THE CONSERVATION VALUES AND STATUS OF KIMBOZA FOREST RESERVE, TANZANIA

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SUMMARY

Kimboza Forest Reserve on the eastern foothills of the Uluguru Mountains in south east Tanzania was chosen for detailed study by the Forest Conservation Group due to its small size and increasing peripheral land use pressures, coupled with outstanding biological importance in terms of community diversity and the presence of endemic taxa.

Kimboza Forest was first reserved by the Germans and presently covers some 385 ha of high rainfall (1700mm) Karstic crystalline limestone formations astride the Ruvu River valley from 200 to 500m altitude.

The vegetation is tall (30m+) lowland rain forest with abundant Aningeria pseudoracemosa, Chlorophora excelsa, Cussonia zimmermannii, Diallium holstii, Rhodognaphalon schumannianum and Terminalia sambesiaca over an understorey of Scorodophloeus fischeri and Sorindeia madagascariensis. Wetter areas are dominated by Elaeis guineensis and Pandanus goetzei with abundant Garcinia spp. The flora is diverse with over 360 taxa, of which 13 species, including several trees, are considered endemic. There are several interesting phytogeographical linkages of which the most prominent is the S.E. Kenya - Usambara-Nguru-Kimboza - Mwanihana - Mahenge element. As Kimboza is virtually the only forest area left on the lower Ulugurus (below 1500m) it has considerable biogeographic and ecological importance in understanding the evolution of the East African forest communities.

Three animal groups have been well collected, millipedes, butterflies and birds. The invertebrate groups show endemic species indicating the isolation of Kimboza and the avifauna with 71 forest species is the richest of all East African lowland forests.

Kimboza is classed as a catchment reserve and is administered by the Regional Forest Catchment officer at Morogoro under the control of the national forest headquarters at Dar es Salaam. Pitsaw logging takes place under licence, mainly for Rhodognaphlon, stocks of Chlorohpora and Khaya being exhausted. For a small reserve logging pressure is intensive, and probably accounts for at least 1% canopy clearance per year.

Pole cutting is seen as a major forest benefit by surrounding villagers and in peripheral or easily accessible areas of the forest over 60% of available poles have been taken. Such pressures on the forest must have an effect on long term canopy replacement. Fuelwood food and medicinal plant collection and hunting are not important uses of the forest.

Encroachment is negligible but continual erosion of forest margins does take place along unbeaconed foot path boundaries. However, non reserved forest has virtually all been cleared for cultivation and Kimboza is no longer contiguous with nearby Ruvu Forest Reserve.

Forest protection is undertaken by two guards, who between them share responsibility for six reserves and all nursery, charcoaling and wood cutting in a heavily populated sub district.

It is concluded that whilst the present level of protection has been adequate to ensure the physical continuation of Kimboza forest, it is not adequate to maintain the biological integrity of the forest in face of increasing pressures from rapidly growing human populations.

The report does make specific recommendations to improve long term conservation status. The first step is seen as an acknowledgement by national and regional authorities that Kimboza does have important biological values and that these be recognized by awarding Kimboza special status within forest planning. Such recognition should include the elimination of logging and an increasing forestry staff patrolling Kimboza. Secondly the report is aware of the value of Kimboza to local people in terms of poles. There is thus a need to provide alternative sources of building poles, as plantations of species such as Eucalyptus, both in village woodlots and as a buffer zone around the entire reserve.

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Introduction

This report on the status and conservation of the Kimboza Forest Reserve of the eastern Uluguru Mountains in Morogoro Region has been prepared in response to several different factors. Firstly, its size, relative accessibility and scale of values made it an ideal study site for students from the University of Dar es Salaam interested in the conservation of natural resources. Secondly, many forest biologists have been working with the lowland forest communities in Tanzania, and Kimboza with its high rainfall and proximity to the Uluguru montane forests, promised to show linkages between low and high altitude forest communities. Thirdly, Kimboza has long been recognized as a forest community of exceptional biological value, containing several endemic taxa and species of great biogeographical interest, Finally, the combination of high biological values coupled with increasing land use pressures suggested this as a suitable site for study by the Forest Conservation Working Group. The group, largely composed of biologists from the University of Dar es Salaam, wishes to stress the importance of forest conservation activities in Tanzania. Kimboza seemed an ideal vehicle on which to focus local, national, and indeed international attention.

This report is written by the Forest Conservation Group, using comments and suggestions put forward by wildlife conservation students of the University of Dar es Salaam. The report is based on field work carried out in April, Jul. OCT 1983 and accessible documented sources in the literature and elsewhere. After this introduction and a following section which describes the physical setting of Kimboza, the report has a short section outlining field methods and then longer sections describing the values of Kimboza and outlining its present conservation status. A final section discusses recommendations for improved conservation. Much of the detailed reporting - species lists and quantitative descriptions, is placed in appendices to the main text.

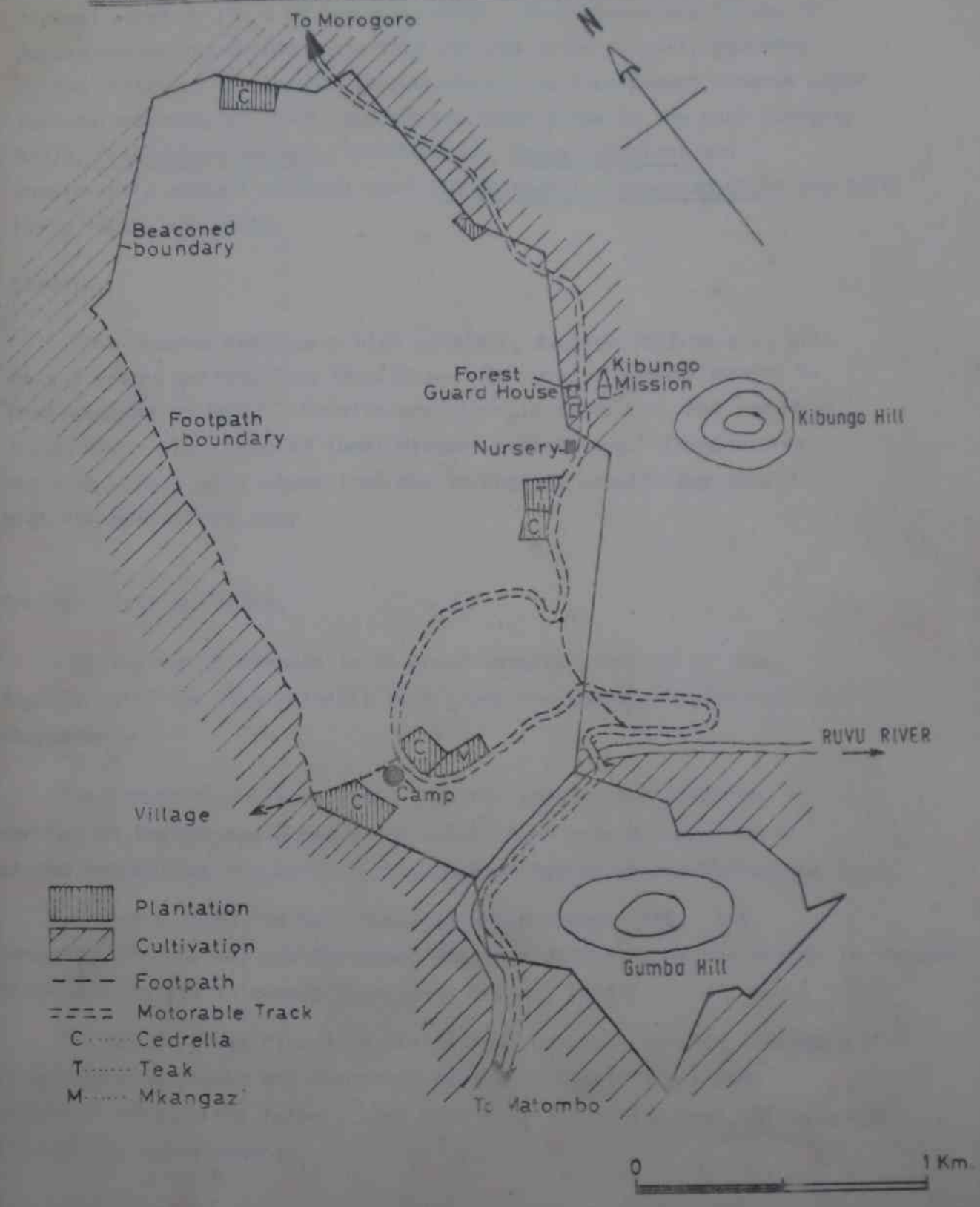
Background Information

Location

Kimboza Forest Reserve, of some 385 hectares ($37^{\circ}48'E$ $7^{\circ}00'S$) lies astride the Ruvu River and is crossed by the main Morogoro to

re 1. Location Map of Kimboza Forest Reserve.

SKETCH MAP OF KIMBOZA FOREST RESERVE



Kisaki road, see figure one. The reserve goes from 500 m. asl at the highest point to 180 m at the Ruvu river. The reserve was initially formed during the German occupation and was later formally gazetted by the British. The reserve is now classed as a catchment reserve under national control, but much logging has taken place in the past (largely Mvule, Chlorophora excelsa, and Mkangazi, Khaya nyassica) and considerable numbers of Msufi-pori (Rhodognaphalon schumannianum) are still being taken, see below.

Climate

The reserve receives a high rainfall, average 1683 mm p.a. with only 3 months getting less than 50 mm. The major rainy season is from November to April. Details are given in table one, and see Pocs (1976) for a discussion of local Uluguru climatology. Temperatures are high with a cool season from May to August. Humidities remain high for much of the year.

Geology, Soil and Water.

Geologically, Kimboza is of great interest, and it is this, together with the high rainfall that gives the forest its distinctive character .

The forest is entirely located on the calcite and dolomite marbles of the Matombo Group which occupies on area of about 90 km^2 of the metasedimentary belt of the Usagaran System of the Mozambique Belt.

The marble forms the Ruvu Syncline which plunges ESE. Its structure is complex, and thrusting together with flow of the marble is thought to exaggerate its thickness (Sampson & Wright, 1964).

The marble gives rise to a distinctive tropical karstic landscape with large isolated blocks and pinnacles of marble (up to 30m x 20m) scattered trhough the forest. The Ruvu River has cut a deep valley/gorge through the forest/marble.

The soils are moderately good for agriculture which is practiced intensively in the surrounding area. The high rainfall probably leads to strong leaching which overcomes the effects of the calcium-rich parent material. Similar soils are described for the Tanga area in Anderson (1963).

The forest contains numerous springs and seepages, many of which continue to flow during the dry season. The steepslopes of the Ruvu valley do lead to considerable surface run-off especially along roads and tracks where the forest cover has been disturbed.

Vegetation

The vegetation virtually all lowland rain forest (Sensu Greenway, 1973) with a closed canopy to 20m, in places to 30m, and with emergents up to 40 m. A distinct middle story at 10-15 m and a shrub layer from 2 5 m are present. Trees of the Leguminosse, Moraceae and Sapotaceae dominate the canopy layer.

Previous Biological Survey

Biological interest in Kimboza goes back to the early German administration with plant collections being made by Stuhlmann in 1894 and Rupprecht for Holtz in 1913. Many of these collections and those of early ornithological studies, are referred to as "East Uluguru foothills", but they obviously relate to Kimboza, Occasional gatherings were made by Greenway in 1930 and by Paulo, Parry and Padwa in the 1950s but it was the major collections of Semsei in 1952 that prompted Polhill (1968) to include Kimboza in his list of Tanzanian botanical sites of great conservation significance.

Ornithological collections go back to German days, but this report uses the recent collections of Stuart and others (Stuart 1983) and their thorough search of the literature.

The University of Dar es Salaam made occasional collections of plants from Kimboza in the 1960s and 1970s (Harris, Wingfield and Mwasumbi collections) and Pocs of the University of Dar es Salaam's Agricultural Campus in Morogoro included Kimboza in his survey of the Uluguru Mountains (Pocs 1976). Kabuye of the East African Herbarium collected briefly in Kimboza in 1972.

Field Activities

Fieldwork with University students and Conservation Group members concentrated on vegetation survey, plant community description and attempts to determine conservation status in both subjective and objective terms.

The reserve is small enough to traverse completely and so recconnaissance and plant collection trips took place in all parts of the reserve. The reserve boundary was followed to check for encroachment by cultivation and or fire. Surrounding villagers were interviewed as to their perception of reserve values, both positive and negative. Plant species of medicinal, nutritional and construction value were pointed out by knowledgeable local residents.

The reserve was crudely mapped as to obvious forms of disturbance - clearing, planting with exotics etc. Note was made of trees cut for timber and pitsawers interviewed. A rapid estimate of the size of clearing and number of subsidiary trees cut was made at some sites. Cutting of smaller stems for house poles (Nguzo) and withies (fito) was noted in general and evaluated quantitatively along a transect crossing the reserve. At random intervals along the transect three belt transects of 100 m by 3 m were censused as to standing available poles and cut stumps.

Forest tree layer composition was assessed by twelve tree tallies as trees over 30 cm diameter. More detailed information on species composition and size classes came from three detailed study plots, each of 25 x 10m subdivided into ten 5 m x 5 m subplots. One plot was located on a steep rocky slope, one in a wet Pandanus community and one in a drier forest site of flat ground.

Primates were recorded on casual encounter and on specific primate census walks. Millipedes were collected intensively during the rainy period (March-April).

Resume of Forest Values

The concept of the "value" of a natural resource is difficult to define as it may be composed of real and immediate financial values or potential values, or have a greater component of diffuse or intangible values which are not as easily quantifiable. Use in terms of medicinal or food plants, water and soil resources protection, ecological reference and ecological stores are examples of the latter. Finally there is the question of aesthetic, scientific and genetic values - the presence of a complex community, of great biological interest, with species richness and endemism attributes.

There is also of course the possibility of perceived negative values, especially by local people who may covet the area for other activities etc.

In this report we recognize the following types of values:

: commercial forest products,

: local forest products and impacts,

: indirect resource values, soil and water,

: scientific, aesthetic and genetic values.

Commercial forest products.

The only value here is that of sawn timber, all extracted by pit sawyers. In the past ~~three~~ 4 main species have been exploited, which, are in descending order of importance: Aningeria pseudo racemosa (Mlembelembe) Chlorophora excelsa (Mvule) Khaya nyasica (Mkangazi) and Pterocarpus tinctorious (Mninga maji).

Local district regulations have apparently prohibited further exploitation of Mvule and Mkangazi, although records do show both have been taken in 1982 and 1983 (Regional Catchment Office, Morogoro).

In the last few years there has been increased use of Rhodognaphalon schumanianum (msufi pori) for sawn planks for quality construction and furniture. Other species taken less frequently are: Albizia gummifera, Antiaris toxicaria, Cordyla africana and Newtonia paucijuga. Semsei in 1952 noted the extensive cutting of Vitex doniana for Kimboza saw mills. V. doniana is a rare constituent of Kimboza Forest Reserve and cutting may have been more frequent in the wetter woodland areas adjacent to the reserve. Kimboza Saw Mills no longer exists.

Some exploitation is legal, regional and local offices registering 4 and 5 licences sold for 1982 and 1983 (part) respectively, and some is clearly illegal (see below under status).

The level of timber exploitation and its monetary value is shown in table 2. The industry is not locally based, pitsawyers and plank carriers coming from Iringa and planks going to Morogoro (at present to fill a large order for Morogoro Stadium).

Government revenue comes from timber royalties, payable as a fixed price per cubic metre of merchantable wood cut. Present royalties are: Msufi pori 80/cu.m., Mkangazi, 120/- cu. m., Mvule 175/- cu. m. Local commercial values are going rates for timber and depend on species, size and plank quality. These rates are not fixed and fluctuate due to factors of supply and demand.

Local forest products

People living in the vicinity of Kimboza use and value the forest for the collection of foodstuffs, medicines, building material and firewood. The forest is therefore an important resource in their community and, as natural woody vegetation becomes more scarce in cultivated areas, the forest will become of increasing importance.

We were not able to quantify such use in terms of dietary or economic inputs, nor in terms of how much is extracted from the forest. We know of no study in East Africa where this has been done. Table 3 lists species of food and medicinal values.

Food plants used are usually uncommon relishes or dry season additives e.g. wild yams, and are not staple parts of the diet. Children will make more use of fruits, especially the climbers Saba and Landolphia. Honey is collected and edible fungi are used. Hunting is a rare activity as animal populations are of very low density, log fall traps have been seen, and bones such as Hyrax have been found in logging camp fires.

Plants of medicinal value are collected by local herbalists and they have lists of many useful species - well over one hundred. On one short walk one informant pointed out several valued plants. Local comment was that as dispensary/clinic medicines become less available in this period of economic shortage, people will turn increasingly to local medicaments. Kimboza area is served however by an efficient mission clinic and drugs are not in short supply.

Cutting for building poles we were able to quantify along an east west traverse of the reserve. We searched for the amount of utilization of house upright posts - nguzo, and wattle weave or withies - fito. The results are discussed in a later section, and indicate heavy use of resources especially near roads and pathways. Lianes are harvested for rope. Palms do not appear to be used for thatching.

Firewood is collected in areas of forest close to villages, there is adequate dead wood and live trees are not yet cut for fuel.

Whilst the forest does have definite positive values in terms of resources for local people, it also houses negative values. Chief of these is the presence of agricultural pests - monkey and bushpigs. Sykes monkeys are notorious crop raiders taking maize, citrus and bananas and they do cause loss to adjacent farms. They are not easy to exclude and necessitate full time vigilance during daylight. Bushpigs are now relatively scarce (due to hunting pressure) but have in the past been excluded by heavy fencing around fields (another use of forest products).

Finally, to the landless, the forest does represent potential farming land and land not exhausted by overcropping.

On balance however the forest is seen as an asset in terms of products it supplies, even though this use is, in theory, illegal.

Indirect resource values, soil and water

The small size of Kimboza (485 ha) mitigates its value as a catchment forest of importance, despite the good forest cover, steep slopes and presence of several springs. It does play a minor catchment role, but all of its water flow goes to the Ruvu River directly and does not supply local communities with water. The importance of the Ruvu River for Dar es Salaam water supply however, led to the Forestry Division refusing permanent water allenation rights from Kimboza for local agriculture in the 1950-60 period (Ministry files).

Small streams and springs arising at the base of massive rock piles are permanent, and much of their character must be due to the forest cover.

Similarly soil resources are protected by the canopy, although the steep slopes with prominent rock does mean some surface flow and consequent soil loss takes place. This loss is greatly accentuated along tracks and footpaths. Adjacent areas to the south east, where forest cover has been cleared, show major signs of erosion including landslips.

Scientific, Aesthetic and Genetic Values

Commercial, local and other resource protection values can be thought of as regional or even national in character. Their impact is felt in the immediate surrounds of Kimboza itself, and there will be some input to the regional economy.

Other values however, may have an importance that is truly of a national and international character. The scientific values of Kimboza forest have that level of importance.

In physical terms, the Kimboza locality is unique: high non-seasonal rainfall on base rich limestone. Nowhere else in Tanzania has these specific characteristics. As a result the vegetation type is distinctive and its long history of relative protection as a reserve allowed the retention of much of its unique character.

All rainforest is impressive and aesthetically pleasing. In Tanzania with less than 1% of its land surface bearing natural forest, there must be great value in maintaining these scattered fragmented remnants. Kimboza is accessible, an all weather road passes through it, it becomes a more important site for science and aesthetic values as a result.

Kimboza has plant and animal species found nowhere else in the world, true endemics. It has species of peculiar distribution patterns and hence of biogeographic interest. It has species and communities that are representative of particular ecological niches. It has an amazing wealth of species - the flora is exceptionally diverse. Conservation effort into maintaining the integrity of Kimboza would protect more species than would may other areas of far greater size.

These scientific values are discussed under the headings of invertebrates, vertebrates including reptiles, birds, mammals, and a much larger section on the flora.

Invertebrates

The only invertebrate groups that we know to have been collected are the millipedes (Diplopoda) and butterflies (Lepidoptera) Rodgers and Homewood (1982) discussing the Usambara Mountain point out the utility of the millipedes in investigating biogeographical relationships. Appendix I lists the millipede fauna

as collected in April 1983 and identified by Dr. R. Hoffman of Radcliffe University, U.S.A. Appendix 2 lists 213 taxa of butterflies collected and identified by J. Kielland in 1981 and 1982. Comments on these collections are included in the appendices, but it is apparent that the faunas are rich and do include a number of endemic taxa, many of which still await formal description and naming.

Vertebrates

We know of no systematic or casual collections of the fish or the herpetofauna of Kimboza. However a distinct taxon of lizard, the Turquoise Blue Dwarf Gecko has been collected in Kimboza. It is apparently restricted to Pandanus palms, and, as it is sympatric with the closely related Lygodactylus picturatus it must be considered as a full species L. williamsi. Other lizards collected include Cordylus cordylus tropidosterum (Cope) and Holaspis guentheri laevis Werner.

The avifauna has been well documented by Stuart (1983) who has compiled the species lists in appendix 3. The list includes 79 species of which 7 are considered 'non forest dependent' giving 72 forest species. This makes Kimboza the richest lowland forest locality yet collected in Tanzania (see Stuart 1981). Kimboza is of interest ecologically as it is the lowest altitude recorded for several species normally considered to be montane forest birds.

The mammals of Kimboza have not been collected. Forest ungulates are relatively rare, as a result of hunting, and include bushpig, red and blue duiker. Two diurnal primates, occur, the lowland black and white colobus (Colobus angolensis) and Sykes monkey (Cercopithecus mitis).

Both are numerous, fairly habituated and so easily observed. Data from 21 km of transect walks suggest a sighting frequency of 1 group of colobus per 1.3 km walked.

The Vegetation

The vegetation was collected intensively and studied quantitatively; this section is therefore very much the longest. A vascular plant species check list is included as appendix 5, a vernacular (Kiluguru, Kiswahili) - latin plant dictionary as appendix 6 and the results of the detailed vegetation analyses as appendix 7.

(I) Structure

Where undisturbed on the flatter less rocky sites, the forest cover atains a closed canopy at between 20 and 30 m with emergents up to 10 m above the canopy. A distinct middle storey exists at 10-15 m and there is a fairly dense shrub layer from 2-5m below this, sometimes with giant herbs predominating. The ground layer is patchy with grasses, herbs and ferns locally common. Woody lianes and climbers are prominent, frequently extending to the tree crowns. Epiphytes are scattered and locally numerous, with macropteridophytes conspicuous. Bryophytes are rare.

Trees reaching 1 m diameter are frequent, and buttressing is common.

(II) Species compositoion.

Major emergent species are: Antiaris toxicaria, Aningeria pseudo-racemosa, Chlorophora excelsa, Cordyla africana, Ficus spp. Parkia filicoidea, Rhodognaphalon schumaniuanum, Ricniodendron heudolottii, Sterculia appendiculata.

Main canopy species are, in addition to many of the above, Cussonia zimmermannii, Dialium holtzii, Newtonia paucijuga, Scorodophleus fischeri and Tessmania sp. nov.

The middle storey is dominated by Scorodophleus and Sorindela madagascariensis. These two are the commonest trees above 20 cm in diameter in the forest. Other components are Bequartiodendron natalense, Diospyros brucei and D. verrucosa, Drypetes natalensis, Funtumia africana, Lannea antiscorbutica, Lettowianthus stellatus, Rauvolfia mombasiana, Pandanus goetzei and Uvariodendron gorgonis.

The shrub layer is variable, but the following are most frequent Allophyllus spp., Cola spp., Diospyros greenwayi, Grandidiera bolvinii, Leptonychia usambarensis (rarely seen as a tree), Ophrypetalum odoratum and several Rubiaceae.

The herblayer depends on surface conditions. Costus is frequent in damper areas. Several Acanthaceae occur and grasses are not common, although Olyra latifolia and Setaria megaphylla are conspicuous in patches. A rocky community with many succulent herbs: Amorphophallus, Dorstenia denticulata, Gonatopus, Impatiens cinnarbarina, Laportea, Steptocarpus Kimbozanus and Zamioculcas is widespread.

Lianess are common and include Acacia sp. Combretum spp., Coccinia, Entada, Grewia, Hippocratea, Landolphia, Paullinia and Saba.

Epiphytes are conspicuous due to the abundance of large ferns, Platycerium and Asplenium nidus, Orchids are rare and include small Aerangis, Angraceum and Bulbophyllum.

(iii) Local Variation

Levees south of the Ruvu River are noteworthy for the abundance of emergent Antiaris and absence of Sorindela from the middle storey.

Close to meandering streams, Garcinia spp predominate in the main canopy, over an understorey rich in Zenkerella egregei and

Diospyros amaniensis. On more permanently water logged soil Breonadia and Mitragyna are typical emergents over a canopy of Pandanus and Elais. Close to streams Dorstenia sp. (Pocs 6280/c) replaces Costus when the light intensity falls.

Local concentrations of additional emergents are occasionally present, eg. Tessmania and Cynometra on rocky ridges. Christiana and Ficus spp are common on rock outcrops. In the understorey there are localised patches of Sloetiopsis, Dorstenia and Thunbergia kirkii especially in small soil accumulations in heavy shade among rock outcrups.

The forest edges along the boundary and the main road bear secondary growth. The scrambler Mezonueron is a frequent element.

Outside the reserve boundary, the vegetation is typically a wooded grassland or woodland, where not cultivated. Frequent tree species include: Albizia versicolor, Combretum spp., Cordia africana, Crossopteryx febrifuga, Pericopsis angolensis, Pterocarpus angolensis and Sterculia quinqueloba. Common grasses are Bothriochloa bladhii, Hyparrhenia cymbaria, Hyparrhenia rufa and Panicum spp.

3. Floristics

A total of 364 species of Anglosperms (flowering plants) and 18 Pteriodophytes (ferns) have been identified from the Kimboza Forest; these are listed by family in appendix 5 Note species typical of adjacent woodlands, cultivations and roadside verges are not included.

The 364 species are distributed in 261 genera and 77 families as follows:

Families with x genera		Genera with x species	
1	34	1	200
2	18	2	37
3	6	3	14
4	4	4	3
5	2	5	1
6	1	6	2
7	2	7	1
8	4	8	0
9	1	9	1
10	1	10	
14	1		
17	1		
20	1		
25	1		

The largest families are the, Apocynaceae, Moraceae, Gramineae and Orchidaceae with 8 genera each and 8, 20, 11 & 8 species respectively, the Annonaceae with 9 genera and 12 species, the Acanthaceae with genera and 22 species, the Sapindaceae with 14 genera and 16 species, the Euphorbiaceae with 17 genera and 25 species, the Rubiaceae with 20 genera and 31 species and the Leguminosae with 26 genera and 29 species (13 in the Caesalpinaideae, 6 in the Momosoideae and 10 in the Papilionoideae).

The largest genera are Acalypha, Allophyllus, Cyperus with 4 species, Justicia with 5, Diospyros and Dorstenia 6, Combretum 7 and Ficus with 9.

4. Endemism, Species of Restricted Distribution and Phytogeography

Kimboza has long been noted for the presence of endemic species (Polhill 1968). The more intensive collecting in 1983 has increased the number of endemics to 13 full species and 4 subspecies, or 4.6%

of the Kimboza flora, which for a small area of 4 km^2, is extremely high. These species are listed in table 4.

Endemic taxa include all life forms from small succulent herbs to canopy trees and cover a wide range of families. This level of endemism is not the consequence of extreme speciation in one or two groups, as has happened elsewhere in the Uluguru Mountains (e.g. Impatiens, Psychotria, Lasianthus, Melastomataceae, FTEA 1958) but rather reflects the distinctive nature of the Kimboza limestone substrate.

The Kimboza flora provides a striking example of species rich lowland rainforest. It has few species more typical of drier lowland forest sites (for example Brachylaena huillensis and Manilkara discolor are absent) and none of the species most characteristic of the harsh environmental conditions of the maritime coral associations (e.g. Diospyros consolatae, Manilkara sulcata, Sideroxylon inerme). Similarly there are few species present which are usually thought of as higher altitude forest plants, although Alsodeiopsis schumannii, Artabotrys monteriorae and Cussonia spicata all occur in Kimboza much below their previously recorded altitudinal limits.

The great majority of plant species in Kimboza have a wide distribution in eastern Africa, and several range all over tropical Africa. Some species have a more restricted distribution and it is these which can allow the analysis of biogeographic patterns.

One distinctive element is that characteristic of the lower levels of the chain of coastal hills and mountains from the Shimba and Taita hills in the north via the Usambaras, Ngurus, Ukagurus and Ulugurus to the Uzungwa and Mahenge mountains in the south. All the eastern slopes receive high rainfalls of 1500 mm per annum and above. Table 5 lists 16 predominantly woody species which fit this pattern and suggests that they can be further split into three groups. Group A are found from Kimboza northwards, eg. Aningeria pseudo-racemosa and Memecylon verruculosum Group B are found from Kimboza southwards, eg. Ixora narcissodora; and Group C are restricted to the centre of the chain Kimboza and Nguru, eg. Uvariodendron gorgonis.

A smaller element are restricted to the wetter forest of the coastal plain itself, eg. Coffea sp. D of FTEA. More difficult to interpret are the long distance affinities, such as Turraea vogelioides, Kimboza, Uganda and West Africa; and Neopaliosya castaneifolia Kimboza, Madagascar and Zimbabwe.

Present Conservation Status

Legal and Policy

Kimboza was originally gazetted under colonial rule but the last legal notice dates from a reduction of 44 hectares in 1964 so,

Kimboza Forest Reserve is reserved under Government Gazettement Notice, Number (GN No 417) of 1964. As a natural forest it is categorised as Catchment Reserve and, as from July 1983, is administered by the Regional Forest Catchment Officer of Morogoro under direction from Divisional Headquarters in Dar es Salaam. Note that catchment forests are considered a national asset and so are controlled from national, and not regional, offices.

No specific policy statement or management plan has been seen for Kimboza Forest Reserve itself. Present policy therefore stems from the national policy of "maintaining the forest in a natural condition so as to assure water and soil protection functions, whilst allowing a level of forest product utilisation which is compatible with such maintainence". This in effect should mean the prevention of disturbance such as encroachment, burning and unlawful cutting or felling of vegetation. A new regional catchment forest plan is under consideration at present, but this does not have any specific provisions regarding Kimboza.

Past policy has suffered from ambiguities as there has been some destruction of the natural forest by the Forestry Division itself! Kimboza Forest Reserve contains within it several plantations of varied size of exotic and native tree species - teak cedrella and mkangazi - of different dates of planting, estimated from the early 1950s to the late 1970s. These plantations are shown on figure 2 and their total size is estimated at:

Teak	- 2 ha	2 plots
Cedrella	- 8 ha	4 plots
Mkangazi	- <1 ha	1 plot
Total	<11 ha or 3% of the reserve.	

Clearing for such plantations has removed the natural vegetation, the resulting shrubby growth under 20 year old Cedrella was estimated to contain about 1/3 of the plant species found in natural forest undergrowth. Cedrella was also noticed to be regenerating, both under parent trees and, probably dispersed by birds, in areas well away from plantations. Other casual "contaminants" of the forest include kapok, citrus, mango and banana.

The sanctity of forest reserve status in theory is maintained by the use of a clearly demarcated boundary and frequent patrolling by forestry personnel to deter illegal utilization.

Kimboza Forest boundaries were followed by student groups and divisional staff. Some clearing and marking of the boundaries had taken place in the previous twelve months. No sign of large scale encroachment was seen, but it was evident that cultivation pressure does come right up to the boundary in several places. It was noticed that for a large part of the western boundary, the cleared boundary was a foot path which wandered in and out of dips and ridges and around rocks and fallen trees. Rarely did the footpath move outside an obstacle, it is the forest that is being eroded - a few metres here and a few metres there. Cultivation then moves up to the path. Planted citrus and remains of rice were seen in areas which should have been reserved.

The forest is cut by several legal and defacto rights of access. The main Morogoro-Kisaki road runs through the reserve, and the vegetation is cut back for some 5m more either side by local Comworks employees. Established tracks and foot paths cut off major bends in the vehicle road and also cut through the forest to neighbouring villages (see Figure 2). Whilst no evidence of illegal activity was seen along these foot paths, they do become areas of secondary vegetation growth and continual passage along them makes the detection and prevention of illegal use more difficult.

Utilisation

Utilisation is considered under the two headings of timber and local use of minor produce.

(a) Timber extraction is all by pit sawing, no mechanised logging takes place. It is of interest to examine timber cutting procedures. Pitsawyers operate by licence, purchasable at the regional catchment office in Morogoro, with the prior approval of the local forest guard. Approval will be given to fell a tree if it is considered 'over mature' and it is considered that its extraction will not violate general rules of catchment forest management - no felling on steepslopes or near springs or streams. Present belief is that the removal of overmature trees enhances and speeds up regeneration and such felling is therefore to be encouraged.

Following the selection of a tree or trees (in theory up to 3 may be taken at one time but at least 5 have been issued on occasion) and the approval of the regional office and the issuing of a licence the tree is felled, sectioned and each section trimmed for mensuration. The guard measures each section, the licencee returns to Morogoro and pays a royalty fee based on mechantable volume on showing the receipt, he is allowed to saw planks and each of which will be stamped by the guard.

Table 2 shows that in the past two years licences for a total of trees (including only 19 msufi pori) were issued for Kimboza, Our traverses of the forest showed over 20 trees felled in the last twelve months. Five sites were active in April and other four in July. All had log sections stamped by the guard and all planks seen were stamped.

We consider that we 'searched' less than 25% of the north western part of the reserve - the actual number of trees taken would thus be very much greater, 50. All trees felled recently were msufi pori,

Rhodognaphalon schumanianum apart from one Cordyla africana, although cut stumps of mvule and mkangazi were seen. Trees were of good size and produced good 12" x 1½-2" planks of 4 m length. Many standing Rhodognaphalon trees of large size were marked with machete blazes, an indication they were due for felling.

Two active sites were examined by students in April 1983 and clearing sizes were estimated at 800 m^2 each, and at least 39 and 53 trees $\geq$ 5 cm diameter had been cut for use as rollers in the vicinity of the site.

In October 1983 the area surrounding four inactive sites (stumps 6 months old or over) was examined more thoroughly. Clearings were measured and identities and girths of cut or broken stumps were recorded. Details of these sites are given in Table 6.

Pitsawningwas not of the highest quality, there being considerable waste and abandonment of bole sections considered to be in difficult places.

One is led to the conclusion that there is more logging taking place than is indicated by licences. That all the planks we saw, both at the road side and on site, were stamped would indicate that the local forest guard was aware of the high level of extraction. The role of the guard is discussed in more detail below.

(b) The collection of minor forest produce from national forest reserves is poorly understood and poorly controlled over large areas of Tanzania. In theory, at law, it is illegal unless done with permission of the appropriate forest authority - by licence, or permit. In practice, in many reserves, the collection of poles or firewood etc. is thought insignificant and not seen as a threat and is ignored or condoned. (In Magombero, in Kilombero District, forest staff spoke of traditional rights!). The Morogoro Forest Catchment Office said no permits had been issued for minor produce, nor would be issue such a permit if applied for.

In Kimboza there are innumerable minor tracks and foot paths leading to pitsaw sites, etc. These provide easy access to the anterior of the forest so as to search for firewood, building poles and traditional medicines and foodstuffs. withies averaging 2-3 cm in diameter. We investigated four sites along a transect marked on figure 2:

A - near to the boundary, close to the main road,
B & C in rocky relatively inaccessible areas with a low stem density.
D - in a flat well forested area ½ km from the western edge.
Results, as % cut of total nguzo and fito are as follows:

Site	% cut nguzo/poles	% cut fito/withies
A	43.7	31.5
B	1.2	0.6
C	2.4	6.6
D	27.1	12.4

Stems taken are at least 2.8 m long and straight, with little branching; they are frequently canopy and understorey tree saplings. Frequent stems cut included Scorodophleus, Cola, Drypetes and Diospyros.

These figures indicate that 'minor forest produce' cutting pressure is not insignificant and that even sites well inside the reserve are heavily cut over. Our survey looked at size only and did not consider species characteristics such as strength, durability and insect resistance. It is possible that proportions of real potential poles taken are higher than indicated.

Biolgoical and Catchment Status

Kimboza Forest still has a closed canopy over most of its extent. Pitsawing clearings, assuming 50 in the past 12 months will have affected less than 2% of the reserve and encroachment and track clearing less than 1%. Certainly the present catchment function has not been impaired, but 1% internal clearing per year will cause a loss of function if the rate continues.

Insufficient is known about the biological values to assess present conservation status. Population size for the smaller endemic plant species, the herbs, shrubs and small trees would appear adequate. Population sizes for the larger trees such as Cynometra and Tessmania may not be adequate for long term survival especially now that Kimboza is not contiguous with nearby and supposedly similar Ruvu Forest Reserve.

Larger mammal populations are already severely reduced, bushbuck, bushpig and the smaller duiker and suni are rare or absent due to continued hunting in a small area. There is no quantitative data on the mammal or bird communities.

Species loss is an insidious process frequently not observable. The present rate of forest cutting may be sufficient to cause some level of extinction - we do not know.

Protection

Kimboza Forest Reserve is administered locally by two field staff, one, a forest assistant III, is on the catchment establishment and reports directly to the District Catchment Officer in Morogoro, and one, a forest attendant I, is a regional employee, reporting via the subdistrict forest office in Mkuyuni to the District Natural Resources Officer. Both have the duties of a forest guard. The catchment guard is responsible for three main reserves - Kimboza, Ruvu and Chamanyani plus three very small reserves Mangala, Milawilila and Gambaula. The district guard is responsible for forest activities in Kimboza ward - nursery, village afforestation, fuel wood and charcoal and logging in non reserved forests.

In practice the two work together and due to shortages, they share one log stamping hammer. Duties as regards the reserved lands include boundary and general patrolling plus checking, measuring and stamping of logging activities and timber planks.

The forest staff have lived in Kimboza for several years and are part of the social community of the village. Because of this the guard we interviewed feels unable to control the cutting of forest produce by villagers. "If I arrest them, they will destroy my crops etc!" No arrest has taken place for the past eight years at least. Pit sawing is done at present by imported labour from Iringa on contract to an entrepreneur in Morogoro, so enforcement of the law regarding timber extraction should not have 'community problems!"

Conservation Attitudes

Surrounding villagers have ambivalent attitudes to the presence of Kimboza Forest Reserve. Land pressure is growing and the reserve is viewed as a reservoir of good cultivation land. The reserve does contain 'vermin' - sykes monkey and bushpig which destroy crops. On the other hand recognition is made of the value of the reserve in terms of food and medicinal plants and building poles. However, if the law is to be interpreted vigorously, such cutting would stop, and people would have an entirely negative view of the forest.

Alternative forest products, poles and firewood; are partly catered for by the development of a nursery on the edge of Kimboza which produces seedlings mainly Eucalyptus, Cassia, Cedrella and Grevillea for surrounding villages. We learn however, that the facility is little used.

Recommendations for Improving Conservation Status

General Recommendations

Conservation cannot take place in a vaccuum, values or objectives which are to be conserved must be clearly laid out and then management activity undertaken which will most easily accomplish the objectives or maintain the values. This report has attempted to document and describe the values of Kimboza Forest Reserve and their current status. These values are an integral part of the natural forest community and so the objective of conservation becomes clear: the maintenance of the forest community in as natural state as possible. Management policy is therefore, also clear: the prevention of disturbance factors which will reduce or impair the functions and values of the natural forest.

Kimboza is one of several natural forest reserves in Morogoro Region and a relatively small one at that. But Kimboza has values much greater than its size would suggest and values which can be considered important at local national and international levels. Kimboza then needs consideration for additional conservation inputs; and whilst all forests are of great value and importance, Kimboza must be thought of as a priority.

This is perhaps the first step in improving the status of Kimboza the recognition of the exceptional values inherent in the natural forest. This final section of the report discusses in more detail specific conservation activities that could be undertaken once such recognition is given.

Specific Recommendations

Separate recommendations can be made regarding immediate measures to improve conservation status in Kimboza. These may be listed as status recognition, protection, catchment forest management, alternate

(a) Status recognition

The biological values of Kimboza AND its probable fragility as a consequence of small size, are sufficient to warrant incorporation into some higher administrative land use category than catchment forest reserve. It has values very much greater than nearby reserves such as Ruvu, Dindila, Mhangala, Chamanyani etc. This greater value needs official recognition; ideally, under the terms of reference of the OAU Africa Convention on Conservation (Algiers Convention), the area should be designated a national nature reserve. Such legal status does not yet exist in Tanzania. National Park status is perhaps inappropriate at this point in time. It is suggested that recognition be made at an internal level at the present time - within the Forest Division and within Morogoro Region. Such recognition could take the form of inclusion in a list of priority areas, or special conservation project areas. Recognition could be made at regional level by formal letters from Ministry clearly setting out the values of Kimboza and requesting cooperation in conservation endeavours.

International recognition could come from the International Union for the Conservation of Nature and Natural Resources and from the Plant species Survival Monitoring Unit in Kew Gardens, U.K.

Recognition can be made at a local level by notices on roads and through pathways, stating the value of Kimboza. Project staff can be made aware of the national importance of Kimboza.

(b) Protection

The concept of protection revolves around the necessity to have strict rules governing use, obvious boundaries relating to such rules and the provision of adquate staff to enforce such rules. The need to have a surrounding population aware of such rules and who understand and respect them is discussed below.

The first point concerns utilisation. Already Kimboza has lost virtually all of its prime timber: mvule and mkangazi; the rate of exploitation of the surviving timber tree - msufi pori - is such as to cause concern. It is argued that the financial value of remaining timber in the 480 ha of Kimboza is insignificant compared to the biological values of the reserve. Timber exploitation should therefore be stopped; no more licences issued and the law, as it applied to logging, be applies more vigorously.

The use of minor forest produce is a more difficult question. The gathering of plant material for foods and medicines is undertaken by a relatively few 'specialist' villagers and cannot be considered detrimental to the forest. Like all aspects of resource use however, it needs to be regulated. Perhaps collectors should have a small permit issued locally? Building pole cutting has reached a level where it must be detrimental to forest dynamics. But, on the other hand, this illegal supply of poles is obviously supplying a real need to local villagers. Prevention of cutting would be difficult and serve to alienate villagers from supporting the forest. Control is needed; again a more limited permit system is suggested and here the imposition of a fee. This however, should be a short term measure, in the long term the provision of alternate resources will be necessary, see below.

The forest boundary requires modification in that the foot path should be beaconed, a swathe cleared and the swathe maintained so as to prevent the foot path "migrating" into the forest! Boundary planting with teak markers would also be valuable.

An extremely critical point concerns the provision of adequate staff numbers. Forestry have long maintained a tradition of self sufficiency with low staff numbers, especially

The values inherent in Kimboza, its unique floristic assemblage, its endemics, its accessibility mean that in many ways it is more valuable than some of our wildlife reserves and parks. And yet the present staff disposition is one who is shared between three reserves! This can be compared with staffing levels of over 70 for Mikumi National Park and over 400 for the Selous Game Reserve! There is then an immediate need for increased staff levels. A more senior forest assistant based at Kimboza, who can oversee all adjacent reserves, plus at least two and ideally three staff members specifically for Kimboza are necessary. Increased visits and patrols by supervisory staff from Morogoro and Dar es Salaam would be required.

(c) Catchment forest management

At the present time there is no specific body of knowledge dealing with the management of catchment forests in tropical Africa. Most natural forest management policy deals with timber production, (coup demarcation, propagation, enhanced growth by selective clearing etc.) and whilst this does contain provisions for catchment purposes these provisions are restricted to specific sites within areas considered generally amenable to exploitation. There is no proper provision for the management of extensive forested slopes.

The repercussions of this lack of specific catchment policy can be noticed when discussing forest management with field foresters in tropical Africa to whom actual intervention involving the felling of overmature trees is seen as a necessity for good management. The reasoning has evolved from the knowledge that overmature trees steadily lose timber value and it is unfortunate that the view has developed that this felling is essential in <u>all</u> natural forest and not merely in typical production forest.

Senescent trees left unfelled mostly break up piece meal, losing branches and canopy sections and ultimately falling as a single decaying bole. Their falling may injure some standing adjacent stems

be impaired and biological values and processes maintained.

If the tree were to be cut for timber the canopy would be larger and so damage more adjacent stems on falling. The pitsawing process would need more trees cut, an area of several hundred square metres would be totally cleared and regeneration trampled, camps would be built, access tracks formed, animals hunted etc. Water storage functions would be altered, a large gap allowing much secondary growth would be formed and biological values reduced, Quite apart from this it is relevant to draw attention to the fact that trees are felled when the only economic trees are felled if overmature. Surely it must be argued if the economic trees need removal at this stage to promote the health of the forest as is sometimes suggested (though wrongly) then non-economic overmature trees should also be felled. This has never been suggested. There has been misinterpretation of forest management for catchments.

This point has been stressed in this report not so much because of its specific relevance to Kimboza, but because it is a concept of importance to all forest areas valued for catchment and biological purposes. It seeks to clarify ideas which appear to be erroneous and which, if taken to extremes, could eventually endanger catchment status. A final suggestion on this topic is the need for a small pamphlet on forest management specifically for catchment purposes, which could be distributed to forest officers. Perhaps the University could be asked to cooperate with Government on this issue.

(d) Provision of alternative resources.

Mention has been made of the value of Kimboza as a source of building poles. Increasingly, as human populationsrise and woody plants become scarce, Kimboza will become a source of fuel wood as well. It is obvious that a small reserve like Kimboza cannot supply such res

supply such resources without loss of value and function. Simple prohibition of cutting will not work. The only long term solution is to ensure the provision of adequate alternative fuel wood and pole wood resources. This is best done by village plantation forestry. Take the resource to the people, instead of having the people come to take the resource. Such plantations can be of immediate protective benefit as well as an indirect benefit, if they are planted as a buffer zone right around the forest. Such a buffer zone, which should be at least 20m wide and preferably 50 metres would serve to further demarcate the reserve and be a barrier to illegal cutting in the reserve. These already exists a nursery at Kimboza; Eucalyptus for poles and Cassia for fuel would be an ideal combination. Labour could come from surrounding villages and funds could be obtainable from sources such as the EEC village mini-project fund.

(e) Conservation awareness.

In the long run the conservation of biological resources can only take place with the approval and support of local communities. There is thus a need now to increase the level of understanding of the necessity to conserve. There is a need for improved conservation education within school curricula and specific discussion of Kimboza values in forums close to Kimboza itself - schools, villages, party ect. Divisional headquarters, regional staff and forestry staff at Kimboza all have a role to play.

The nursery facility at Kimboza can be extended to include a small demonstration plot and a wall with relevant posters, photographs and value messages - in Swahili! The mission at Kimboza is another potential source of education.

Table 1. Rainfall and Temperature Data - Kimboza Forest Reserve

Month	Ruvu Crossing Rainfall	Mkuyuni Village Rainfall	"Kimboza" Temperature*
January	184 mm	169 mm	26°C
February	170	161	26
March	265	267	25
April	278	336	25
May	110	203	24
June	43	41	23
July	39	42	22
August	39	46	22
September	56	47	23
October	109	91	24
November	161	106	25
December	228	190	26
Total	1683 mm	1700 mm	Mean
	13 year mean	4 year mean	Estimated

*Mean Temperature Data, from Pocs (1976).

Table 2. Commercial Timber Values in Kimboza - 1979 - 1983

Year	No. of Licences Sold	No. of Trees Felled	Species		Volume cu. metres.	Royalty Value
1979	NIL	-	-		-	-
1980	6	12	Aningeria	6	27.6	386.40
			Terminalia	1	4.1	56.00
			Khaya	2	11.0	673.75
			Chlorophora	1	6.4	524.80
			Rhodognapholon	2	11.0	154.00
					60.1	1794.25
1981	3	9	Aningeria	5	27.6	2208.00
			Khaya	2	8.2	984.00
			Chlorophora	2	7.1	1242.50
					42.9	4434.45
1982	4	17	Aningeria	2	11.1	886.40
			Khaya	2	6.5	784.80
			Chlorophora	2	4.4	266.50
			Rhodognaphalon	5	20.6	1651.20
			Antiaris	4	11.8	947.20
			Cordyla	2	4.1	326.40
					58.5	4862.50
1983 (Jan-Sept) only)	5	20	Chlorophora	1	2.5	441.50
			Khaya	1	3.3	393.60
			Rhodognaphalon	14	73.2	5859.20
			Albizia	4	16.4	1312.00
					95.4	8006.30

Total Timber from 1980 to 1983 (September) = 256.9 cu. metres which gave a royalty payment of 19,098/= to Government and, estimating a commercial value of 2,500/= per cu. metre for pitsawn class 2 timber, a total value of 642,000/=.

TABLE 3. Forest Products Utilised by Local People in Kimboza Forest Reserve

Species	Vernacular	Use
A. Medicine		
Acalypha spp.	Kifulwe	Medicine - stomach
Hoslundia opposita	Mzekozeko	Medicine - tonic
Indigofera spicata	Kamagara	Medicine - stomach
Launaea cornuta	Mchunga	Medicine - measles
Menispermaceae	Mwevu	Medicine - headaches
Newtonia paucijuga	Mbira	Medicine - stomach
B. Foodstuffs		
Costus afer	Ugobedi	Tubers
Dioscorea spp.	Chanana, Chikwa	Tubers
Hoslundia opposita	Mzekozeko	Relish
Menispermaceae	Mbarega, Mganga	Leaf - Vegetable
Pachystela brevipes	Msambwa	Fruit
Saba florida	Mbungo	Fruit

C. Plus timber trees, plus lianes for rope, eg. Strophanthus spp., plus saplings and shrubs for building poles, e.g. Uvariodendron, Cola spp. plus firewood.

The list of medicinal and food plants is not exhaustive, but a collection by one elderly villager in a morning.

Table 4 Plant Species Considered Endemic to Kimboza Forest Reserve.

1. Endemics at the species level

Adhatoda sp. nov.	Herb	Acanthaceae
Annonaceae, genus indet (semsei 810)	small tree	Annonaceae
Asystasia sp. nov. (WAR 2512)	Herb	Acanthaceae
Asystasia sp. nov. (Mw 12358)	Herb	Acanthaceae
Baphia pauloi	Small tree	Papilionoideae
Cynometra uluguruensis	Canopy tree	Caesalpinoideae
Dorstenia sp.=Pocs 6280	Succulent herb	Moraceae
Garcinia bifasciculata	Small tree	Guttiferae
Impatiens cinnarbarina	Succulent herb	Balsaminaceae
Steroptacarpus kimbozensis	Succulent herb	Gesneriaceae
Tessmania sp. nov.	Canopy tree	Caesalpinoideae
Styasasia sp. nov. A. of Kew	Herb	Acanthaceae
Vitex sp. near buchanani not matched at Kew	Small tree	Vitaceae

2. Endemic at the subspecific level

Chassalia discolor grandifolia	Shrub	Rubiaceae
Diphasia morogoroensis subalata	Shrub-small tree	Rubiaceae
Illigera madagascariensis forma	Climber	Hernandiaceae
Pavetta crebrifolia kimbozanus	Shrub	Rubiaceae

Table 5. Biogeographical Elements within the Kimboza Flora

(1) Species of the lower levels of the S.E. Kenya - Usambara - Uzungwa Mountain Chain.

A. Kimboza - North	B. Kimboza - South	C. Kimboza - Nguru
Aningeria pseudoracemosa	Clamydacanthus dichrostachyus	Garcinea semsei
Cynometra sp. A	Guibourtia schliebenii	Uvariodendron gorgonis
Isolona cauliflora	Ixora tanzaniensis	Millettia semsei
Lasiodiscus mildbraedii ferruginea	Millettia elongatistyla	
Memecylon verruculosum	Tricalysia Wingfield 4091	
Notobuxus cordata		
Psychotria leucopoda		
Trycalysia acidophylla		
Suregada lithoxyla		

(2) Species of forests of the southern coastal plain

Coffea sp. D of FTEA	Lannea antiscorbutica
Cynometra sp. near C. alexandri	Oeceoclades lonchophylla

(3) Species of West African affinity

Indigofera mildbraediana	Turraea vogeliodes

(4) Species with Madagascan affinity

Illigera madagascariensis	Neopalissya castaneifolia

Table 6. Details of Pitsawing Sites in Kimboza
(All timber was Rhodognaphalan - Msufipori).

Details Recorded	Sites 1	2	3
Dimensions (m) of clearing	40 x 15	35 x 30	40 x 18
Area of clearing	600m^2	1050	720
Platform or not	No	No	Yes
Tree height	38m.	34, 28	36
Tree girth	3.1m	3.4, 3.3	4.4
Log length used	11.5m	16, 14	15.3
Nos of trees (10 cm dbh) Cut/Damaged in size class			
10-11 cm dbh	15	21	16
20-29 cm dbh	4	6	6
30-39 cm dbh	3	3	2
40-60 cm dbh	1	1	1
60+ cm dbh	0	1	1
	23	32	26
Basal Area of stems	0.90 m^2	1.66	1.25
Basal Area with timber tree	1.66 m^2	2.62	2.79

Species cut/damaged, sites combined.

Scorodophleus	8	Entada	1	Strychnos	1
Sorindeia	7	Uvariodendron	1	Combretum	1
Rauvolfia	1	Bridelia	1	Bequartiodendron	1
Zenkerella	3	Cynometra	2	Rhodognaphlon	1(+4)
Markhamia	1	Pancovia	2	Unknown	30
Chlorophora	1	Ophrypetalum	2		
Bosquia	1	Cola	4		
Aningeria	1	Diospyros	4		

APPENDIX I

THE MILLIPEDE FAUNA OF KIMBOZA FOREST RESERVE

This list is based on collections made in April 1983.

No.	Species Name	Comments
	Family Spirostreptidae	
1.	Spirostreptus strongylopygus	Known from the Usambaras
2.	Haplogonopus inflatannulus	Known from the Ulugurus, common, this is the millipede that exudes copious noxious fluid smelling of cyanide!
3.	Pseudotibiozus sp. nov.	New species
	Family Oxydesmidae	
4.	Lyodesmus rubidopsis	Known previously from Kimboza
5.	Rhododesmus c.f. planus	Known from Uluguru, Usambara, Uzungwa.
	Family Harpagophoridae	
6.	? Apoctenophora	Similar to East Usambara forms.
	Family Gomphodesmidae	
7.	Astrodesmus sp.	Need a male for species confirmation
	Family Odontopygidae	
8,9,10.	Three species	Not yet identified.

Millipedes have been identified by Dr. R. Hoffman of Radford University, Virginia, U.S.A. There are interesting biogeographic links to the Usambara Mountains lowland forests.

APPENDIX 2

A PRELIMINARY CHECKLIST OF THE BUTTERFLIES OF THE KIMBOZA FOREST, ULUGURU MTS. OF EASTERN TANZANIA

BY

J. Kielland

This list is almost entirely based on my own and my assistant Izidoro Thadeo's collections in 1982, all together 30 days, divided on 3 trips.

Species	Habitat	Frequency in Kimboza	General Frequency
PAPILIONIDAE			
1. Papilio dardanus tibullus	F	xxx	xx
2. " echericides echericides	F	o	xx
3. " constantinus	F, HW	x	o
4. " nireus lyaeus	Fm, W	xxx	xxx
5. " demodocus	U	xx	xxx
6. " ophidicephalus	F	x	xx
7. Graphium angolanus	W	x	xx
8. " leonidas leonidas	W	xx	xx
9. " philonoe	W, F	x	xx
10. " antheus	Fm, W	x	xx
11. " policenes	F	x	xxx
12. " polystratus	F, Fm	xx	xx
13. " porthaon	F, Fm	o	x
14. " colonna	F	x	0
15. " kirbyi	F	x	o
PIERIDAE			
16. Appias phaola isokani	F	o	x
17. " lasti	Fm, HW	x	xx
18. " sabina phoebe	W, F	xx	xx
19. " epaphia contracta	W, F	x	xx
20. Belenois creona severina	W, Fm	x	xxx

21.	Belenois sochalia agrippinides	W, Fm	o	xxx
22.	" thysa thysa	W, Fm	xx	xxx
23.	Dixeia orbona vidua	W	x	xx
24.	" pigea	W	xx	xxx
25.	" spilleri	W, Fm	xx	x
26.	Mylothris agathina	W	xx	xxx
27.	Leptosia alcesta inalcesta	F, HW	o	xx
28.	Colotis calais calais	W	o	xxx
29.	" evippe complexivus	W	xx	xxx
30.	Eronia cleodora dilatata	F, HW	o	xx
31.	Nepheronia argia mhondana	F	x	xx
32.	" thalassina sinalata	F, HW	x	xx
33.	Catopsilia florella	U	xxx	xxx
34.	Eurama hecabe solifera	HW, F	x	xxx
35.	" senegalensis	HW, F	x	xx
36.	" floricola nivea	F, HW	xxx	xx
37.	" brigitta	W, Fm	xxx	xxx
38.	" hapale	S, Rs, W	x	xx
39.	" desjardinsii	W, Fm	xx	xxx
40.	" regularis	W, Fm	x	x

NYMPHALIDAE

41.	Euxanthe tiberius tiberius	F	x	x
42.	" wakefieldi	F	xx	xx
43.	Charaxes varanes vologeses	W, Fm	xx	xxx
44.	" candiope	F	x	xxx
45.	" protoclea azota	F	o	xx
46.	" lasti esp. n.	F	xx	
47.	" castor flavifasciatus	W, Fm	xx	xx
48.	" brutus alcyone	F, HW	xx	xx
49.	" pollux geminus	F	x	xx
50.	" violetta melloni	F	xx	xx

51.	"	bohemani	W	o	xx
52.	"	cithaeron kennethi	F	xx	xxx
53.	"	zoolina zoolina	W	xxx	xxx
54.	"	dilutus dilutus	F, Fm	x	xx
55.	"	jahlusa argynnides	F, Fm	xxx	xx
56.	"	tavetensis	F	o	x
57.	"	achaemenes	W	xx	xxx
58.	"	baumanni baumanni	Fm	xxx	xx
59.	"	guderiana guderiana	W	xx	xxx
60.	"	contrarius	F	xx	x
61.	"	viola kirki	W	o	xx
62.	"	ethalion littoralis	F, W	x	xx
63.	Cymothoe	coranus coranus	F	o	x
64.	Euptera	pluto kinugnana	F	xxx	xx
65.	Euryphura	achlys	F	x	x
66.	Bebaeria	mardania orientis	F, HW, C	o	x
67.	Euphaedra	neophron neophron	F, HW	xx	xx
68.	"	orientalis	F	x	x
69.	Hamanumida	daedalus	W, Oh	xx	xxx
70.	Aterica	galene theophane	F, HW	xx	xx
71.	Catuna	sicorana	F	xx	xx
72.	Pseudacraea	boisduvali trimeni	F, HW	x	x
73.	"	eurytus conradti	F	x	x
74.	"	lucretia exapnca	F, HW	xxx	xx
75.	Neptis	saclava marpessa	F, HW	xx	xx
76.	"	laeta	W	xx	xxx
77.	"	alta	W	o	x
78.	"	nina	F	xxx	xx
79.	Cyrestis	camillus sublineata	F	x	x
80.	Sallia	moranti dubiosa	F, HW	xx	xx

81.	Salia natalensis	F	xx	xx
82.	" sp. n.	F	x	x
83.	Byblia anvatara acheloia	W	xxx	xxx
84.	Neptidopsis ophione velleda	F, HW	xxx	xxx
85.	Eurythela dryope angulata	F, HW	xxx	xx
86.	Apaturopsis chleocharis schultzei	F, HW	o	o
87.	Hypolimnas misippus	W, Oh	xx	xx
88.	" deceptor deceptor	F, W	x	xx
89.	" dubius wahlbergi	F, HW	xx	xx
90.	" usambara	F	x	o
91.	Salamis temora virescens	F	o	x
92.	" parhassus	F	xx	xxx
93.	" cacta amaniensis	F	x	o
94.	Junonia natalica natalica	W, Fm	xx	xxx
95.	" terea elgiva	F	xxx	xxx
96.	" oenone oenone	W, Oh	xxx	xxx
97.	" hierta cebrene	W, Oh	xx	xxx
98.	" orithya madagascariensis	W, Oh	x	xx
99.	Lachnoptera iole ayresii	F	o	xx
100.	Phalanta phalantha aethiopica	W	xx	xxx
101.	" eurytis columbina	F	xx	xxx
	DANAIDAE			
102.	Danaus chrysippus	U	xx	xxx
103.	Amauris niavius dominicanus	F	xx	xx
104.	" ochlea ochlea	F, C	xx	xxx
	SATYRIDAE			
105.	Melanitis leda africana	W, F	xx	xxx
106.	Gnophodes betsimena diversa	F	x	xx
107.	Bicyclus ena	W	x	x
108.	" campinus ocelligerus	F, HW	xxx	xxx
109.	" anynana	W, F	x	xx
110.	" safitza	W, Fm	xxx	xxx

111.	Henotesia perspicua	W, Oh	xx	xxx
112.	Physcaenaura jacksoni	F, Fm	xxx	xx
113.	Ypthima granulosa	W	xxx	xxx

ACRAEIDAE

114.	Bematistes aganice montana	F, HW	xx	xx
115.	" adrasta	F	x	x
116.	Acraea satis	F	0	x
117.	" quirina rosa	F	x	xxx
118.	" terpsichore neobule	W	0	xx
119.	" punctimarginea	F	xx	0
120.	" igola	F	xx	x
121.	" pseudolycia astrigera	W	0	xx
122.	" natalica natalica	W	xxx	xxx
123.	" encedon	W	x	xxx
124.	" enonina	W, S, Oh	xxx	xxx
125.	" servona orientis	F	xxx	xx
126.	" esebria	F	xx	xx
127.	Pardopsis punctatissima	W	0	x

LIBYTHEIDAE

128.	Libythea labdaca laius	F, Fm	xx	xx

LYCAENIDAE

129.	Alaena nyassae ochracea	Rw	x	x
130.	" picata	Rf, Rs	x	x
131.	Pentila tropicalis mombasae	F	xx	xx
132.	" rogersi rogersi	F	x	x
133.	Ornopholidotos paucetia pauceda	F, HW	xx	xx
134.	Teriomima subpunctata	F	0	xx
135.	" puella	F, HW, Rs	0	0
136.	" parva	F	0	x
137.	Baliochila latimarginata	F	0	x

138.	Baliochila dubiosa	F	0	0
139.	Eresinopsides bichroma	F	0	0
140.	Lachnocnema brimu	F, W	xx	0
141.	Spindasis nyassae	W	0	x
142.	" ella	W	0	x
143.	" tavetensis	W	0	xx
144.	Lipaphnaeus aderna spindasoides	F	0	0
145.	Epamera silanus alticola	F	0	x
146.	" diametra	F	0	0
147.	" mermis	F	0	0
148.	Etesiolaus sp. n.	F	x	
149.	Hypolycaena philippus	W, Oh	xx	xxx
150.	" buxtoni rogersi	W, F	xx	xx
151.	Anthene indefinita	W, F	x	xx
152.	" definita	W	0	xxx
153.	" rubrimaculata	F	0	x
154.	" liodes	F	xx	xx
155.	" lunulata	W, Oh	x	xxx
156.	Anthene amarah	W, Oh	xx	xxx
157.	" larydas	W	x	xx
158.	" kersteni	W	xx	xxx
159.	Cupidopsis jobates	W, Oh	x	x
160.	Pseudonacaduba sichela	W, Fm	xx	xxx
161.	Lampides boeticus	U	x	xxx
162.	Cacyreus lingeus	Fm, W	xx	xxx
163.	Leptotes pirithous	W, F	x	xxx
164.	Euchrysops malathana	W, Oh	xx	xxx
165.	" osiris	W, Oh	x	xxx
166.	Castalius stempfferi	Hw, Fm	x	0
167.	Tarucus grammicus	W, Fm	x	x
168.	Zizeeria knysna	W, Oh	xx	xxx
169.	Zizina antanossa	W, Oh	xxx	xxx
170.	Zizula hylax	W, Oh	o	xxx
171.	Azanus mirza	W, Fm	xx	xx
172.	" moriqua	W, F	x	xx

173.	Azanus jesous	W	0	xx
174.	" natalensis	W	0	xx
175.	Eicochrysops hippocrates	S, Fm	xx	xx
176.	Oboronia bueronica	F	xx	xxx
177.	Freyeria trochilus	W, Oh	0	xx

HESPERIIDAE

178.	Coeliades forestan	W, Fm	xx	xxx
179.	" sejuncta	F	0	x
180.	Celaenorrhinus kimboza	F	0	
181.	" zanqua	F	0	x
182.	" galenus	F	x	xxx
183.	Tagiades flesus	F, Hw	xx	xxx
184.	Eretis melania	Fm, F	x	xx
185.	Sarangesa maculata	F	x	xx
186.	Netrobalane canopus	Hw, F	0	x
187.	Spialia dromus	W	xx	xx
188.	" spio	W	x	xx
189.	Ampittia parva	F, S	x	xx
190.	" kapenas	W, Fm	xx	xx
191.	Gorgyra diva	F, Hw	0	x
192.	" bibulus	F	0	x
193.	Teniorhinus harona	W	xx	xxx
194.	" herilus	F, Hw	x	x
195.	Pardaloides incerta incerta	F	xx	xxx
196.	Acada biceriatus	W	x	xxx
197.	Acleros plotzi	F, Hw	x	xx
198.	" mackenii	F, Hw	0	xxx
199.	Andronymus neander neander	W, F.	x	xxx
200.	" caesar philander	W, F	xx	xx
201.	Artitropa milleri milleri	F	0	x

202.	Monza punctata	F, Hw	x	xx
202a	" " f. crola	F, Hw	0	0
203.	Platylesches galesa	F	0	xx
204.	" picanini	F	0	xx
205.	Pelopidas mathias	W	0	xx
206.	" thrax inconspicua	W, Fm	x	xx
207.	Borbo lugens	F	xxx	xxx
208.	" fatuellus	F, Hw	xx	xxx
209.	" detecta	W	xx	xx
210.	" micans	S, W	0	x
211.	" ferruginea	F	0	0
212.	" borbonica	W, Oh	x	xx
213.	" gemella	W	xx	xx
214.	Gegenes niso brevicornis	W, Oh, F	xx	xxx
215.	" hotentota	W, Oh	0	x

ABBREVIATIONS IN THE TEXT

o	rare to very rare	Rw	rocky woodland
x	uncommon	Oh	open habitat
xx	common	s	marshy habitat
xxx	very common	W	woodland (deciduous)
F	forest in general	Hw	heavy woodland
Fm	forest margin	U	ubiquitous
Rf	riverine forest	C	cultivated land, gardens
Rs	river sides		

General frequency is the rate of occurrence in general for the species concerned. Frequency is a subjective estimate of abundance in Kimboza at the time of our collections.

NOTES ON OCCURRENCES AND INTERESTING SPECIES

One peculiarity of the Kimboza Forest is the apparent absence of several ordinarily common species of lowland forests and also other parts of the Ulugurus. This, probably, originates in the nature of the geology of this particular area which is limestone formation , and therefore would lack several species of plants, common on other formations. On the other hand, endemics occur and also, certain usually rare species appear to be quite common. Some of the absent species, generally occurring in forests down to 250 to 300 m., are as follows: Euphaedra zaddachi crawshayi, Pseudacraea dolomena usagara, N. trigonophora N. goochi, Sallya boisduvali, Neptidopsis fulgurata - platyptera, and the genus Precis, particularly numerous in woodlands, was entirely absent, Also the Colotis species were poorly represented (many normally penetrated forests along roads and paths).

No. 46 This is a new subspecies of Charaxes lasti, probably endemic to the Kimboza Forest. The nominate race occurs at Pugu Hills and Turiani and then to the Usambaras and Kenya. The description is in print. No. 82. This new species of Sallya, described in a forthcomming paper, is surprisingly widespread, occurring fairly commonly in the Pugu Hills and has also been taken at Sanje and Mufindi. No. 90, A local and beautiful species occurring in the Usambaras, Kimboza and at Pugu, in very dense forest. This species will not survive if its habitat is only partly exploited.
No. 119. A very local species of lowland forests of E. Usambara and Kimboza Forest. No. 139, Larger and with ochreous markings more extended than in specimens from Pugu and may constitute a distinct subspecies, but only 3 females have been taken. No. 140. This is generally not at all common, but seems to be quite frequent in

the Kimboza Forest. No. 147, Also known from the Usambaras. No. 148, In the Usambaras and W. Tanzania (Kigoma) to Uganda and Zaire occurs Etesiolaus catori cottoni. The Kimboza specimens are not E. catori, they are superficially close, but with different genitalia. It is likely that the Usambara and the Kimboza population are the same species and undescribed. 180. This species is endemic to the Kimboza Forest and is not common even here.

Appendix 3. The Bird Species of Kimboza Forest Reserve

* Palm-nut Vulture
Southern Banded Snake Eagle
Little Sparrowhawk
African Goshawk
\+ African Hawk Eagle
Crowned Eagle
Kenya Crested Guinea Fowl
Lemon Dove
Bronze Naped Pigeon
Tambourine Dove
Brown necked Parrot
Livingstones Turaco
\- Barred long tailed Cuckoo
Klass Cuckoo
Yellow bill
African Wood Owl
Barred Owlet
Palm swift
Bohm's Spinetail
Mottled throated Spinetail
Narina's Trogon
Bar-tailed Trogon
Green Wood Hoopoe
Silvery cheeked Hornbill
Trumpeter Hornbill
Crowned Hornbill
White-eared Barbet A distinctive subspecies found here
Yellow-rumped Tinker bird
Green Tinker bird
Scaly-throated Honey guide
Golden-tail Woodpecker
Cardinal Woodpecker
African Broadbill

Square-tailed Drongo
Green-headed Oriole
* White necked Raven
Pale-breasted Illadopsis
Black Cuckoo Shrike
Purple-throasted Cuckoo Shrike A distincitiv subspecies fo here
Grey Cuckooo Shrike
\+ Stripe-cheeked Greenbul
Little Greenbul
Yellow-bellied Greenbul
Nicator
Tiny Greenbul
Fischer's Greenbul
Yellow-streaked Greenbul
Common Bulbul
\+ White-chested Alethe
Red-capped Robin Chat
Red-tailed Ant Thrush
\+ White-starred Forest Robin
Black-headed Apalis
Evergreen Forest Warbler
Grey-backed Camaroptera
Kretschmer's Long bill
Ashy Flycatcher
Lead-coloured Fly catcher
Forest Batis
Black & White Fly catcher
Little Yellow Fly catcher
\+ White-tailed Crested Fly catcher
Crested Fly catcher
Black-backed Puffback

+ Black-fronted Bush Shrike
  Four-coloured Bush Shrike
  Retzs' Helmet Shrike
  Chestnut-fronted Helmetshrike
* Red-winged Starling
+ Kenrick's Starling
  Collared Sunbird
  Uluguru Violet-backed Sunbird
  Olive Sunbird
  Yellow White-eye
  Dark-backed Weaver
  Peter's Twinspot
  Lesser Seed-cracker Central African species, rare, this is northern limit.

Notes

1. A total of 79 species, of which 7 are considered to be "not forest dependent" (birds marked * in this list)

2. Of the 72 forest species, 9 are normally considered as montane species and are probably only visitors to Kimboza in the cool season (marked + in this list).

Appendix 4. The Vascular Plants of Kimboza Forest Reserve

This list is compiled from collections and observations made by the authors augmented by data from past collections, notably those of S.R. Semsei who collected extensively in July 1952 and T. Pocs who collected intermittently in the 1970s.

The list is divided into Dicotyledons, Monocotyledons and vascular Cytograms; within these sections species are listed by family in alphabetical order.

Abbreviations for collectors are as follows:

WAR	- W.A. Rodgers	SEM SR	Semsei
MW	- L.B. Mwasumbi	GR	P. Greenway
DSM	- Dar es Salaam University		H. Harris
s.r.	- sight record.		

ANGIOSPERMS - DICOTYLEDONS

ACANTHACEAE

Adhatoda sp. nov.	MW 12420
A. sp.	SEM 282
Asystasia multiflora KLOTZSCH	s.r.
A. sp. nov. 1	WAR 2512
A. sp. nov. 2	MW 12358
Barleria prionitis L.	
Brillantaisia pubescens OLIVER var. riparia BURRMITT AND VOLLESEN	WAR 2532
Chlamydacanthus dichrostachyus MILDBR.	WAR 2600
Justicia gangetica (L.) T. ANDERSON	s.r.
J. glabra ROXB.	WAR 2495
J. insularis T. ANDERSON	H 3233
J. interrupta (LINDAU) C.B. CLARKE	DSM 2672
J. nyassana LINDAU	SR
J. pseudorungia LINDAU	MW 12350
Phaulopsis imbricata (FORSSIKA) SWEET	WAR 2533
Pseuderanthemum hildebrandtii LINDAU	WAR 2519
P. tunicatum (AFZEL.)MILNE-REDH.	WAR 2507
Sclerochiton obtusisepalus C.B. CLARKE	MW 12433
S. vegelii (NEES)T.ANDERSON subsp. holstii (LINDAU)NAPPER	SEM 794
Styasasia sp. nov.	WAR
Thunbergia heterochondros MILDBR.	MW 12448
T. kirkii HOOK. f.	MW 12426

AMARANTHACEAE

Achyranthes aspera L.	s.r.
Psilotrichum fallax C.C. TOWNSEND	MW 12466
P. majus PETER	WAR 2488

ANACARDIACEAE

Lannea antiscorbutica (HIERN) ENGL.	MW 12451
Mangifera indica L. (contaminant)	s.r.
Sorindeia madagascariensis DC.	s.r.

ANNONACEAE

Artabotrys brachypetalus BENTH.	WAR 2562
A. monteiroae OLIVER	MW 12389
Asteranthe asterias (S. MOORE)ENGL. & DIELS var. asterias	MW 12342
Isolona cauliflora VERDC.	WAR 2672
Lettowianthus stellatus DIELS	
Monanthotaxis trichocarpa (ENGL. & DIELS) VERDC.	MW 12332
Ophrypetalum odoratum DIELS	MW 12371
Uvaria sp.	SR
Uvariodendron gorgonis VERDC.	PAULO 163

(N.B. PARRY 816, sterile, in the Lushoto Herbarium and shelved as Polyceratocarpus scheffleri ENGL. & DIELS, is probably this species.)

U. sp. 1	WAR 2640
U. sp. 2	WAR 2627
ANNONACEAE: genus indeterminate	SEM 810, in FTEA

APOCYNACEAE

Funtumia africana (BENTH.) STAPF	MW 12398
Landolphia cf. kirkii DYER	s.r.
Rauvolfia mombasiana STAPF	DSM 2049
Saba florida (BENTH.)BULLOCK	DSM 2060
Schizozygia coffaeoides (BROJER)BAILLON	DSM 325
Strophanthus zimmermannianus PLANCHON	DSM 2673
Tabernaemontana holstii SCHUMANN	s.r.
Voacanga africana STAPF	MW 12386

ARALIACEAE

Cussonia spicata THUNB.	s.r.
C. zimmermannii HARMS	s.r.

ASCLEPIADACEAE

Cryptolepis apiculata SCHUMANN	
Gomphocarpus rostratus (N.E.BR.) BULLOCK	SEM 816
Mondia ecornuta (N.E.BR.) BULLOCK	DSM 332
Parquetina nigrescens (AFZEL.) BULLOCK	MW 12335
Pergularia daemia (FORSSKAL) CHIOV.	SEM 838
Secamone parvifolia (OLIVER) BULLOCK	WAR 2529
Tylophora conspicua N.E. BR.	GR 2521

BALANITACEAE

Balanites Wilsoniana DAWE $ SPRAGUE	WAR 2503

BALSAMINACEAE

Impatiens cinnabarina GREY-WILSON	MW 12421
I. wallerana HOOK. f.	WAR 2644

BIGNONIACEAE

Markhamia acuminata (KLOTZSCH) SCHUMANN	WAR 2500

BOMBACACEAE

Ceiba pentandra (L.) GAERTNER (contaminant)	s.r.
Rhodognaphalon schumannianum ROBYNS	MW 12414

BORAGINACEAE

Ehretia litoralis GURKE	DSM 327

BURSERACEAE

Commiphora pteleifolia ENGL.	s.r.
C. zimmermannii ENGL.	MW 12394; WAR 2597

BUXACEAE

Notobuxus cordata R.-SM.	WAR 2505

CELASTRACEAE

Hippocratea sp.	WAR 2565
Maytenus heterophylla (ECKLON & ZEYHER) N.ROBSON	MW 12477
M. senegalensis (LAM.)EXELL	s.r.
M. undata (THUNB.) BLAKELOCK	MW 12362
Salacia madagascariensis (LAM.) DC.	s.r.
S. stuhlmanniana LOES.	WAR 2566

COMBRETACEAE

Combretum chionanthoides ENGL. & DIELS	Pocs 6054D
C. holstii ENGL.	MW 12455
C. padoides ENGL. & DIELS	GR 2525
C. pentagonum LAWSON	WAR 2559
C. schumannii ENGL.	WAR 2604
C. sp. 1	WAR 2574
C. sp. 2 (liane; persistent petiolar spines)	WAR 2567
Terminalia sambesiaca ENGL. & DIELS	MW 12336

COMPOSITAE

Vernonia aemulans VATKE	WAR 2509

CONNARACEAE

Byrsocarpus orientalis (BAILLON) BAKER	s.r.
Cnestis confertiflora GILG	DSM 2418

CONVOLVULACEAE

Turbina stenosphon (HALLIER f.) MEEUSE	WAR 2570

CRASSULACEAE

Kalanchoe obtusa ENGL.	Pocs 6800F

CUCURBITACEAE

Coccinea grandis (L.) VOIGT	MW 12465
Cyclantheropsis parviflora (COGN.) HARMS	Pocs 6060F
Gerrardanthus grandiflorus COGN.	WAR 2639
Momordica calantha GILG	MW 12430
M. peteri A. ZIMMERM.	DSM 2684
Peponium vogelii (HOOK.f.) ENGL.	WAR 2506

EBENACEAE

Diospyros amaniensis GURKE	WAR 2635
D. brucei F. WHITE	MW 12333
D. greenwayi F. WHOLE	DSM 2664
D. mespiliformis HOCHST. ex A. DC.	SEM 747
D. verrucosa HIERN	WAR 2602
D. zombensis (B.L. BURTT) F. WHITE	SEM 844

ERYTHROXYLACEAE

Erythroxylum fischeri ENGL. var heckmannianum ENGL.	MW 12476

EUPHORBIACEAE

Acalypha engleri PAX	MW 12377
A. neptunica MUELL. ARG.	DSM 2671
A. ornata A. RICH.	MW 12359
A. racemosa BAILLON	MW 12360
Alchornea laxiflora (BENTH.) PAX & K. HOFFM.	WAR 2636
Antidesma membranaceum MUELL. ARG.	MW 12390
Bridelia cathartica BERTOL. f.	MW 12334
Croton macrostachyus DEL.	MW 12464
Drypetes natalensis (HARVEY) HUTCH.	DSM 2670
D. parvifolia (MUELL. ARG.) PAX & HOFFM.	MW 12444
D. usambarica (PAX) HUTCH.	Pocs 6054D
Erythrococca usambarica PRAIN	MW 12404
Euphorbia geniculata ORTEGA	KABUYE 266
E. usambarica pax	MW 12416
Macaranga capensis (BAILLON) SIM	WAR 2485
Micrococca mercurialis BENTH.	MW 12435

Mildbraedia carpinifolia (PAX) HUTCH.	s.r.
Neoholstia tenuifolia (PAX) RAUSCHERT var. glabrata (PRAIN) R.-SM.	MW 12368
Neopalissya castaneifolia (BAILLON) PAX	WAR 2560
Ricinodendron heudelotii (BAILLON) PIERRE ex PAX	s.r.
Suregada lithoxyla (PAX & K. HOFFM.) PRAIN	SEM 842
S. zanzibariensis BAILLON	SEM 824
Synadenium cf grantii HOOK. f.	s.r.
Tragia scheffleri BAKER	Pocs 6274A

FLACOURTIACEAE

Grandidiera boivinii JAUB.	MW 12345
Oncoba spinosa FORSSKAL	MW 12338
Scolopia zeyheri (NEES) HARVEY	SEM 762

GESNERIACEAE

Streptocarpus kimbozanus B.L. BURTT	MW 12382

GUTTIFERAE

Garcinia bifasciculata N. ROBSON	MW 12344A
G. Symsei VERDC.	MW 12344
G. volkensii ENGL.	MW 12441

(N.b. in the Dar es Salaam Herbarium Pocs 6466A is listed as G. livingstonei T. ANDERSON but the specimen has not been traced)

HERNANDIACEAE

Gyrocarpus americanus JACQ. subsp. africanus KUBITZKI	SEM 764
Illigera madagascariensis PERRIER	Pocs 6188J

ICACINACEAE

Alsodeiopsis schumannii (ENGL.) ENGL.	WAR 2637
Pyrenacantha kaurabassana BAILLON	DSM 2086

LEGUMINOSAE : CAESALPINIOIDEAE

Afzelia quanzensis WELW.	s.r.
Cassia hirsuta L. (contaminant)	PADWA 320(In FTEA)
Cordyla africana LOUR.	MW 12439
Cynometra ulugurensis HARMS	HOLTZ 3100(In FTEA)
C. cf. alexandri C.H. WRIGHT	WAR 2586
C. sp. A of F.T.E.A.	WAR 2497
Dialium holtzii HARMS	SEM 757
Guibourtia schliebenii (HARMS) LEONARD	WAR 2617
Isoberlinia scheffleri (HARMS) GREENWAY	SEM 846
Mezonueron angolense OLIVER	SEM 791
Scorodophloeus fischeri (TAUBERT) LEONARD	MW 12472
Tessmannia sp. nov.	WAR 2499
Zenkerella egregia LEONARD	MW 12400

LEGUMINOSAE : MIMOSOIDEAE

Acacia brevispica s.l.	s.r.
Albizia glaberrima (SCHUM. & THONN.) BENTH.	s.r.
A. gummifera (J. GMELIN) C.A. SMITH	SEM 751
Entada pursaetha DC.	s.r.
Newtonia paucijuga (HARMS) BRENAN	MW 12473
Tetrapleura tetraptera (SCHUM. & THONN.) TAUBERT	WAR 2592

LEGUMINOSAE : PAPILIONOIDEAE

Baphia pauloi BRUMMITT	DSM 2470
Craibia zimmermannii (HARMS) DUNN	MW 12489
Dalbergia obovata E. MEYER	MW 12491
Dolichos trilobus L. var. trilobus	KABUYE 277
Erythrina sacleuxii HUA	WAR 2583
Glycine wightii (WIGHT & ARN.) VERDC. subsp. wightii	WAR 2535
Indigofera mildbraediana J.B. GILLETT	SEM 795
Millettia elongatistyla J.B. GILLETT	MW 12443
M. semseii J.B. GILLETT	WAR 2588
Pterocarpus tinctorius WELW.	MW 12340

LOGANIACEAE	
Strychnos mitis S. MOORE	s.r.
S. sp.	MW 12402
LORANTHACEAE	
Tapinanthus sansibarensis (ENGL.) DANSER	WAR 2643
MALPIGHIACEAE	
Acridocarpus sp.	WAR 2564
MALVACEAE	
Abutilon sp.	s.r.
Hibiscus faulknerae VOLLESEN	SEM 774
H. platycalyx MASTERS	MW 12463
Sida veronicifolia LAM.	GR 2519
MELASTOMATACEAE	
Memecylon verruculosum BRENAN	WAR 2514
MELIACEAE	
Cedrella odorata L. (contaminant)	s.r.
Khaya nyassica BAKER f.	WAR 2628
Trichilia emetica VAHL	MW 12458
Turraea mombassana C.DC.	MW 12469
T. vogelioides BAGSH. & BAKER f.	MW 12480
MELIANTHACEAE	
Bersama abyssinica FRESEN.	s.r.
MENISPERMACEAE	
Cissampelos pareira L. var. hirsuta (DC.) FORMAN	DSM 2058
Jateorhiza palmata (LAM.) MIERS	MW 12355
MONTINIACEAE	
Grevea eggelingii MILNE-REDH.	MW 12373

MORACEAE

Antiaris toxicaria LESCHEN.	WAR 2491
Bosquela phoberos BAILLON	SEM 837
Chlorophora excelsa (WELW.) BENTH & HOOK. f.	s.r.
Dorstenia alta ENGL.	s.r.
D. denticulata PETER	MW 12409
D. kamerunlana ENGL.	MW 12428
D. kyimbelaensis DE WILD.	SEM 768
D. scaphigera BUREAU var. alata (ENGL.) DE WOLF	DSM 2686
D. spl 1	Pocs 6280C
D. sp. 2	MW 12339
Ficus capensis THUNB.	MW 12417
F. exasperata VAHL	SEM 766
F. Ingens (MIQ.) MIQ.	SEM 840
F. leprieurii MIQ.	WAR 2480
F. natalensis (MIQ.) HOCHST.	SEM 834
F. nekbudu WARB.	s.r.
F. populifolia VAHL	WAR 2493
F. vallis-choudae DEL.	WAR 2632
F. sp.	WAR 2493A
Morus mesozygia STAPF	WAR 2590
Sloetiopsis usambarensis ENGL.	MW 12470

OCHNACEAE

Ochna thomasiana ENGL. & DIELS	MW 12471

OLACACEAE

Olax gambecola BAILLON	MW 12468

OLEACEAE

Jasminum pauciflorum BENTH.	MW 12380
Olea mildbraedii (GILG & SCHELLENB.) KNOBL.	SEM 759

PASSIFLORACEAE

Basananthe sp.	s.r.

PIPERACEAE

Peperomia blanda KUNTH.	MW 12436
Piper umbellatum L.	MW 12408

PLUMBAGINACEAE

PLumbago zeylanica L.	KABUYE 270

RHAMNACEAE

Helinus integrifolius (LAM.) KUNTZE	Pocs 6188M
Lasiodiscus mildbraedii ENGL. subsp. ferrugineus (VERDC.) FADEN	MW 12478
Ziziphus mucronata WILLD.	MW 12459

RUBIACEAE

Breonadia microcephala (DEL.) RIDSD.	MW 12406
Canthium pallidum (SCHUMANN) BULLOCK	MW 12396
C. sylvaticum HIERN	SEM 800
Chassalia discolor SCHUMANN subsp. grandiflora VERDC.	Pocs 6274D
Coffea pseudozanguebarica BRIDSON	MW 12393
C. sp. D. of F.T.E.A. ms.	WAR 2411
Cremaspora triflora (THONN.) SCHUMANN	WAR 2577
Geophila repens (L.) I.M. JOHNSTON	WAR 2528
Ixora narcissodora SCHUMANN	MW 12413
I. tanzaniensis BRIDSON	WAR 2517
Kraussia speciosa BULLOCK	MW 12330
Leptactina platyphylla (HIERN) WERNHAM	MW 12395
Meyna tetraphylla (SCHWEINF.) ROBYNS	WAR 2521
Mitragyna rubrostipulata (SCHUMANN) HAVIL.	MW 12412
Oxyanthus pyriformis (HOCHST.) SKEELS subp. tanganyikensis BRIDSON	WAR 2638
Pavetta crebrifolia HIERN var. kimbozensis (BREMEK.) BRIDSON	MW 12376
Pentas bussei K. KRAUSE	MW 12456
P. micrantha BAKER	MW 12362
Polysphaeria cleistocalyx VERDC. var. cleistocalyx	WAR 2606
P. dischistocalyx BRENAN	MW 12385

Psychotria lauracea (SCHUMANN) PETIT	MW 12357
P. leucopoda PETIT	MW 12365
P. tanganyicensis VERDC.	MW 12384
Rothmannia fischeri (SCHUMANN) OBERM.	MW 12460
R. manganjae (HIERN) KEAY	SEM 760
Rytigynia binata (SCHUMANN) ROBYNS	MW 12351
R. eikii (K. KRAUSE & SCHUMANN) BULLOCK	SEM 819
Tricalysia acidophylla ROBBRECHT	MW 12434;
T. ovalifolia HIERN var. glabrata (OLIVER) BRENAN	SEM 763
T. sp.	MW 12405
RUBIACEAE: Genus indeterminate 1	Mw 12461
RUBIACEAE: genus indeterminate 2	WAR 2629

RUTACEAE

Diphasia morogoroensis KOKWARO var subalata KOKWARO	KABUYE 267
Teclea simplicifolia (ENGL.) VERD.	WAR 2515
T. trichocarpa (ENGL.)ENGL.	MW 12352
Vepris cf. stolzii VERD.	WAR 2613
Zanthoxylum usambarensis (ENGL.) KOKWARO	MW 12356

SAPINDACEAE

Allophylus africanus P. BEAUV.	SEM 755
A. pervillei BLUME	MW 12382
A. stachyanthus GILG	WAR 2558
A porrhiza paniculata RADLK.	WAR 2610
Blighia unijugata BAKER	MW 12475
Cardiospermum halicababum L.	WAR 2591
Chytranthus sp.	S.r.
Deinbollia borbonica SCHERFF	s.r.
Filicium decipiens (WIGHT & ARN.) THWAITES	MW 12401
Lecaniodiscus fraxinifolius BAKER	MW 12447A
Lepisanthes senegalensis (JUSS. ex POIRET)LEENH.	SEM 781
Macphersonia hildebrandtii O. HOFFM.	s.r.
Majidea zanguebarica OLIVER	MW 12447
Pancovia golungensis (HIERN) EXELL & MENDONCA	DSM 2684

Paullinia pinnata L.	s.r.
Zanha golungensis HIERN	MW 12403

SAPOTACEAE

Afrosersalisa cerasifera (WELW.) AUBREV.	s.r.
Aningeria pseudo-racemosa J. HEMSLEY	WAR 2575
Bequertiodendron natalense (SONDER)HEINE&J.HEMSLEY	DSM 2433
Malacantha alnifolia (BAKER) PIERRE var alnifolia	MW 12499A
Mamilkara sansibarensis (ENGL.)DUBARD	WAR 2608
Mimusops aedificatoria MILDBR.	WAR 2611
M. riparia ENGL.	MW 12490
Pachystela brevipes (BAKER) ENGL.	MW 12453
P. msolo (ENGL.) ENGL.	MW 12375

SOLANACEAE

Solanum goetzei DAMMER	WAR 2527
S. nigrum L.	WAR 2486

STERCULIACEAE

Cola greenwayi BRENAN	MWA 12348
C. stelecantha BRENAN	MW 12450
C. sp.	WAR 2624
Leptonychia usambarensis SCHUMANN	MW 12374
Sterculia appendiculata SCHUMANN	MW 12382

THYMELAEACEAE

Synaptolepis alternifolia OLIVER	s.r.

TILIACEAE

Christiana africana DC.	MW 12479
Grewia forbesii MASTERS	s.r.
G. goetzeana SCHUMANN	MW 12454
G. pachycalyx SCHUMANN	WAR 2479

ULMACEAE

Celtis gomphophylla BAKER	WAR 2589
C. wightii PLANCHON	SEM 820
C. zenkeri ENGL.	MW 12337
Trema orientalis (L.) BLUME	SEM 836

URTICACEAE

Laportea aestuans (L.) CHEW	SEM 799
L. lanceolata (ENGL.) CHEW	MW 12442
Urera cameroonensis WEDD.	MW 12485
U. fischeri ENGL.	MW 1248[illegible]
U. hypselodendron (HOCHST. ex A. RICH) WEDD.	MW 12[illegible]19

VERBENACEAE

Clerodendrum capitatum (WILLD.) SCHUM. & THONN.	MW 12440
Vitex buchananii GURKE vel sp. aff.	WAR 2581
V. doniana SWEET	SEM 787
V. strickeri VATKE & HILDEBR.	MW 12391

VIOLACEAE

Rinorea arborea (THOUARS) BAILLON	MW 12446

VITACEAE

Cayratia ibuensis (HOOK. f.) SUESSENG.	WAR 2618
Cissus oliveri (ENGL.) GILG	WAR 2510
C. rotundifolia (FORSSKAL) VAHL	WAR 2501
Cyphostemma hildebrandtii (GILG) DESCOINGS	MW 12397
Rhoicissus tridentata (L.f.) WILD & R. DRUMM.	s.r.

ANGIOSPERMS - MONOCOTYLEDONS

AGAVACEAE

Dracaena deremensis ENGL.	MW 12483
D. usambarensis ENGL.	GR 2531
Sanseviera cf. braunii ENGL. & K. KRAUSE	s.r.

AMARYLLIDACEAE

Scadoxus multiflorus (MARTYN) RAF.	Pocs 6060B

ARACEAE

A. stuhlmannii (ENGL.) ENGL.	POLHILL & WINGFIELD 4623
Anchomanes difformis (BLUME) ENGL.	s.r.
Callopsis volkensii ENGL.	DSM 2068
Culcasia scandens P. BEAUV.	WAR 2482
Gonatopus boivinii HOOK. f.	s.r.
Zamioculcas zamiifolia (LODD.) ENGL.	DSM 2061

COMMELINACEAE

Aneilema aequinoctiale (P. BEAUV.) KUNTH	WAR 2424
Coleotrype boecknerana MILDBR.	MW 12427
Commelina benghalensis L.	Pocs 6466M
C. zambesiaca C.B. CLARKE	KABUYE 265
Pollia condensata C.B. CLARKE	MW 12422
Zebrina sp. (contaminant)	s.r.

CYPERACEAE

Cyperus alternifolius L.	DSM 2667
C. difformis L.	s.r.
C. renschii BOECKELER	MW 12378
C. rotundus L.	DSM 2067
Mariscus dubius (ROTTB.) HUTCH.	Pocs 6188G
Scleria lithosperma (L.) SW.	MW 12347
S. racemosa POIRET	MW 12418

DIOSCOREACEAE

Dioscorea hylophila HARMS	MW 12361
D. sansibarensis PAX	Pocs 6188H

FLAGELLARIACEAE

Flagellaria guineensis SCHUM.	s.r.

GRAMINEAE

Bambusa sp. (contaminant)	s.r.
Leptochloa obtusiflora HOCHST.	WAR 2576
L. squarrosa PILGER	DSM 2679
L. uniflora A. RICH.	DSM 2677
Olyra latifolia L.	Pocs 6188B
Oplismenus hirtellus (L.) P. BEAUV.	SEM 817
Panicum pleianthum PETER	WAR 2530
P. trichocladum SCHUMANN	DSM 2678
Paspalum conjugatum BERGIUS	DSM 2680
Setaria megaphylla (STEUDEL) T. DURAND & SCHINZ	SEM 801
Sporobolus tenuissimus (SCHRANK) KUNTZE	KABUYE 271

LILIACEAE

Asparagus falcatus L.	WAR 2522
A. setaceus (KUNTH) JESSOP	s.r.
Chlorophytum heynei BAKER	MW 12386

MUSACEAE

Musa sp. (contaminant)	s.r.

ORCHIDACEAE

Acampe pachyglossa REICHB. f.	WAR 2599
Aerangis kirkii (ROLFE) SCHLTR.	MW 21431
Angraecum cf. stolzii SCHLTR.	MW 12370; WAR 2474
Bulbophyllum longiflorum THOUARS	WAR 2474, 2634
Diaphananthe c.f. lorifolia SUMMERH.	MW 12482B
Microcoelia exilis LINDLEY	MW 12432
Oeceoclades lonchophylla (REICHB. f.) GARAY & P. TAYLOR	MW 12425
Polystachya tessellata LINDLEY	WAR 2633

PALMAE

Elaeis guineensis JACQ.	s.r.
Phoenix reclinata JACQ.	s.r.

PANDANACEAE

Pandanus goetzei WARB.	s.r.

TECOPHILAEACEAE

Cyanastrum holstifolium WNGL.	WAR 2526

ZINGIBERACEAE

Aframomum sp.	s.r.
Costus afer KER GAWLER	DSM 324
Kaempferia rosea SCHWEINF. ex BENTH. & HOOK. f.	CRIBB ET AL. 10405

VASCULAR CRYPTOGAMS

ADIANTACEAE

Actiniopteris radiata (SW.) LINK	MW 12457
Adiantum confine FEE	WAR 2579
A. incisum FORSSKAL	WAR 2580
P. tripartita SW.	DSM 6054H

ASPLENIACEAE

Asplenium friesiorum C. CHR.	Pocs 6526A
A. gemmiferum SCHRADER	WAR 2588
A. holstii HIERON.	DSM 2065
A. nidus L.	Pocs 6466J
A. rutifolium (BERGIUS) KUNZE	DSM 2683
A. theciferum (KUNTH) METT.	s.r.

DAVALLIACEAE

Davallia chaerophylloides (POIRET) STEUDEL	DSM 2069
Nephrolepis biserrata (SW.) SCHOTT	DSM 2056

POLYPODIACEAE

Microgramma lycopodioides (L.) COPEL.	MW 12437
Microsorium punctatum (L.) COPEL.	WAR 2481
Phymatodes scolopendria (BURM. f.) CHING	DSM 2063
Platycerium elephantotis SCHWEINF.	Pocs 6465B

THELYPTERIDACEAE

Amphineuron opulentum (KAULF.) HOLTTUM	Pocs 6280F
Christella dentata (FORSSKAL) HOLTTUM MW	mw 12415.

Appendix 5 PLANT VERNACULAR NAMES

Names given here are mainly Kiluguru, although some are Kiswahili (e.g. Mgude, Mtonga, Mwisa) and others are used widely in south east Tanzania, (e.g. Nyakititu, Mpululu in Kingindo and Kipogoro). Care must be taken over the use of names as different people differ in the use of names and one name may refer to more than one tree, and one tree may have more than one name!

Chana) Chikwa) Dendego)	Dioscorea spp. (edible yam)
Kamagara	Indigofera spicata (weed)
Kidimudimu	Suregada zanzibarensis, Drypetes natalensis
Kifule	Acalypha spp.
Kigwe	Aningeria pseudoracemosa
Kilembannembo	Celtis spp.
Kiswila	Gomphocarpus rostratus
Malagala-mkole	Ziziphus mucronata
Mbanamu	Lannea antiscorbutica
Mbanizo	Psychotria lauracea
Mbarega	Minispermaceae
Mbefu	Trema orientalis
Mbira	Antiaris toxicaria
Mbogole	Garcinia spp.
Mbungo	Saba florida, Landolphia spp.
Mbuni pori	Polysphaeria cleistocalyx
Mchunga	Launaea cornuta (weed)
Mdaa	Diospyros zombensis
Mdagaviro	Canthium sylvaticum
Mduru	Mimusops
Mduru mweupe	Aphania senegalensis
Mfugusa	Pterocarpus tinctorius
Mfuru	Vitex doniana
Mgombogombo	Malacantha alnifolia
Mgude	Sterculia appendiculata
Mgwina	Breonadia microcephala
Mhande	Scorodophleus fischeri, Isoglossa sp.

Mhave	Millettia
Mhengele, Mhengere,	Dialium holstii
Mhilihili	Sorindeia madagascariensis
Mhovu	Newtonia paucijuga
Mkenene	Uvariodendron gorgonis
Mkenge	Albizia gummifera
Mkongo	Afzelia quanzensis
Mkongonolo	Cussonia zimmermannii
Mkongoro	Tetrapleura tetraptera
Mkululu	Diospyros mespiliformis
Mkumbulu	Isoberlina sp. ? scheffleri
Mkunde	Parkia filicoidea
Mkunga	Erythrina sacleuxii
Mkunganaro	Cussonia zimmermannii
Mkuyu	Ficus spp.
Mkwaya	Ficus spp.
Mlagala	Ziziphus mucronata
Mlama	Combretum schumannii
Mlama mnyeupe	Combretum apiculatum
Mlelawana	Maytenus undata
Mlembelembe	Aningeria pseudoracemosa
Mlenqwalenqwa	Rauvolfia mombasiana, Rothmannia fischeri
Mlungulungu	Psychotria leucopoda, Xanthoxylum sp.
Mndizi	Rinorea sp.
Mngombokombo	Commiphora zimmermannii
Mnyabonde	Lettowianthus stellatus
Mnyanza	Albizia versicolor
Mpemi	Trema orientalis
Mpera mwitu	Combretum schumanii
Mpigito	Alchornea laxiflora
Mpingo kamba	Dalbergia obovata
Mpululu	Terminalia sambesiaca
Msambwa	Pachystela msolo
Msanyanzale	Maytenus senegalensis
Msasa	Ficus exasperata
Msegesetundu	Mitragyna stipulata

Msegwa	Pterolobium stellatum
Msenyenzri	Scolopia zeyheri
Msewi	Rothmannia sp. aff. R. fratrum.
Msongambwa	Grevea eggelingii
Msufi pori	Rhodognaphalon schumannianum
Mtitu	Diospyros mespiliformis
Mtomvu tomvu	Funtumia africana, Mimusops sp.
Mtonga	Strychnos mitis
Mtonga mweusi	Garcinia sp.
Muenene	Uvariodendron gorgonis
Mvule	Chlorophora excelsa
Mwana	Ophrypetalum odoratum
Mwila mondo	Lettowianthus stellatus
Mwevu	Jateorhiza palnata
Mwisa	Bridelia sp.
Mzekozeko	Hoslundia opposita
Mzinda nguruwe	Drypetes natalensis
Mzugo	Bosqueia phoberos
Nyakititu	Diospyros spp.
Ugobedi	Costus afer
Zegea	Setaria chevalieri

Appendix 6.

Quantitative Analysis of the Vegetation of Kimboza Forest Reserve

This appendix presents the results of the three quantitative plot and twelve tree tally analyses in Kimboza. Methods were outlined in an earlier section and are given in more detail by Hall & Okali (1978). These methods are now in widespread use in Tanzanian forest studies.

The twelve reconnaissance tree tally samples, each of some fifty trees of 30 cm or more in diameter at breast height, provide an interesting picture of gross variation in the forest canopy composition. Over 81 species of large trees were recorded in this exercise and the results for the most numerous 46 species are given in table A1, (species with a cumulative % frequency of 6 or more). Only 13 of these were encountered in six or more samples, most species occurred in four or fewer sites. The most frequently found species were not necessarily the most numerous, see table A2. Animal dispersed species were the most widespread (Dialium holtzii, Sorindeia madagascariensis Ficus nekbudu, Parkia filicoidea). Contributing the greatest numbers were middle storey trees with a tendency to be gregarious (Scorodophloeus fischeri, Sorindeia madagascariensis, Pandanus goetzei, Garcinia semsei) and which have perhaps an association with a particular part of the forest (Scorodophloeus) or particular habitats (Pandanus and Garcinia) Frequent large trees (Aningeria pseudoracemosa, Cussonia zimmermannii, Rhodognaphalon schumannianum, Terminalia sambesiace) were more thinly distributed.

Figure A1 shows the results of these samples as a series of pie diagrams related to forest site, and contrasts in species composition do stand out. Scorodophloeus fischeri and Sorindeia madagascariensis are codominants in the north and east of the reserve (sample sites 1, 2, 5, 8). Pandanus goetzei and Garcinia semsei make a common combination in the more waterlogged centre of the reserve (3,4,6). Antiaris toxicaria is characteristic of sandy levees near the Ruvu River (10, 11 and especially 12). Tessmannia sp. nov. appears to be rather

restricted to the western boundary (7, 9) and this may explain why it has been overlooked in earlier field work in Kimboza.

Timber species did not account for a large proportion of trees in any of the twelve samples, and the relative importance of each sample varied from site to site. The total number of timber trees encountered is too small to allow inferences to be drawn. It is worth stressing here again that the number of timber species is small and they are very distinctive. The limited size of Kimboza means a high intensity standard enumeration of commercial trees could by easily and quickly done. "Timber species" here refer to: Aningeria pseudoracemosa, Cedrella mexicana, Chlorophora excelsa, Cordyla africana, Khaya nyassica, Pterocarpus tinctorious and Rhodognaphalon schumannianum.

Figure A2 is a diagrammatic to scale picture of all three plot profiles, and tables A3, A4, A5 give quantitative data on plots 1, 2 and 3 respectively.

Plot 1, on a flat loam near our main camp was in a species rich tall forest community (see sample sites 7 and 9). This plot was dominated by a 25m tall Ficus nekbudu with a wide spreading canopy. Under this was a diverse middle layer from 5-15m tall, in which many canopy species were represented. Regeneration included large numbers of Sorindeia madagascariensis and Bequartiodendron natalense (Sm and Bn). Plot 1 is species rich with 65 vascular plants, the structure is uniform and there are no large gaps.

Plot 2 was heterogenous, the eastern end was water logged clay adjoining a stream which ran through the plot and the western half was a better drained clay loam. The east was dominated by Pandanus goetzei (P.g.) and the west by Cola stelecantha (C.s.). Both these dominants were regenerating profusely. This plot was markedly poorer, 45 vascular species, as is to be expected in a more extreme habitat.

Plot 3 contained relatively few trees due to the massive outcropping of rock. Species present had low but wide crowns forming only a single layer. Woody plants were diverse but the numbers of enumerated plants were too small to draw inferences on regeneration. Despite the extent of rock the plot was relatively species rich, having 55 vascular plant spcies.

The general impression from these admittedly few sample sites and plots is of a typical lowland rainforest with high diversities of trees and a high species complement generally, even within small areas.

Table A1 Tree Species Composition Data (% frequency) from Fifty Tree Plots (Only species with a cumulative frequency of 6 or more are included, T = Timber).

		PLOT NUMBER												
Species		1	2	3	4	5	6	7	8	9	10	11	12	F
Aningeria pseudoracemosa	T		2		6	2			2	4	8	4		7
Antiaris toxicaria										2	4	4	22	4
Bosqueia phoberos										2			7	2
Bridelia sp.					6			4			2		3	4
Cedrella mexicana					2								12	2
Chlorophora excelsa	T	6	2				2		2			2		5
Cola sp.				2				10		2	8			4
Combretum schumannii						8		2	2				2	4
Commiphora zimmermannii		2	2	2		6	2		2					6
Cordyla africana	T		2					2			4			3
Cussonia zimmermannii	T	2	2		4	10		6	8	2				7
Cynometra sp. A		8	2					2		2			2	5
Dialium holstii		2	2	2		6	2	2	2	2		2	2	10
Diospyros greenwayi								10			6	4		3
D. mespiliformis			4	2						4	2	2		5
D. verrucosa						2		2	4	2	2			5
Drypetes natalensis						4				2	2			3
D. reticulata				6	4			2						3
Ficus exasperata					4							8	9	3
F. nekbudu			2	2		4	2	2		2	2	4		8
Garcinia semsei				34	24		10	6		2	12			6
Khaya nyassica	T			2			2			4	2			4
Lannea antiscorbutica		6	4		2							4		4
Lecaniodiscus fraxinifolius		6	6			4		2						4
Lettowianthus stellatus					2	2	2					2		4
Malacantha alnifolia								6			2			2
Markhamia acuminata				2	2		4	4						4
Mimusops sp.			2	4	2		6	8			2			6
Newtonia paucijuga			2							2	2	2	2	5
Pachystela brevipes				2	2						4			3
Pancovia golungensis								2		2	2	2		4

Species	1	2	3	4	5	6	7	8	9	10	11	12	f
Pandanus goetzei	2		20	16		30	2		6		12		7
Parkia filicoidea	6	6		4		4			8	4	4	5	8
Pterocarpus tinctorius T								6					1
Rauvolfia mombasiana				4		2			2	2			4
Rhodognaphalon schumannianum	2	2	2				12		6		2		6
Riciniodendron heudelotii			2					4		2	6	5	5
Scorodophleous fischeri	29	26			18	8		24			6	5	7
Sorindeia madagascariensis	10	18			16	6	2	16		16	14	2	9
Sterculia appendiculata	4				4			8		2	2	2	6
Strychnos mitis	4	2				6							3
Terminalia sambesiaca	2	4				4	2	2	8	2			8
Tessmannia sp. nov.							10		18				2
Zanthoxylum sp.					4			4		2			3
Zenkerella egregia			6										1
Ziziphus mucronata		2		6	2	2							4

Table A2 Analysis of Tree species Composition Data

(a) Best Represented Species and Contribution (%) and plot diversity index

Plot	Species	%	Diversity
1	Scorodophloeus fischeri	29	0.107
2	Scorodophloeus fischeri	26	0.101
3	Garcinia semsei	34	0.153
4	Garcinia semsei	24	0.088
5.	Scorodophloeus fischeri	18	0.073
6	Pandanus goetzei	30	0.109
7	Rhodognaphalon schumannianum	12	0.060
8.	Scorodophloeus fischeri	24	0.087
9	Tessmania sp. nov.	18	0.060
10	Sorindeia madagascariensis	16	0.060
11	Sorindeia madagascariensis	14	0.045
12	Antiaris toxicaria	22	0.098

(b) Most Frequent Species ($^{x}/_{12}$ plots)

Dialium holtzii	10
Sorindeia madagascariensis	9
Ficus nekbudu	8
Parkia filicoidea	8
Terminalia sambesiaca	8
Aningeria pseudoracemosa	7
Pandanus goetzei	7
Scorodophloeus fischeri	7
Cussonia zimmermannii	7
Garcinia semsei	6
Mimusops sp.	6
Rhodognaphalon schumannianum	6
Sterculia appendiculata	6

(c) Most Numerous Species ($^{x}/_{611}$ trees)

Scorodophloeus fischeri	58
Sorindeia madagascariensis	50
Pandanus goetzei	44
Garcinia semsei	44
Parkia filicoidea	20
Cussonia zimmermannii	17
Tessmania sp. nov.	14
Aningeria pseudoracemosa	14
Rhodognaphalon schumannium	13
Terminalia sambesiaca	13
Mimusops sp.	12
Dialium holtzii	12

Table A. Plot Enumeration Data, Kimboza Forest Reserve

Kimboza Camp Plot 1 : SAMPLE AREA 5 x 25 m (0.0125 ha)

BASAL AREA (stems ≥ 3 cm DBH) : 35.6 $m^2 ha^{-1}$

INDIVIDUAL DENSITY (INDIVIDUALS ≥ 3 cm DBH) : 1920 ha^{-1}

STEM DENSITY (STEMS ≥ 3 cm DBH) : 200.0 ha^{-1}

Number of SPECIES ENUMERATED : 14

NUMBER OF INDIVIDUALS ENUMERATED : 24

	DBH						
	≥ 3 cm	≥ 5 cm	≥ 10 cm	≥ 15 cm	≥ 20 cm	≥ 25cm...	≥ 65 cm
of cies	14	13	8	2	1	1	0
of lviduals	24	20	10	2	1	1	 0
of lviduals ha	1920	1600	800	160	80	80	 0

INDEX OF DIVERSITY (INDIVIDUALS ≥ 3 cm dbh) : 0.076

GREATEST CONTRIBUTIONS TO BASAL AREA (INDIVIDUALS ≥ 3 cm DBH (%)):

Ficus nekbudu (71.6); Chlorophora excelsa (5.4); Parkia filicoidea (3.5) Bequaertiodendron natalense (3.3); Diospyros mespiliformis (3.3).

GREATEST CONTRIBUTIONS TO DENSITY (INDIVIDUALS ≥ 3 cm DBH (%)):

Bequaertiodendron natalense (25.0); Allophylus pervillei (12.5); Sorindeia madagascariensis (8.3); Garcinia semsei (8.3); Diospyros mespiliformis (8.3).

Species list	Individuals ≥ 3 cm dbh			
	Rooted frequency /5 5m x 5m sub plots		% Basal area contribution	% Density contribution
	Regenerating	Enumerated		
Allophylus pervillei	5	2	0.7	12.5
Bequaertiodendron natalense	5	2	3.3	25.0
Chlorophora excelsa	0	1	5.4	4.2

Diospyros greenway	5	1	0.5	4.2
D. mespiliformis	3	1	3.3	8.3
Ficus nekbudu	0	1	71.6	4.2
Garcinia semsei	1	1	3.0	8.3
Malacantha alnifolia	5	1	0.6	4.2
Markhamia acuminata	0	1	2.2	4.2
Parkia filicoidea	4	1	3.5	4.2
Rhoicissus tridentata	0	1	1.6	4.2
Sorindeia madagascariensis	5	2	2.0	8.3
Strychnos mitis	3	1	1.1	4.2
Tarenna sp.	4	1	1.2	4.2

Other woody species and herbs

	Rooted frequency/5 5m x 5m subplots		Rooted frequency/5 5m x 5m subplots
Acalypha neptunica	3	Euphorbiaceae (2463)	1
Amorphophallus fischeri	1	Filicium decipiens	1
Aningeria pseudoracemosa	1	Khaya nyasica	2
Artabotrys sp.	1	Landolphia parvifolia	1
Bosqueia phoberos	2	Lecaniodiscus fraxinifolius	1
Callopsis volkensii	4	Leptonychia usambarensis	3
Cedrella mexicana	1	Macphersonia hildebrandtii	1
Chytranthus sp	5	Maytenus undata	1
Cissus rotundifolius	1	Millettia elongatistyla	2
Clerodendrum capitatum	1	Mimusops kummel	1
Coffea sp.	1	Monanthotaxus trichocarpus	4
Cola sp.	5	Nephrolepis biserrata	1
Culcasia scandens	5	Newtonia paucijuga	2
Deinbollia borbonica	2	Ochna thomasiana	1
Dialium holstii	1	Olax gambecola	1
Drypetes natalensis	4	Olyra latifolia	3
D. reticulata	4	Pachystela brevipes	2
Erythoxylum emarginatum	2	Pancovia golungensis	4

Paullinia pinnata	1	Synantolenis alternifolia	1
Psychotria leucopoda	1	Taclea nobilis	2
P. tanganyikensis	5	T. sp.	1
Saba florida	3	Tricalysia sp. nov.	3
Salacia madagascariensis	1	Turraea mombasiana	2
S. stuhlmannii	1	T. vogeliodes	1
Sansevieria? braunei	2	Uvariodendron gorgonis	1
Sclerochiton vogelii	2		

Species complement:

65 species (of which 14 were $\geq$ 3 cm dbh).

Table A4 Plot Enumeration Data, Kimboza Forest Reserve

KIMBOZA PANDANUS PLOT - 2: SAMPLE AREA 10 x 25 m (0.025ha)

BASAL AREA (STEMS ≥ 3 cm DBH) : 38.8 $m^2 ha^{-1}$

STEM DENSITY (STEMS ≥ 3 cm DBH) : 2760 ha^{-1} (no multiple stems)

NUMBER OF SPECIES ENUMERATED : 15

NUMBER OF INDIVIDUALS ENUMERATED : 69

	DBH							
	≥ 3 cm	≥ 5 cm	≥ 10 cm	≥ 15 cm	≥ 20 cm	≥ 25 cm	≥ 30 cm	≥ 35 cm
No. of species	15	10	7	6	5	4	2	0
No. of individuals	69	48	24	12	12	6	2	0
No. of individuals h^{-1}	2760	1920	960	680	480	240	80	-

INDEX OF DIVERSITY (INDIVIDUALS ≥ 3 cm DBH) : 0.309

GREATEST CONTRIBUTIONS TO BASAL AREA (INDIVIDUALS ≥ cm DBH (%):

Pandanus goetzei (55.0); Pterocarpus tinctorius (9.2); Filicium decipiens (8.2); Rhodognaphalon schumannianum (8.2).

GREATEST CONTRIBUTIONS TO DENSITY (INDIVIDUALS ≥ 3 cm DBH) (%):

Pandanus (44.9); Cola stelecantha (29.0); Pterocarpus tinctorius (17.4).

Species list: Individuals ≥ 3 cm dbh

Identity	Rooted Frequency/10 5m x 5m subplots		% basal area contribution	% density contribution
	Regenerating	Enumerated		
Bosqueia phoberos	0	1	0.8	1.4
Cola stelecantha	3	2	5.8	29.0
Deinbollia borbonica	0	1	0.2	1.4
Drypetes natalensis	1	1	5.4	4.3
Filicium decipiens	0	1	8.2	1.4
Garcinia semsei	0	1	0.2	1.4

Leptonychia usambarensis	4	1	0.2	1.4
Millettia elongatistyla	0	1	5.9	1.4
Mimusops sp.	0.	2	0.3	2.9
Pandanus goetzei	9	9	55.0	44.9
Paullinia pinnata	3	1	0.1	1.4
Pterocarpus tinctorius	4	6	9.2	17.4
Rhodognaphalon schumanniannum	1	1	8.2	1.4
Sorindeia madagascariensis	3	1	0.4	1.4

Other woody species and herbs

	Rooted frequency/10 5m x 5m sub-plots		Rooted frequency 5mx5m sub-plots
Allophylus pervillei	5	Oplismenus hirtus	4
Amorphophallus sp	1	Psychotria tanganyikensis	1
Angraecum? stolzii	1	Ricinodendron hendelotii	1
Asplenium sp	1	Rinoerea (?)	1
Asystasia sp	3	Saba florida	5
Basananthe sp	1	Sapindaceae	1
Bequaertiodendron natalense	2	Uvariodendron gorgonis	1
Chytranthus sp.	2	Zamioculcas zamiifolia	1
Cissus/Cyphostemma	1		
Clerodendrum capitatum	1		
Cola greenwayi	1		
Coleotrype boecknerana	2		
Combretum sp	1		
Costus afer	5		
Culcasia scandens	9		
Dorstenia sp.	4		
Euphorbiaceae(?)	1		
Ficus nekbudu	1		
Microsorium punctatum	2		
Nephrolepis biserrata	2		
Olyra latifolia	1		
Ophyropetalum odoratum	1		

Species complement:

45 species (of which 15 were $\geq$ 3 cm dbh).

Table A5. Plot Enumeration Data, Kimboza Forest Reserve

KIMBOZA RUVU ESCARPMENT PLOT -3 : SAMPLE AREA 10 x 25m (0.025 ha)

BASAL AREA (STEMS ≥ 3 cm DBH): 14.3 m^2 ha^{-1}

INDIVIDUAL DENSITY (INDIVIDUALS ≥ 3 cm DBH): 2240 ha^{-1}

STEM DENSITY (STEMS ≥ 3 cm DBH): 2560 ha^{-1}

NUMBER OF SPECIES ENUMERATED : 18

NUMBER OF INDIVIDUALS ENUMERATED : 56

DBH

No. of species	≤ 3cm	≥5cm	≥10cm	≥ 15cm	≥ 20cm	≥25cm	≥ 30cm	≥35cm
No. of Individuals	18	14	6	3	2	1	1	0
No. of individuals (ha^{-1})	56	41	8	4	2	1	1	0
	2240	1640	320	160	80	40	40	-

INDEX OF DIVERSITY (INDIVIDUALS ≥ 3 cm dbh): 0.107

GREATEST CONTRIBUTIONS TO BASAL AREA (INDIVIDUALS ≥ 3 cm DBH(%)):
Sorindeia madagascariensis (21.6); Pandanus rabaiensis (15.9); Cola stelecantha (13.4); Uvariodendron gorgonis (10.3).

GREATEST CONTRIBUTIONS TO DENSITY (INDIVIDUALS ≥ 3cm DBH(%)):
Cola stelecantha (26.8); Funtumia africana (14.3); Allophylus pervillei (8.9)? Pandanus rabaiensis (8.9).

Species list: Individuals ≥ 3 cm dbh

	Rooted frequency/10 5m x 5m sub-plots		% Basal area contribution	% density contribution
	Regenerating	Enumerated		
Allophylus pervillei	1	3	8.3	8.9
Aningeria pseudoracemosa	0	2	0.9	3.6
Annonaceae sp.	0	1	0.3	1.8
Artabotrys sp.	1	1	0.6	1.8
Bosquiea phoberos	1	1	4.3	1.8
Neopalissya castaneifolia	4	1	1.6	1.8
Cola stelacantha	6	7	13.4	26.8
Combretum sp.	2	3	5.5	5.4

Diospyros greenwayi	7	1	0.6	1.8
Elaeodendron buchanani	0	2	3.0	5.4
Funtumia africana	6	5	6.7	14.3
Garcinia semsei	8	3	4.5	5.4
Lannea antiscorbutica	0	1	0.5	1.8
Malpighiaceae (Acridocarpus)	2	1	0.2	1.8
Pandanus goetzei	6	2	15.9	8.9
Sorindeia madagascariensis	10	2	21.6	3.6
Urera sp.	4	2	1.9	3.6
Uvariodendron gorgonis	2	1	10.3	1.8

Other woody speceis and herbs

	Rooted frequency/10 5m x 5m subplots		Rooted freq./10
Acanthaceae	6	Hippocratea sp.	3
Amorphophallus sp	6	Leptonychia usambarensis	7
Angraecum stolzii	4	Monanthotaxis sp	2
Antiaris toxicaria	7	Olyra latifolia	1
Beguaertiodendron natalensis	5	Oplismenus hirtellus	1
Canthium pallidum	1	Parkia filicoidea	1
Christiania africana	1	Pavetta crebrifolia	1
Clerodendrum capitatum	1	Psychotria lauracea	2
Commiphora pteleifolia	1	P. sp.	2
Compositae	1	Saba florida	2
Cucurbitaceae	1	Salacia madagascariensis	3
Culcasia scandens	9	Schizozygia coffeeoides	1
Cynometra sp. A	8	Secamone parvifolia	2
Cyphostemma hildebrandtii	2	Tabernaemontana holstii	3
Deinbollia borbonica	2	Tarenna	5
Dioscorea sp	1	Thunbergia sp	5
Dorstenia alta	4	Vepris sp.	1
Drypetes sp.	1	Zamioculcas zamiifolia	7
Gonatopus boivinii	4		

Species complement:

55 species (of which 18 $\geq$ 3 cm dbh)

Figure A3 (Opposite) Profile Diagrams from Three Quantitative Study Plots.

Plot 1. Flat loam in reserve centre.

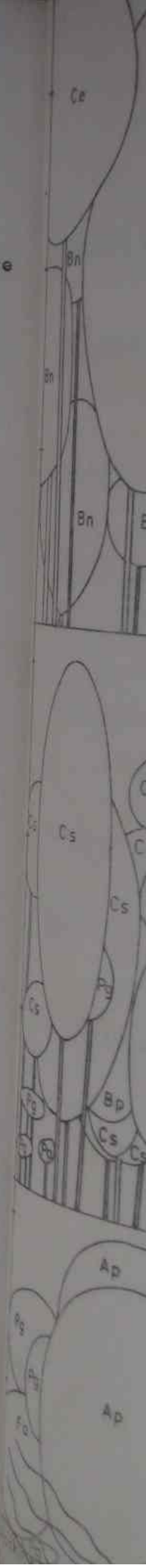
Ap. Allophyllus pervillei
Bn. Beguartiodendron natalense
Ce. Chlorophora excelsa
Dg. Diospyros greenway
Dm. Diospyros mespiliformis
Fn. Ficus nekbudu
Gs. Garcinia sensei
Mac Markhamia acuminata
Mal Malacantha alnifolia
Pf Parkia filicoidea
Sm Sorindeia madagascariensis

Plot 2. Water logged clay

Bp Bosqueia phoberos
Cs Cola stelecantha
Db Deinbollia borbonica
Ms Mimusops sp.
Pg Pandanus goetzei
Pt Pterocarpus tinctorious
Sn Sorindeia madagascariensis

Plot 3. Steep slope with massive rock outcrops

Ap Allophyllus pervillei
Cs Cola stelecantha
Fa Funtumia africana
G. Garcinia sensei
La Lannea antiscrobutica
Nc Neopalissya castaneifolia
Pg Pandanus goetzei



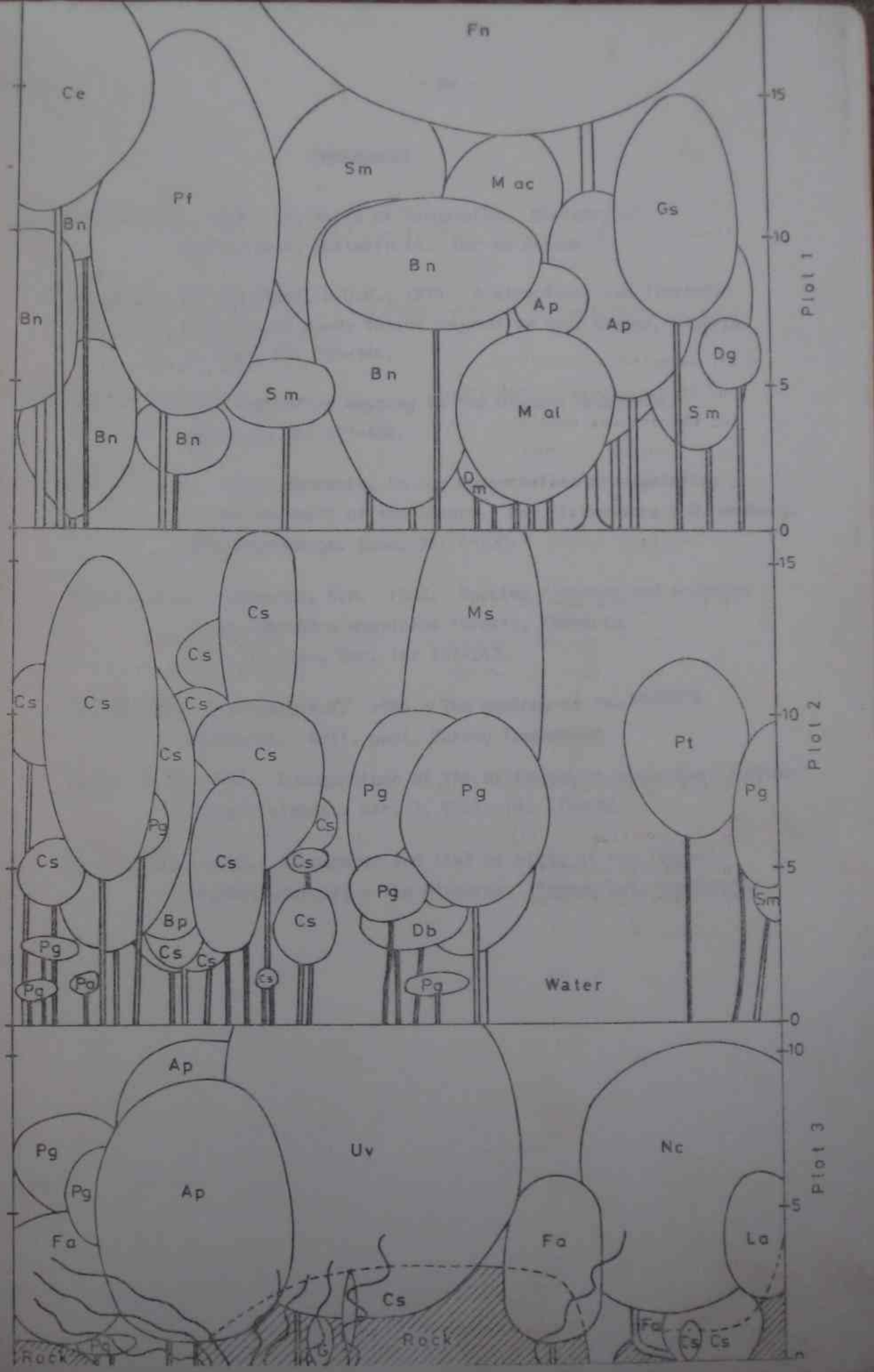
ams from Three

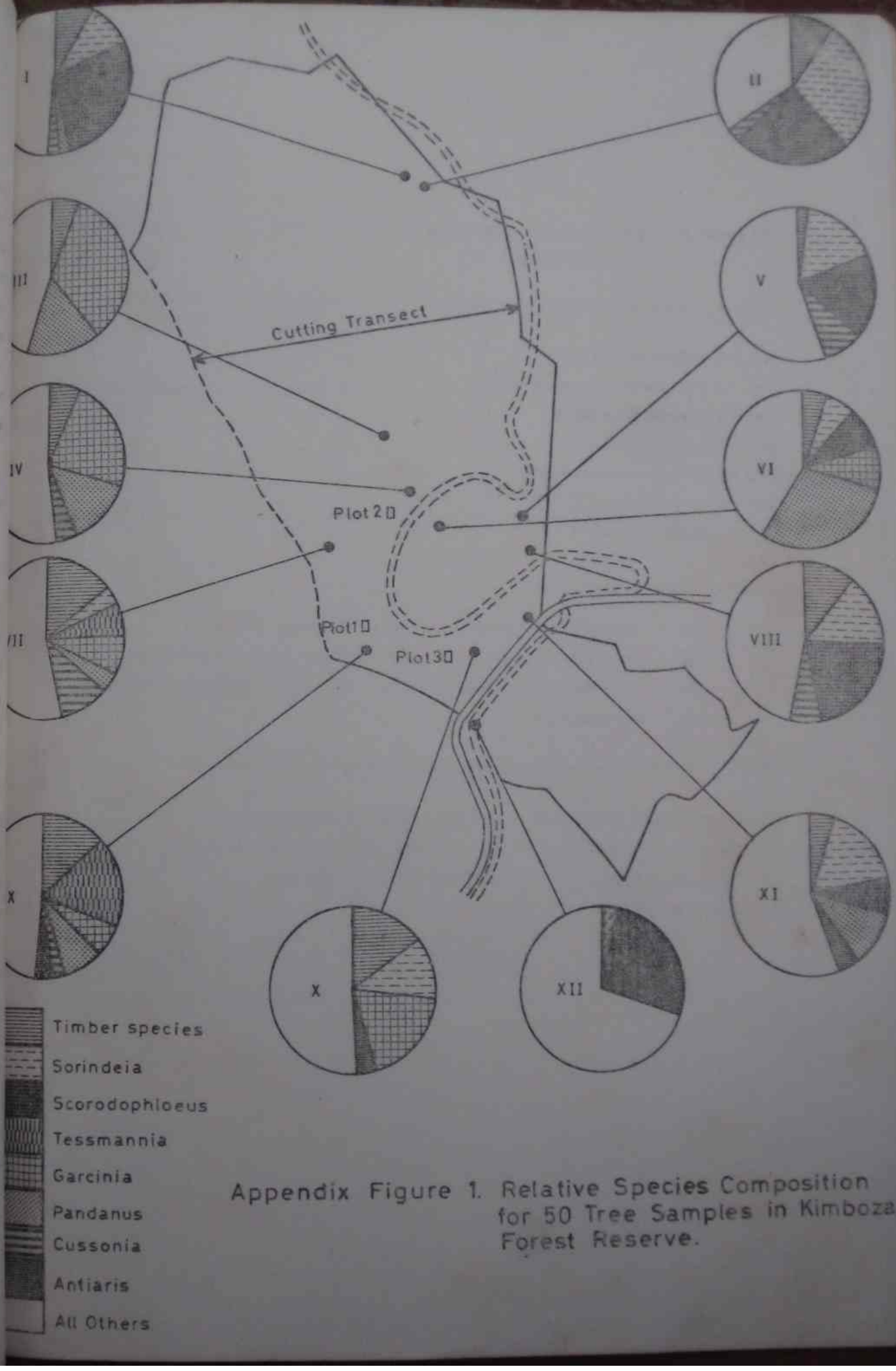
Mac Markhamia acumi
Mal Malacantha alnifo
Pf Parkia filicoide
Sm Sorindeia madagas

Pandanus goetzei
Pterocarpus tinctorius
Sorindeia madagascarie

rops

antiscrobutica
ssya castaneifolia
s goetzei





Appendix Figure 1. Relative Species Composition for 50 Tree Samples in Kimboza Forest Reserve.

REFERENCES

Anderson, G. 1963. The Soils of Tanganyika. Ministry of Agriculture, Bulletin 16. Dar es Salaam.

Hall, John, B. and Okali, D.U.U. 1979. A structural and floristic analysis of woody fallow vegetation near Ibadan, Nigeria J. Ecol. 67: 321-346.

Pocs, T. 1976. Vegetation mapping in the Uluguru Mountains. Boissiera 24: 477-498.

Polhill, R.M. 1968. Tanzania, In the Conservation of Vegetation In Africa South of the Sahara. Eds. I. Hedberg & O. Hedberg. Acta Phytogeogr. Suec. 54: 1-320.

Rodgers, W.A. & Homewood, K.M. 1982. Species richness and endemism in the Usambara mountains forests, Tanzania. Biol. J. Linn. Soc. 18: 197-242.

Sampson, D.N. & Wright, A.E. 1964. The geology of the Uluguru Mountains. Bull. geol. Survey Tanganyika.

Stuart, S.N. 1981. A comparison of the avifaunas of seven East African forest islands. Afr. J. Ecol. 19: 133-152.

Stuart, S.N. 1983. A computerised list of birds of the Tanzania mountain forests - the Ulugurus. Typescript, Cambridge.