ha or less. The 150 small forests form only 1% of the total closed canopy forest.

The main forest areas have been surveyed and gazetted. The combined area of gazetted forest reserves, (1.7 million ha) and partially forested areas that have been proposed for gazettement (0.5 million ha) is approximately 2.2 million ha or 2% of the total land area. Of this, approximately 56% (1.24 million ha) is closed canopy indigenous forests; 36% (90,000 ha) is open canopy indigenous forests; while 8% (165,000 ha) are plantations consisting mainly of exotic species.

Most of the closed canopy forests are in areas of high or medium potential land, where over 80% of the human population and agricultural production are also concentrated. Closed forests in the extensive arid and semi-arid lands (ASALs) are found mainly on isolated mountains, and in discontinuous narrow bands along permanent or seasonal rivers; while along the coastal belt are found remnants of forests and extensive mangrove forests. In addition, the ASALs which cover approximately 80% of the total area contain most of the woodlands, bushlands and wooded grasslands with a total of 2 million hectares.

The area under woody vegetation has decreased mainly due to legal excision for agriculture and to a similar extent to settlement. Since the commencement of gazettement, official records of degazettement total 390,000 ha amounting to 13% of the total gazetted area (1.7 million ha). Presently, the average annual loss of forests is approximately 5,000 ha per year, while that of woodlands, bushlands and wooded grasslands is decreasing at an estimated rule of 50,000 ha.

Furthermore, there is pressure on forest land by forest communities and small or large scale commercial users. The position of forests and their products in the rural economy has gained recognition more in response to environmental and socioeconomic problems arising due to declining forest and tree cover;

over-exploitation of existing resource, scarcity of tree and forest based products and market development for commodities that were traditionally free and abundant commodities.

Many of the traditional uses of trees and forest products have been overtaken by the modernization of the economy. Critical present day needs are faced with a much higher level of demand than supply though this varies with the region Linder consideration.

The forestry sectors contribution to GDP is given at 1%, but if its intangible benefits are unaccounted for, this is likely to be more in the range of 10%-15%. An indication of the importance now attached to trees, forests and products is manifested in the effort now invested in the sector. The Government, NGOs, private and community projects and programmes found in afforestation, reforestation, social/community forestry, agroforestry, tree seeds and nursery programmes and woodfuel energy conservation and substitution are among the numerous effort to conserve the forests.

The overall government policy still remains the up-grading of living standards for the people of Kenya. To this effect, various structural changes have been initiated based on recommendations documented in the Sessional Paper No. 1 of 1986. Of special relevance in socioeconomic terms for the rural economy is provision of basic needs for all Kenyans, firmly based on the assumption of rising employment, productivity and incomes so that private households can provide for themselves most of the food, shelter and clothing, and provision of water, education and health needs for themselves.

1.4 DISEASES AND PESTS

In the recent past, major diseases and pests have affected both crops and forest trees. A few examples include citrus greening, nematodes in bananas, cypress aphid, greater grain borer in maize and birds in cereal crops.

CHAPTER 2
Indigenous Plant Genetic Resource

An approximation of Kenya's ecological diversity distinguishes between:-

- areas of relatively high agricultural potential, concentrated in the Rift Valley, surrounding highlands and the plains along the shores of Lake Victoria that comprises very high potential 6,785,000 ha (12%), and medium potential 3,157,000 ha (5%)
- the arid and semi-arid lands (ASALs) to the north and east, defined as areas where average rainfall is less than 50% of open-pan evaporation. This comprises 42,160,000 ha (74%) while 9% 4,867,000 ha constitutes all other lands.

Further, Kenya lies at the intersection of four major zones of plant species diversity:

a) Guineo-Congolian

Kenya possesses the eastern most fragments of the Guineo-Congolian region, now restricted to the degraded forests of Kakamega and the adjacent Bojoge forest. Although not rich in national endemics, this region is the only remaining patch of one of Kenya's most species rich biotic communities. The entire area remains under intense pressure from encroachment and unsustainable extractive use.

b) Zanzibar-Inhambane Mosaic

Along the coast, Kenya once possessed a narrow strip of vegetation (50-200 km wide) belonging to the Zanzibar-Inhambane Regional Mosaic. Due to population pressure and changes in land use, the forest component of this vegetation is now highly fragmented. Each surviving region shows a high level of endemism and all remaining patches are under threat. Only two (Shimba Hills National Park and Arabuko-Sokoke National Reserve) currently receive any protection.

c) Somali-Maasai Region

These upland dry-evergreen forests now occur only as relic stands along the eastern edges of the Rift Valley of Kenya and Northern Tanzania. The most important protected areas are Ol Doinyo Sabuk National Park, Nairobi Forest Reserve. Small parts of the latter lie within Nairobi National Park (80 ha), or the City Park and Arboretum (100 ha).

d) Afro-Montane Region

This is the best studied forest type in Kenya, growing on the higher reaches of the Rift Escarpment and Central highlands. These forests serve important watershed function, in addition to providing sites for high plant and animal biodiversity. Although some high altitude montane forests are well protected by isolated positions and protected area status, others are being eroded at increasingly rapid rates. There are several prime areas for increased protection including, for example, Mau forest (30% degraded in the last 10 years) and Mt. Kenya (lower slope threatened by encroachment by small-farm agriculture and illegal logging).

It is estimated that between 8000-9000 species of plants occur in Kenya. 2000 of these are trees and shrubs. Of these categories of trees and shrubs, about 5% are considered endangered and about 8% rare, whereas 20% of the herbaceous species may be endangered. Overall knowledge about higher plant genetic resources in Kenya is perhaps above average for tropical endemics. A preliminary listing of endemics and/or threatened species records 392 national endemics, a further 336 regional endemics, 6 known extinctions and at least 258 species are threatened. *Aloe sp.*, *Dalbergia melanoxylon*, *Juniperus procera*, *Melicia exelsa*, *Vitex keniensis*, *Olea africana* and *Octoea usambarensis* all have presidential protection. Additionally there are 45 known wild vegetable species and 200 wild fruit species in Kenya. There are also 110 species of multipurpose (including medicinal) forest species all with modest economic promise. Grasses stored at the Gene Bank are 264 species but all of them are indigenous.

About 80% of Kenya's land (490,000 km2) is covered by savanna, arid and semi-arid lands; major habitats for a diversity of grass species. These habitats support 342 grass species consisting of six major varieties *re Paniceae* (137), *Andropogoneae* (74), *Eragrosteae* (39), *Chlorodeae* (33), *Aristideae* (16), and *Sporoboleae* (43) (Kenya biodiversity study, 1992). Records from National Museums of Kenya herbarium collections suggest that 61 of these grass species are only documented in Kenya to date. They therefore, form a unique national heritage supporting the national dairy and beef industry in

addition to their immense value in suppressing environmental degradation. Consequently are worth some conservation efforts. National Museums of Kenya conservation efforts are targeted towards the sustainable utilization of this diversity through complementary strategies in documentation, research, conservation and education.

Examples of two grass species in low frequency in Kenya:

a. *Trichoneura hirtella*

b. *Chloris woodii*

2.1 FOREST GENETIC RESOURCE

2.1.1 Forest Resource Types

There are six main categories of forest types in Kenya although these can be broken down in many more classifications that closely reflect local conditions. Beentje (1990), for example, identified some 23 different formations comprising of 16 in the interior and 7 near the coast. The five main forest types include:

- Closed broadleaf forests; comprising mainly the western Kenya rainforests (Mt. Elgon forests, Kakamega forest, North and South Nandi forests), the wet montane (Aberdares forest, Mt. Kenya forest, Mau forests, Cherangani Hills and Kaptagat forests), the drier croton types (Nairobi forests, Marmanet and Ol'Arabel forests, Shimba Hills forests, Kaya forests), the coastal types (Arabuko-Sokoke forest, Shimba Hills forests, Kaya forests, Boni/Dodori forests), and the riverine forests (e.g. Tana River forests);
- Open broadleaf forests; comprising of wet upland (dominated by *Hagenia*), dry upland (dominated by *Afrocrania*, also including, northern mountain forests, Taita Hills and Ngulia forests, Chyulu Hills forests, Machakos and Kitui forests') and coastal forest communities (dominated by *Cynometra* and *Combretum*);
- Coniferous forests; comprising mainly of the *Podocarpus* and *Cedar* forest tree compositions;
- Bamboo forests; comprising of only *Arundinaria alpina* in the montane zones from 2400 m and above;
- Mangrove forests; occurring in the coastal inlet and creek waters and dominated by *Rhizophota* and *Ceriops*.

2.2 CATEGORIES OF FORESTS, OWNERSHIP AND MANAGEMENT (SEE APPENDIX IV)

2.2.1 Gazetted Forests

These are legally owned by the Government of Kenya and are forests which have been surveyed, demarcated on the ground and declared as forest reserves. At present, these cover some 1.7 million ha. Gazetted forests are managed directly by the Forest Department (FD) on behalf of the state.

2.2.2 Gazetted National Parks and National Reserves

These also contain forests and other types of woody vegetation. Such forests are managed by the Kenya Wildlife Service (KWS). Also through the legally binding FD-KWS Memorandum of Understanding (MOU), several forest reserves have been selected for joint management by both FD and KWS.

2.2.3 Ungazetted Surveyed Forests

These are government forest reserves whose proposed boundaries are well defined. These have been proposed for gazettement for a long time but continue to remain under the management tenure arrangement with the County council, sometimes with the assistance of the Forest Department. This category of ownership includes a number of large closed-canopy forests even though most surveyed forests are relatively small.

2.2.4 National Forest Monuments

These are forest areas gazetted as monuments to enhance conservation of biodiversity and cultural values. These include the Gede ruins, Kitale riverine forest, the coastal Kaya forests etc. Management of national monuments is under the responsibility of the National Museums of Kenya.

2.2.5 Proposed Forest Reserves

These are blocks and units of forests that have been proposed for gazettement by the Forest Department mainly as a result of their being in need of protection. Their ownership is variable, ranging from community owned Kaya

groves, forests on hilltops and threatened forests under County Councils. This category of forests includes the Tana River forest blocks.

2.2.6 Unsurveyed Forests

These are mainly on trust lands and are meant for community use. Trust land forests are under the management of County Councils, but in practice, little management is carried out. With the exception of the Loita Hills, most of these forests are small. There are no plans at present of gazetting these forests.

2.2.7 Private Forests

These comprise of forests mostly on farmlands. Estimates of forests on private land has not been easy as most of these occur as individual trees or boundary tree planting and few woodlots. In 1989 it was estimated that private forest vegetation may have been about 124,000 ha. This cover has continued to increase on farms though marginally as availability of fuelwood continues to decline from the public forests, thus necessitating planting by farmers for mostly subsistence conservation.

Most of the large blocks of forests especially those considered important for conservation of biodiversity have already been protected as forest reserves, while a few are of National Park or Nature Reserve status. However, the exercise of gazettement of important forest areas still continues.

Some of the smaller forests are gazetted while others are not. Unfortunately, these forests are located in areas of high human population density.

2.3 THREATS ON FOREST ECOSYSTEMS

Recent surveys show that most important indigenous species that are harvested may be termed as threatened due to complete clearance of their habitats, selective logging, conversion of habitats to agriculture or plantations as well as over-exploitation. Details of the most important species that are extracted are shown in Appendix I while Table 1 shows the most important species that are threatened. *Prunus africana* which is also one of the main species harvested has now been declared as endangered. Records for the last decade or so indicate that indigenous forests have declined at a rate of 5,000 ha per year through excisions.

Tree poaching is a major threat particularly in the highland forests of Mt. Kenya and Aberdares and the Kakamega-South Nandi forests. It has been estimated that "authorized" and illegal cutting of indigenous trees are removing some 50,000 m^3 of the commercially economic timber and pole wood annually. Such degradation through over-exploitation has led to a 40-60% loss of standing wood volume from most forest reserves in the last 30 years. More critical in this threat is erosion of unique germplasm and a gross degradation of biodiversity, not only of the flora, but also of animals whose habitats are destroyed.

Table 1 Important species which are threatened in Kenya

Species	Uses
Acacia nilotica	Fodder, fuelwood, shade
Brachylaena huillensis	Carvings
Entandrophragma angolensis	Timber
Olea africana	Timber, charcoal
Prunus africana	Timber
Dalbergia melanoxylon	Carvings
Polyscias kikuyuensis	Plywood
Populus ilicifolia	Boat making
Melicia excelsa	Timber

The Kenya Government recognizes that the current use of Forest Genetic Resource (FGR) has exceeded reforestation and is eroding the forest and woodland resource base in the country at an increasing rate. To counteract this, several measures and programmes have recently been formulated aimed at sustainable management of these natural forests and therefore contributing to the conservation of forest genetic resources. These include:

- a national campaign on planting of indigenous species;
- in situ conservation of indigenous forest genetic resources;
- involvement of adjacent communities in decision making on the use and management of forests;
- establishment of seed centres and creation of extension networks by training members of women's groups, individual farmers and foresters to increase seed production;
- closer collaboration among institutions concerned with forests resources;
- disallowing excisions of forests and proposing the gazettement of selected forests;

- disallowing the conversions of indigenous forests to plantations;
- a strong campaign on farm forestry development by strengthening the forestry extension service and development of agroforestry systems;
- development of the Kenya Forestry Master Plan for a holistic forest management;
- revision of the forestry policy.

Agriculturally there has been increased loss of genetic diversity, due to desertification, changes in land use, population pressure (both human and livestock) and modernization in Agriculture (adoption of genetically narrow based varieties). To overcome this problem the Government, with technical and financial support from the Federal Republic of Germany established the national genebank in 1983; to conserve crop plant genetic resources comprising of landraces of indigenous crops, their wild or weedy relatives, breeding lines as well as obsolete varieties.

2.4 OTHER WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

Kenya is endowed with a unique heritage of diverse germplasm of forages (grasses, legumes and browse plants), cereals (sorghums and millets), pulses (pigeon peas and cowpeas), tuber crops (cassava, yams and sweet potatoes), oil crops (castor, sesame and vernonia), fruit trees (tropical fruit plants) and vegetables (amaranthlus, gynandropsis, cucumies etc). Appendix II is a summary of some of these materials that still occur in the wild.

Most of these genetic resources are in imminent danger of genetic erosion as stated above. By discouraging deforestation and protecting areas with high genetic diversity, the government tries to check the erosion rate. However, factors like desertification are a natural catastrophe that normally require enormous investment. Effects of the current high populations shall still be felt despite the present population control measures that are being undertaken.

With the recent influx of refugees together with their livestock to the northern parts of Kenya, it has been a double blow, in the sense that the area normally experiences long spells of dry seasons. There is an urgent need for funds to assist in conducting emergent collection expeditions in this region. Outside help is definitely imperative.

Parts of Coast, Eastern and North Eastern Kenya are believed to have wild relatives of coffee. Given the arid nature of this region, these species are bound to be drought tolerant. Also in the wild are a number of plant species that have not been developed commercially. This category comprises of indigenous vegetables, indigenous fruit plants and oil crops (Appendix II).

Vernonia galamensis, for example, is a wild plant with unique oil suitable for industrial use. It is yet to be developed as a commercial crop. However, such plant genetic resources are in severe threat in the wild, through deforestation and other environmental degradation processes (e.g. fuelwood harvesting).

2.5 LAND RACES ("FARMERS' VARIETIES") AND OLD CULTIVARS

In Kenya most landraces and old cultivars have been conserved mainly by farmers. For most indigenous crops, farmers mainly use traditional. varieties, e.g. millets, sorghum, pigeon peas etc. For others like maize (Zea mays), use of traditional varieties is only to a limited extent. This is also true for crops that are basically commercial and/or are staple food.

The Government normally encourages use of improved varieties whenever available. This policy is meant to ensure sufficiency in food products. But in cases where farmers feel that the traditional variety is superior to the improved variety, they insist on using it.

Generally, local people value indigenous plant diversity. Although inadequately, there are a number of ways in which they conserve diversity. Multi-cropping and growing of diverse genotypes of a given species in the same field is a common practice of many small scale farmers. Farmers also use various traditional seed storage techniques to preserve their materials. An example is conserving of seed over the fire place.

At the NMK indigenous plant genetic resources are conserved through the indigenous food plant programme that has assisted to develop kitchen gardens with central garden at the NMK grounds for related research.

This has been strengthened through the NMK indigenous knowledge centre which focuses on enthnobotanical value of existing NMK collections in relation to past, present and cultural changes.

CHAPTER 3
Conservation Activities

3.1 *IN SITU* CONSERVATION ACTIVITIES OF FORESTS

The Forest Department (FD) which falls under the Ministry of Environment and Natural Resources is the main agency concerned with the in situ conservation and management of indigenous forests. The other key players are the National Museums of Kenya, National Genebank of Kenya and Kenya Wildlife Service.

Programmes and projects on conservation of Forest Genetic Resources (FGR) have tended to be uncoordinated and specific rather than addressing conservation as a whole. Most of them have also not lasted long enough to have a meaningful impact. On-going and completed assistance include that from the World Bank IV Project for plantation forestry (Kenya Forestry Development Project, KFDP); FINNIDA for the Kenya Forestry Master Plan and forest extension service for on-farm forestry; ODA which funded the Kenya Indigenous Forest Conservation Programme (KIFCON) and the coastal programme for biodiversity surveys of selected forests; European Community that funded the Indigenous Forest Conservation and Management Project (COMIFOR) which extends and compliments the work of KIFCON and the German Development Agency (GTZ) for training and management.

Other projects have been funded by ADB for specific forest areas; DANIDA for forest extension service and afforestation of selected hilltops; the Netherlands for afforestation of the ASALs and USAID, ODA and JICA for universities.

Additional funding especially for the protection of forests has come from collaboration with other government institutes which relate to FGR. These include the Kenya Wildlife Service (KWS) and The National Museums of Kenya (NMK).

Furthermore, the Kenya Forestry Research Institute, a parastatal under the Ministry of Research, Technical Training and Technology maintains strong links with the Forest Department. Unfortunately, most research has in the past concentrated on exotic species as funding for natural forests has been limited due to unavailability of funds.

In addition, the Permanent Presidential Commission on Soil Conservation and Afforestation advises the government on policy; The Ministry of Agriculture, Livestock Development and Marketing has an active and wide-reaching extension programme that includes farm forestry. There is also a very strong NGO movement which is involved directly or indirectly in forest conservation. Unfortunately, information from NGO work is not well distributed.

Although the Forest department is mandated to manage the gazetted forests, they do not have the capacity to do so, and therefore intensive management is not practiced especially for the small forests.

The department has also only recently been allocated an increased role in forest conservation. The Forest Reserves have been managed mainly by law enforcement, licensing extraction of forest produce, fire protection, control of wild animal problems both in adjacent forest plantations and on farms, and the maintenance of infrastructure.

Measures mentioned above have in the past not been very successful. This is because there has been no creation of awareness and the involvement of adjacent communities and commercial users in decision making related to the sustainable management of forests. However, more recently, it has been realized that the participation of these communities is important.

Those forests under National Parks and Nature Reserves are managed by the County Councils with support from the KWS in a similar manner as the FD except that there is no extraction of forest produce, while in some forests ecotourism is exercised.

Many of the smaller forests have been managed by, and have survived because of the local communities which have exerted traditional control over their use. However, over the years, most of these forests have become less important to the local communities and the practices that have protected them have broken down. The importance of the role of these communities should be recognized and they should be encouraged to continue managing these forests.

Several programmes and activities have been undertaken in the assessment of FGR but none of them has been comprehensive as they have been either too short lived or not intensive enough. There is therefore no detailed knowledge on forest resources, their rates of degradation and depletion and the socio-economic impact.

The programmes/activities that have been undertaken include the establishment of Forest Ecological Seed Zones of Kenya by the Kenya Forestry

Seed Centre (KFSC) which was done specifically for the seed collection purposes with the unit of reference as the vegetation type. The Department of Remote Sensing and Resource Survey (DRSRS) has unpublished data on the status of the gazetted forests. The Forest Department also, through its inventory section and KIFCON, have published and unpublished data on some species of selected forests. They have identified their uses and status.

Genetic studies on indigenous species have been limited mainly due to inadequacy of funds. For example there has been no detailed analysis to determine when a forest area is threatened to an extent where *ex situ* conservation measures of all important material should be undertaken. At the same time it is noted with concern that small but most valuable forests are being lost irretrievably. Funds for such studies are urgently needed.

Proposals for in-depth studies on population structures including provenance and progeny trials, genetic marker studies, and studies on phenology of some important indigenous species have already been drawn. These studies will be essential in providing valuable data to be used in undertaking *ex situ* and *in situ* conservation measures and other activities for these species.

Following recommendations from the 1987 Plant Genetic Resources workshop, held in Kenya (specifically recommendation 10) the National Museums of Kenya (NMK) was given the mandate for *in situ* conservation. Since then it has been involved in identification of endangered plant genetic resources and their habitats.

The NMK has projects focusing on threatened habitats. The herbarium department of the NMK undertakes inventories on species and their habitats and recommends accordingly for either *in situ* or *ex situ* protection. Special units such as the Coast Forest Conservation Unit (CFCU.) is currently looking at threatened habitats, such as forests threatened by hotel expansion and quarrying at the coastal region, and taking appropriate steps in gazetting them as National Monuments. They cover, the rich plant diversity in coastal sacred places known as Kayas. The unit collaborates with council of elders (Community) to protect these areas. Over 20 habitats (Kayas) with the rich native flora and fauna have been documented, protected and strategies for biological resource use agreed with the adjoining community. This is an expensive exercise involving local surveillance (guarding) that is initiated by the local community with the logistical support from the NMK.

Other *in situ* sites on protected areas exist (e.g. those protected under the Kenya Wildlife Services and Forest department). The NMK undertakes inventories on rare, threatened and endemic PGR even when the plants are

under protection. For example rare endemics such as *Millettia leucantha* Vatke and *Baphia keniensis* Brummit have been monitored by the Plant Conservation and Propagation Unit (PCPU) in Tsavo and Meru national parks respectively. Both seed germplasm and a replicate plant stock have been acquired at the NMK seed bank and plant nursery display garden respectively.

The PCPU has a field team that targets on sensitive areas for conservation. Through undertaking field studies on the ecological status Of Such habitats, appropriate action is normally undertaken. For example, the team has undertaken such work on Saiwa swamp near Kitale in collaboration with the Kenya Wildlife Service, where some rare plants were identified as deserving both *in situ* and *ex situ* conservation. Similar work is also being undertaken in wetlands and other threatened habitats by other NMK departments working under the centre for biodiversity.

3.2 *EX SITU* CONSERVATION

There are several institutions responsible for ex situ conservation of plants. These are the national genebank and KEFRI while national museums of Kenya supplements and complements work done by others. *Ex situ* conservation is in form of seed, arboreta, botanic gardens and field genebanks.

3.2.1. The National Genebank

The genebank was established in 1983 and became fully operational in 1988.

The establishment was financed both by the Kenyan Government and the Federal Republic of Germany through GTZ. The activities to date have remained mainly donor funded while the government has continued to offer personnel support in addition to provision of land. Besides GTZ, other donors that have supported the project include Swedish International Development Agency (SIDA) and Food and Agriculture Organization (FAO). The genebank is currently financially insecure, a problem it is intending to address by incorporating commercial activities in its routine work.

The conserved materials are held at the central genebank for long term storage. The active collections are held at the commodity research centres for crop plants.

A list of genera currently held at the genebank is attached as appendix 1. They comprise mainly of indigenous material with a few global and regional collections namely: sorghum, sesame etc. These materials have not been replicated elsewhere.

On average, 1500 accessions are donated to the users each year. This figure can be higher if you consider utilization of active collections held at the research centres in the country. The main users include breeders and other researchers in national programmes. Materials are also donated for use in other national and international institutions.

For the taxa and regions that have been covered so far, the collections represent the diversity existing in the field. They are also within our capacity to maintain, according to the acceptable standards provided continued financial assistance is available. Further financial assistance is also required to the enable the genebank us cover the other regions (arid and semi-arid areas) that have not been covered before.

The collecting policy is mission oriented. Normally specific regions of the country are targeted. Remote localities are a priority. Random sampling techniques are used in all collection missions. In each mission, any taxa that is considered to be potentially valuable is collected.

3.2.1.1 Seed Storage

After drying the collections to below 7% moisture content they are packaged in aluminum foil packets and preserved in a room maintained under -20°C. The drying cell runs at 20°C and 15-20% relative humidity.

So far, maintenance of the storage facilities has not been a major problem. But with the current donor support coming to an end, it is unlikely that the government alone shall be able to shoulder the inherent high maintenance costs. External support is still imperative.

As has been stated, the base collection is not as yet duplicated elsewhere for safety. However, there are negotiations going on for having them duplicated.

A new incoming sample takes on average, 3 to 4 weeks to process and have it stored. However during the harvesting peak, a backlog may be created as our drying cell cannot handle as many accessions as necessary. When this is the case the backlog is normally cleaned, placed in drying bags and kept at room temperature to await being dried. It is imperative that a pre-drying unit is established where such material can be held. This shall ensure that the moisture content is brought down to appropriate levels.

The storage facilities are about three quarters full. It is estimated that they shall take 15 or more years to be full. The National Genebank of Kenya stores materials for other national and international genebanks subject to availability of space. These countries contribute to the multiplication and regeneration costs. They should also be ready to allow for free exchange of the material.

3.2.1.2. Documentation

The collections are well documented with a complete computerized database. Both morphological characterization and agronomic evaluation are integrated into the documentation system. The information that accompany the samples include storage, characterization, evaluation, seed testing and passport data. In some cases we also have the indigenous knowledge and breeders records included. This is very important as quality documentation enhances utilization of samples. Information is normally made available to users through computer printouts.

A major problem in documenting samples of wild relatives is verifying the names. Assistance in taxonomic expertise is crucial.

The documentation records are fully duplicated but are stored within the same building. Arrangements are underway to have them stored elsewhere in the country.

3.2.1.3 Evaluation and characterization

No clear distinctions are made between preliminary evaluation and characterization of the collections. Both procedures are carried out by the genebank staff in collaboration with plant breeders in National programmes. IPGRI descriptors are utilized with minimal modifications.

Approximately fifty per cent of the national collection has been characterized and undergone preliminary evaluation. Only a small percentage has undergone secondary evaluation both at the genebank and the locality of origin. The data include morphological, physiological and disease and pest susceptibility.

Evaluation data are important for revealing gaps, genotype diversity and identifying duplicates. Such information may be used in designing collection and conservation programmes.

It is imperative that all users avail the resulting data from their work for use by other scientists however this has not always been the case.

It is the policy of the National Genebank of Kenya that both preliminary evaluation and characterization be carried out together in a single cycle. Secondary evaluation should be the role of plant breeders and other germplasm users. International collaboration on germplasm evaluation with the coordinating genebank taking a leading role should be encouraged.

3.2.1.4 Regeneration

Materials held at the genebank are supposed to be regenerated whenever viability falls below a minimum of 85% for most species. For other species e.g. the grass species, this requirement is flexible. Whereas land and personnel have never been a constraint in so far as undertaking regeneration is concerned, the finances normally are. Regeneration of some accessions has sometimes been deferred owing to unavailability of funds in such a case assistance is sought.

The genebank regeneration activities are carried out jointly by genebank staff and plant breeders in accordance with the laid down procedures so as to avoid genetic drift, contamination or any form of selection.

3.2.2 Kenya Forestry Seed Centre

The Kenya Forestry Seed Centre (KFSC) holds the national forestry genetic collection in form of bulk seed to meet seed demand for on going tree planting programmes. KFSC is a short term gene bank with a storage capacity of about 12 tones. It holds seeds well above the annual planting demands. About 200 different tree species are stocked. Although the emphasis is on indigenous species, exotic species that are planted in the country are also included in the collection.

KFSC also stores seeds for the International Center for Research in Agroforestry (ICRAF) although the management of the germplasm is undertaken by ICRAF.

The need for a forestry seed centre arose when the government started an intensive campaign of tree planting to meet its energy requirements especially in the rural areas. At the same time, an awareness of the potential and the importance of indigenous tree and shrub species developed. There was also need to regulate the import and export of the national tree germplasm.

KFSC was established in 1985, with the support of the German aid. Today, KFSC is a sub-programme of the Kenya Forestry Research Institute (KEFRI). The project came to an end in 1993 by which time, it was expected that KFSC

(supported by GOK) would be self-sustainable. However, although the government sees this as a worthwhile investment, there is a shortage of funds.

The main users of the seeds are government organizations (.mainly the forest department) who consume 50% of the seeds while the other half is consumed by private users.

KFSC has divided the country to different seed zones and any collection done is specific in terms of species and the seed zones. To be able to capture all the genetic diversity of a species, collections must be made from all possible seed zones. However, the present collections do not meet this important requirement due to lack of funds. Furthermore, some species of trees that are not routinely used in afforestation purposes are not given priority. The centre can not with the present budget consistently dedicate resources to achieve this important goal.

3.2.2.1 Storage Facilities

The seed store is composed of 3 cold rooms with a volume of about 75 m^3. One room is maintained at 10°C and in it is stored the orthodox species. The other rooms are maintained at +3°C and +1°C where the more heat sensitive seeds are stored. The seeds are put in air tight plastic containers after they are dried to the species specific moisture content level, which is around 8-10 % for most species. These standards have been adopted from International Seed Testing Association (ISTA) where applicable, developed locally through research or adopted from research results from collaborators. Some base collection have been stored by the National Genebank of Kenya whose bulk collection are of plants other than forest species. The processing period depends on the species and the centre has a capacity to use a hot room for seed drying when the weather does not permit sun drying.

There are plans to expand, duplicate and establish ex situ conservation stands. Furthermore, although the facilities for short term storage of these forest tree seeds are adequate, there is need to expand on the long term storage facilities which are presently minimal.

3.2.2.2 Documentation

Each seed-lot is documented comprehensively with data of the seed lot and its seed source. All is maintained in a computerized data base that has been locally designed and based on Dbase. The program enables the back up of the documentation on safety floppies.

There is a published catalogue made available to users through several distribution outlets (post, seminars, agricultural shows etc.) free of charge. The most up to date representation is obtained by printing the stocklist.

A net-working exists within the East African Tree Seed Centre Region where each centre circulates to the other centres its seed catalogue at the beginning of every year. The process was initiated formally during the Annual Coordinating Meeting of Tree Seed Centres in East Africa held in October 1994.

3.2.3 National Museums of Kenya

The National Museums of Kenya is responsible for ex situ conservation of rare, endangered and endemic species as well as other useful plants that are not targets of the other institutions. All the species conserved are those not covered elsewhere (though part of our heritage) and are targeted for botanic garden development in Kenya. A Herbarium based approach is used whereby the priority plants for conservation are selected through screening Herbarium records, Publications (e.g. published floras), literature as well as gathering information from experts on specific taxa and plant sampling is used to ensure the capture of a broad genetic base. In particular, plants with the following characteristics are sampled:

- *Milletia leucantha* Vatke
- *Baphia keniensis* Brummit
- *Milletia oblata* Dunn. ssp *teitensis* Gillett
- *Albizia tanganyicensis* Bak. ssp. *Adamsoniorum* Brenan

Over 100 seed accessions of rare orchids are also maintained at low moisture level and under refrigerator conditions.

3.2.3.1 Storage facilities

The establishment of the storage facility has been set up with the financial sup port from the Government of Kenya (GOK) and the UK Overseas Development. Once seed moisture is reduced to recommended (IPGRI) standards through the use of 1:2 (Silica gel: seed) ratio in portable incubators; packing is done in suitable containers for active collections. Processed seed is sealed in air-tight conditions in sealed Polythene, bottled and stored at minus 20 degrees Celsius in a 1.7 m x 0.64 m x 0.8 m domestic chest deep freezer. This chest deep freezer facility is maintained at room conditions at the National Museums of Kenya.

The use of aluminum foils, as packing material for stored seed germplasm is now explored for long term security storage of accessions. However, the accessions in the chest deep freezer are always duplicated in live plants in a nursery (on development to a botanic garden) at the museums. In cases where seed quantities permit, duplication is maintained with the Kenya Forestry Seed Centre. In such cases where this is feasible, then the unit has the responsibility for testing the duplicated germplasm.

3.2.3.2 Documentation

Excellent documentation is adopted for all conservation activities (in situ and ex situ) at the NMK, since all the plant accessions are properly documented before their storage or display at the nursery. Passport data is a primary source of information for conservation work and other utility programmes, hence it is made to be as exhaustive as possible.

However, a range of documentation and therefore databases exist at the NMK, specifically in the following fields, that support PGR activities at the Museums:

- indigenous food plants,
- indigenous knowledge,
- rare and endangered plants,
- endemic plants,
- medicinal plants,
- ornamental plants.

These data sets are continuously being up-dated since all the plant germplasm (seeds, whole plants) are related to the herbarium database at the NMK. A manual card index is maintained for the field collected plants and entries made onto the Herbarium database for the voucher specimen. In addition, a computerized database exists for the rare orchids of Kenya and is currently being expanded to include all the collections. This is based in BRAHAMS, i.e. Botanical Research and Herbarium Management Systems. A bio-diversity data base funded through Global Environment Facility (GEF) funds further supports the Herbarium PGR data base.

Information exchange on our collections is facilitated through correspondence, print outs on request and use of retrieved cards on request.

3.2.3.3 Evaluation

Unlike programmes in agriculture and forestry where the plant genetic resources are evaluated for use (e.g. for inherent characters in breeding, pest resistance etc.), the plant genetic resources at the National Museums are evaluated for bio-diversity related needs. Active evaluation programmes are based on the following fields:

Mycorrhizal diversity: from specific to, habitat characterization.

Propagation: particularly for the vegetative propagation of the critically rare species or those producing recalcitrant seeds.

Taxonomy: focusing on the intra and inter specific variation in relation to the habitat factors etc.

Genetics: genetic variation in wild population.

Chemical activity: use for toxicity on malarial parasites, Leishmania etc.

However, minimal regeneration is done, except when the above needs dictate and in specific cases where ex situ stocks are needed for plant re-introductions.

3.2.4 Botanic Gardens/Field Genebanks/Arboreta

According to global biodiversity standards of 1992 there are five botanic gardens with living PGR accessions in Kenya (see Anon. 1992 Global biodiversity, WRMC report). These include City park, Mazeras botanic garden and the Nairobi arboretum. The PCPU of NMK monitors and documents existing rare plants in these botanic gardens. As a result therefore the NMK has been monitoring all known wild populations of the species, that can be used to broaden the genetic diversity of such collections at the arboretum. Plant stocks of such species have been set up at the National Museums plant nursery.

The nursery is at an advanced stage of being transformed into a botanic garden. Satellite NMK nurseries to support the upcoming botanic garden have been setup and PGR collection guidelines prepared for long-term safe and professional use of the conserved resources. Plans are also underway to start small gardens in appropriate ecological zones to support the NMK site based conservation activities. In some cases this work has revealed that these gardens do not have representative samples of all genotypes that occur in the wild. There is a network of field genebanks located in various parts of the country where materials that cannot be conserved as seed are maintained.

They include those species that are either recalcitrant seeded and\or do not produce viable seed. These field genebanks are far from being complete as a number of species are yet to be addressed. The major bottleneck has been the availability of funds.

CHAPTER 4
In-Country Uses of Plant Resources

Kenya's own plant genetic resources, notably crop plants are used as cultivars per se by farmers and for research (breeding and crop management and protection) by scientists. Exotic accessions are used largely as genepools for agronomically desirable traits harnessed in the crop improvement programmes.

4.1 USE OF PGR COLLECTIONS

Crop species most frequently used in our national projects, and the number of scientists involved in research on them (in parenthesis) are: maize (40), wheat (20), rice (15), sorghum and millet (20), root and tuber crops, e.g. cassava and sweet and Irish potatoes (35), grain legumes (20), vegetables and fruits (20), oil seed crops (8), pyrethrum (4), sugarcane (8), macadamia nuts (2)), flowers (2) and herbs and spices (4). Percentages of accessions used in the past three years are: maize (80%), wheat (75%), rice (20%), sorghum and millet (55%), root and tuber crops (80%), grain legumes (65%) and oil seed crops (50%). Some 70-90% of all the accession used commercially are of "local" origin, although most of them originated from outside Kenya in the distant past. The major external sources are: CIMMYT (maize and wheat), IRRI (rice), ICRISAT (sorghum and millet), IITA (cassava), CIP (Irish potatoes), JICA (nuts) and CIAT (grain legumes).

Approximately 1,100 plant species are maintained by the National Genebank of Kenya. Of these, some 400 are of micro-commercial type (home garden), 100 are macro-commercial and 600 species are, so far, never used in in-country projects on a commercial basis. A potential for break through in future research/commercial endeavors.

Both material from within and outside the country held at the Genebank are mainly used in crop improvement research. The consumers include plant breeders and other scientists from relevant disciplines namely agronomists, pathologists, entomologists, etc. Table 1.1 gives a list of materials commonly utilized.

Table 1 Listed are some of the PGR materials commonly utilized in agricultural research

Genus	No. of times requested	Access. (%)
Sorghum	9	60
Stylosantehs	5	60
Macroptilium	8	50
Cucurbit	8	72
Phaseolus	8	65
Centrosema	7	50
Zea	7	80
Mucuna	7	70
Panicum	6	45
Triticum	6	75
Eleusine	5	55

The recipient organizations are:
Kenya Agricultural Research Institute
National Universities
International Council for Research in Agroforestry (ICRAF)
Russian Embassy
Bangladesh
Ben Gurion University
UNESCO
B.A.T. (British American Tobacco) and
Laikipia Research Project

4.2 IMPROVING PGR UTILIZATION

Characterization and multiplication/regeneration is done in collaboration with plant breeders and other research scientists. This enhances utilization of the material in the sense that in the process, the scientists familiarize themselves with the available material.

In the pipeline is the formation of crop groups. Once established, these will assist in identifying gaps, if any, that exist. They will then be addressed accordingly. The main constraints are funds for maintaining the functioning of such working groups; and other fora, where knowledge on plant genetic resources utilization can be exchanged.

To-date, (Kenya) farmers obtain most cereal crop cultivars through the research systems (KARI) and seed production systems, as well as the species farmers

keep traditionally, but in future community based seed banks are expected to complement the current source of genetic resources which farmers use.

4.3 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

The main functions of Kenya's national plant breeding programmes are to:

1. evaluate exotic germplasm for adaptation to the local conditions and needs;
2. improve the adapted germplasm accessions for high food, feed and fibre yield and quality; and
3. introduce desirable agronomic characteristics into high yielding cultivars to stabilize yield.

The ultimate objectives of our plant breeding programmes are to:-

1. widen the genetic base of crops and thereby reduce vulnerability to biotic stresses;
2. increase crop production vertically and horizontally;
3. diversify production systems in order to spread crop production risks; and
4. address consumer demands, such as palatability and grain milling quality of cereal crops.

The national plant breeding activities are primarily focussed on three goals:

- Achieving internal self sufficiency in food and fibre production.
- Maintaining adequate levels of strategic cereal food reserves.
- Increasing export opportunities of industrial crops such as tea, coffee and pyrethrum and whenever possible, food crops such as maize.

The amount and quality of scientific research currently undertaken by KARI is adequate to meet national needs for most major crops, at least in terms of conventional breeding and adaptive research. However, such crop protection areas such as pathology, virology, entomology and nematology need strengthening. Also, packaging of new technology packages which are agronomically acceptable by farmers need polishing. The major constraint to effective research in Kenya today is the inadequate and unsustainable funding opportunities. Adequate funding of research programmes from both internal and external sources and ensuring smooth financial flow would overcome the

problem. Plant breeding activities are currently supported by the government and donors as well as by local and foreign private companies. The products of crop improvement are made available to farmers easily through seed stockists and research centres making available propagules other than seed.

Varieties developed through national effort are valuable to all categories of farmers in the order: commercial farmers (hybrids), semi-commercial farmers (composites) and subsistence farmers (landraces and advanced generations of improved varieties). Farmers are involved in plant breeding activities through representations in centre research advisory committee (CRAC) meetings and maize seed allocation panels and in variety evaluation as active participants in off-station and on-farm research trials. Improved varieties of crop plants are available to all types of farmers as long as the variety fits the ecological niche where the farmer lives. The main constraint to better seed production is genetic quality control aggravated by isolation and some man-made problems which adversely affect the distribution of quality seed.

4.4 USE OF FOREST GENETIC RESOURCES

KFSC supplies approximately 30-40 per cent of the regeneration material for tree establishment. One seed collection by farmers in community based organization with NGO input and by the Forest Department particularly for indigenous species accounts for a large proportion of germplasm regenerated. The Forest Department also supplies seedlings to farmers through their nurseries.

Table 2 Some commonly used tree species Indigenous Exotic

Indigenous	Exotic
Markhamia lutea	*Pinus patula*
Prodocarpus latifolia	*Eucalyptus spp*
Prunus africana	*Azadirachta indica*
Maesopsis eminii	*Graveillea robtista*
Sesbania sesban	*Calliandra calothrsus*
Cordia abyssinica	*Dovyalis caffra*
Croton megalocarpus	*Terminalis mentalis*
Croton macrostachys	*Cassia siamea*
Olea africana	*Cassia spectabilis*
Olea welwitschii	

Clients include mostly the Forest Department and also other Government Institutions (Ministry of Agriculture/Kenya Posts and Telecommunications, Education and Research Institutions, Kenya Power and Lighting Company etc.), NGOs (VI project in Kitale, Plan International, Bellerive Foundation etc.), private firms (GTZ rescue, Brooke Bond, KNFU, Oserian Flower Company etc.) and farmers.

Seed supply from the KFSC headquarters is upon request from the users. Most seeds planted by the government is supplied through the Ministry of Environment. Farmers and private persons can obtain the seeds directly from KFSC although some germplasm is being supplied through stockists. The latter method is at a trial stage. Further, seeds and seedlings are obtained by farmers through other related ministries and NGOS.

Various categories for seed production have been established over the years. Most of the seed is obtained from natural forest areas that have been designated as seed sources after rating them according to the selection criteria for the species and use. Such categorizing established for other purposes have also been designated as seed sources if they meet required criteria. In addition, seed stands and seed orchards have been established specifically for seed production. However, seed orchards have been established only for exotic species but not for indigenous species mainly due to lack of funds and also emphasis on exotic species. Furthermore, seed production is largely user driven and KFSC strives to meet targets as demanded by users.

4.4.1 Tree Improvement and Seed Supply

The main function of the national tree improvement programme has been to breed for specific characteristics such as fast growth, disease and pest resistance and drought tolerance. In the past these programmes have been biased towards exotic species but future tree improvement programmes will address both exotic and indigenous species.

The ultimate objective of the tree breeding programme is to increase productivity per unit area. This will result in increasing export opportunities, broadening the genetic base of both indigenous and exotic species and in so doing reduce crop vulnerability to catastrophes such as diseases and pests. The programme also strives to diversify in terms of the number of species used for various purposes in order to provide alternatives in cases of catastrophes and also from the conservation point of view. The amount and quality of scientific tree breeding in the country is below the national needs and goals, this has been due to inadequate funds. These activities have in the past been funded by the government.

The products of the tree improvement efforts have been made available to farmers through distribution of seed by the KFSC which works closely with the tree improvement programme. Such material has been valuable to all types of farmers.

The improved material is not, yet available to all farmers mainly due to lack of awareness or due to the unavailability of material. This could be overcome through strengthening of the forestry extension services, improvement of infrastructure, seed technology, collection, production and storage facilities.

4.4.2 Improving FGR Utilization

The main achievements of FGR activities is the creation of awareness on the importance and value of indigenous tree species and the availability of improved material; the establishment of the National Tree Seed Centre which had developed originally unknown technologies of seed harvesting, processing, storage and utilization; redrafting of the forestry policy in line with the current needs; establishment of a national programme on conservation of FGR; and fulfillment of the agreed obligations under the international environmental and other forest related conventions.

Traditional plant production has also been increased due to agroforestry development and the participation of people in the sustainable management of forest resources. Furthermore, the socio-economic status of the people has been improved.

These conservation activities are poorly related to improvement, breeding, seed production and utilization of forest genetic resources, due to lack of institutional coordination, finance and technical barriers.

In Kenya, the greatest value of FGR is the sustainability of genetic diversity for the common good of mankind and for future generation. It is for this reason that these resources will be potentially more valuable and profitable in the long term.

In the short term, these resources could be made more profitable by documentation of data from inventories, ecological and genetic studies, seed collections etc.; better coordination among international agencies and among national institutions related to FGR; and participation of people in decisions concerning the sustainable management of FGR. These, activities could be made possible through financial assistance and training.

4.5 BENEFITS DERIVED FROM THE USE OF FGR

The country is deriving clear benefits from its indigenous FGR. The main direct benefit are the wood forest based products, non-wood forest products, foreign exchange and improvement of socio-economic status of the people while the main indirect benefits includes the ecological services (nationally, regionally and globally). There is also sale of seeds and exchange of improved material with other overseas institutions. Collaboration with other partners in research at all levels is also practiced.

4.5.1 Improving PGR Utilization

The funds are required to mount local and external PGR collection missions. Adequate funding of focused research programmes should in future serve to improve the utilization of PGR material directly or indirectly by supporting biotechnology in novel techniques, e.g.

a. Using RFLPs (restriction fragment length polymorphism) for mapping genomes of all important plant species and determining genetic distances between accessions of a given plant species;

b. Using cell and tissue culture methods for rapid multiplication of propagules and to incorporate resistance to abiotic stresses such as metal toxicity; and

c. Using MAS (Marker Assisted Selection) and QTL's (quantitative trait loci) identification to facilitate selection on PGR's.

To ensure that the ultimate objective of our national PGR conservation effort is tangible in terms of utilization of the resources, adequate funds are required for rejuvenation of germplasm at the central storage point and of the active collection at the points of utilization in a well organized way, taking cognizance of species longevity in storage and random genetic drift based on sampling size and allelic frequencies in the base population. Efficient cold storage facilities, or efficient maintenance of the available facilities, are required to circumvent the need for too frequent rejuvenation. Donor, local, private and public funding and careful planning would meet the objective, with the terms that the local funding sources take up the ultimate responsibility of PGR conservation.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

5.1 National Goals of the PGR

1. Rehabilitation of conservation activities for active collection in the commodity research centres.
2. Standardization of the methods of documentation of the PGR.
3. Establishment of the central genebank facility.
4. Collection of the PGR from the field, commodity research centres, national and international institutions for the central genebank.
5. Regeneration, evaluation and characterization of the PGR.
6. Conserve and enhance utilization of PGR.

5.2 National Programmes

There is a national plant genetic resources programme that operates sectorally. Efforts to manage these programmes closely have been put into place but are yet to be implemented.

Presently, there are a series of different elements formally or informally sponsored by various governmental organizations, NGOs, commercial firms, some farmers and international agencies. Although the different elements cover conservation issues and the use of PGR, the efforts are piecemeal, uncoordinated and therefore results in duplication of efforts, fragmented information, incomplete assessment and less impact.

The main objectives of the government in maintaining a national PGR programme are:

1. To promote the preservation of genetic resources and biological diversity in ecosystems and to preserve their cultural values.

2. To achieve sustainable utilization of resources and ecosystems for the benefit of the present generation, while ensuring their potential to meet the needs of future generations.
3. To ensure that development policies, programmes and projects do take environmental consideration into account from the onset.
4. To initiate and sustain well coordinated programmes of environmental education and training at all levels of the society.

The Ministry of Environment and Natural Resources through the National Environment Secretariat (NES) formed in 1974 has the overall duty of enhancing resource management countrywide.

The National Environment Secretariat in 1981, formed the Interministerial Committee on Environment (IMCE) composed of government ministries and departments to provide a national forum to discuss and formulate policy ideas on environment.

Due to the importance of plant genetic resources (PGR), a national committee on PGR was formed in 1987 with various institutional responsibilities designated as follows:

1. The National Museums of Kenya chairs the committee and also takes the responsibility of in situ conservation in collaboration with other institutions.
2. Ex situ conservation of PGR was given to the National Genebank of Kenya which is the secretary.
3. Conservation of Forest Genetic Resources was given to Kenya Forestry Research Institute (KEFRI).

The national committee also included University of Nairobi (UoN), Department of Survey and Remote Sensing (DSRS), National Council for Science and Technology (NCST), Kenya Energy and Environment Organizations, KARI, MALDM, and MENR to coordinate the conservation of PGR in Kenya.

In addition to the national committee on PGR, protection is also provided by national legislation, national decrees and by international legislation made by governments. The most important decree made in late 1980's required that 90% of trees raised in nurseries be of indigenous species.

The annual programme and budget for PGR is approved by the Treasury and has a budget line. However, PGR like other programmes that relies solely on

treasury does not have a secure level of funding as there are consistent budget cuts and ceilings which lead to non sustainability of funds and uncertainty.

5.3 TRAINING AND CAPACITY BUILDING

The national programme is not adequately staffed with trained personnel. There is a need to expand training programmes and establish professional standards needed for PGR management and conservation. Skilled professional manpower is necessary in strengthening institutional capabilities of our agencies.

The skills available in the national programme include statistical sampling, seed science, agronomic evaluation, taxonomy, data management, plant and tree breeding, social and anthropological techniques, germplasm, etc. The Gene Bank of Kenya also has personnel trained in plant genetic resources management.

Training is offered in all these skills and the national institutes that offer them include Moi, Kenyatta, Egerton and Nairobi Universities, Kenya Forestry Research Institute, National Museums of Kenya, National Genebank, Department of Remote Sensing and Rangeland, Kenya Agricultural Research Institute, and some NGOs. These courses could be offered nationally, and regionally at all levels. There is enough demand for viability of such courses, but international input in terms of funds would be needed to get such courses started.

The farmers who are the ultimate users of PGR are trained through the extension system methods like individual farm visits, demonstrations, field days and short courses in farmer training centres.

The training in the country involves both men and women but because of the past social trend men outnumber women particularly at the managerial level. All ethnic groups in the country have equal opportunity to benefit fully from the investment in staff training in these programmes.

Staff turnover is usually too rapid to allow these programmes to benefit fully from the investment in staff training, due to inadequate conducive working environment and opportunities. This problem can be addressed through motivation of staff.

Training and capacity building will require participatory strategy involving government, NGOs, local communities, private sector and international community at all levels.

5.4 NATIONAL LEGISLATION

Efforts are underway to prepare a comprehensive and coherent national policy and legislation on environmental management and protection to guide all concerned in a holistic way about proper management of the environment. Existing policies are fragmented and sectoral.

Kenya's environment policy aims at integrating various facets of environment into the national development plan. Existing legislation on environmental management is being reviewed. Laws on environmental conservation whose implementation have often been conflicting, are therefore expected to be harmonized.

Summary of the Existing Laws and Regulations for Protecting the Environment
Currently there are legal provisions focused on the protection of genetic resources.

5.4.1 Protection of Forest Resources

Tree germplasm has been under the control of the Seeds and Plant Varieties Act (Cap. 326). This Act was inadequate as it is primarily for agricultural seed. The tree seeds and plant varieties (tree seed) regulations were therefore drafted in 1993 specifically for forest germplasm and should be in effect soon.

Access to Kenya's FGR has been fairly liberal, resulting in various national and international organizations accessing the resources and depositing them in gene banks abroad. The draft regulations address the issues of the tree germplasm, production, quality and import and export and stress the need to have more stringent quarantine controls than those that are already in existence.

The main objectives of the law is to have stability, and protect the users, producers and dealers in tree germplasm.There are also gaps in the Legal Framework regarding indigenous knowledge as it is regarded as a product of nature and also the rights for material found in the wild or being cultivated on a limited scale by the Local Communities. UNESCO and WIPO are addressing such issues.

5.4.2 Plant Protection

Plant protection law is provided by the Plant Protection Act (Cap. 324), Seed and Plant Varieties Act (Cap. 326), Grass Fires Act (Cap). 327) and Suppression of Noxious Weeds Act (Cap. 325). The concern of the Plant Protection Act is to provide for the prevention of the introduction and widespread of diseases destructive to plants (which includes every member of the vegetable Kingdom).

The Act plays a dual role of providing for the protection of both specific plant species and their habitats. The introduction of exotic species and their quarantine is also a concern of this Act. Thus introduction of plants which are likely to spread diseases or pests is prohibited and penalties are prescribed for offenders.

The Seed and Plant Varieties Act is concerned with the production and marketing of seeds.

5.4.3 Wildlife Species

The national wildlife legislation for Kenya, which is mainly found under the Wildlife (Conservation and Management) Act (Cap. 376) of the laws of Kenya, does not specifically make provisions regulating trade in world plants and this is a lacuna which will be addressed through the ongoing legal review.

In as far the issues raised under the guidelines relate to indigenous wild plants that fall under the classification of wildlife, the regulating mechanism for international trade is through CITES (Convention of International Trade in Endangered Species of Wild Flora and Fauna).

Kenya is a signatory to the convention and all permits for export or international trade in the species covered under the convention should be subject to permits issued by Kenya Wildlife Service (KWS) in accordance with the rules and regulations of the convention. KWS is the management and scientific authority for Kenya in as far as CITES is concerned. Arrangements to incorporate CITES rules and regulations into our national legislation as appropriate are underway through the ongoing study for review of Kenya's wildlife laws (which is being done by KWS).

5.5 INTELLECTUAL PROPERTY RIGHTS (IPR)

Kenya has IPR legislation. The Intellectual Property Rights are administered by:-

a. Kenya Industrial Property Officer (KIPO). KIPO administers industrial property rights that include patents, industrial designs, utility model, technovations and technology transfers. These are protected under the Industrial Property Act (Cap. 509). Trademarks and service marks are protected under the Trade Marks Act (Cap. 506).

b. The Attorney-General Chambers administering copyrights under the Copyright Act (Cap. 130).

KIPO protects parts of products of biotechnological processes in form of inventions. The Industrial Property Act (Cap. 509) has a provision for protection of genetic resources or improvement thereof which involve inventions. Such inventions could be in the field of biotechnology and may involve microbiological processes or products from such processes.

Plans to repeal our Industrial Property Act in order to include the compulsory clauses of the negotiation are underway. The effects of IPR legislation on our genetic resources programme is receiving attention and interest from researchers and those working in intellectual property offices in Kenya.

KIPO being a young institution established in 1989 and the relevant act (Industrial Property Act) having been in existence since 1989 only, it is too early to have come across many specific cases of instances to show possible effects of IPR legislation which had not been anticipated. But with time there may be such cases.

As a member of FAO undertaking on PGR, Kenya subscribes to the principle of free exchange of genetic material but there is a standing technical committee which advises the Director of Agriculture on the importation of PGR. The committee has mandate to vet certain materials. Authority to collect germplasm in Kenya can only be given by the Office of the President through consultation with relevant institutions.

Currently, there is a great need of assistance on legal matters concerning PGR. This is by training and attachments of patent examiners and legal officers in KIPO to well established patent offices in Europe, USA arid Japan to gain practical knowledge in handling inventions relating to genetic resources. FAO can also assist in funding joint seminars or workshops with KIPO on themes relating to protection of genetic resources.

5.6 OTHER POLICIES

The government's policy as laid out in the Sessional Paper No. 2 of 1994 on National Food Policy is to increase food production. The previous policy on subsidies when it existed tended to promote the use of the improved varieties at the expense of traditional varieties of crops.

The government has now liberalized the pricing and marketing of food crops hence farmers can grow what is most profitable. The main aim of the policy on seed is to ensure adequate supplies of high quality seeds of improved varieties of a wide range of crops.

However, this policy may also have a negative impact on conservation of PGR due to neglect of traditional varieties.

Improved varieties are bred at the research centres. The basic seed is then given to seed companies for multiplication. Farmers are contracted by seed companies to multiply the seeds. These farmers are provided with seeds by seed companies while the farmers provide all other inputs. One of the major incentives given to these seed farmers is that they are assured of a market for the seed at higher price than the commercial crop.

There are no incentives for the production and marketing of improved varieties in forestry. This has a negative influence on the farmers especially from the fact that trees have a longer life cycle than crops. Although the farmers realize the importance of trees, they would take option of crop production as it would earn them revenue faster.

The national PGR programmes staff and experts have not been fully involved in the planning of major development projects. This trend is now changing and such involvement is increasing.

Previously most of the projects were normally not appraised, monitored and/or evaluated for their impact on the conservation and utilization of FGR. Consequently, the objectives of the projects were not realized.

5.7 TRADE, COMMERCIAL AND OTHER INTERNATIONAL AGREEMENTS

Policies on both local and foreign trade in PGR are regulated, monitored and implemented by relevant ministerial legal notices, parliamentary enactment (laws), bilateral, regional and multilateral organizational agreements and memoranda of cooperation.

Trade policy in plant genetic resources or products have been largely formulated and implemented by relevant ministries and parastatal bodies. The Ministry of Commerce and Industry has control through the Acts administered by it.

5.8 THE IMPACT OF TRADE POLICIES ON PGR

Trade policies implemented by various national institutions have generally had a positive impact on PGR development in the country.

Imposition of import and/or export bans have been instituted whenever food security, national health and/or environment are threatened.

Although importation and exportation have been liberalized, the requirements of licensing and permits are still in place for some items on health, environment and security grounds.

CHAPTER 6
International Collaboration

Kenya became a signatory of the convention on biological diversity at the time of the United Nations Conference on Environment and Development on 11th June 1992.

Kenya ratified the convention on biodiversity on the 26th July, 1994 and participated in the First Conference of the Parties to the Biodiversity that took place in Nassau, Bahamas on 28th November to 9th December 1994.

Provisions stipulating specific commitments towards achieving these goals are covered in 42 legally binding articles spanning a broad range of areas. Such as measures for conservation and sustainable use of biodiversity, financing arrangements, access to genetic resources, transfer of technologies derived from these resources and biosafety related to genetically modified organisms.

Agenda 21 articulates the institutional development and capacity building for effective biodiversity management. It also stresses the importance of institutional coordination within the framework for the convention on biological diversity.

Kenya has several Global Environment Facility (GEF) projects relevant to biodiversity.

These include:

a. Support for conservation and local communities on the Tana River.

b. Plus several small projects from the GEF small grants facility. The regional GEF projects include:

1. Environmental Management of Lake Victoria, involving Kenya, Uganda and Tanzania.
2. East African Regional Biodiversity Project on “Institutional Support for the Protection of East African Biodiversity” funded by UNDP and executed by FAO, the project started in October 1992 and expects to finish in late 1996.

A major goal of the project is integrated activity between institutions at both national and regional levels. While most activities are national in nature, the merits of developing and maintaining strong regional ties, through some integration of training and research activity, have been recognized.

There is also the Kenya National Environment Action Plan (NEAP) which addresses the issues and recommendations on biodiversity.

In Kenya, environment and biodiversity concerns and capabilities have been located at the district administration level. This brings environmental capabilities closer to the implementation level. It allows environmental planning to take place close to where local knowledge is available.

6.1 FAO GLOBAL SYSTEM

Kenya is a member of the FAO commission and it is also a signatory of the FAO undertaking on plant genetic resources. Therefore Kenya has formal collaboration with FAO Global Systems. Kenya's institutions that deal with plant genetic resources work very closely with the International Plant Genetic Resources Institute (IPGRI) whose sub-Saharan office is based in Nairobi.

Kenya is also a member of international plant protection convention under FAO.

6.2 AGRICULTURAL RESEARCH CENTRES

6.2.1 The Consultative Group on International Agricultural Research (CGIAR)

Centre	Area of Collaboration
IPGRI	Funding of multiplication and characterization activities
	Short and long term courses
	Development of international linkages
	Provision of publications
	Provision of technical and scientific advisory services
ILRI	Short term training
	Germplasm exchange
	Germplasm collection and characterization

Centre	Area of Collaboration
ICRISAT	Germplasm evaluation and characterization Germplasm exchange Technical personnel exchange visits
ICRAF	Germplasm collection Provision of publications Agroforestry research
IITA	Short term training Germplasm exchange
ICARDA	Germplasm exchange Short term training
CIMMYT	Short term training Germplasm exchange Provision of publications
CIP	Short term training Germplasm exchange Provision of publications
IRRI	Short term training Germplasm exchange Provision of publications
CIAT	Short term training Germplasm exchange Provision of publications
ISNAR	Organization of national agricultural centres

The support received from CGIAR centres has come from centre staff based in the country and elsewhere.

The assistance required from CGIAR centres is not always adequate. Areas in which their continued financial and technical assistance is particularly imperative include: training, germplasm collection, evaluation, characterization and documentation. CGIAR centres should conduct workshops and conferences where progress being made in conservation of plant genetic resources could be discussed and knowledge exchanged.

The mode of communication is through visits, consultations and correspondences. The existing mechanisms are inadequate and more efficient networking system is required. Use of fax machines and networking the computer systems is necessary.

In the next decade, IPGRI has the task of establishing more efficient coordination mechanisms among the global genebanks. Establishment of standardized germplasm documentation system is necessary to enhance efficient exchange of information. IPGRI should assist in establishing and strengthening national programmes to work towards curbing the high rate of loss of genetic resources.

6.2.2 Regional Research Centres

Kenya has no formal relationship with Regional Research Centres but participates in several African research networks, these include Agro-forestry Research Network for Africa (AFRENA), which is coordinated by ICRAF; the East African Root Crops Research Network (EARRNET) which is coordinated by IITA; the Regional Potato and Sweet Potato Improvement Programme for Central and Eastern Africa (PRAPACE) which is coordinated by ICRISAT; AFNETA which is coordinated by ILRI; in spite of the existence of these networks the full benefits have not been realized and there is need to strengthen them for the benefit of the National Agricultural Research Systems.

6.3 REGIONAL INTER-GOVERNMENTAL INITIATIVES

The only inter-governmental initiatives that Kenya is participating in is IGADD however, other inter-governmental initiatives which are at different stages of formation include ASERECA, AMCE and SPAAR.

However, IGADD has not been active due to heterogeneity of the member countries and the political and social turmoil that have afflicted the different countries.

6.4 BILATERAL INTER-GOVERNMENTAL INITIATIVES

Kenya has got bilateral agreements with the following countries in support of the various components of plant genetic resources; the Federal Republic of Germany, Britain, Sweden, Canada, Japan, Finland, United States of America and the Netherlands.

On forestry genetic resources work, there are plans to initiate a forestry research network in sub-Saharan Africa with the assistance from FAO. There is also interest to involve CIFOR in forest research programmes in Eastern Africa.

6.5 INTERNATIONAL TRADE

The international conventions and agreements that regulate bilateral, regional and multilateral trade in plant genetic resources and which form part of Kenya's trade policy are:-

1. Bilateral trade agreements

2. Regional trade cooperation
   - EU-ACP Lome Convention
   - United Nations Conference on Trade and Development (UNCTAD)
   - Common Nlarket for Eastern and Southern Africa COMESA (Former PTA)
   - World Trade Organization (formerly GATT)

3. International Organizations that affect Kenya trade policy on PGR
   - International Sugar Organization
   - Inter-governmental Group on Tea Organization
   - International Tropical Timber Organization
   - International Group on Bananas
   - Inter-governmental Group on Oil Seeds, Fats and Oils
   - Inter-governmental Group on Rice

CHAPTER 7
National Needs and Opportunities

7.1 URGENT NEEDS

- Training of patent examiners and legal officers in the Kenya Industrial Property Office in order to handle inventions relating to plant genetic resources.
- Fund the genebank and collaborating centres adequately in order to maintain its capacity to undertake mandated activities.
- Development of comprehensive legal provisions focussed on protection of plant genetic resources.
- Conduct emergency collection missions in the arid and semi-arid regions of the country where genetic erosion is occurring at an alarming rate. Influx of refugees along with their livestock to these areas has a devastating effect on the continued existence of plant genetic resources.
- Systematic collection and documentation of germplasm of wild species, relatives of crop plants and races.
- Systematic documentation of indigenous knowledge on conservation and use on plant genetic resources by supporting communities to document it.
- Train the customs officers in identification and trafficking methods of plant genetic material.
- Rehabilitate, expand existing field gene banks and establish new field genebanks.
- Determine socio-economic issues affecting sustainable management of FGR.
- Undertake genetic and ecological studies on FGR for endangered species.

7.2 NEEDS

- Coordination of programmes and projects on conservation of plant genetic resources.
- Provision of adequate budgetary allocations for plant genetic resources programmes.
- Conduct inter and intra specific diversity, assessment studies.
- Training, both long-term and short-term in such specialized areas as germplasm health, documentation, taxonomy and biotechnology.
- Protection of the habitats with high genetic diversity.
- Rehabilitation of areas where desertification is approaching e.g. afforestation programmes.
- Propagation and conservation of endangered species.
- Undertake more research in conservation and development of natural forests and indigenous tree species.
- Creation of awareness and involvement of local communities in decision making at the planning and implementation of projects and programmes in plant genetic resources.
- Establish in vitro conservation facilities to enable conservation of plant species that cannot be conserved as seed. Examples include *Musa* spp, *Ipomoea* spp, *Manihot* spp, *Chrysanthemum* spp, *Dioscorea* spp, *Anacardium* spp.
- Undertake a characterization and evaluation of our national collection to enhance utilization of the materials.
- Provision of conservation and documentation facilities and equipment e.g. the drying units, expansion of seed handling and storage capacity.
- Further promote the duplication of the base collection and germplasm elsewhere.
- Establish networking and information exchange on various programmes and projects on plant genetic resources.
- Document socio-culturally conserved forests and the plant species contained therein.

- Collaboration, cooperation and coordination nationally and internationally on germplasm evaluation and availability of the information for genebank documentation. For example strengthening of the national coordination committee on PGR, and crop networks.
- Establish community on farm conservation.
- Maintain genetic purity of PGR so that we can avail high quality seed to the farmers.
- Avail improved material to farmers through strengthening of forestry extension services, improvement of infrastructure, seed production and storage.
- Establish an organized system for the production and marketing of trees and tree products.
- Create awareness nationally of intellectual property rights of Kenyans.
- Develop a clear national policy for controlling the transfer of PGR.
- Document work by non-governmental organizations in plant genetic resources conservation activities.

7.3 OPPORTUNITIES

- There exist huge potential to practice extractive conservation of wild plant species by utilization of their fruits or flowers into products with commercial potential hence provide incentives for conservation of these wild plants *in situ*.
- There are indigenous knowledge systems in our communities which the government should help the communities to document and if possible patent for the benefit of those communities.

CHAPTER 8
Global Plan of Action

- Set up a protocol on biosafety under the biodiversity convention.
- Establish a comprehensive database on soils, climate, topography, geology, and biodiversity to monitor status and trends of genes, species and ecosystems and to predict the impact of future changes.
- Involve the International Customs Union in controlling the transfer and flow of PGR.
- Set up an international fund on PGR activities.
- Equitable sharing of benefits arising from utilization of PGR.
- Development of comprehensive legal provisions focussed on protection of plant genetic resources.
- Conduct emergency collection missions in the arid and semi-arid regions of the world where genetic erosion is occurring at an alarming rate. Influx of refugees along with their livestock to these areas has a devastating effect on the continued existence of plant genetic resources.
- Systematic collection and documentation of indigenous knowledge on conservation and use on plant genetic resources by supporting communities to document it.
- Initiate, rehabilitate and expand existing field genebanks and establish new field genebanks.

APPENDIX I

Important Species, their Uses and their Status

Botanical Name	Common Name	Common Usage	Status
Afzelia Quancensis	Mbambakofi (Kiswa)	Carving/floor/furn,	Threatened
Albizia fummifera	Mukurwe (Kik)	Timber/veneer	Threatened
Aningeria altisa	Mukungu (Kiluya)	Timber/plywood	Good
Antiaris toxicaria	Mulundu (Kiluya)	Timber/furniture	Good
Avicenia marina	Mich/mangrove (Kiswa)	Timber/poles	Restricted
Bosquiea phoberos	Mbarakaya (Kiswa)	Veneer/furniture	Restricted
Brachylaena hutchinisi	Muhuya (Kik) Muhugu(Kiswa)	Carving/floor	Threatened
Brachystgia speciformis	Mriti/Mrithi (Kiswa)	Timber	Threatened
Bruguiera gymnorhiza	Mvuli (Mangrove)(Kiswa)	Carving/timber	Good
Melicia excelsa	Mvuli (common)	Furniture/floor	Restricted
Chrysophyllum albida	Mululu (Kiluya)	Timber/plywood	Threatened
Combretum schumanii	Mungurure	Carving/floor	Threatened
Cordia spp.	Muringa; Mkomari Mngoma (Kik, Kiluya)	Furniture	Good/restricted
Croton macrostacys	Mutundu (Kik)	Const, timber/plywood	Restricted
Croton megalocarpus	Mukinduri (Kik) Msine (Kiluya)	Const, timber/plywood	Good
Dalbergia melanoxylon	Mpingo (Kis), Ebony (English)	Carving/Mus. Inst.	Threatened
Dombeya goetzenni	Mukeu (k)	Joinery	Threatened
Euphorbia spp.	Euphorbia	Plywood	N/A
Fagara macrophylla	Shikhuma (Kiluya)	Furniture	Restricted
Fiscus spp. Euphorbia	Satinwood	Plywood	Threatened
Funtumia africana	Mutundo (Kak)	Timber/plywood	Threatened
Hagenia abyssinica	Rosewood	Joinery furn/floor	
Juniperus procera	Cedar	Joinery furn/floor	Restricted
Maesopsis eminii	Mutere (Ki) Msisi	Joinery furn/floor	Restricted
Manilkara butugi	Kydilani (Kak)	Timber/furniture	Good
Manilkara zanzibarensis	Ngambo (Kis)	Boats/furn/joinery	Threatened
Manilkara buchanani	Mukli (kimeru)	Timber/furniture	Threatened
Newtonia paucijuga	Mkanauni	Timber	Threatened
Ocotea usambaraensis	Campor (English) Muthati (kik)	Joinery/furniture	Restricted
Olea africana	Mutamaiyu (Kik)	Flooring/carving	Threatened

Botanical Name	Common Name	Common Usage	Status
Olea hochstetteri	Macharage (kik)	Flooring/carving/furn	Threatened
Olea welwitschii	Elgon Olive (Eng) Loliodo (Kiluya)	Flooring/carving/furn	Threatened
Podocarpus spp	Podo	Timber/furniture	Threatened
Polyscias kikuyuensis	Mutati (Kik)	Plywood	Restricted/vulnerable
Prunus africana	Muiri (ki)	Lorries/bridge/floor	Endangered
Trachylobium verruscosum	Mtandarusi	Boats/furn/timber	Good
Trichilia roka	Muyama (kak)	Furniture/veneer	Good
Vetex keniensis	Meru oak (Eng Muhuru (kik)	Furniture/veneer	Threatened
Erythrophleum quineense	Mkelele		Restricted/Threatened
Terminalia catappa	Mkungu		Restricted/Threatened
Populus ilicifolia			Restricted/Threatened

APPENDIX II

Some of the Crop Plant Genetic Resources that still occur:

Forage grasses	*Chloris spp* *Eragrostis spp* *Panicum spp*	*Digitaria spp* *Hyperrhenia spp* *Pennisetum spp*	*Echnochloa spp* *Lolium spp* *Cenchrus spp*
Forage legumes	*Centrosema spp* *Desmodium spp* *Neonotonia spp* *Vigna spp*	*Clitoria spp* *Lathyrus spp* *Stylosanthes spp*	*Crotalaria spp* *Macroptilium spp* *Trifolium spp*
Browse plants	*Acacia spp* *Sesbania spp*	*Cassia spp*	*Crotalaria spp*
Cereals	*Eleusine spp*	*Sorghum spp*	
Pulses	*Vigna spp*		
Oil crops	*Racinus cummunii*	*Vernonia galamensis*	
Vegetables	*Amaranthus spp* *Solanum spp*	*Gynandropsis spp*	*Citrullus spp*
Fruits	*Adansonia digitata*	*Cordia sinensis*	*Carissa edulis*

Amaranthus graecizans L.
Carrisa edulis (forsk) Vahl
Vangueria infausta Burch. *ssp*. infausta
Azanza garkeana F.Hoffm Exell & Hillcoat

Other indigenous PGR (ornamentals) in *ex situ* cultivation are:

Saintpaulia rupicola - B.L. Burtt.
Ansellia africana - Lindl.

Ornamentals/Endemics

1. *Saintpaulia teitensis.*
2. *Encepharlatos kisambo* (CITES II).
3. *Encepharlatos tegulaneuos* (CITES II).
4. *Euphorbia wkefieldii* (IUCN red data book).
5. *Croton alienus.*
6. *Synadenium compacteum.*

Coffee

1. *Coffee fadenii.*
2. *Psychotria crassopetala.*
3. *Psychotria petitii.*

Regional endemics

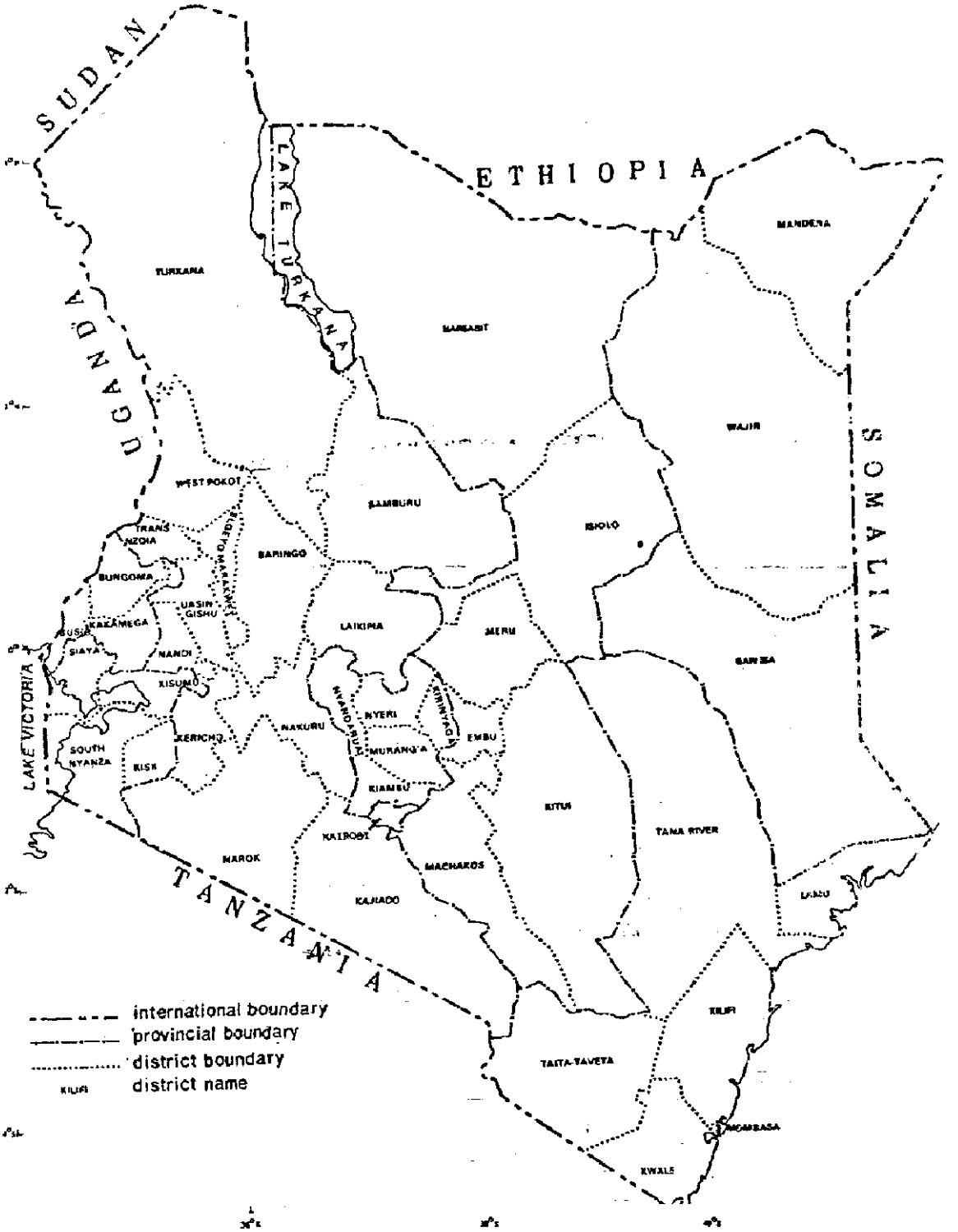
1. *Balances wilsoniana.*
2. *Gigasiphon macrosiphon.*

Medicinal plants

1. *Aloe secundiflora.*
2.. *Asparagus sp.*
3. *Vernonia sp.*
4. *Ozoroa insignis.*
5. *Ethulia scheffleri.*

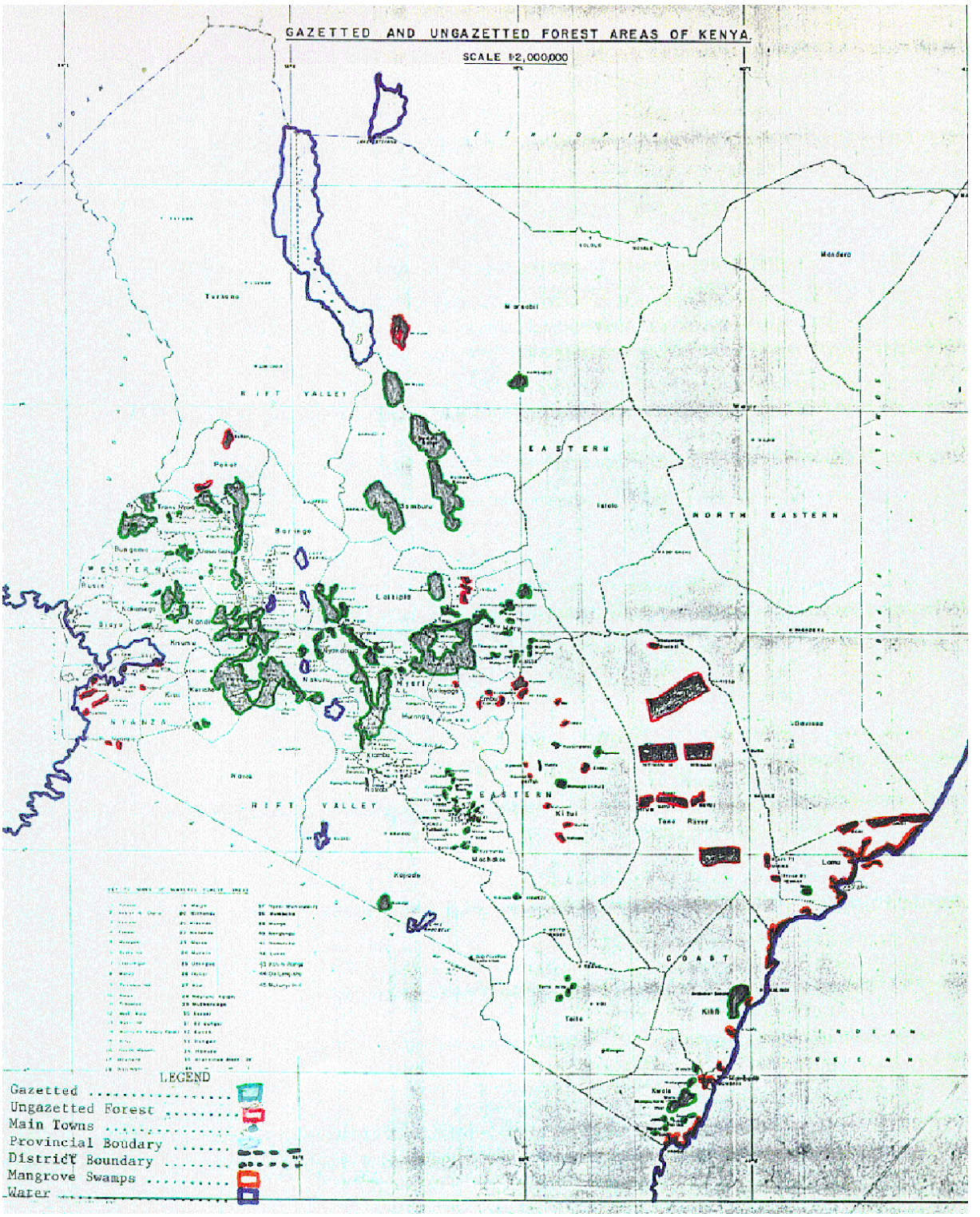
APPENDIX III

ADMINISTRATIVE MAP OF KENYA, D.NO. 94008



APPENDIX IV

GAZETTED AND UNGAZETTED FOREST AREAS OF KENYA



Abbreviations

ADB	Africa Development Bank
AFRENA	Agro-forestry Research Network of Africa
ASAL	Arid and Semi Arid Lands
BRAHAMS	Botanical Research and Herbarium Management System
BAT	British American Tobacco
CGIAR	Consultative Group on International Agricultural Research
CFCU	Coast Forest Conservation Unit
COMESA	Common Market for Eastern and Southern Africa
COMIFOR	Indigenous Forest Conservation and Management Project
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Centre for Maize and Wheat ImprovementCIP International Potato Centre
CITES	Convention of International Trade in Endangered Species
DANIDA	Danish International Development Agency
DRSRS	Department of Remote Sensing and Resource Survey
EARRNET	East Africa Root Crops Research Network
FAO	Food and Agriculture Organization
FINIDA	Finish International Development Agency
FGR	Forest Genetic Resources
FD	Forest Department
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GTZ	German Development Agency
GOK	Government of Kenya
IPR	Intellectual Property Rights

ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Centre for Research in Semi-Arid Tropics
IGGAD	Inter Governmental Authority on Drought and Development
IMCE	International Committee on Environment
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
IPGRI	International Plant Genetic Resources Institute
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
JICA	Japan International Cooperation Agency
KARI	Kenya Agricultural Research Institute
KIFCON	Kenya Indigenous Forest Conservation Programme
KFDP	Kenya Forestry Development Project
KWS	Kenya Wildlife Service
KEFRI	Kenya Forestry Research Institute
KFSC	Kenya Forestry Seed Centre
KNFU	Kenya National Farmers Union
KIPO	Kenya Industrial Property Office
MAS	Marker Assisted Selection
MALDM	Ministry of Agriculture, Livestock Development and Marketing
MENR	Ministry of Environment and Natural Resources
MOU	Memorandum of Understanding
NMK	National Museums of Kenya
NDP	National Development Plan
NGO	Non Government Organization
NP	National Park
NCST	National Council of Science and Technology
NEAP	National Environment Action Plan
ODA	Overseas Development Agency (Britain)

OECD	United Nations Conference on Environment and Development
OTL	Quantitative Trait Loci
PCPU	Plant Conservation and Propagation Unit
PRAPACE	Potato and Sweet Potato Improvement Programme for Central and Eastern Africa
RFLP	Restriction Fragrant Length Polymorphism
SPAAR	Special Programme for African Agricultural Research
SIDA	Swedish International Development Agency
USAID	United States Agency for International Development
UNESCO	United Nations Educational Scientific and Cultural Organization
UON	University of Nairobi
UNDP	United National Development Programme
WIPO	World Intellectual Property Office

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MENR

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J M Mbeva
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