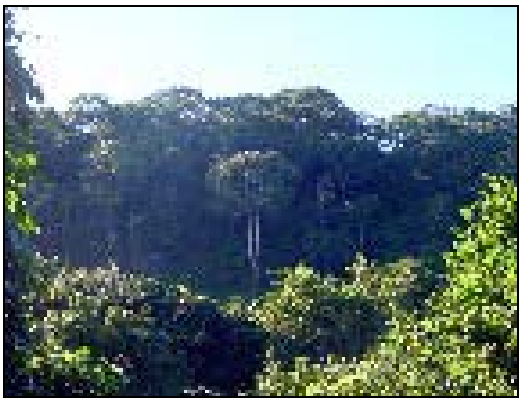
Environmental Management and Biodiversity Conservation of Forests, Woodlands, and Wetlands of the Rufiji Delta and Floodplain

A Preliminary Biodiversity (Flora) Assessment of Selected Forests of the Rufiji Floodplain

L. B. Mwasumbi, H. O. Suleiman, & V. M Lyaruu



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For more information please contact:

Project Manager,
Rufiji Environment Management Project
P O Box 13513
Dar es Salaam, Tanzania.
Tel: 44 Utete Rufiji or 2666088 / 0741 322366 Dar es Salaam
Email: rempute1@bushmail.net or iucndar@epiq.or.tz

1 The Rufiji District Council implements Rufiji Environment Management Project with technical assistance from IUCN – The World Conservation Union, and funding from the Royal Netherlands Embassy.

Rufiji Environment Management Project - REMP

Project Goal: To promote the long-term conservation through 'wise use' of the lower Rufiji forests, woodlands and wetlands, such that biodiversity is conserved, critical ecological functions are maintained, renewable natural resources are used sustainably and the livelihoods of the area's inhabitants are secured and enhanced.

Objectives

- To promote the integration of environmental conservation and sustainable development through environmental planning within the Rufiji Delta and Floodplain.
- To promote the sustainable use of natural resources and enhance the livelihoods of local communities by implementing sustainable pilot development activities based on wise use principles.
- To promote awareness of the values of forests, woodlands and wetlands and the importance of wise use at village, district, regional and central government levels, and to influence national policies on natural resource management.

Project Area

The project area is within Rufiji District in the ecosystems affected by the flooding of the river (floodplain and delta), downstream of the Selous Game Reserve and also including several upland forests of special importance.

Project Implementation

The project is run from the district Headquarters in Utete by the Rufiji District Administration through a district Environmental Management Team coordinated by the District Executive Director. The Project Manager is employed by the project and two Technical Advisers are employed by IUCN.

Project partners, particularly NEMC, the Coast Region, RUBADA, The Royal Netherlands Embassy and the Ministry of Natural Resources and Tourism, collaborate formally through their participation in the Project Steering Committee and also informally.

Project Outputs

At the end of the first five –year phase (1998-2003) of the project the expected outputs are:

An Environmental Management Plan: an integrated plan for the management of the ecosystems (forests, woodlands and wetlands) and natural resources of the project area that has been tested and revised so that it can be assured of success - especially through development hand-in-hand with the District council and the people of Rufiji.

Village (or community) Natural Resource Management Plans: These will be produced in pilot villages to facilitate village planning for natural resource management. The project will support the implementation of these plans by researching the legislation, providing training and some support for zoning, mapping and gazettement of reserves.

Established Wise Use Activities: These will consist of the successful sustainable development activities that are being tried and tested with pilot village and communities and are shown to be sustainable

Key forests will be conserved: Forests in Rufiji District that have shown high levels of plant biodiversity, endemism or other valuable biodiversity characteristics will be conserved by gazettement, forest management for conservation, and /or awareness-raising with their traditional owners.

Executive Summary

A floristic study was undertaken in selected forests in the Rufiji floodplain for three weeks in February 2000. Results indicate that all forests in the Lower River Rufiji Basin have suffered considerably from human interference including commercial felling of trees for timber production; effects of fire; encroachment for agricultural production and other extractive activities such as charcoal burning; building pole collection and carving logs particularly from the African blackwood or *Dalbergia melanoxylon*. The three forests of Kichi Hills, Weme and Ilu have suffered most from indiscriminate cutting of trees for timber. Other riverine forests along the Rufiji River, among them Ruge Ruge, Mtanza and Kihingo forest, are severely affected by encroachment in a bid to expand farmlands. The evidence of continued human disturbance is exemplified by the population structures of the three forests that are declining or unstable.

Of the three forests studied, Weme and Ilu are smaller and very close to each other, only separated by a narrow corridor of wooded grassland. Probably these were one forest in the past separated as a result of fire or rising level of the land from alluvial depositions from the highlands that demarcated the two lakes of Weme and Ilu. For effective and better management of the forests, which are important refugia for wildlife, the two can be integrated into one unit, as they are floristically very similar. The two forests have Sorensen's Similarity Index of 0.54.

The important ecological parameters of the forests included: 143 plant species with 1533 individuals collected from Kichi Hills; 144 species with 1573 individuals from Weme; and Ilu recorded the lowest values of 90 species and 636 individuals. As for species richness, Kichi Hills forest had the highest species richness of juvenile trees and shrubs per unit area sampled. This suggests that Kichi Hills forest is a potentially self-sustaining ecosystem, capable of replacing itself in case of any disturbance that will remove the mature trees. The population is stable in Kichi Hills, and the vegetation is in mid successional stage as compared to the other two forests where the disturbance is rather recent.

In this study, we recommend:

- Proper auditing of bioresources available in the Rufiji floodplain forests through multidisciplinary research. There is very little documentation of plant specimen collections from the Rufiji Basin except from the Kichi Hills forest and from nearby forests conducted by Frontier Tanzania.
- Gazetting these forests into nature reserves and clearly demarcating forest boundaries particularly for the Kichi Hills forest.
- Thirdly, in order to harmonise relations with the local people and for the sustainable management of the forest resources, we recommend that the forests should be managed communally under community-based forestry scheme, which has proven a great success in some parts of northern Tanzania.

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List of Acronyms

CBH	Circumference at Breast Height
Cec	Cation Exchange Capacity
DBH	Diameter at Breast Height
FTEA	Flora of Tropical East Africa
FZ	Flora Zambesiaca
GPS	Global Positioning System
PH	Hydrogen Ion Concentration
REM P	Rufiji Environmental Management ProJECT
TANRIC	Tanzania Natural Resources Information Centre
TORs	Terms of Reference
UDSM	University of Dar es Salaam

1 Introduction

1.1 Background Information

The Rufiji floodplain is potentially rich with regard to agricultural production, forestry and fishing, recently part of the floodplain has been appendixed to Selous Game Reserve, thereby increasing its aesthetic value. Due to this potential and the periodic disastrous floods that greatly affect the lives of people and crops, many research projects have been undertaken in the area. Cook (1974) examined the soil characteristics and potential of the floodplain for supporting cultivation and giving satisfactory yields. Production of handcrafts and other forest extracts by the local community which have great impact on vegetation in the Rufiji floodplain have been thoroughly analyzed by Havnevik (1980). In his account, Havnervik (1980) mentions *Afzelia quanzensis, Khaya anthotheca, Milicia excelsa, Newtonia buchananii, Pterocarpus angolensis* and *Bombax rhodognaphalon* as heavily exploited timber trees in the Rufiji basin. He also cited various types of mangrove species used for logging, charcoal burning, and building materials. These species include *Rhizophora mucronata, Ceriops tagal, Avicenia marina, Sonneratia alba, Heritiera littoralis, Bruguiera gymnorrhiza, Lumnitzera racemosa* and *Xylocarpus granatum*. However, in the present study no mangrove species were encountered. Sandberg (1974) reviews the impact of Stiegler's Gorge Dam on agricultural production in the Rufiji floodplain. Anderson (1961) constructed an irrigation potential map of the Lower Rufiji Valley. The forestry inventory of the Rufiji floodplain was produced in 1973 for the first time. Periodic floods necessitated the government to resettle people from south Rufiji floodplain to north Rufiji floodplain, areas less affected by floods and easily accessible by road between 1964 and 1973. In the south-western valley of the floodplain people have retained their farms. The great agricultural potential of the south Rufiji floodplain is attributed to prevalence of rich alluvial deposits and brown humic soils. Farmers are able to harvest twice in a year from this part of the floodplain.

1.2 Location and Description of the Study Area

Rufiji District is located in the Coast Region and has its district headquarters at Utete. The approximate location is $7^{0}30$'S to $8^{o}40$'S and $37^{o}50$' to $39^{o}40$'E along the East Coast of Tanzania. The selected forests for floristic studies within the Rufiji floodplain included Weme, Ilu which are close together and which may have been separated through fire effect. Weme is located at $8^{o}03$'S, $38^{o}53$'S to $38^{o}56$'E while Ilu is also $8^{o}03$'S, $38^{o}56$'S to $38^{o}57$'E. A permanent lake surrounds each forest, which provide fish to the local community of fishermen. The lakes spill over forest margin; a fact that may contribute to high level of groundwater that maintains the respective forests to be moist and evergreen all year round. The Rufiji Basin is the most extensive in comparison with the dry forests in the West Rufiji floodplain.

Kichi Hills forest is a lowland coastal forest where the typical forest occupies ridge tops and valleys. On forest margins are thickets and bushland with no sharply defined boundaries. The forest has been occupied since colonial times and its inhabitants were evicted in 1972 from the south Rufiji floodplain. The descendants are coming back in full force at present, and since the forest is not protected by any legislation, there is a great risk of encroachment and consequent loss of biodiversity and ecosystem integrity in general. Kichi Hills are located at an elevation of 100m to about 600m above the sea level, with Misolu peak reaching the highest altitude of 671m (2020 ft). It lies at northeast edge of Selous Game Reserve located between $38^{o}15$'E and $8^{0}10$'E. It is transversed by a road from Utete town to Kingupira, Selous Game Reserve. There are about 45 households in the forest growing maize, cassava, sorghum, rice, but their crops are facing great damage from agricultural vermin such as elephants, monkeys and wild pigs.

The other sites were randomly selected to include Ruge Ruge groundwater forest, on the way to Lake Utunge, and Kihingo groundwater forest patch in Mloka. The Mtanza riverine forest was also sampled. The forests were assessed using the rapid ecological appraisal method based on enumerating 50 closest trees in each site. Hall, Lovett and Rodgers (Rodgers pers. comm have used this method extensively in Tanzania. Also as a mimeographed report of Mazumbai Forest 1980)

1.2.1 Topography, Geology and Soils

In the area of Coastal Tanzania lying between the Rufiji and Ruvuma Rivers, the coastal lowlands are narrower than in the northern and central areas, but the sedimentary belt includes the Kichi and Matumbi Hills, all being above 300m. Deep quaternary deposits occur along the Rufiji River. Blackish grey to grey clayey vertisols (black cotton soils) occur along riverbanks and in pans (Mbugas) away from the rivers. These

soils are associated with water logging so that plant species which cannot tolerate water logging can not survive under these soils. But some species like *Dalbergia melanoxylon* and *Hyphaene compressa*, which do not have specific soil requirements, can grow in both black cotton soils in the wooded grassland of Rufiji floodplain and in the tropical ferruginous sandy soils, common in miombo woodlands and the Kichi Hills. They normally support dry or semi-dry forest types. Black sandy clay soils, which are a result of seasonal flooding occur in the Rufiji floodplain and are occupied by ground water and riverine forest.

1.2.2 Climate

The climate of Rufiji District tends to have one long dry season and one short rainy season. However, these trends can vary from year to year or after over a long period. The data from the Meteorological Department shows that the area west of Utete town is the driest in the Coast Region with annual rainfall ranging from 600 – 800m. This is also indicated by the isohytes from the Atlas of Tanzania (1976), the rain decreasing from east to west (see Table 1). Vollesen (1980) noted that in the Selous Game Reserve, rainfall increases gradually westwards with increasing elevation. The distribution of various forests in the Rufiji floodplain is greatly influenced by the amount of precipitation an area receives. For example, the forests in the east are moist and evergreen due to high ground water level, humidity and mist. Further westwards the forests become dry or semi-dry with characteristic deciduous trees. However, groundwater forests of Ruge Ruge and Kihingo in Mloka in the southwestern valley are also evergreen. Another caution to note is that in the vegetation maps, abandoned settlements to the south of Rufiji River floodplain have extensive patches of closed mango trees which are easily grouped as forests on Atlas or in an aerial survey. There are very few metereological field stations in Rufiji District, and even those already established, are not supplying rainfall data continuously.

Table 1: Mean Monthly rainfall in millimetres in Rufiji District (Source TANRIC, UDSM)

Month	Mtanza (West)	Kibiti (North)	Utete (Central)	Mohoro (South)
January	110.5	152.5	108.8	119.6
February	56.9	91.0	101.9	105.7
March	135.1	11.3	154.5	159.7
April	140.0	261.0	193.0	269.2
May	63.2	23.4	71.8	102.1
June	2.5	5.7	11.1	10.9
July	1.5	11.1	6.4	6.4
August	6.9	2.5	6.6	15.0
September	13.0	41.6	14.1	12.3
October	24.6	43.6	30.5	37.8
November	31.8	55.3	86.1	98.7
December	11.5	87.6	100.4	158.5

NB: For Mtanza, the mean is based on 4 years of observation; Kibiti 2 years; Utete 38 years and Mohoro 21 years.

1.3 The Conservation Value of Plants in the Forests Studied: Why Should We Conserve Species Diversity in the Rufiji Basin?

1.3.1 Genetic information

The economic contribution of plants to humanity has a long history as plants have always been used as sources of food, shelter, fuel, clothing, recreational as well as for cultural needs. For example, the use of plants to remedy ailments in human beings can be traced back to about 300 years BC in the era of Hippocrates, who is regarded now as "the father of medicine". It is estimated that there are more than 250 000 plant species in the world, (Tanzania has about 13 000 species) and very few of these have been used or fully researched for their potential as a direct source of medicine or food to human population. Forest species are known to contain untapped resources in terms of genetic material that could be used to improve the qualities of their domesticated analogues. A vivid example is the wild coffee relatives found in many forests in Tanzania which could be used to breed better quality coffee varieties free of diseases such as the coffee berry disease. Recently a wild relative of coffee was unveiled in a tropical forest in Comoro with very low levels of cafeine and studies are underway to cross breed this with the domesticated coffee. Continued human decimation of these forests is likely to cause a marked reduction or elimination of certain individuals even

before their potential is discovered.

1.3.2 Scientific values

The assemblage of plants in a forest community is more or less comparable to a databank in which a lot of scientific information can be retrieved. Such information is likely to disappear undiscovered in the process of forest degeneration. During the survey in the Rufiji floodplain forests, a number of plants collected and screened in Department of Chemistry of the University of Dar es Salaam showed very promising antimalarial activities. These were samples of root bark, stem bark and fruits of *Cleistochlamys kirkii*, *Polyalthia tanganyikensis* and *Artabotrys brachypetalum*. It is important that in future a more potent drug to cure chronic malaria, which is now resistant to chloroquine, could be obtained from these annonaceous plants. Today, approximately 120 pure chemical substances used in medicine all over the world are derived from less than 90 higher plants. There still exists a very large knowledge gap on the medicinal values of our forest species, and suggesting that the phytochemical screening process should go hand in hand with local knowledge available from local traditional healers.

1.3.3 Educational values

Conserved forests can serve as educational centres for all groups of people to include scientists, local community and even schools. It is possible to write guide books with vernacular and scientific names of the forest plants and their uses. This is one way of disseminating indigenous knowledge that is available with old people to the present generation.

1.3.4 Cultural heritage and traditional economy

In Kichi Hills forest, prior to resettlement of the local people in the Rufiji basin, people had established a very elaborate system of living. Abrupt changes which saw these people shifted to lower Rufiji basin between 1969 and 1972 disrupted their traditional economies and cultures. This is a complex and sensitive issue and traditional cultures should be respected and modified gradually in order to harmonise relations and suit the need of the local communities. Such practice could take a form of introducing a community-based forestry management scheme.

1.3.5 Ecotourism and recreational natural sites

Forests are sites that have great tourism potential particularly if they are properly managed. For example tropical primary forests have microhabitats which harbour diversified forms of fauna and flora. Certain groups of fauna such as birds which require specific niche conditions can be used as indicators of forest condition, and therefore are of potential tourist attraction. For the case of Rufiji floodplain forests, establishment of campsites around Lakes Weme and Ilu could be one way of promoting ecotourism in the area, where visitors could be involved into array of activities such as surfing, boat racing, birds viewing and fishing. The peak of Kichi Hills could be developed as an observation point, accessed from the road by the foot track passing through several vegetation zones.

1.4 Terms of Reference (ToR)

The botanical survey was conducted in selected forests in the Rufiji floodplain, the main objective was to provide Rufiji District Council with a description of the flora. The Terms of Reference as stipulated in contract EARO/75475/503 were:

1. Provision of a checklist of plants occurring in the selected forests in the Rufiji floodplain through search of scientific literature and other recorded information as well as field surveys and collections.
2. Identification of biodiversity hotspots involving any of the plants in the checklist.
3. Identification of species or taxonomic groups that could serve as indicators of environmental conditions.
4. Designing long-term ecological monitoring programme of the forests.
5. Submission of a comprehensive and detailed report covering the above categories of information.

1.5 What was accomplished

All points 1-5 have been accomplished. For point no. 4, 10 permanent plots each (20 x 50m) were established in this study. All trees were identified, marked and tagged. To study the shrubs and juvenile trees, 5 x 2m plots were nested in the 50 by 20m plots and for herbs and grasses 0.5 x 2m plots were used. Voucher specimens of all plants have been collected and are deposited at the Dar es Salaam University Herbarium.

2 Methodology

Nested Quadrat Method (Stohlgren *et al*. 1995) was used to study the vegetation of the forests. Trees were enumerated in 50 x 20m plots, whereas 5 x 2m quadrats were used to study shrubs and juvenile trees and 0.5 x 2m was used for herbs and grasses. For the riverine forests along Rufiji River, the quick method, which considers the first 50 closest trees to a datum point, was used. Hall, Lovett and Rodgers (Rodgers pers. comm.) have used the method extensively in Tanzanian forests and it gives satisfactory results. In order to assess the conservation value of plant species encountered during this study we relied on literature provided by CITES (1996), IUCN (1996), field data, Beentje (1994) and Harvnevik (1980). Whereas Harvnevik (1980) deals with those plant species widely used in crafts and extractive industries and the main contributor to forest degradation, Beentje (1994) gives an account of threatened species found along the coast. We also relied on the information provided by Forest Ordinance of 1995 (Cap. 389) section 30, which prohibits harvesting of certain plant species, which have been over exploited in the past.

The data were analyzed using different indices such as Sørensen (1948) Similarity Index, Shannon & Wiener (as in Magurram 1988) and Rarity index.

Sørensen's Similarity Index is derived from the relation

$$C = 2W/(a + b)$$

Where W is the number of species shared commonly by two sites
a & b are total number of individuals found in each site.

The Shannon & Wiener Diversity Index, that accounts for species richness and how the species are distributed, is derived from the relation

$$H^1 = -\sum(p_i \ln p_i)$$

Where p_i is the proportion of the individual i in the total sample or the relative density in our case of each individual.

The Rarity Index is a measure of species' abundance, and it takes into consideration the number of times an individual is encountered in the sampling plots (i.e. frequency) and its abundance (density).

A summation of the two relative measures gives the Rarity Index. This is a modified Importance Value Index (IVI) that considers basal areas separately. The lower the index, the rarer the species is and vice versa.

An extensive literature survey was conducted at the UDSM Library East Africana section, Institute of Resource Assessment Documentation Centre, Tanzania Natural Resources Information Centre (TANRIC), University of Dar es Salaam Herbarium Library using literature from Flora of Tropical East Africa (FTEA 1952-) series, Flora Zambesiaca (FZ 1960-), Vollesen 1980 etc).

3 Results

3.1 Description of the Vegetation of Selected Forests in the Rufiji Floodplain

3.1.1 Floristic Compositions of Kichi Hills, Weme and Ilu forests

A more or less complete checklist of plant species encountered in the survey is provided as Appendix 1 and most information is summarized as tables in Appendix 2. Weme forest to the south of the floodplain had the highest number of species (144), followed by Kichi Hills forest (143) and Ilu forest had 90 species. A total of 1533 individuals were sampled from Kichi Hills forest, 1573 from Weme and 636 from Ilu forest. As for species richness per unit area sampled, Weme had the highest species richness of 80 trees, followed by Kichi with 68 trees and Ilu was the last with 56 trees (see Table 2). However, species richness for juvenile trees and shrubs was different and Kichi had the highest number of 71, followed by Weme with 61 and Ilu was the last with 38 species. This partly explains the recovery ability of the three forests, in this case Kichi being in the mid succesional stage having the biggest number of regenerants. Considering the limited time used to carry out this survey, and that sampling was confined to one sampling season only, it is obvious that the checklist provided for these forests is not exhaustive. However, a more intensive sampling at different times of the year might yield more species.

Table 2: **Species richness of trees, shrubs and juvenile trees per unit area sampled in the three forests of the Rufiji floodplain. Suffix [1] represent total area sampled for trees and [2] is for juvenile trees and shrubs**

Forest	Total number of trees	Total number of shrubs and juvenile trees	Total area sampled in hectares	
Kichi Hills	68	71	2.75^{1}	0.0275^{2}
Ilu	56	38	1.2^{1}	0.012^{2}
Weme	80	61	2.9^{1}	0.029^{2}

In the analysis of the data from the three forests, a number of indices were used including, Sorensen's (1948) Similarity Index, Rarity Index and Shannon and Wiener Diversity Index as in Magurram (1988) (see Appendix 2). Sorensen's Similarity Index which is dependent on the number of common species shared by any two forests being compared at any time indicate that Weme and Ilu forests show the highest similarity of 0.54. This was followed by Kichi Hills forest and Weme forest with a similarity of 0.40 and Kichi and Ilu forests had the lowest similarity of 0.27. (under normal condition, similarity may range from 0, in case there are no common species in those areas under comparison and 1 where there is 100% common species). Probable explanation for high similarity between Ilu and Weme forests is that both forests are located very close to each other on the same alluvial floodplain, and each is surrounded by a permanent water body. The narrow corridor of grassland and wooded grassland which separates the two forests is indicative that it is secondarily derived and probably the two forests were once continuous but were separated from each other by alluvial deposits from the Rufiji River with time or through the effect of fire.

The altitudinal range as well as geological formation and topography of Kichi Hills forest renders it distinct from the other two forests, coinciding with distribution limits of many species. The distribution range of a species is controlled by environmental factors for which the organism has the narrowest range of adaptability or control. Other important factor controlling species distribution apart from changes in environmental conditions include evolutionary changes that greatly influence the potential range of species. This explains high dissimilarity between species confined to Kichi Hills and the two forests probably due to different levels of precipitation as well as the nature of the soils.

Of the species that were sampled, 27 are broad-niched in that they commonly occur in all three forests in more or less the same frequencies (see Table 3). These species that can interact positively with other species have been referred to as generalists (Crawley 1989), as they do not have specific habitat requirements, such as specific soil groups, topography, altitude etc. Such species include *Afzelia quanzensis, Asystasia gangetica, Cassia abbreviata, Chazaliella abrupta, Combretum zeyheri, Commelina benghalensis, Fernandoa magnifica, Hymenocardia ulmoides, Isoglossa lactea, Kigelia africana, Lettowianthus stellatus,*

Lonchocarpus capassa to mention a few. Contrary to this, some species were found to be confined to a single forest only and these are narrow-niched or specialist species. There were 63 such species in the Kichi Hills, 38 in Weme forest and only 13 for Ilu forest, suggesting that Kichi Hills is more diverse than the other two forests. For detailed account of the species names refer to Appendices 1 & 2.

3.1.2 DBH size classes and population structure of the three forests

A plot of various DBH size classes and total number of individuals in each size classes for the three forests indicate that they exhibit unstable or interrupted population structures. This is so because there are very few individuals in the biggest size classes and for some populations, some size classes are not represented. This is a clear result of disturbance, which has taken the form of selective removal of big individuals for timber production. Comparatively, Kichi Hills forest shows a relatively stable expanding population as the pattern shown is more or less exponential (see figures 1-3). This is so because for a stable population that is expanding, the lowest size classes have the highest number of individuals and the numbers get progressively lower as you move towards bigger size classes (see also Lyaruu *et al.* 2000). Possible explanation of this is that the Kichi Hills were logged a long time ago and now the forest has recovered. Both Weme and Ilu forests are still being logged and therefore their populations are rather unstable.

3.1.3 Floristic composition of other selected forests along the Rufiji Floodplain

During the visit to the three forests mentioned above, we also visited some heavily disturbed forests along the Rufiji floodplain. These included Kihingo forest in Mloka, Ruge Ruge forest and Mtanza forests. Due to time limitation, the forests were sampled using the rapid method of enumerating 50-nearest trees. This method has been used in forestry in Tanzania by Hall, Lovett and Rodgers at different times, and it gives a fairly good representation of the forest composition. The three forests are located to the south of the floodplain, an area which has a great potential for agricultural production due to regular deposition of rich alluvial soils brought from upcountry during the rainy seasons. Continued wetness of the land from the floods makes it possible to harvest from the same piece of land twice in a year. As a result, vast areas of the former forest have been cleared by small-scale farmers who are migrating into the area in big numbers to cultivate maize, rice, pigeon peas, and an assortment of vegetables. Ground truthing has shown that what is seen in old maps of this area as extensive forest stands near the river bank no longer exist, but are extensive stands of mango trees. Some forests edges are located more than 10 kilometres from the riverbank and the area in between cultivated.

Kihingo Forest

In Kihingo forest, a total of 200 trees from 4 sampling sites were recorded. A total of 13 species were encountered and probably, by rough approximation, this corresponded to a tree density of approximately 200 trees per hectare and a species richness of 13 trees per hectare. These figures are very low compared to what has been reported from other similar forests (see e.g. Murphy & Lugo 1986, Lovett *et al*. 1997, Lyaruu *et al*. 2000). Kihingo forest is dominated of two species *Trichilia emetica* and *Acacia sieberana*, which accounted for approximately 64% of the 200 trees sampled. *Trichilia emetica* is an indicator of high water table and are commonly found in ground water forests. The low tree density and total absence of common timber trees such as *Pterocarpus angolensis, Afzelia quanzensis* and *Brachystegia spiciformis* can be attributed to their selective removal for timber extraction. Lack of saplings and seedlings of common timber species is an indication of their inability to regenerate under disturbed conditions.

Ruge Ruge Forest

This forest is totally submerged during the rainy season, bringing in a lot of rich alluvial deposits from the highlands. Just as it is the case for Kihingo forest, there has been indiscriminate cutting of trees to open farmalands. A total of three sites (i.e. 150 trees) were sampled in this forest. All timber trees have been harvested from this forest, and at present, apart from the stumps, there are hardly any timber species regenerants. The most important trees encountered in this forest included *Borassus aethiopum, Lonchocarpus capassa, Trichilia emetica, Combretum zeyheri, Kigelia africana, Sclerocarya birrea* and *Antidesma venosum*. The commercial harvesting of fruits of the climber *Saba comorense* (locally known as mabungo) is done extensively in this forest. The harvesting process of fruits is rather unsustainable and it significantly contributes to the loss of biodiversity of the forest as it entails felling trees in order to obtain the fruits that are borne in crowns of some other forest tree species.

Mtanza Forest

Mtanza forest is more species rich with 22 species compared to other forests visited along the flood plain. Likewise, as in other forests, extensive forest clearing is common in this forest. The farm corridor separating Rufiji river and the current forest is rather narrow and it only takes one hour to walk to the forest edge from the river. The most conspicous feature of the forest is the extensive tall stands of the dominant *Acacia sieberana*, extending from the river bank to the forest where the land is not cultivated. Probably such species indicate high levels of soil fertility and water as this floodplain is quite extensive. Tree species encountered in this forest included *Drypetes gerrardii, Terminalia sericea, Acacia sieberana, Afzelia quanzensis, Bombax rhodognaphalon* and *Sterculia quinquiloba*. The presence of at least three timber species indicates that the forest has not been overexploited for timber. It could also mean that harvesting took place a long time ago and what is seen now is secondary vegetation.

Generally, these forests have no future as long as people are migrating into the area in large numbers to practice agriculture and also to harvest other forest products. We were informed that the forests are intact about 20 kilometres from the river bank as people are discouraged to cut down the forest because the floods never reach there and so it is unproductive. Moreover, long distances discourage people from harvesting forest products there. So long as this is the most fertile part of the flood plain, continued forest decimation is likely to continue and so loss of biodiversity and ecosystem integrity.

3.2 Biodiversity of the Rufiji Floodplain Forests: Hotspots and Bioindicators

3.2.1 Coastal Forest Endemics in the Rufiji Basin

The coastal belt, extending from south-east coast of Mombasa through Tanzania, including the islands of Zanzibar, Pemba and Mafia to Mozambique belong to Zanzibar-Inhambane regional mosaic in the sense of White (1983), and the Rufiji floodplain falls under this phytochorion. This phytochorion as a whole is endowed with 3,000 plant species including 27 described endemic genera and 6 unknown taxa. Also 42% of the 190 forest tree species at present known are Zanzibar-Inhambane endemics (White1983). Out of the 27 endemic genera cited for the Zanzibar-Inhambane regional Mosaic, 5 of them are also found in the Rufiji floodplain. These are *Lamprothamnus* (a monotypic genus), *Lettowianthus, Ophrypetalum, Pseudobersama* and *Schlechterina*, also a monotypic genus. Local strict endemic species are currently not known, but near endemics are well documented from the Rufiji basin. They are referred to as "near endemics" because such species are also known from other sites within the Zanzibar-Inhambane Regional Mosaic. Such species include *Acalypha gillmannii, Albertisia undulata, Diospyros lourieriana, Lettowianthus stellatus, Ophrypetalum odoratum* var. *odoratum, Mildbraedii carpinifolia, Olax pentandra, Pancovia holtzii, Polyalthia tanganyikensis, Rytigynia pergracilis, Schlechterina mitostemmatoides, Setaria sulcata, Tarenna drummondii, Uvariodendron kirkii* and *Vangueria randii* ssp. v*ollesenii*.

An important ecological aspect of the Rufiji basin is that it marks the most northern end of areas experiencing one rainy season. A number of species known as linking elements between Tongaland-Pondoland Regional Mosaic as well as Malagasy are found in the Rufiji basin as their northern most distributional range. The linking species include *Drypetes arguta, Acalypha gillmannii, Olax pentandra, Dichapetalum arenarium* and *Sapium armatum*. Some plant species encountered during the survey which are new FTEA records for the area included *Cassia abbreviata* ssp. *beraeana* and *Dichapetalum edule*. These were previously only known from Lindi and Mtwara regions according to FTEA (1952-). Two species found in the vegetation survey *viz*. *Caloncoba welwitschii* and *Polysphaeria dischistochlamys* represent new altitudinal range extensions.

3.2.2 Bioindicators of the Environmental Conditions

Indicator species can be defined as those species which are particularly sensitive to increased levels of pollutants and other human induced activities which will in turn impair ecosystem function and consequently cause negative habitat changes and loss of ecosystem integrity. Ecosystem integrity is defined as the occurance of all species of organisms, be it plants or animals of all age/size classes in a definite proportion of social organization without human interference (Halle *et al*. 1978). One of the terms of reference in this study was to identify any indicator groups found in the Rufiji basin. The indicator species were considered under the following categories: anthropogenic indicators (i.e. those which implicate human involvement such as

logging, charcoal burning, clearing etc.); those which indicate forest health e.g. epiphytes and orchids; light indicators and atmospheric moisture indicators. The forests studied are impoverished of vascular plant epiphytes such as orchids, mosses, ferns and bryophytes. This is a clear sign of continued disturbance in these forests. Epiphytic life form is dependent on prevalence of big trees which form their habitats. Indiscriminate felling of the big timber trees in these forests is likely to be the cause of absence of such life forms of plants. Elsewhere research has shown that epiphytic life forms are highly susceptible to changes in forest habitats caused by human disturbance, and their abundance and diversity is an indirect measure of forest health (Turner *et al*. 1994). Alternatively, being dry forests, the low level of precipitation is not enough to sustain epiphytic life form in such forests.

3.2.3 Human-induced disturbance indicators

Anthropogenic activities in these forests include logging and clearing for cultivation. Large scale logging was witnessed in all forests sampled and this was evidenced by prevalence of tracks, saw pits, dead stumps, fallen unlogged logs, and even some already processed timber pending removal from the forest. The major timber trees known to be harvested from this area include *Milicia excelsa, Brachystegia spiciformis, Afzelia quanzensis* and *Bombax rhodognaphalon*. Based on DBH size classes, there are no sizeable timber trees of these species at present in all forests except for the gnarled individuals that were left because of being unsuitable for timber production.

Felling of the timber trees creates gaps which are in turn colonized by fast growing pioneer species such as the species of *Panicum trichocladum* and other herbaceous life forms. These fast growing pioneer species suppress the recruitment of timber species, with the exception of the few coppicing trees of *Milicia excelsa* witnessed in some of our plots. It has been documented that indigenous timber species in Tanzania have regeneration difficulties (Willan 1965). Recent settlements for cultivation and fishing were seen at Weme and Kichi Hills forest. This is a threat to biodiversity of the forests as the clearing method involves burning, which consquently affects the seedlings and saplings of the forest trees and severely affects the seed bank quality by introducing invasive weed seeds and those of agricultural crops. The previously disturbed vegetation of the Kichi Hills forest is now recovering since people were evacuated from the lower Rufiji between 1969 and 1972 and is in the late seral stage, approaching climax. This is why the vegetation canopy in addition to the high number of forest trees is stratified and dominated by entangled mass of impenetrable lianas such as *Saba comorense, Strychnos* spp., *Hugonia castaneifolia*, *Grewia* spp*., Clerodendrum cephalanthum* and *Albertisia undulata*.

3.2.4 Light indicators

This is a group of plants that help indicate whether the level of illumination in a forest has changed, particulary signifying canopy destruction. Such species surveyed included *Albizia petersiana* (since this is predominantly a woodland species, its presence in a forest indicates transitional stage to woodland from a forest, through tree felling), *Bridellia cathartica* and *Carpoditera africana*. In some forests parts that are relatively undisturbed and closed are found shade loving indicator species such as *Panicum peteri* and *Panicum comorense*.

3.2.5 Atmospheric moisture indicator species

These are plant groups that thrive in areas with high precipitation and relatively high humidity. These are the forest health indicator species such as orchids, bryophytes, ferns, mosses, liverworts and lichens. None of the above were encountered in the Rufiji forests because these are dry forests, or it could be that the epiphytes disappeared with diappearance of big size classes. Other indicator species included *Acacia polyacantha* ssp. *campylacantha* and *Sorindeia madagascariensis* categorized as indicators of physiognomy. Such species are confined to the floodplain with high water table and in riverbanks that are permanently moist.

3.3 Long-term Monitoring Programme

A long-term monitoring programme is important in that it provides data that will show how vegetation is changing over a period of time provided baseline information of the vegetation is available. This is particularly applicable to vegetation which has been subjected to disturbance and it is recuperating after the disturbing agents have been removed. The importance of such data rests on its usefulness in developing sustainable management plan necessary for promotion of biodiversity conservation.

One of the items in the terms of reference was to draw a long-term monitoring programme for Rufiji floodplain forests. Among the most important factors which influence vegetation of an area include changing soil conditions and precipitation. Selection of plots for long-term monitoring was done with extreme care ensuring that all natural habitat types and microhabitats as well as those sites with unique vegetation composition were included. By using the Nested Quadrat Method, within each transect, permanent plots of 50 x 20m were selected from which all trees with diameter at breast height (DBH) of 10 cm or more were identified to species level, marked and tagged with labelled aluminium tags. In the 50 x 20m plot, were nested 5 x 2m plot for monitoring shrubs and juvenile trees and in turn 0.5 x 2m plot for herbs and grasses. The demographic data collected from the permanent plots included plant species' names, plot and transect number, DBH and height. This information on the plots selected for long-term monitoring is provided separately as appendix 3. Other useful information collected included the location of the plot in terms of latitude and longitude, date of monitoring, names of data collectors and relevant notes on site condition such as levels of disturbance, elevation, slope, soils and vegetation. Such data will be collected after every two to three years, and their boundaries should be clearly demarcated for easy relocation.

3.4 Conservation status of plant species in the Rufiji District

Coastal forests are known to be very species rich and have several endemic and near endemic species (Clarke & Dickinson 1995). Decimation of such habitats caused by unsustainable management of bioresources pose a great challenge to their survival. Some of the forest plant endemics such as *Tessmania densiflora* and *Acalypha gillmannii* are known from two sites only and therefore need high conservation priority. Below is a table indicating conservation needs of species occuring in selected forests in Rufiji District. For some other species such as *Afzelia quanzensis, Bombax rhodognaphalon, Dalbergia melanoxylon* and all species of *Markhamia*, it is clear that such species are widespread in most of the coastal forests (see table 3). Although this is the case, such species are not managed sustainably where they occur and that is why they are proteceted by Forest Ordinance of 1995. Lack of proper mangement plan for the above species is likely to cause problems in future taking into consideration the long rotation time of most indigenous species. As an example, depending on the type of soil and precipitation, *Dalbergia melanoxylon* may have a rotation time of between 70 to 100 years.

Table 3: Conservation status of plant species occurring in 5 forests in Rufiji District i.e. Kichi, Weme and Ilu (included in our survey) and Kiwengoma(Kiw), Namakutwa (Nam) and Mchungu (Mch)(from Clarke & Dickinson 1995).

Relative densities and frequencies are provided as appendix 2. + indicates present in that particular forest

Species name	Kichi	Weme	Ilu	Kiw	Mch	Nam	Conservation status
Acalypha gillmannii	+						Rare; only known from 3 sites heavily destructed (FTEA 1952-)
Afzelia quanzensis	+	+	+		+		Vulnerable; overexploited for timber, canoe making (Forest Ordinance 1995)
Balanites wilsoniana			+				Vulnerable (beentje 1994)
Diospyros kabuyeana	+			+			Vulnerable (Beentje 1994)
Euphorbia candelabrum			+				Protected by CITES Appendix II (1996)
Euphorbia nyikae			+				Protected by CITES Appendix II (1996)
Khaya nyasica				+			Vulnerable due to over harvesting (Forest Ordinance 1995)
Milicia excelsa	+						Vulnerable due to overharvesting (Forest Ordinance 1995)
Bombax rhodognaphalon			+	+		+	Becoming rare due to over harvvesting for timber products & canoe building
Uvariodendron gorgonis				+			Endangered (Beentje 1994)
Tessmania densiflora	+			+			Rare; Only known from two sites
Saintpaulia ionatha				+			Overharvested for indoor decoration; Exported to Europe for horticulture
Dalbergia melanoxylon	+	+	+	+	+	+	Overharvested for carving wood; exported logs (Protected by Forest Ordinance 1995)
Newtonia buchananii	+						Protected by Forest Ordinance (1995) due to overharvesting
Markhamia (all spp.)	+	+	+	+			Protected by Forest Ordinance (1995) due to over harvesting

4 Conclusions and Recommendations

1. From data that was collected from the selected forests in Rufiji floodplain, it is evident that a lot of disturbance in the form of selective removal of big timber trees has been going on for a long time. This might have impaired the ecosystem function somehow because in the absence of the big forest trees, many changes are possible, such as tremendous loss of biodiversity of shade loving fauna. Other processes such as mineralization, and recruitment of indigenous species is supressed as they are outcompeted by the pioneer species. It is evident that lack of legislation and other technicalities such as forest supervision staff and infrastructure have contributed significantly to degeneration of these forests. Another factor is that the indigenous people have been depending on these forests through out their life as the major income provider. It is recommended that all forests in the Rufiji basin should be gazetted and put under some kind of management that will harmonize sustainable utilization of forest resources by the local community without affecting the ecosystem in general. We suggest that forest boundaries are clearly demarcated and initiate some kind of community-based forest management programme that will involve the indigenous community.

2. As for Ilu and Weme forests, since they are floristically very similar and they occur in close proximity, these two forests could be merged into one for a better and effective management. Kichi Hills forest is an important biodiversity centre and should be gazetted as a forest reserve to ensure its existance. There is not much scientific data from the Kichi Hills forest except for some part time scientists who have visited the area with their specific issues in mind. Therefore there is a knowledge gap on the Kich Hill bioresources together with other forests in the basin as well. Detailed multidisciplinary scientific research in the area with a view of understanding better the biodiversity potential of the basin is recommended.

3. The long-term ecological monitoring permanent plots are important in that they will indicate how these forests are changing over time. Since the major determinants of successional path are soils and precipitation, and that the amount of precipitation is unlikely to change, it is important to have baseline data of the soils of the Rufiji floodplain forests. We recommend soil sampling from all permanent plots for analysis using the standard procedures for soil analysis in Dar es Salaam. Among the interesting parameters are, cation exchange capacity (cec), pH, exchangeable bases, total nitrogen, organic carbon and traces of heavy metals.

4. In order to make the local people less dependent on forests for their day to day living, we recommend Rufiji District authorities in collaboration with the Ministry of Natural Resources and Tourism promote ecotourism in the area. There are several tourist attractions in the Rufiji floodplain, including the beautiful lakes of Weme, Ilu and the Rufiji River itself. Camping sites could be established around the lakes for water sports and fishing. Mingling ecotourism and community forestry in the Rufiji Basin will be one solution for improving the welfare of the local community.

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6 Appendices

Appendix 1: Checklist of Plant Species found in Three Forests Sampled in the Rufiji Flood Plain

For the life forms, C = climber; T = tree; SS = scandent shrub; S = shrub; L = liana; H = herb; CH = climbing herb; SL = scandent liana; G = graminoids i.e. grasses & sedges; SC = scandent climber; ST = small tree. X indicates species presence

SPECIES NAME	KICHI HILLS	WEME FOREST	ILU FOREST	LIFE FORM	FAMILY
Abrus precatorius L.	X	-	-	C	FABACEAE
Acacia nigrescens Oliv.	-	X	-	T	MIMOSACEAE
Acacia nilotica (L.) Del.	-	X	-	T	MIMOSACEAE
Acacia robusta Burch.	-	X	X	T	MIMOSACEAE
Acacia sieberana DC.	X	-	-	S	MIMOSACEAE
Acalypha gillmannii A. R. Smith	X	-	-	S	EUPHORBIACEAE
Acalypha neptunica Muell. Arg.	X	-	-	S/T	EUPHORBIACEAE
Achyranthes aspera L.	-	-	X	H	AMARANTHACEAE
Adenia dolichosiphon Harms	X		-	C	PASSIFLORACEAE
Afzelia quanzensis Welw.	X	X	X	T	CAESALPINIACEAE
Agelaea setulosa Schellenb.	-	-	X	SS	CONNARACEAE
Albertisia undulata (Hiern) Forman.	X	-	-	SS	MENISPERMACEAE
Albizia glaberrima (Schum. & Thonn.) Benth.	X	-	-	T	MIMOSACEAE
Albizia harveyi Fourn	-	X	X	T	MIMOSACEAE
Albizia petersiana (Bolle) Oliv.	X	-	-	T	MIMOSACEAE
Alchornea laxiflora (Benth.) Pax. & Hoffm.	X	X	-	S	EUPHORBIACEAE
Alchornea sp.(Kitwana)	X	-	-	S	EUPHORBIACEAE
Allophylus abyssinicus (Hochst.) Radlk.	-	X	X	S	SAPINDACEAE
Amblygonocarpus andongensis (Oliv.) Exell & Torre	X	-		T	MIMOSACEAE
Aneilema aequinoctiale (P. Beauv.) Kunth.	-	X	X	H	COMMELINACEAE
Annona senegalensis Pers.	X	-	-	S/T	ANNONACEAE
Antidesma venosum Tul.	X	X	-	S	EUPHORBIACEAE
Artabotrys brachypetalus Benth.	-	X	X	L	ANNONACEAE
Asystasia gangetica (L.) T. Anders	X	X	X	H	ACANTHACEAE
Balanites wilsoniana Dawe & Sprague	-	-	X	T	BALANITACEAE
Baphia kirkii Bak.	-	X	-	T	FABACEAE
Basananthe lanceolata (Engl.) De Wilde	X	-	-	CH	PASSIFLORACEAE
Bersama abyssinica (Sim.) Verdc.	-	X	X	T	MELIACEAE
Blepharis maderaspatensis (L.) Roth.	X	-	-	H	ACANTHACEAE
Blighia unijugata Baker	-	X	-	T	SAPINDACEAE
Bombax rhodognaphalon K. Schum.	-	-	X	T	BOMBACACEAE
Borassus aethiopum Mart	-	X		T	PALMACEAE
Brachystegia spiciformis Benth.	-	X	-	T	CAESALPINIACEAE
Bridelia cathartica Bertol.f.	-	X	-	SS/T	EUPHORBIACEAE
Byttneria glabra K Schum	X	-	-	T	STERCULIACEAE
Caloncoba welwitschii (Oliv.) Gilg.	X	X	-	S	FLACOURTIACEAE
Capparis sepiaris L.	X	X	-	SS	CAPPARACEAE
Carpodiptera africana Mast.	X	-	-	S/T	TILIACEAE
Cassia abbreviata Oliv.	X	X	X	T	CAESALPINIACEAE
Cassipourea malosana (Bak.) Alston	X	-	-	T	RHIZOPHORACEAE
Caturanegan spinosa (Thunb.) Tirven	X	X	-	S/T	RUBIACEAE
Chazaliella abrupta (Hiern) Petit & Verdc.	X	X	X	S	RUBIACEAE
Chrebera trichoclada Welw.	-	X	-	T	OLEACEAE
Chrysophyllum gorungosanum Engl.	-	X	-	T	SAPOTACEAE
Cleistochlamys kirkii (Benth.) Oliv.	X	-	-	T	ANNONACEAE
Clerodendrum cephalanthum Oliv.	-	X	-	SS	VERBENACEAE
Clerodendrum myricoides (Hochst.) Vatke	-	X	X	SS	VERBENACEAE
Cola clavata Mast.	-	X	-	T	STERCULIACEAE
Cola discoglypremnophylla Brenan & Jones	X	-	X	S/T	STERCULIACEAE
Cola microcarpa Brenan	-	X	-	S/T	STERCULIACEAE
Combretum molle G. Don.	X	-	X	T	COMBRETACEAE
Combretum pentagonum Laws.	X	-	-	SS	COMBRETACEAE
Combretum zeyheri Sond.	X	X	X	S/T	COMBRETACEAE
Commelina benghalensis L.	X	X	X	H	COMMELINACEAE

Appendix 1 Continued

SPECIES NAME	KICHI HILLS	WEME FOREST	ILU FOREST	LIFE FORM	FAMILY
Commiphora eminii Engl.	X	-	-	T	BURSERACEAE
Commiphora serrata Engl.	X	-	X	T	BURSERACEAE
Commiphora zanzibarica (Baill.) Engl.	X	-	-	T	BURSERACEAE
Cordia faulkenerae Verdc.	-	X	-	S	BORAGINACEAE
Cordyla africana Lour.	-	X	-	T	CAESALPINIACEAE
Crassocephalum rubens (Jacq.) S. Moore	-	X	-	H	ASTERACEAE
Crossopteryx febrifuga (G. Don.) Benth.	X	X	-	T	RUBIACEAE
Crotolaria goodiiformis Vatke	X	X	-	S	FABACEAE
Croton macrostachyus Del.	-	X	-	T	EUPHORBIACEAE
Cussonia zimmermannii Harms	X	-	-	T	ARALIACEAE
Cyperus exaltatus Retz.	-	X	X	G	CYPERACEAE
Dalbergia melanoxylon Guill. & Perr.	-	X	-	T	FABACEAE
Deinbollia borbonica Scherffi	-	X	X	S	SAPINDACEAE
Dialium holtzii Harms	X	X	-	T	CAESALPINIACEAE
Dichapetalum aneranium Bret.	-	X	-	SL	DICHAPETALACEAE
Dichapetalum edule	X	X	-	SL	DICHAPETALACEAE
Dichapetalum stuhlmannii Engl.	X	-	-	SS	DICHAPETALACEAE
Dichrostachys cinerea (L.) Wight & Arn.	X	X	-	St	MIMOSACEAE
Digitaria milanjiana (Rendle) Stapf	-	X	-	G	POACEAE
Diospyros loureireana	-	-	X	T	EBENACEAE
Diospyros mespiliformis DC.	X	X	-	T	EBENACEAE
Diospyros verrucosa Hiern	X	-	-	ST	EBENACEAE
Diplorhynchus condylocarpon (Muell. Arg.) Pichon	-	X	-	S	APOCYNACEAE
Dobera loranthifolia (Warb.) Harms	-	X	X	T	SALVADORACEAE
Dombeya cincinnata K. Schum.	X	-	-	S	STERCULIACEAE
Drypetes arguta (Muell. Arg.) Hutch.	X	-	X	T	EUPHORBIACEAE
Drypetes natalensis (Harv.) Hutch.	X	X	-		EUPHORBIACEAE
Drypetes reticulata Pax	-	X	-	ST	EUPHORBIACEAE
Elaeodendron schweinfurthianum (Loes.) Loes.	-	X	X	ST	CELASTRACEAE
Elephantopus scaber L.	-	X	-	S	ASTERACEAE
Englerophytum natalense	X	-	-	H	
Erythrina sacleuxii Hua	X	-	X	T	FABACEAE
Erythroxylum emarginatum Thonn.	-	X	X	S	ERYTHROXYLACEAE
Eugenia capensis (Eckl. & Zeyh.) Sond.	X	-	-	S	MYRTACEAE
Euphorbia candelabrum Kotschy	-	X	X	T	EUPHORBIACEAE
Euphorbia nyikae Pax & Burret	-	-	X	T	EUPHORBIACEAE
Fernandoa magnifica Seem	X	X	X	T	BIGNONIACEAE
Ficus bussei Mildbr.	X	-	-	T	MORACEAE
Ficus natalensis (Miq.) Hochst.	-	-	X	T	MORACEAE
Flueggea virosa Baill.	-	X	-	S	EUPHORBIACEAE
Garcinia livingstonii T Anders	-	X	X	S/T	GUTTIFERAE
Gardenis ternifolia ssp. jovis-tonantis	X	-	-	S	MALVACEAE
Gossypioides kirkii (Mast.) Hutch.	X	-	-	SS	TILIACEAE
Grewia bicolor Juss.	-	X	X	S/T	TILIACEAE
Grewia forbesii Mast.	-	X	X	SS	TILIACEAE
Grewia holstii Burret.	X	X	-	SS	TILIACEAE
Grewia lepidopetala Garcke	-	X	-	S	TILIACEAE
Grewia microcarpa K. Schum.	-	X	-	S	TILIACEAE
Haplocoelopsis africana F.O. Davies	-	-	X	T	SAPINDACEAE
Haplocoelum inoploeum Radlk.	-	X	X	T	SAPINDACEAE
Harungana madagascariensis Poir	X	-	-	ST	GUTTIFERAE
Hemarthria natans Stapf	-	-	X	G	POACEAE
Hibiscus surattensis L.	-	X	X	H	MALVACEAE
Holarrhena pubescens (Burch.-Ham.) Wall	-	X	-	T	APOLACEAE
Hugonia castaneifolia Engl.	X	-	-	L	LINACEAE
Hymenaea verrucosa Gaert..	-	X	X	T	CAESALPINIACEAE
Hymenocardia ulmoides Oliv.	X	X	X	T	HYMENOCARDIACEAE
Hyparrhenia filipendula (Hochst.) Stapf	X	-	-	G	POACEAE
Hyphaene compressa H. Wendl.	-	X	X	T	PALMAE

Appendix 1 Continued					
SPECIES NAME	**KICHI HILLS**	**WEME FOREST**	**ILU FOREST**	**LIFE FORM**	**FAMILY**
Isoglossa lactea	X	X	X	H	ACANTHACEAE
Jasminium fluminense Vell.	-	-	X	C	OLEACEAE
Keetia zanzibarica (Klotzsch) Brids	-	-	X	SC	RUBIACEAE
Kigelia africana (Lam.) Benth.	X	X	X	T	BIGNONIACEAE
Lamprothamnus zanguebaricus Hiern	-	X	X	S	RUBIACEAE
Landophia kirki Dyeri	X	X	-	C	APOCYNACEAE
Lannea schweinfurthii (Engl. (Engl)	X	X	-	ST	ANACARDIACEAE
*Leptactina platyphylla (*Hiern) Wernhi	X	X	-	S	RUBIACEAE
Leptochloa chinensis (l.) Nees	X	-	-	G	POACEAE
Lettowianthus stellatus Diels	X	X	X	T	ANNONACEAE
Lindackeria bukobensis Gilg	X	-	-	S	FLACOURTIACEAE
Lippia javanica (Burm.f.)Spreng.	X	-	-	S	VERBENACEAE
Loesneriella africana	-	X	-	C	CELASTRACEAE
Lonchocarpus capassa Roffe	X	X	X	T	FABACEAE
Maerua kirkii (Oliv.) F. white	-	X	-	S	CAPPARIDACEAE
Majidea zanguebarica Oliv. .	-	X	-	T	SAPINDACEAE
Makhamia acuminata (KL.) K. Schum.	-	-	X	S	BIGNONIACEAE
Manilkara discolor (Sond.) J.H. Hem.	-	X	-	T	SAPOTACEAE
Margaritaria discoidea (Baill.) Webster	X	X	X	S	EUPHORBIACEAE
Mariscus hemisphaericus *(Boeck.) C.B. Cl.*	X	-	-	G	CYPERACEAE
Markhamia lutea (Benth.) K. Schum.	-	X	-	T	BIGNONIACEAE
Markhamia obtusifolia (Bak.) Sprague	X	X	X	T	BIGNONIACEAE
Memecylon sansibaricum Taub.	X	-	-	S	MELASTOMATACEAE
Milbraedia carpinifolia (Pax) Hutch.	X	-	-	S	EUPHORBIACEAE
Milicia excelsa (Welw.) C.C. Berg	X	-	-	T	MORACEAE
Millettia stuhlmannii Taub.	X	X	-	T	FABACEAE
Mimusopsis fruticosa A.DC.	X	-	-	T	SAPOTACEAE
Monanthotaxis buchananii (Engl.) Verdc.	-	X	X	SS	ANNONACEAE
Nesogordonia holtzii (Engl.) Capuron	-	X	-	T	STERCULIACEAE
Newtonia buchananii (Bak.) Gilb. & Bout.	X	-	-	T	MIMOSACEAE
Nymphaea lotus L	-	X	-	H	NYMPHACEAE
Ochna holstii Engl.	-	X	X	T	OCHNACEAE
Ochna mossambicensis K1.	-	X	-	ST	OCHNACEAE
Olax pentandra Sleumer	X	X	-	T	OCHNACEAE
Oldenlandia lancifolia (Schumach.) DC.	-	X	-	H	RUBIACEAE
Oncoba spinosa Forssk.	-	X	X	ST	FLACOURTIACEAE
Ophrypetalum odoratum Diels	X	-	-	S	ANNONACEAE
Oxyanthus pyriformis *(Hochst.) Skeels*	X	-	-	S	RUBIACEAE
Oxyanthus zanguebaricus Hiern) Brids.	X	-	-	S	RUBIACEAE
Ozoroa insignis Del.	X	-	-	ST	ANACARDIACEAE
Pancovia holtzii Gilg	X	-	-	S	SAPOTACEAE
Panicum comorense Mez	X	X	X	G	POACEAE
Panicum laticomum *Nees*	X	X	-	G	POACEAE
Panicum maximum Jacq.	X	X	X	G	POACEAE
Panicum peteri	-	X	-	G	POACEAE
Panicum trichocladum K. Schum.	X	X	-	G	POACEAE
Paulinia pinnata L	X	-	-	C	SAPINDACEAE
Pavetta refractifolia K. Schum.	-	X	-	S	RUBIACEAE
Pentas bussei K. Krause	X	-	-	S	RUBIACEAE
Phyllanthus amarus Schum. & Thonn.	-	-	X	A	EUPHORBIACEAE
Phyllanthus leucanthus Pax	X	-	-	H	EUPHORBIACEAE
Phyllanthus reticulatus Poir	X	-	-	SS	EUPHORBIACEAE
Phyllanthus sp.	-	X	-	S	EUPHORBIACEAE
Polyalthia tanganyikensis Vollesen	X	-	-	S	ANNONACEAE
Polysphaeria dischistocalyx Brenan	-	-	X	S	RUBIACEAE
Polysphaeria multiflora *Hiern*	-	X	-	S	RUBIACEAE
Pseudolachnostylis maprouneifolia Pax	X	X	-	T	EUPHORBIACEAE
Psilotricum scleranthum Thw.	X	X	X	S	AMARANTHACEAE
Psychotria punctata Vatke	X	-	-	S	RUBIACEAE
Pteleopis myrtifolia (Laws.) Engl. Diels	X	X	X	T	COMBRETACEAE
Pyrostria bibracteata (Bak.) Cavaco	X	-	-	S	RUBIACEAE
Rauvolfia mombasiana Stapf	-	X	X	ST	APOCYNACEAE

Appendix 1 Continued					
SPECIES NAME	**KICHI HILLS**	**WEME FOREST**	**ILU FOREST**	**LIFE FORM**	**FAMILY**
Rinorea elliptica (Oliv.) Kuntze	-	X	X	S	VIOLACEAE
Rothmannia ravae (Chiov.) Brids.	X	X	-	S	RUBIACEAE
Rourea orientalis Baill.	X	X	-	S	CONNARACEAE
Rytigynia pergracilis Verdc.	X	-	X	S	RUBIACEAE
Rytigynia binata (K. Schum.) Robyns	X	X	-	ST	RUBIACEAE
Saba comorensis (Bojer) Pichon	X	-	X	L	APOCYNACEAE
Salacia leptoclada Tul.	X	-	-	SS	CELASTRACEAE
Salacia madagascariensis (Lam.) DC.	X	X	-	SS	CELASTRACEAE
Sapium armatum Pax & K. Schum.	X	-	-	S	APOCYNACEAE
Schizozygia coffaeoides (Bojer) Baill.	-	X	X	S	APOCYNACEAE
Schlechterina mitostemmatoides Harms	X	X	-	C	PASSIFLORACEAE
Sclerocarya birrea (A. Rich.) Hochst.	-	X	X	T	ANACARDIACEAE
Scorodophloeus fischeri (Taub.) J. Leon.	X	-	-	T	CAESALPINIACEAE
Setaria homonyma (Steud) Chiov.	X	-	-	G	POACEAE
Sideroxylom inerme L.	X	-	-	T	SAPOTACEAE
Sorindeia madagascariensis DC.	-	X	X	T	ANACARDIACEAE
Spermacoce sinensis (Klotzsch) Hiern	X	-	-	H	RUBIACEAE
Spirostachys africana Sond.	-	X	X	T	EUPHORBIACEAE
Sporobolus pyramidalis P. Beauv.	-	X	-	G	POACEAE
Sterculia africana (Lour.) Fiori	-	X	X	T	STERCULIACEAE
Sterculia appendiculata K. Schum.	X	-	X	T	STERCULIACEAE
Sterculia quinqueloba (Garcke) K. Schum.	X	X	-	T	STERCULIACEAE
Stereospermum xunthianum Cham.	-	X	X	T	APOCYNACEAE
Strophanthus courmontii Franch.	-	X	-	C	APOCYNACEAE
Strophanthus kombe Oliv.	-	X	-	SS	LOGANIACEAE
Strychnos henningsii Gilg	X	X	-	ST	LOGANIACEAE
Strychnos madagascariensis Poir	X	X	X	T	LOGANIACEAE
Strychnos panganensis Gilg	-	-	X	C	LOGANICEAE
Stylochiton natalensis Schott	-	X	-	H	ARACEAE
Suregada zanzibariensis Baill	X	X	X	S	EUPHORBIACEAE
Synaptolepis kirkii Oliv.	X	X	X	SC	THYMELACEAE
Tamarindus indica L.	-	X	X	T	CAESALPINIACEAE
Tarenna drummondii Brids.	X	-	-	ST	RUBIACEAE
Terminalia sericea DC.	X	X	X	T	COMBRETACEAE
Tetracera boiviniana Baill.	X	-	-	S	DILLENIACEAE
Tetracera litoralis Gilg.	-	X	-	SS	DILLENIACEAE
Thylachium africana Lour.	-	X	-	S	CAPPARACEAE
Tragia furialis Prain	X	-	-	C	EUPHORBIACEAE
Tricalysia ovalifolia Hiern	X	-	-	S	RUBIACEAE
Triclisia sacleuxii (Pierre) Diels	-	X	-	C	MENISPERMACEAE
Triumfetta rhomboidea Jacq.	X	X	-	H	TILIACEAE
Turraea nilotica Kotschy & Peyr.	X	-	X	ST	MELIACEAE
Uvaria acuminata Oliv.	X	-	-	SS	ANNONACEAE
Vangueria infausta Burch.	X	-	-	ST	RUBIACEAE
Vangueria randii S. Moore	-	X	-	SS	RUBIACEAE
Vetiveria nigritana (Benth.) Stapf	-	X	-	G	POACEAE
Vitex buchananii Gurke	X	X	-	S	VERBENACEAE
Vitex doniana Sweet	-	-	X	T	VERBENACEAE
Voacanga thouarsii Stapf	X	X	X	T	APOCYNACEAE
Xerroderis stuhlmannii (Taub.) Mend. & Souza	X	X	X	T	FABACEAE
Ximenia caffra Sond.	X	-	-	S	OLACACEAE
Xylopia odoratissima Oliv.	-	-	X	T	ANNONACEAE
Xylopia parviflora (A. Rich.) Benth.	X	X	X	T	ANNONACEAE
Xylotheca tettensis (Klotzsch)	-	X	X	S	FLACOURTIACEAE
Zanthoxylum chalybeum Engl.	X	-	X	ST	RUTACEAE
Zanthoxylum holtzianum (Engl.) Waterm.	X	X	-	S	RUTACEAE
Ziziphus pubescens Oliv	-	-	X	T	RHAMNACEAE
TOTAL		**143**	**144**	**90**	

Appendix 2:Species distribution of different plant groups and their ecological parameters from three selected forests in the Rufiji flood plain.

NB: RD = Relative density, RF = Relative Frequency, RI = (RD+RF) = Rarity Index; Shannon Diversity $H' = R_D \ln R_D$

KICHI HILLS: I: HERBS, SEEDLINGS & GRASSES

No.	Species Name	No.of individuals	Rel. Dens.	Freq.	RF	RI	RD ln RD Diversity
1	*Blepharis maderaspatensis*	1	0.0025	1	0.0113	0.0138	0.0149
2	*Basananthe lanceolata*	1	0.0025	1	"	0.0138	0.0149
3	*Rytigynia uhligii*	1	0.0025	1	"	0.0138	0.0149
4	*Albertisia undulata*	39	0.098	3	0.034	0.132	0.2276
5	*Alchornea laxiflora*	20	0.05	3	0.034	0.084	0.1497
6	*Panicum comorense*	1	0.0025	1	0.0413	0.0138	0.0149
7	*Ipomoea wightii*	5	0.012	4	0.045	0.165	0.053
8	*Gossypioides kirkii*	3	0.0076	1	0.0113	0.0873	0.03708
9	*Sapium armatum*	3	"	2	0.022	0.0296	0.03708
10	*Xylopia parviflora*	32	0.081	3	0.034	0.115	0.2035
11	*Cola discoglypremnophylla*	1	0.0025	1	0.0113	0.0138	0.0149
12	*Landolphia kirkii*	36	0.091	4	0.045	0.136	0.2181
13	*Synaptolepis kirkii*	3	0.0076	2	0.022	0.0296	0.03708
14	*Hugonia castaneifolia*	1	0.0025	1	0.0113	0.0138	0.0149
15	*Dialium holstii*	3	0.0076	2	0.022	0.0296	0.03708
16	*Grewia holstii*	5	0.012	2	"	0.032	0.053
17	*Dichapetalum edule*	2	0.005	2	"	0.027	0.0265
18	*Setaria homonyma*	8	0.02	2	0.0113	0.0313	0.0782
19	*Isoglossa lactea*	13	0.33	1	0.022	0.053	0.1125
20	*Uvaria acuminata*	15	0.038	2	0.045	0.083	0.1242
21	*Panicum laticomum*	2	0.005	4	0.0113	0.0163	0.0265
22	*Panicum trichocladum*	18	0.045	1	0.022	0.067	0.1395
23	*Psychotria punctata*	1	0.0025	2	0.0113	0.0138	0.0149
24	*Vangueria randii*	2	0.005	1	"	0.0163	0.0265
25	*Tricalysia ovalifolia*	1	0.0025	1	"	0.0138	0.0149
26	*Tragia furialis*	1	0.0025	1	"	0.0138	0.0149
27	*Drypetes natalensis*	2	0.005	1	"	0.0168	0.0265
28	*Memecylon schliebenii*	8	0.02	2	0.22	0.042	0.0782
29	*Scorodophloeus fischeri*	8	0.02	1	0.0113	0.0313	0.0782
30	*Suregada zanzibarensis*	2	0.005	1	"	0.0163	0.0265
31	*Leptochloa chinensis*	2	"	1	"	0.0163	0.0265
32	*Panicum maximum*	87	0.22	4	0.45	0.265	0.331
33	*Triumfetta rhomboidea*	1	0.0025	1	0.0113	0.0138	0.0149
34	*Asystasia gangetica*	5	0.012	2	0.022	0.034	0.053
35	*Abrus precatorius*	4	0.01	1	0.0113	0.0213	0.04605
36	*Pteleopsis myrtifolia*	9	0.022	4	0.045	0.067	0.0839
37	*Tetracera boiviniana*	1	0.0025	1	0.0113	0.0138	0.0149
38	*Mariscus hemisphaericus*	1	0.0025	1	"	"	0.0149
39	*Hyparrhenia filipendula*	5	0.012	1	"	0.0233	0.053
40	*Spermacoce sinensis*	14	0.035	1	"	0.0463	0.1173
41	*Margaritaria discoidea*	2	0.005	2	0.022	0.027	0.0265
42	*Indigofera viscosa*	1	0.0025	1	0.113	0.0138	0.0149
43	*Catunaregam spinosa*	2	0.005	1	"	0.0163	0.0265
44	*Dichrostachys cinerea*	1	0.0025	1	"	0.0138	0.0149
45	*Commiphora sp.*	1	"	1	"	"	0.0149
46	*Hymenocardia ulmoides*	1	"	1	"	"	0.0149
47	*Commelina benghalensis*	1	"	1	"	"	0.0149

No.	Species Name	No.of individuals	Rel. Dens.	Freq.	RF	RI	RD ln RD Diversity
48	*Harungana madagascariensis*	4	0.01	2	0.022	0.032	0.04605
49	*Acalypha neptunica*	1	0.0025	1	0.0113	0.0138	0.0149
50	*Milletia usaramensis*	1	"	1	"	0.0138	0.0149
51	*Acacia sieberana*	4	0.01	1	"	0.0213	0.04605
52	*Vitex buchanannii*	1	0.0025	1	"	0.0138	0.0149
53	*Combretum zeyheri*	1	0.0025	1	"	"	0.0149
54	*Mimusops fruticosa*	4	0.01	1	"	0.0213	0.04605
55	*Salacia leptoclada*	2	0.005	1	"	0.0163	0.0265
		394	**1**	**88**	**1**	**2**	

KICHI HILLS - SHRUBS + JUVENILE TREES

	Species Name	No.of indiv.	Rel. Dens. (RD)	Freq.	(RF)	Rarity Index (RI)	RD ln RD
1	*Suregada zanzibarensis*	4	0.0109	2	0.0122	0.0231	0.0492
2	*Acacia sieberana*	5	0.0136	1	"	0.0197	0.0584
3	*Acalypha neptunica*	7	0.0191	2	0.0122	0.0313	0.0756
4	*Adenia stenodactyla*	1	"	1	"	"	0.0161
5	*Afzelia quanzensis*	3	0.0081	2	0.0122	0.0203	0.039
6	*Albertisia undulata*	3	0.0081	1	0.0061	0.0142	0.039
7	*Albizia petersiana*	3	0.0081	2	0.0122	0.0203	0.039
8	*Alchornea laxiflora*	31	0.0846	11	0.0674	0.152	0.2089
9	*Annona senegalensis*	2	0.0054	1	0.0061	0.0115	0.0282
10	*Antidesma venosum*	1	0.00273	1	0.0061	0.0088	0.0161
11	*Apodytes sp.*	1	0.00273	1	"	0.0088	0.0161
12	*Caloncoba welwitschii*	3	"	2	0.0122	0.0203	0.039
13	*Calpodiptera sp*	1	0.00273	1	0.0061	"	0.0161
14	*Capparis sepiaris*	3	0.0081	1	0.0061	0.0142	0.039
15	*Cathium bibracteum*	1	"	1	"	"	0.0161
16	*Catunanegam spinosa*	6	0.0163	2	0.0122	0.0285	0.0671
17	*Chazaliella abrupta*	1	"	1	"	"	0.0161
18	*Cola discoglypremnophylla*	4	"	3	0.0184	0.0293	0.0492
19	*Combretum molle*	2	0.0054	2	0.0122	0.0176	0.0282
20	*Combretum zeyheri*	5	0.0136	4	0.0245	0.0381	0.0584
21	*Crotalaria goodiformis*	6	0.0163	1	0.0061	0.0224	0.0671
22	*Dichapetalum stuhlmanii*	7	"	5	0.0306	0.0497	0.0756
23	*Dichapetalum edule*	16	0.0437	5	0.0306	0.0743	0.1367
24	*Dichapetalum verrucosa*	3	0.0081	1	"	0.0142	0.039
25	*Dichrostachys cinerea*	1	"	1	"	"	0.0161
26	*Diospyros mespiliformis*	7	0.0191	2	0.0122	0.0313	0.0756
27	*Diospyros verrucosa*	15	0.0409	5	0.0306	0.0715	0.1307
28	*Drypetes gerrardii*	2	0.0054	1	"	0.0115	0.0282
29	*Eugenia capensis*	1	0.00273	1	0.0061	0.0088	0.0161
30	*Fernandoa magnifica*	1	0.00273	1	0.0061	0.0088	0.0161
31	*Gardenia jovis-tonantis*	1	"	1	"	"	0.0161
32	*Grewia holstii*	2	0.0054	1	"	0.0115	0.0282
33	*Grewia lepidopetala*	3	0.0081	2	0.0122	0.0203	0.039
34	*Haplocoelopsis africana*	4	0.0109	3	0.0184	0.0293	0.0492
35	*Harungana madagascariensis*	1	0.00273	1	"	0.0088	0.0161
36	*Hugonia castaneifolia*	3	0.0081	2	0.0122	0.0203	0.039
37	*Hymenocardia ulmoides*	12	0.0327	5	0.0306	0.0633	0.1118
38	*Landolphia kirkii*	1	0.00273	1	0.0061	0.0088	0.0161
39	*Lettowianthus stellatus*	3	0.0081	1	0.0061	0.0142	0.039
40	*Lippia javanica*	4	0.0109	2	0.0122	0.0231	0.0492
41	*Markhamia obtusifolia*	19	0.0519	5	0.0306	0.0825	0.1535
42	*Memecylon schliebenii*	4	0.0109	2	0.122	0.0231	0.0492
43	*Milicia excelsa*	2	0.0054	1	"	"	0.0282

	Species Name	No.of indiv.	Rel. Dens. (RD)	Freq.	(RF)	Rarity Index (RI)	RD ln RD
44	*Milletia stuhlmannii*	10	0.0273	4	0.0245	0.0518	0.0983
45	*Milletia usaramensis*	4	0.0109	2	0.0122	0.0231	0.0492
46	*Ochna schweinfurthiana*	1	"	1	0.0061	0.0088	0.0161
47	*Oxyanthus speciosus*	2	0.0054	1	0.0061	0.0115	0.0282
48	*Pancovia holstii*	1	0.00273	1	0.0061	0.0088	0.0161
49	*Pentas bussei*	1	0.00273	1	"	0.0088	0.0161
50	*Pteleopsis myrtifolia*	26	0.071	6	0.0368	0.1078	0.1878
51	*Rinorea angustifolia*	10	0.0273	1	0.0061	0.0088	0.0983
52	*Rothmania ravae*	2	0.0054	1	0.0061	0.0115	0.0282
53	*Rourea orientalis*	2	0.0054	2	0.0122	0.0176	0.0282
54	*Rytigynia binata*	8	0.0218	3	0.0184	0.0402	0.0834
55	*Rytigynia uhligii*	2	0.0054	2	0.0122	0.0176	0.0282
56	*Salacia leptoclada*	20	0.0546	7	0.0429	0.1036	0.1587
57	*Salacia madagascariensis*	1	"	1	"	"	0.0161
58	*Sapium armatum*	4	0.0109	3	0.0184	0.0293	0.0492
59	*Schlecterina mitostemattoides*	2	0.0054	1	0.0061	0.0115	0.0282
60	*Sterculia quinqueloba*	1	"	1	"	"	0.0161
61	*Strychnos heningsii*	2	0.0054	1	0.0061	0.0115	0.0282
62	*Strychnos madagascariensis*	4	"	1	0.0061	0.017	0.0492
63	*Synaptolepis kirkii*	1	0.00273	1	0.0061	0.0088	0.0161
64	*Tetracera litoralis*	1	0.00273	1	0.0061	0.0088	0.0161
65	*Tricalysia ovalifolia*	4	0.0109	2	0.0122	0.0231	0.0492
66	*Turraea nilotica*	1	"	1	"	"	0.0161
67	*Uvaria accuminata*	4	0.0109	4	0.0245	0.0354	0.0492
68	*Vangueria infausta*	5	0.0136	3	0.0184	0.032	0.0584
69	*Vangueria randii*	4	0.0109	2	0.0122	0.0231	0.0492
70	*Vitex buchanannii*	1	"	1	"	"	0.0161
71	*Ximenia caffra*	1	0.00273	1	"	0.0088	0.0161
72	*Xylopia parviflora*	40	0.109	13	0.797	0.1887	0.2415
73	*Zanthoxylum holtzianum*	3	0.0081	2	0.0122	0.0203	0.039
		371	1	163	1	2	

KICHI HILLS - TREES

	Species Name	No.of indiv.	Rel. Dens. (RD)	Freq.	Rel Freq.	Rarity Index (RI)	RD ln RD
1	*Sterculia appendiculata*	1	0.00129	1	0.0039	0.00519	0.0086
2	*Rourea orientalis*	1	0.00129	2	0.0079	0.00519	0.0086
3	*Albizia spp*	1	0.00129	1	0.0039	0.00519	0.0086
4	*Dichrostachys cinerea*	1	0.00129	1	0.0039	0.00519	0.0086
5	*Markhamia obtusifolia*	131	0.169	22	0.0869	0.2559	0.3005
6	*Milletia usaramensis*	103	0.133	14	0.0553	0.1883	0.2683
7	*Pteleopsis myrtifolia*	88	0.1138	17	0.0671	0.1809	0.2473
8	*Hymenocardia ulmoides*	52	0.0672	16	0.0632	0.1304	0.1814
9	*Xylopia parviflora*	38	0.0491	13	0.0513	0.1004	0.1479
10	*Tarenna drummondii*	23	0.0426	12	0.0474	0.09	0.1344
11	*Dialium holstii*	25	0.0323	11	0.0434	0.0757	0.1108
12	*Sapium armatum*	14	0.0181	10	0.039	0.0571	0.0726
13	*Haplocoelopsis africana*	21	0.0271	7	0.0276	0.0547	0.0977
14	*Commiphora zanzibarica*	8	0.0181	8	0.0316	0.0497	0.0726
15	*Diospyros mespiliformis*	14	0.0181	6	0.0237	0.0418	0.0726
16	*Albizia petersiana*	4	0.0219	4	0.0158	0.0377	0.0836
17	*Memecylon schliebenii*	16	0.0206	3	0.0118	0.0324	0.0799
18	*Diospyros verrucosa*	12	0.0155	4	0.0158	0.0313	0.0645
19	*Scorodophloeus fischeri*	1	0.00129	4	0.0158	0.00519	0.0086
20	*Cussonia zimmermannii*	5	0.0103	5	0.0197	0.03	0.0471
21	*Hollarhena pubescens*	7	0.00905	5	0.0197	0.0287	0.0426
22	*Cola discoglypremnophylla*	13	0.0168	5	0.0197	0.0286	0.0686

	Species Name	No.of indiv.	Rel. Dens. (RD)	Freq.	Rel Freq.	Rarity Index (RI)	RD ln RD
23	*Combretum zeyheri*	4	0.0077	4	0.0158	0.0235	0.0374
24	*Dichapetalum stuhlmannii*	5	0.0065	4	0.0158	0.0223	0.327
25	*Lettowianthus stellatus*	5	0.0065	4	0.0158	0.0223	0.0327
26	*Combretum spp*	2	0.0142	2	0.0079	0.0221	0.0604
27	*Leptactina platyphylla*	4	0.0051	4	0.0158	0.0209	0.0269
28	*Vitex buchanannii*	4	0.0051	4	0.0158	0.0209	0.0269
29	*Zanthoxylum holtzianum*	7	0.00905	3	0.0118	0.0208	0.0426
30	*Combretum molle*	3	0.0077	3	0.0118	0.0195	0.0374
31	*Strychnos madagascariensis*	3	0.0065	3	0.0118	0.0183	0.0327
32	*Rytigynia binata*	2	0.0103	2	0.0079	0.0182	0.0471
33	*Ambylgonocarpus andongensis*	4	0.0129	4	0.0158	0.0171	0.0561
34	*Dombeya cincinnata*	4	0.0051	3	0.0118	0.0169	0.0269
35	*Terminalia sericea*	3	0.0051	3	0.0118	0.0169	0.0269
36	*Afzelia quanzensis*	3	0.00388	3	0.0118	0.0156	0.0215
37	*Strychnos heningsii*	3	0.0038	3	0.0118	0.0156	0.0215
38	*Turraea nilotica*	5	0.0065	2	0.0079	0.0144	0.0327
39	*Catunaregam spinosa*	2	0.0051	2	0.0079	0.013	0.0269
40	*Grewia holstii*	2	0.0051	2	0.0079	0.013	0.0269
41	*Pseudolachnostylis maproneufolia*	2	0.0038	2	0.0079	0.0117	0.0215
42	*Rothmania ravae*	2	0.0025	2	0.0079	0.0104	0.0149
43	*Sideroxylon inerme*	2	0.0025	2	0.0079	0.0104	0.0149
44	*Tricalysia ovalifolia*	2	0.00129	2	0.0079	0.0092	0.0086
45	*Drypetes arguta*	4	0.0051	1	0.0039	0.009	0.0269
46	*Mimusops fruticosa*	1	0.00129	1	"	0.00519	0.0086
47	*Annona senegalensis*	1	0.00129	1	0.0039	0.00519	0.0086
48	*Newtonia buchanannii*	1	0.00129	1	"	0.00519	0.0086
49	*Commiphora eminii*	2	0.0025	1	0.0039	0.0064	0.0149
50	*Carpodiptera sp.*	1	0.00129	1	0.0039	0.00519	0.0086
51	*Turraea nilotica*	1	0.00129	1	0.0039	0.00519	0.0086
52	*Ozoroa insignis*	1	0.00129	1	0.0039	0.00519	0.0086
53	*Drypetes gerrardii*	1	0.00129	1	0.0039	0.00519	0.0086
54	*Fernandoa magnifica*	1	0.00129	1	0.0039	0.00519	0.0086
55	*Mildbraedia caprinifolia*	1	0.00129	1	0.0039	0.00519	0.0086
56	*Kigellaria africana*	1	0.00129	1	0.0039	0.00519	0.0086
57	*Phyllanthus reticulatus*	1	0.00129	1	0.0039	0.00519	0.0086
58	*Cassia abbreviata*	1	0.00129	1	0.0039	0.00519	0.0086
59	*Erythrina abyssinica*	1	0.00129	1	0.0039	0.00519	0.0086
60	*Voacanga thouarsii*	1	0.00129	1	0.0039	0.00519	0.0086
61	*Drypetes natalensis*	1	0.00129	1	0.0039	0.00519	0.0086
62	*Rinorea angustifolia*	1	0.00129	1	"	0.00519	0.0086
63	*Hymenocardia acida*	1	0.00129	1	0.0039	0.00519	0.0086
64	*Lannea stuhlmannii*	1	0.00129	1	0.0039	0.00519	0.0086
65	*Zanthoxylum chalybeum*	1	0.00129	1	0.0039	0.00519	0.0086
66	*Harungana madagascariensis*	1	"	1	0.0039	0.00519	0.0086
67	*Vangueria infausta*	1	0.00129	1	0.0039	0.00519	0.0086
		773	**1**		**1**	**2**	

WEME FOREST - HERBS, SEEDLINGS & GRASSES

Species Name	No.of indiv.	Rel. Dens. (RD)	Freq.	Rel Freq.	Rarity Index (RI)	Shannon
Flagellaria guineensis	1	0.00216	1	0.0097	0.01186	0.0132
Deinbollia borbonica	1	0.00216	1	0.0097	0.01186	0.0132
Polysphaenia multiflora	1	0.00216	1	0.0097	0.01186	0.0132
Panicum peteri	30	0.0649	1	0.0194	0.0194	0.1779
Tricalysia ovalifolia	1	0.00216	2	0.0097	0.01186	0.1953
Psilotrichum scleranthum	35	0.0757	11	0.1067	0.1824	0.1953
Chazaliella abrupta	11	0.0238	3	0.0291	0.0529	0.0889
Commelina benghalensis	24	0.0519	6	0.0582	0.1101	0.1535
Salacia leptoctada	2	0.0043	2	0.0194	0.0237	0.0234
Cyperus exaltatus	16	0.0346	1	0.0097	0.443	0.1164
Asystasia gangetica	9	0.0194	4	0.0388	0.0582	0.076
Crotalaria goodiiformis	10	0.0216	5	0.0485	0.0701	0.0828
Lamprothamnus zanguebaricus	3	0.0065	1	0.0097	0.0162	0.327
Panicum maximum	48	0.1038	5	0.0485	0.1523	0.235
Schlecterina mittostematoides	33	0.0714	11	0.1067	0.1781	0.188
Suregada zanzibarensis	2	0.0043	1	0.0097	0.014	0.0234
Baphia kirkii	1	0.00216	1	0.0097	0.0118	0.0132
Caloncoba welwitschii	2	0.0043	2	0.0194	0.0237	0.0234
Landolphia kirkii	6	0.0129	3	0.0291	0.042	0.0561
Strychnos madagascariensis	3	0.0065	1	0.0097	0.0162	0.0327
Sporobolus sp.	20	0.0432	1	0.0097	0.0529	0.1357
Panicum trichocladum	48	0.1038	3	0.0291	0.1329	0.235
Hyphaene coriacea	3	0.0065	1	0.0097	0.0162	0.0327
Ipomoea wightii	2	0.0043	1	0.0097	0.014	0.0234
Panicum laticomum	26	0.0562	5	0.0485	0.1047	0.1617
Phyllanthus amara	2	0.0043	2	0.0194	0.0237	0.0234
Reissantia indica	19	0.0411	2	0.0194	0.0605	0.1311
Monanthotaxis buchanannii	1	0.00216	79	0.0097	0.01186	0.0132
Grewia holstii	1	0.00216	1	0.0097	0.01186	0.0132
Erythroxylum fischeri	4	0.00865	1	0.0097	0.0183	0.041
Strophanthus kombe	1	0.00216	1	0.0097	0.01186	0.0132
Isoglossa lacteal	27	0.0584	3	0.291	0.0875	0.1658
Capparis sepiaris	1	0.00216	1	0.0097	0.0183	0.041
Aneilema aequanoctiales	16	0.0346	6	0.0582	0.0928	0.1163
Panicum comorense	47	0.1017	9	0.0873	0.189	0.2324
Triumfetta rhomboidea	3	0.0065	1	0.0097	0.0162	0.0327
Garcinia livingstonii	2	0.0043	1	0.0194	0.0237	0.0234
	462	**1**	**103**	**1**	**1**	

WEME - SHRUBS AND JUVENILE TREES

Species Name	No. of indiv.	Rel. Dens. (RD)	Freq. (F)	Rel. Freq. (RF)	Rarity Index (RI)	Shannon Diversity
Garcinia livingstonii	3	0.0096	1	0.0072	0.0168	0.0446
Alchornea laxiflora	3	0.0096	1	0.0072	0.0168	0.0446
Polysphaenia multiflora	1	0.0032	1	0.0072	0.0104	0.0184
Rinorea elliptica	3	0.0096	2	0.0014	0.011	0.0446
Suregada zanzibarensis	12	0.0385	6	0.0432	0.0817	0.1254
Deinbollia borbonica	14	0.045	7	0.0504	0.0954	0.1395
Chazaliella abrupta	46	0.148	17	0.1223	0.2703	0.283
Monanthotaxis buchanannii	9	0.0289	5	0.0359	0.0648	0.1024
Rinorea ilicifolia	1	0.0032	1	0.0072	0.0104	0.0184

Lamprothamnus zanguebaricus	15	0.0482	3	0.0216	0.0698	0.1462
Species Name	**No. of indiv.**	**Rel. Dens. (RD)**	**Freq. (F)**	**Rel. Freq. (RF)**	**Rarity Index (RI)**	**Shannon Diversity**
Spirostachys africana	3	0.0096	1	0.0072	0.0168	0.0446
Acacia nigrescens	1	0.0032	1	0.0072	0.0104	0.0184
Dalbergia melanoxylon	1	0.0032	1	0.0072	0.0104	0.0184
Tamarindus indica	1	0.0032	1	0.0072	0.0104	0.0184
Allophylus abyssinica	1	0.0032	1	0.0072	0.0104	0.0184
Maerua kirkii	1	0.0032	1	0.0072	0.0104	0.0184
Leptactina platyphylla	5	0.016	4	0.0288	0.0448	0.0661
Landolphia kirkii	2	0.0064	2	0.0014	0.0078	0.0323
Elaeodendron buchanannii	1	0.0032	1	0.0072	0.0104	0.0184
Erythroxylum fischeri	4	0.0128	3	0.0216	0.0344	0.0558
Clerodendrum cephalanthum	1	0.0032	1	0.0072	0.0104	0.0184
Schlecterina mittostematoides	6	0.0193	3	0.0216	0.0409	0.0762
Tetracera litoralis	2	0.0064	2	0.0014	0.0078	0.0323
Olax pentandra	8	0.0257	2	0.0014	0.0271	0.0941
Pteleopsis myrtifolia	7	0.0225	5	0.0359	0.0584	0.0854
Hymenaea verrucosa	2	0.0064	2	0.0014	0.0078	0.0323
Zanthoxylum chalybeum	4	0.0128	2	0.0014	0.0142	0.0558
Sorindeia madagascariensis	1	0.0032	1	0.0072	0.0104	0.0184
Synaptolepis kirkii	1	0.0032	1	0.0072	0.0104	0.0184
Caloncoba welwitschii	7	0.0225	1	0.0072	0.0297	0.0854
Grewia lepidopetala	1	0.0032	1	0.0072	0.0104	0.0184
Crotalaria goodiiformis	3	0.0096	3	0.0216	0.312	0.0446
Xylotheca tettensis	21	0.0675	7	0.0504	0.1179	0.1819
Acacia nilotica	1	0.0032	1	0.0072	0.0104	0.0184
Oncoba spinosa	8	0.0257	2	0.0014	0.0271	0.0941
Hymenocardia acida	5	0.016	3	0.0216	0.0376	0.0661
Psilotrichum scleranthum	6	0.0193	2	0.0014	0.0207	0.0762
Grewia holstiii	1	0.0032	1	0.0072	0.0104	0.0184
Ochna atropurpurea	1	0.0032	1	0.0072	0.0104	0.0184
Dichrostachys cinerea	2	0.0064	2	0.0014	0.078	0.0323
Flueggea virosa	1	0.0032	1	0.0072	0.0104	0.0184
Clerodendrum myricoides	3	0.0096	1	0.0072	0.0168	0.0446
Rytigynia uhligii	2	0.0064	1	0.0072	0.0136	0.0323
Grewia bicolor	16	0.0514	5	0.0359	0.0873	0.1525
Markamia obtusifolia	2	0.0064	1	0.0072	0.0136	0.03232
Holarrhena pubescens	4	0.0128	2	0.0014	0.0142	0.0558
Combretum zeyheri	1	0.0032	1	0.0072	0.0104	0.0184
Strophanthus courmontii	1	0.0032	1	0.0072	0.0104	0.0184
Reissantia indica	32	0.103	5	0.0359	0.1389	0.2341
Voacanga thouarsii	3	0.0096	3	0.0216	0.0312	0.0446
Hymenocardia ulmoides	1	0.0032	1	0.0072	0.0104	0.0184
Zanthoxylum holtzianum	1	0.0032	1	0.0072	0.0104	0.0184
Strychnos madagascariensis	1	0.0032	1	0.0072	0.0104	0.0184
Triumfetta rhomboidea	19	0.0611	4	0.0288	0.0899	0.1708
Rothmania ravae	1	0.0032	1	0.0072	0.0104	0.0184
Schizozygium coffeoides	1	0.0032	1	0.0072	0.0104	0.0184
Rourea orientalis	2	0.064	1	0.0072	0.0136	0.0323
Grewia forbesii	3	0.0096	3	0.0216	0.0312	0.0323
Hibiscus surattensis	3	0.0096	1	0.0072	0.0168	0.0323
Diospyros mespiliformis	1	0.0032	1	0.0072	0.0104	0.0184
	311		139			

WEME - TREES

Species Name	No. of indiv.	Rel. Dens. (RD)	Freq. (F)	Rel. Freq. (RF)	Rarity Index (RI)	Shannon Diversity
Deinbollia borbonica	2	0.002	2	0.006	0.008	0.0124
Majidea zanguebarica	2	0.002	1	0.003	0.005	0.0124
Bersama abyssinica	6	0.007	1	0.003	0.01	0.0347
Afzelia quanzensis	15	0.018	11	0.033	0.051	0.0723
Lettowianthus stellatus	32	0.038	13	0.039	0.077	0.1242
Polysphaeria multiflora	1	0.001	1	0.003	0.004	0.0069
Hyphaene coriacea	5	0.006	3	0.009	0.015	0.0306
Voacanga thouarsii	56	0.067	19	0.058	0.125	0.1811
Markamia obtusifolia	26	0.031	8	0.024	0.055	1076
Tamarindus indica	7	0.008	6	0.018	0.026	0.0386
Milletia stuhlmannii	111	0.134	38	0.115	0.249	0.2693
Grewia lepidopetala	6	0.007	3	0.009	0.016	0.0347
Rothmania ravae	1	0.001	1	0.003	0.004	0.0069
Cassia abbreviata	6	0.007	4	0.012	0.019	0.0347
Suregada zanzibarensis	41	0.049	16	0.049	0.098	0.1477
Diospyros zombensis	9	0.011	7	0.021	0.032	0.0496
Pteleopsis myrtifolia	121	0.147	26	0.079	0.226	0.2818
Combretum zeyheri	19	0.023	9	0.027	0.05	0.0867
Zanthoxylum chalybeum	4	0.005	4	0.012	0.017	0.0265
Lamprothamnus zanguebaricus	9	0.011	4	0.012	0.023	0.0496
Brachystegia spiciformis	14	0.017	7	0.021	0.038	0.0692
Ochna holstii	2	0.002	2	0.006	0.008	0.0124
Spirostachys africana	25	0.03	13	0.039	0.069	0.1052
Acacia nigrescens	8	0.009	5	0.015	0.024	0.0424
Acacia robusta	2	0.002	2	0.006	0.008	0.0124
Salvadora persica	2	0.002	1	0.003	0.005	0.0124
Isolona odoratissima	20	0.024	4	0.012	0.036	0.0895
Grewia bicolor	47	0.057	13	0.039	0.096	0.1632
Strychnos pungens	1	0.001	1	0.003	0.004	0.0069
Euphorbia nyikae	10	0.012	5	0.015	0.027	0.053
Markamia platycalyx	9	0.011	6	0.018	0.029	0.0496
Baphia kirkii	2	0.002	1	0.003	0.005	0.0124
Xerroderis stuhlmannii	10	0.012	8	0.024	0.036	0.053
Pseudolachnostylis maproneufolia	2	0.002	2	0.006	0.008	0.0124
Sterculia quinquiloba	2	0.002	2	0.006	0.008	0.0124
Erythroxylum fischeri	1	0.001	1	0.003	0.004	0.0069
Diospyros mespiliformis	12	0.014	3	0.009	0.023	0.0597
Drypetes natalensis	12	0.014	2	0.006	0.02	0.0597
Drypetes usambarica	3	0.004	1	0.003	0.007	0.0221
Lonchocarpus cappasa	1	0.001	1	0.003	0.004	0.0069
Albizia harveyii	1	0.001	1	0.003	0.004	0.0069
Acacia nilotica	2	0.002	2	0.006	0.008	0.0124
Lannea stuhlmannii	1	0.001	1	0.003	0.004	0.0069
Hymenocardia ulmoides	38	0.041	5	0.015	0.061	0.1416
Diplorynchus condylocarpon	2	0.002	1	0.003	0.005	0.0124
Oncoba spinosa	2	0.002	2	0.006	0.008	0.0124
Hymenaea verrucosa	2	0.002	2	0.006	0.008	0.0124
Kigelia africana	1	0.001	1	0.003	0.004	0.0069
Sclerocarya birrea	2	0.002	2	0.006	0.008	0.0124
Xylotheca tettensis	1	0.001	1	0.003	0.004	0.0069

Species Name	No. of indiv.	Rel. Dens. (RD)	Freq. (F)	Rel. Freq. (RF)	Rarity Index (RI)	Shannon Diversity
Canthium burtii	1	0.001	1	0.003	0.004	0.0069
Dalbergia melanoxylon	2	0.002	2	0.006	0.008	0.124
Margaritaria discoides	1	0.001	1	0.003	0.004	0.0069
Cassipourea malosana	1	0.001	1	0.003	0.004	0.0069
Fernandoa magnifica	2	0.002	2	0.006	0.008	0.124
Grewia microcarpa	1	0.001	1	0.003	0.004	0.0069
Xylopia parviflora	13	0.016	8	0.024	0.04	0.0661
Antidesma venosum	2	0.002	1	0.003	0.005	0.0124
Zanthoxylum holtzianum	20	0.024	6	0.018	0.042	0.0895
Vitex buchanannii	1	0.001	1	0.003	0.004	0.0069
Rauvolfia mombasiana	18	0.022	5	0.015	0.037	0.0839
Cordyla africana	1	0.001	1	0.003	0.004	0.0069
Strychnos madagascariensis	2	0.002	2	0.006	0.008	0.0124
Sterculia africana	4	0.005	2	0.006	0.011	0.0265
Zanthoxylum holtzianum	2	0.002	1	0.003	0.005	0.124
Rinorea elliptica	10	0.012	2	0.006	0.018	0.053
Dichapetalum aneranium	1	0.001	1	0.003	0.004	0.0069
Rytignia uhligii	1	0.001	1	0.003	0.004	0.0069
Bridellia cathartica	1	0.001	1	0.003	0.004	0.0069
Catunaregam spinosa	1	0.001	1	0.003	0.004	0.0069
Terminalia sericea	2	0.002	2	0.006	0.008	0.012
Commiphora serrata	1	0.001	1	0.003	0.004	0.0069
Cola clavata	1	0.001	1	0.003	0.004	0.0069
Dichrostachys cinerea	1	0.001	1	0.003	0.004	0.0069
Drypetes reticulata	2	0.002	2	0.006	0.008	0.0124
Dialium holtzii	2	0.002	1	0.003	0.005	0.0124
Manilkara discolor	1	0.001	1	0.003	0.004	0.0069
Sorindeia madagascariensis	1	0.001	1	0.003	0.004	0.0069
Chrysophyllum sp.	1	0.001	1	0.003	0.004	0.0069
Crossopteryx febrifuga	1	0.001	1	0.003	0.004	0.0069
Schrebera trichoclada	1	0.001	1	0.003	0.004	0.0069
	825	1	329	1		

ILU FOREST - HERBS, SEEDLINGS AND GRASSES

NO.	Species Name	No. of ind.	Rel. dens. (RD)	Freq.	Rel. freq. (RF)	Rarity Index (RI)	Diversity RDlnRD
1	*Isoglossa lactea*	68	0.39	7	0.2333	0.6233	0.367
2	*Panicum comorense*	20	0.115	2	0.0666	0.1816	0.248
3	*Aneilema acquinoctiales*	1	0.0057	1	0.0333	0.039	0.0294
4	*Cyperus exaltatus*	2	0.011	1	"	0.0443	0.0496
5	*Asystasia gangetica*	6	0.0344	2	0.0666	0.101	0.116
6	*Phyllanthus amara*	1	0.0057	1	0.0333	0.039	0.0294
7	*Psilotrichum scleranthum*	1	"	1	"	0.039	0.0294
8	*Cyathula prostrata*	20	0.115	1	"	0.1483	0.248
9	*Uvaria acuminata*	1	0.0057	1	"	0.039	0.0294
10	*Panicum maximum*	10	0.057	1	"	0.0903	0.163
11	*Reissontia indica*	3	0.0172	1	"	0.0505	0.0698
12	*Diaspyros zombensis*	1	0.0057	1	"	0.039	0.0294
13	*Saba comorensis*	11	0.0632	2	0.0666	0.1298	0.174
14	*Sorindeia madagascariensis*	12	0.0689	2	0.0666	0.1385	0.184
15	*Commelina benghalensis*	1	0.0057	1	0.0333	0.039	0.0296
16	*Rauvolfia mombasiana*	3	0.172	1	"	0.0505	0.0698
17	*Agelaea setulosa*	6	0.0344	2	0.0666	0.101	0.116
18	*Panicum peteri*	7	0.0402	1	0.0333	0.0735	0.129
19	*Combretum pentagonum*	1	0.0057	1	0.0333	0.039	0.0294
		174	**1**	**30**	**1**		

ILU FOREST - SHRUBS & JUVENILE TREES

No.	Species Name	No. of ind.	Rel. Dens.	Freq.	Rel. freq.	Rarity index	Shannon Diversity
			RD		**RF**	**RI**	**RDlnD**
1	*Monanthotaxis buchanannii*	3	0.0204	3	0.0517	0.0721	0.0794
2	*Drypetes arguta*	2	0.0136	1	0.0172	0.0308	0.0584
3	*Haplocoelum inopleum*	2	"	1	0.0172	0.0308	0.0584
4	*Grewia forbesii*	1	0.0068	1	0.0172	0.024	0.0339
5	*Combretum zeyheri*	3	0.0204	3	0.0517	0.0721	0.0794
6	*Lonchocarpus cappasa*	1	0.0068	1	0.0172	0.024	0.0339
7	*Deinbollia borbonica*	12	0.0816	3	0.0517	0.1333	0.2044
8	*Jasminium fluminense*	2	0.0136	2	0.0344	0.048	0.0584
9	*Commiphora serrata*	1	0.0068	1	0.0172	0.024	0.0339
10	*Suregada zanzibarensis*	3	0.0204	1	0.0172	0.0376	0.0794
11	*Reissantia indica*	4	0.0272	1	0.0172	0.0444	0.098
12	*Chazaliella abrupta*	1	0.0068	1	0.0172	0.024	0.0339
13	*Haplocoelopsis africana*	1	"	1	0.0172	0.024	0.0339
14	*Garcinia livingstonii*	1	"	1	0.0172	0.024	0.0339
15	*Psilotrichum scleranthum*	1	"	1	0.0172	0.024	0.0339
16	*Commiphora africana*	1	"	1	0.0172	0.024	0.0339
17	*Pteleopsis myrtifolia*	2	0.0136	1	0.0172	0.0308	0.0584
18	*Hibiscus surattensis*	1	0.0068	1	0.0172	0.024	0.0339
19	*Ochna holstii*	1	0.0068	1	0.0172	0.024	0.0339
20	*Xylotheca tettensis*	6	0.0408	3	0.0517	0.0925	0.1305
21	*Oncoba spinosa*	3	0.0204	2	0.0344	0.0548	0.0794
22	*Rytigynia pergracilis*	3	0.0204	1	0.0344	0.0548	0.0794
23	*Clerodendrum nyricoides*	1	0.0068	1	0.0172	0.024	0.0339
24	*Erythroxylum fischeri*	1	0.0068	2	0.0172	0.024	0.0339

25	*Voacanga thouarsii*	8	0.0544	1	0.0344	0.0888	0.1584
No.	**Species Name**	**No. of ind.**	**Rel. Dens.**	**Freq.**	**Rel. freq.**	**Rarity index**	**Shannon Diversity**
26	*Achyranthes aspera*	2	0.0136	1	0.0172	0.0308	0.0584
27	*Allophylus abyssinicus*	1	0.0068	1	0.0172	0.024	0.0339
28	*Euphoribia nyikae*	1	"	1	0.0172	0.024	0.0339
29	*Grewia bicolor*	1	"	1	0.0172	0.024	0.0339
30	*Artabotrys brachypetalus*	2	0.0136	1	0.0172	0.0308	0.0584
31	*Rinorea elliptica*	6	0.0408	1	0.0172	0.058	0.1305
32	*Saba comorensis*	15	0.102	3	0.0517	0.1537	0.2328
33	*Sorindeia madagascariensis*	27	0.183	3	0.0517	0.2347	0.3108
34	*Keetia zanzibarica*	7	0.0476	3	0.0517	0.0993	0.1449
35	*Schizozygia coffaeoides*	10	0.068	2	0.0344	0.1024	0.1828
36	*Balanites wilsoniana*	1	0.068	1	0.0172	0.024	0.0339
37	*Agelaea setulosa*	6	0.0408	2	0.0344	0.0752	0.1305
38	*Culcasia scandens*	3	0.0204	1	0.0172	0.0376	0.0794
		147	**1**	**58**			

ILU FOREST - TREES

No.	**Species Name**	**No. of ind.**	**Rel. Dens.**	**Freq.**	**Rel. freq.**	**Rarity index**	**Shannon Diversity**
1	*Drypetes arguta*	23	0.073	3	0.022	0.095	0.91
2	*Afzelia quanzensis*	10	0.031	7	0.0515	0.083	0.1076
3	*Balanites wilsoniana*	2	0.006	2	0.0147	0.021	0.0306
4	*Euphorbia nyikae*	26	0.0825	5	0.0367	0.119	0.2058
5	*Haplocoelum inoploeum*	4	0.0126	2	0.0147	0.027	0.0551
6	*Hyphaene coriacea*	18	0.057	10	0.0735	0.131	0.1632
7	*Commiphora serrata*	6	0.019	5	0.0367	0.056	0.0753
8	*Lettowianthus stellatus*	8	0.0253	3	0.022	0.047	0.093
9	*Markhamia obtusifolia*	17	0.0539	5	0.0367	0.091	0.1574
10	*Sterculia appendiculata*	3	0.0095	2	0.0147	0.024	0.0442
11	*Tamarindus indica*	8	0.0253	5	0.0367	0.062	0.093
12	*Xerroderis stuhlmannii*	4	0.0126	3	0.022	0.035	0.0551
13	*Xylotheca tettensis*	1	0.0031	1	0.0073	0.01	0.0179
14	*Combretum zeyheri*	3	0.0095	2	0.0147	0.024	0.0442
15	*Oncoba spinosa*	3	0.0095	2	0.0147	0.024	0.0442
16	*Spirostachys africana*	21	0.0666	4	0.0294	0.096	0.1804
17	*Xylopia parviflora*	21	0.0666	7	0.0515	0.118	0.1804
18	*Grewia forbesii*	2	0.006	2	0.0147	0.021	0.0306
19	*Grewia bicolor*	3	0.0095	3	0.022	0.032	0.0442
20	*Suregada zanzibarensis*	16	0.0507	4	0.0294	0.08	0.1511
21	*Sclerocarya birrea*	3	-0.0095	3	0.022	0.032	0.0442
22	*Dobera loranthifolia*	1	0.0031	1	0.0073	0.01	0.0179
23	*Cola discoglypremnophylla*	4	0.0126	2	0.0147	0.027	0.0551
24	*Voacanga thouarsii*	8	0.0253	5	0.0367	0.062	0.093
25	*Albizia harveyii*	1	0.0031	1	0.0073	0.01	0.0179
26	*Zanthoxylum holtzianum*	1	0.0031	1	0.0073	0.01	0.0179
27	*Acacia robusta*	3	0.0095	2	0.0147	0.024	0.0442

No.	Species Name	No. of ind.	Rel. Dens.	Freq.	Rel. freq.	Rarity index	Shannon Diversity
28	*Bombax rhodognaphalon*	2	0.006	1	0.0073	0.013	0.0306
29	*Diasopyros zombensis*	4	0.0126	3	0.022	0.035	0.0551
30	*Hymenocardia ulmoides*	4	0.0126	2	0.0147	0.027	0.0551
31	*Hymenaea verrucosa*	2	0.006	2	0.0147	0.021	0.0306
32	*Margaritaria discoidea*	3	0.0095	2	0.0147	0.024	0.0442
33	*Lamprothamnus zanguebaricus*	4	0.0126	2	0.0147	0.027	0.0551
34	*Cassia abbreviata*	1	0.0031	1	0.0073	0.01	0.0179
35	*Pteleopsis myrtifolia*	7	0.022	2	0.0147	0.037	0.0839
36	*Strychnos madagascariensis*	2	0.006	1	0.0073	0.013	0.0306
37	*Strychnos pungensis*	2	0.006	1	0.0073	0.013	0.0306
38	*Stereospermum kunthianum*	2	0.022	1	0.0073	0.013	0.0839
39	*Sterculia africana*	7	0.006	3	0.022	0.044	0.0306
40	*Ziziphus pubescens*	2	0.0095	2	0.0147	0.021	0.0442
41	*Terminalia sericea*	3	0.0095	1	0.0073	0.017	0.0306
42	*Fernandoa magnifica*	2	0.006	2	0.0073	0.017	0.0442
43	*Turraea nilotica*	3	0.0095	2	0.0147	0.021	0.0306
44	*Polysphaeria dischistocalyx*	2	0.006	1	0.0147	0.024	0.0306
45	*Monanthotaxis buchanannii*	2	0.006	1	0.0073	0.013	0.0179
46	*Elaeodendron buchananii*	1	0.0031	1	0.0073	0.013	0.0179
47	*Synaptolepis kirkii*	1	0.0031	1	0.0073	0.01	0.0551
48	*Erythrina abyssinica*	4	0.0126	1	0.0073	0.01	0.2105
49	*Sorindeia madagascariensis*	27	0.0857	4	0.0073	0.02	0.0306
50	*Vitex doniana*	2	0.006	2	0.0294	0.115	0.0179
51	*Bersama abyssinica*	1	0.0031	1	0.0147	0.021	0.0179
52	*Ficus naztalensis*	1	0.0031	1	0.0073	0.01	0.0442
53	*Drypetes natalensis*	3	0.0095	2	0.0073	0.01	0.0179
54	*Kigelia africana*	1	0.0031	1	0.0073	0.024	
	TOTAL	**315**	**1**	**136**			

Appendix 3:Long-term monitoring programme for seven selected permanent plots from Weme, Ilu and Kichi Hills forests.

Where GPS readings are not avavilable, plots can be easily located as they are placed 100 m apart. The plot size is 50 x 20 m. T stands for transect number and P for plot number

WEME FOREST

SITE: T_1 P_1
GPS LOCATION: 08°02' 29.7" S, 038°54'13.5"E

TREE NO.	NAME SPECIES	CBH	HEIGHT	REMARKS
1.	*Deinbollia borbonica*	34.0	5.0	
2.	*Majidea zanguebarica*	39.0cm	5.0m	
3.	*Majidea zanguebarica*	49.0 cm	10 m	
4.	*Bersama abyssinica*	46.0 cm	8.5 m	
5.	*Afzelia quanzensis*	55.0cm	9.5m	2 stemmed
6.	*Lettowianthus stellatus*	60/48 cm	11m	2 stemmed
7.	*Bersama abyssinica*	45/50/130cm	14.0m	3 stemmed
8.	*Bersama abyssinica*	65.00cm	12.0m	
9.	*Bersama abyssinica*	80/60/100cm	13.0m	3 stemmed/leaning
10.	*Tamarindus indica*	49.0cm	10.0m	
11.	*Afzelia quanzensis*	90.0cm	13.0 m	
12.	*Millettia stuhlmannii*	52.0cm	9.0 m	
13.	*Bersama abyssinica*	55.0cm	13.0 m	
14.	*Bersama abyssinica*	68 cm	13 m	
15.	*Millettia stuhlmannii*	55 cm	12 m	
16.	*Polysphaeria multiflora*	40 cm	9 m	
17.	*Hyphaene compressa*	113 cm	12 m	
18.	*Bersama abyssinica*	62/82cm	18 m	multi branched
19.	*Voacanga thouarsii*	120.0cm	13 m	
20.	*Markhamia obtusifolia*	90/45cm	12 m	two stemmed
21.	*Lettowianthus stellatus*	34.0cm	8 m	
22.	*Codyla africana*	99.0cm	15 m	

WEME FOREST
SITE: T_2 P_6
GPS Location: 08° 03' .03" S; 038° 54'.01" E

1.	*Millettia stuhlmannii*	50.0cm	13.0 m	
2.	*Spirostachys africana*	36.0cm	12.0m	
3.	*Euphorbia nyikae*	56.0cm	9.0 m	
4.	*Grewia bicolor*	36.0cm	10 m	
5.	*Acacia nigrescens*	170.0cm	21m	
6.	*Spirostachys africana*	55.0cm	13 m	
7.	*Spirostachys africana*	70.0cm	13 m	
8.	*Euphorbia nyikae*	40.0cm	9 m	
9.	*Erythroxylum emarginatum*	45 cm	14 m	
10.	*Euphorbia nyikae*	50.0cm	9 m	
11.	*Diospyros mespiliformis*	65 cm	15 m	
12.	*Spirostachys africana*	55/70cm	13m	2 stemmed
13.	*Diospyros mespiliformis*	36cm	13m	
14.	*Diospyros mespiliformis*	34cm	13m	
15.	*Diospyros mespiliformis*	36cm	13m	
16.	*Diospyros mespiliformis*	50cm	15m	
17.	*Diospyros mespiliformis*	80cm	16m	

18.	*Diospyros mespiliformis*	50cm	16m	
19.	*Diospyros mespiliformis*	55cm	17m	
20.	*Diospyros mespiliformis*	50cm	17m	
21.	*Diospyros mespiliformis*	50cm	16m	
22.	*Diosypros mespiliformis*	45cm	15m	
23.	*Diosypros mespiliformis*	45cm	15m	
24.	*Euphorbia nyikae*	60 cm	12m	
25.	*Tamarindus indica*	45 cm	12m	
26.	*Drypetes natalensis*	36 cm	12m	
27.	*Diospyros mespiliformis*	130 cm	18m	
28.	*Diospyros mespiliformis*	200 cm	19m	
29.	*Millettia stuhlmannii*	46 cm	14m	
30.	*Drypetes reticulata*	46 cm	12m	
31.	*Drypetes reticulata*	60/55cm	14m	2 stemmed
32.	*Diospyros mespiliformis*	175 cm	19m	
33.	*Diospyros mespiliformis*	89 cm	18 m	
34.	*Markhamia obtusifolia*	74 cm	13 m	
35.	*Lettowianthus stellatus*	80 cm	14 m	
36.	*Markhamia obtusifolia*	57 cm	12 m	
37.	*Tamarindus indica*	250 cm	18 m	

WEME FOREST
SITE: T_3P_5
GPS LOCATION: NOT RECORDED

1.	*Vangueria randii*	43.0cm	14.0 m	
2.	*Millettia stuhlmannii*	120.cm	17.0 m	
3.	*Pteleopsis myrtifolia*	36.0 cm	10.0 m	
4.	*Lettowianthus stellatus*	72 cm	18 m	
5.	*Millettia stuhlmannii*	62 cm	16 m	
6.	*Lettowianthus stellatus*	88 cm	16 m	
7.	*Lettowianthus stellatus*	50 cm	14 m	
8.	*Afzelia quanzensis*	340.0cm	18 m	
9.	*Suregada zanzibariensis*	65.0 cm	13 m	
10.	*Millettia stuhlmannii*	78.0cm	18 m	
11.	*Xylopia parviflora*	34/42/52/50/60cm	14 m	many stems
12.	*Pteleopsis myrtifolia*	54.0 cm	16 m	
13.	*Hymenocardia ulmoides*	111.0cm	17.0 m	
14.	*Millettia stuhlmannii*	72.0cm	18.0 m	
15.	*Voacanga thouarsii*	62.0cm	13.0 m	
16.	*Millettia stuhlmannii*	58.0 cm	13.0 m	
17.	*Millettia stuhlmannii*	72.0 cm	15.0 m	
18.	*Suregada zanzibariensis*	36.0 cm	10.0 m	
19.	*Suregada zanzibariensis*	62 cm	16 m	
20.	*Suregada zanzibariensis*	42 cm	13 m	
21.	*Suregada zanzibariensis*	77 cm	15 m	
22.	*Grewia bicolor*	42 cm	12 m	
23.	*Dalbergia melanoxylon*	120 cm	14 m	
24.	*Pteleopsis myrtifolia*	67 cm	17 m	
25.	*Millettia stuhlmannii*	62.0cm	16m	
26.	*Millettia stuhlmannii*	140.0cm	17m	
27.	*Markhamia obtusifolia*	88.0 cm	19 m	
28.	*Suregada zanzibariensis*	39.0cm	13 m	2 stemmed
29.	*Markhamia obtusifolia*	40.0cm	10m	
30.	*Millettia stuhlmannii*	90 cm	16 m	
31.	*Pteleopsis myrtifolia*	107.0 cm	19m	

ILU FOREST
SITE: T_4 P_3
GPS LOCATION: 08° 02'01.2"S, 038° 55' 19.5"

1.	*Drypetes arguta*	70.0cm	8 m	
2.	*Tamarindus indica*	240.0cm	20.0cm	
3.	*Drypetes arguta*	78.0cm	12.5 m	
4.	*Drypetes arguta*	69.0cm	13.0 m	
5.	*Lettowianthus stellatus*	48.0cm	8.0 m	
6.	*Markhamia obtusifolia*	81.0cm	13.0 m	
7.	*Drypetes arguta*	38.0cm	7.0 m	
8.	*Drypetes arguta*	113.0 cm	11.5 m	
9.	*Lettowianthus stellatus*	48.0 cm	8.0 m	
10.	*Drypetes arguta*	51.0cm	7.5 m	
11.	*Afzelia quanzensis*	170.0cm	18.0 m	
12.	*Sterculia appendiculata*	169.0cm	23.0 m	
13.	*Markhamia obtusifolia*	102.0 cm	19.5 m	
14.	*Drypetes arguta*	51.0cm	7.5 m	
15.	*Drypetes arguta*	34.0 cm	7.0 m	
16.	*Drypetes arguta*	115.0 cm	15.0 m	
17.	*Haplocoelum inoploeum*	65.0 cm	10.5 m	
18.	*Markhamia obtusifolia*	125.0 cm	20 m	
19.	*Haplocoelum inoploeum*	40.0cm	9.0 m	
20.	*Markhamia obtusifolia*	106.0 cm	18.0 m	
21.	*Markhamia obtusifolia*	79.0 cm	11.5 m	
22.	*Drypetes arguta*	59.0 cm	8.0 m	
23.	*Xeroderris stuhlmannii*	89.0 cm	20.0 m	
24.	*Hyphaene compressa*	81.0 cm	9.0 m	
25.	*Drypetes arguta*	66.0 cm	11.0 m	
26.	*Drypetes arguta*	118.0 cm	10.0 m	
27.	*Drypetes arguta*	54.0 cm	5.0 m	
28.	*Drypetes arguta*	44.0 cm	8.5 m	
29.	*Markhamia obtusifolia*	61/51/48cm	10.0 m	3 – stemmed
30.	*Balanites wilsoniana*	77.0 cm	12 m	
31.	*Drypetes arguta*	40.0cm	9 m	
32.	*Commiphora serrata*	40.0cm	9 m	
33.	*Drypetes arguta*	70.0 cm	12 m	
34.	*Euphorbia nyikae*	53.0 cm	9.5 m	
35.	*Xylotheca tettensis*	35.0 cm	8.0 m	
36.	*Hyphaene compressa*	88.0cm	14.0 m	

ILU FOREST
SITE: T_9 P_1
GPS LOCATION: 08° 02' 02 – 23.7"S; 038° 54'42.1" E

1.	*Vitex doniana*	154.0cm	17.5 m	
2.	*Xeroderris stuhlmannii*	110.0cm	17.5m	
3.	*Hyphaene compressa*	95.0 0cm	17.0 m	
4.	*Sorindeia madagascariensis*	152.0cm	13.0 m	
5.	*Sarindeia madagascazriensis*	133.0 cm	15 m	
6.	*Erythrina abyssinica*	86.0 cm	10.0 m	
7.	*Erythrina abyssinica*	58.0 cm	9.0 m	from same base
8.	*Erythrina abyssinica*	58.0 cm		
9.	*Erythina abyssinica*	130.0 cm	12.0 m	
10.	*Sorindeia madagascariensis*	58.0 cm	9.5 m	
11.	*Sorindeia madagascariensis*	100.0cm	13.0 m	
12.	*Sorindeia madagascariensis*	62.0 cm	14 m	3 stemmed

13.	*Sorindeia madagascariensis*	160.0 cm	8 m	
14.	*Sorindeia madagascariensis*	64.0 cm	9.5 m	
15.	*Sorindeia madagascariensis*	163.0 cm	13.0 cm	

KICHI HILLS FOREST
SITE: T_1 P_1
GPS LOCATION: 08°14'18.5"S, 038° 39'02.7"E

1.	*Pteleopsis myrtifolia*	152 cm	25m	
2.	*Rothmannia ravae*	60.0 cm	13m	
3.	*Turraea nilotica*	40.0 cm	10 m	
4.	*Zanthoxylum holtizianum*	65.0 cm	14 m	
5.	*Millettia usaramensis*	52 cm	14 m	2- stemmed
6.	*Millettia usaramensis*	61 cm	14 m	
7.	*Markhamia obtusifolia*	60 cm	14 m	
8.	*Markhamia obtusifolia*	60 cm	13 m	
9.	*Ozoroa insignis*	120 cm	20 m	
10.	*Tarenna drummondii*	60 cm	15 m	
11.	*Drypetes natalensis*	40 cm	12 m	
12.	*Tarenna drummondii*	70 cm	20 m	
13.	*Commiphora serrata*	70 cm	20 m	
14.	*Tarenna drummondii*	60 cm	12 m	
15.	*Xylopia parviflora*	120 cm	25 m	
16.	*Markhamia obtusifolia*	60 cm	18 m	
17.	*Afzelia quanzensis*	50 cm	9 m	
18.	*Xylopia parviflora*	70 cm	15 m	
19.	*Xylopia parviflora*	80 cm	15 m	
20.	*Tarenna drummondii*	40 cm	10 m	
21.	*Markhamia obtusifolia*	51 cm	11 m	
22.	*Millettia usaramensis*	140 cm	18 m	
23.	*Markhamia obtusifolia*	51 cm	11 m	
24.	*Markhamia obtusifolia*	36 cm	10 m	
25.	*Diospyros verrucosa*	55 cm	13 m	2 –stemmed
26.	*Diospyros verrucosa*	69 cm		
27.	*Commiphora serrata*	172 cm	20 m	
28.	*Markhamia obtusifolia*	44 cm	19 m	
29.	*Tarenna drummondii*	40 cm	14 m	
30.	*Diospyros mespiliformis*	50 cm	10 m	
31.	*Dialium holtzii*	152 cm	25 m	
32.	*Diospyros mespiliformis*	50 cm	14 m	2 – stemmed
33.	*Diospyros mespiliformis*	42 cm	12 m	
34.	*Millettia usaramensis*	84 cm	16 m	
35.	*Markhamia obtusifolia*	60 cm	13 m	
36.	*Dichapetalum stuhlmannii*	46 cm	10 m	
37.	*Markhamia obtasifolia*	64 cm	16 m	
38.	*Markhamia obtusifolia*	50 cm	14 m	
39.	*Millettia usaramensis*	49 cm	11 m	
40.	*Millettia usaramensis*	64 cm	15 m	
41.	*Fernandoa magnifica*	43 cm	12 m	
42.	*Markhamia obtusifolia*	50 cm	14 m	
43.	*Millettia usaramensis*	45 cm	15 m	
44.	*Hymenocardia ulmoides*	48 cm	9 m	
45.	*Markhamia obtusifolia*	40 cm	15 m	
46.	*Millettia usaramensis*	47 cm	10 m	
47.	*Sapium armatum*	57 cm	17 m	
48.	*Mildbraedia carpinifolia*	48 cm	18 m	
49.	*Markhamia obtusifolia*	56 cm	16 m	

50.	*Hymenocardia ulmoides*	56 cm	12 m
51.	*Millettia usaramensis*	67 cm	20 m
52.	*Millettia usaramensis*	46 cm	17 m
53.	*Lettowianthus stellatus*	42 cm	13 m

KICHI HILLS FOREST
SITE: T_2 P_2
GPS LOCATION: 08°14 25.5"S, 038° 39'05.5"E

1.	*Cola discoglypremnophylla*	38 cm	12 m
2.	*Cola discoglypremnophylla*	48 cm	16 m
3.	*Commiphora serrata*	310 cm	31 m
4.	*Cola discoglypremnophylla*	40 cm	12 m
5.	*Cola discoglypremnophylla*	40 cm	12 m
6.	*Tricalysia ovalifolia*	37 cm	10 m
7.	*Haplocoelopsis africana*	36 cm	11 m
8.	*Haplocoelopsis africana*	56 cm	15 m
9.	*Cola discoglypremnophylla*	41 cm	12 m
10.	*Haplocoelopsis africana*	48 cm	13 m
11.	*Tarenna drummondii*	92 cm	25 m
12.	*Millettia usaramensis*	66 cm	14 m
13.	*Cola discoglypremnophylla*	54 cm	14 m
14	*Commiphora serrata*	234 cm	27 m
15.	*Markhamia obtusifolia*	73 cm	18 m
16.	*Cola discoglypremnophylla*	38 cm	12 m
17.	*Haplocoelepsis africana*	40 cm	15 m
18.	*Millettia usaramensis*	100 cm	28 m
19.	*Diospyros mespiliformis*	45 cm	11 m
20.	*Tarenna drummondii*	45 cm	14 m
21.	*Haplocoelopsis africana*	98 cm	9 m
22.	*Commiphora serrata*	183 cm	32 m
23.	*Commiphora serrata*	147 cm	32 m
24.	*Diospyros mespiliformis*	47 cm	14 m
25.	*Dialium holtzii*	140 cm	30 m
26.	*Sapium armatum*	75 cm	22 m
27.	*Tarenna drummondii*	37 cm	14 m
28.	*Lettowianthus stellatus*	63 cm	13 m
29.	*Tarenna drummondii*	53 cm	17 m
30.	*Tarenna drummondii*	56 cm	17 m
31.	*Lettowianthus stellatus*	43 cm	17 m
32.	*Millettia usaramensis*	100 cm	28 m
33.	*Haplocoelopsis africana*	42 cm	12 m
34.	*Haplocoelopsis africana*	36 cm	8 m
35.	*Diospyros mespiliformis*	46 cm	13 m
36.	*Millettia usaramensis*	90 cm	32 m
37.	*Millettia usaramensis*	120 cm	26 m
38.	*Tarenna drummondii*	54 cm	17 m
39.	*Pteleopsis myrtifolia*	148 cm	33 m
40.	*Tarenna drummondii*	57 cm	22 m
41.	*Commiphora serrata*	160 cm	31 m

NEAR KICHI HILLS PEAK
SITE: T_2 P_9
GPS LOCATION: 08°13'53.8"S, 038° 38'48.3" E

1.	*Scorodophloeus fischeri*	50cm	29 m	
2.	*Scorodophloeus fischeri*	43 cm	13 m	
3.	*Scorodophloeus fischeri*	115cm	26 m	
4.	*Scorodophloeus fischeri*	108 cm	25 m	
5.	*Scorodophloeus fischeri*	115 cm	29 m	
6.	*Mimusops fruticosa*	44 cm	11 m	
7.	*Scorodophloeus fischeri*	50 cm	13 m	
8.	*Newtonia buchananii*	240 cm	30 m	
9.	*Scorodophloeus fischeri*	45 cm	17 m	
10.	*Scorodophloeus fischeri*	45 cm	17 m	
11.	*Scorodophloeus fischeri*	85 cm	22 m	
12.	*Scorodophloeus fischeri*	72 cm	19 m	
13.	*Cola discoglypremnophyl*la	44 cm	17 m	
14.	*Rinorea angustifolia*	40 cm	10 m	
15.	*Scorodophloeus fischeri*	48 cm	16 m	
16.	*Pteleopsis myrtifolia*	65 cm	18 m	
17.	*Newtonia buchananii*	130 cm	22 m	
18.	*Sterculia appendiculata*	96 cm	23 m	
19.	*Scorodophloeus fischeri*	83 cm	18 m	
20.	*Cassia abbreviata*	72 cm	17 m	
21.	*Scorodophloeus fischeri*	88 cm	19 m	
22.	*Newtonia buchananii*	150 cm	21 m	
23.	*Tarenna drummondii*	47 cm	13 m	
24.	*Tarenna drummondii*	85 cm	21 m	
25.	*Tarenna drummondii*	46 cm	15 m	
26.	*Mimusops fruticosa*	39 cm	9 m	
27.	*Scorodophloeus fischeri*	120 cm	22 m	
28.	*Scorodophloeus fischeri*	59 cm	20 m	
29.	*Scorodophloeus fischeri*	90 cm	21 m	
30.	*Scorodophloeus fischeri*	65 cm	22 m	
31.	*Scorodophloeus fischeri*	42 cm	19 m	
32.	*Markhamia obtusifolia*	117 cm	22 m	
33.	*Scorodophloeus fischeri*	63 cm	21 m	2 – stemmed
34.	*Scorodophloeus fischeri*	58 cm		
36.	*Mimusops fruticosa*	47 cm	17 m	
37.	*Scorodophloeus fischeri*	87 cm	22 m	
38.	*Mimusops fruticosa*	87 cm	20 m	
39.	*Scorodophloeus fischeri*	140 cm	19 m	

Appendix 4: Check-list of Plant species in three Coastal forests

Kiwengoma (K), Namakutwa (N) and Mchungu (M) in Rufiji District.
(Source: Clarke & Dickinson 1995)

Species name	K	N	M	Family
Acacia adenocalyx Brenan & Exell	x			Mimosaceae
Acacia nilotica (L.) Del.			x	Mimosaceae
Acacia sieberana DC.	x			Mimosaceae
Acridocarpus alopecuras Sprague	x			Malipighiaceae
Adenia schlibenii	x			Passifloraceae
Afzelia quanzesis Welw.			x	Caesalpinaceae
Agelanthus longipes	x			Loranthaceae
Albizia petersiana (Bolle) Olive	x			Mimosaceae
Albizia versicolor Oliv.			x	Mimosaceae
Alchornea laxiflora (Benth.) Pax & Hoffm.	x	x		Euphorbiaceae
Allophylus africanus P. Beav.	x			Sapindaceae
Anacardium occidentale L.			x	Anacardiaceae
Antidesma venosum Tul.	x			Euphorbiaceae
Aporrhiza paniculata Radlk.	x			Sapindaceae
Asteranthus lutea Vollesen	x			Annonaceae
Baikiaea ghesquireana J. Leonard		x		Caesalpinaceae
Balanites maughamii Sprague			x	Balanitaceae
Baphia kirkii Baker	x		x	Caesalpinaceae
Barringtonia racemosa (L.) Spreng.			x	Barringtoniaceae
Bauhinia tomentosa L.	x			Caesalpinaceae
Bersama abyssinica Fres.	x			Melianthaceae
Bivinia jalbertii Tul.	x	x		Flacourtiaceae
Blighia unijugata Bak.		x		Sapindaceae
Bombax rhodognaphalon K. Schum.	x	x		Bombacaceae
Borassus aethiopum Mart.			x	Palmaceae
Brachystegia microphylla Harms		x		Caesalpinaceae
Brachystegia sp.	x			Caesalpinaceae
Bridellia atroridis Mull. Arg.	x			Euphorbiaceae
Bridellia acathartica Bertol. f.			x	Euphorbiaceae
Bridellia micrantha (Hochst.) Baill.		x		Euphorbiaceae
Burrtdavya nyasica Hoyle	x			Rubiaceae
Caloncoba welwitschii	x	x		Flacourtiaceae
Canthium mombazense Baill.		x		Flacourtiaceae
Cassia abbreviata Oliv.	x			Caesalpinaceae
Cassia burttii Baker f.	x	x		Caesalpinaceae
Cassia petersiana (Bolle) Lock	x			Caesalpinaceae
Cassia zambesiaca Oliver			x	Caesalpinaceae
Cassia sp. (Exotic)	x			Caesalpinaceae
Chlorophytum sp. nov.	x			Anthericaceae
Clausena anisata (Willd.) Benth.	x			Rutaceae
Cola microcarpa Brenan	x			Sterculiaceae
Combretum adenogonium A. Rich.	x	x		Combretaceae
Commiphora africana (A. Rich.) Engl.				Burseraceae
Commiphora zimmermannii (Engl.) Gillett	x			Burseraceae
Craibia zimmermannii (Harns) Dunn.	x		x	Papilionaceae
Croton pseudopulchellus Pax	x			Euphorbiaceae
Croton sylvaticus Hochst.	x	x		Euphorbiaceae
Cussonia zimmermannii Harms	x			Araliaceae
Cynometra sp.	x			Caesalpinaceae

Species name	K	N	M	Family
Dalbergia obovata E. Meyer	x			Papilionaceae
Deinbollia borbonica Scheff.	x	x		Sapindaceae
Dialium holtzii Harms	x	x		Caesalpinaceae
Dichapetalum stuhlmannii Engl.		x		Dichapetalaceae
Dicliptera sp.		x		Acanthaceae
Digitaria gymnostachya Pilg	x			Gramineae
Diospyros kabuyeana F. White	x	x		Ebenaceae
Diospyros mespiliformis A.D.C.	x			Ebenaceae
Diospyros squarrosa Klotzsch	x			Ebenaceae
Diospyros usambarensis F. White	x			Ebenaceae
Diospyros verrucosa Hiern	x	x		Ebenaceae
Diospyros zombensis (B.L. Burtt.) F. White	x			Ebenaceae
Dracaena deremensis Engl.	x			Agavaceae
Dracaena usambarensis Engl.	x			Agavaceae
Drypetes sp.			x	Euphorbiaceae
Ehretia cymosa Thonn.			x	Boraginaceae
Ellipanthus hemandradenioides Brenan	x			Connaraceae
Engleraphyton malagalismontanum (Sond.) Pennigton	x			Sapotaceae
Euphorbia usambarensis Pax			x	Euphorbiaceae
Ficus lingua De Wild. & Th. Dur.			x	Moraceae
Ficus scassellattii Pamp.			x	Moraceae
Ficus sycomorus L.	x			Moraceae
Garcinia buchanannii Bak.	x			Guttiferae
Garcinia livingstonei T. Anders.			x	Guttiferae
Gardenia ternifolia Schum. & Thonn.			x	Rubiaceae
Gardenia transvenulosa Verdc.		x		Rubiaceae
Grewia conocarpa K. Schum.	x			Tiliaceae
Grewia goetzeana K. Schum.	x			Tiliaceae
Grewia monticola Sond.	x			Tiliaceae
Grevea eggelingii Milne-Redh.	x			Montiniaceae
Harrisonia abyssinica Oliv.	x			Asclepiadiaceae
Holarrhena pubescens (Buch.-Ham) G. Don	x			Apocynaceae
Hymenaea verrucosa Gaetn.	x	x	x	Caesalpinaceae
Hymenocardia ulimoides Oliver.	x		x	Hymecardiaceae
Inhambanella henriquensii (Engl. & Warb.) Dubard	x			Sapotaceae
Isoberlinia scheffleri (Harmns) Greenway	x			Caesalpinaceae
Isolona heinsii Engl. & Diels	x			Annonaceae
Khaya anthotheca (Welw.) C. DC.	x			Meliaceae
Kigelia africana (Lam.) Benth.	x			Bignoniaceae
Lannea antiscorbitica (Hiern) Engl.	x			Anacardiaceae
Lepisanthes senegalensis (Poir.) Leenh.	x		x	Sapindaceae
Leptactina oxyloba K. Schum.	x			Rubiaceae
Lettowianthus stellatus Diels	x	x		Annonaceae
Maclura africana (Bureau) Corner	x			Moraceae
Maerua triphylla A. Rich.	x			Capparidaceae
Mallotus oppositifolius (Geisel.) Mull. Arg.	x	x		Euphorbiaceae
Manilkara sansibarensis (Engl.) Dubard	x			Sapotaceae
Markhamia acuminata (Klotzsch.) K. Schum.		x		Bignoniaceae
Markhamia obtusifolia (Baker) Sprague	x			Bignoniaceae
Millettia bussei Harms		x		Papilionaceae
Millettia impressa Harms	x			Papilionaceae
Milicia excelsa (Welw.) C.C. Berg	x	x		Moraceae
Monodora junodii Engl. & Diels	x			Annonaceae
Mystroxylon aethiopicum (Thunb.) Loes.			x	Celastraceae

Species name	K	N	M	Family
Newtonia paucijuga (Harms) Brenan	x			Mimosaceae
Olax obtusifolia De Wild.	x			Olacaceae
Olax pentandra Sleumer	x			Olacaceae
Oncoba spinosa Forssk.	x			Flacourtiaceae
Ophrypetalum odoratum Diels	x			Annonaceae
Oxyanthus zanguebaricus (Hiern) Bridson	x			Rubiaceae
Parinari curatellifolia Benth.			x	Chrysophyllaceae
Parkia filicoidea Oliv.	x			Mimosaceae
Pavetta sp.	x			Rubiaceae
Phyllanthus nummulariifolius Poir.	x			Euphorbiaceae
Phyllanthus rhizomatosus A.R.- Sm.	x			Euphorbiaceae
Phyllocosmus lemaireanus (De Wild. & Th. Dur.) Th. & H. Dur.			x	Ixonanthaceae
Polysphaeria multiflora Hiern	x	x		Rubiaceae
Pouteria alnifolia (Bak.) Robert	x	x		Sapotaceae
Psorosperum febrifugum Spach	x			Guttiferae
Psychotria lauracea (K. Schum.) Petit.	x			Rubiaceae
Pteleopsis apetala Vollesen	x			Combretaceae
Pterocarpus tinctorius Welw.	x	x		Papilionaceae
Ricinodendron heudelotii (Baill.) Pierre	x	x		Euphorbiaceae
Rinorea angustifolia (Thon.) Baill.	x			Violaceae
Rinorea elliptica (Oliv.) O. Ktze.	x			Violaceae
Rinorea sp. A. FTEA	x			Violaceae
Rinorea welwitschii (Oliv.) Kuntze.	x			Violaceae
Rothmannia macrosiphon (Engl.) Bridson		x		Rubiaceae
Rothmannia manganjae (Hiern.) Keay	x			Rubiaceae
Rothmannia ravae (Chiov.) Bridson	x			Rubiaceae
Rourea orientalis Baill.	x			Connaraceae
Rytigynia decussata (K. Schum.) Robyns	x			Rubiaceae
Rytigynia pergracilis Verdc.	x			Rubiaceae
Saintpaulia ionantha H. Wendl.	x			Gesneriaceae
Salacia madagascariensis (Lam.) DC.		x		Celastraceae
Sapium armatum Pax & K. Schum.	x	x		Euphorbiaceae
Sapium ellipticum (Krauss) Pax	x			Euphorbiaceae
Scolopia rhamniphylla Gilg		x		Flacourtiaceae
Scorodophloeus fischeri (Taub.) J. Leonard	x			Caesalpinaceae
*Setaria megaphylla (*Steud.) Th. Dur. & Schinz	x			Gramineae
Sideroxylon inerme L.			x	Sapotaceae
Sorindeia madagascariensis DC.	x	x	x	Anacardiaceae
Stereospermum kunthianum Cham.	x			Bignoniaceae
Sterculia appendiculata K. Schum.	x			Sterculiaceae
Streblus usambarensis (Engl.) C.C. Berg	x			Moraceae
Strychnos sp.			x	Strychnaceae
Suregada zansibariensis Baill.	x	x	x	Euphorbiaceae
Tabernaemontana elegans Stapf.			x	Apocynaceae
Tamarindus indica L.	x		x	Caesalpinaceae
Tapiphyllum burnettii Tennant	x			Rubiaceae
Tarenna supra-axittaris (Hamsley) Bremek.	x		x	Rubiaceae
Tessmannia densiflora Harms	x	x		Caesalpinaceae
Tetrapleura tetraptera (Schumach. & Thonn) Taub.	x			Umbelliferae
Tricalysia pallens Hiern.	x			Rubiaceae
Tricalysia sp. nov.	x			Rubiaceae
Trichilia emetica Vahl	x			Meliaceae
Uvariodendron gorgonis Verdc.	x			Annonaceae
Vangueria madagascariensis Gmel.	x	x		Rubiaceae

Species name	**K**	**N**	**M**	**Family**
Vismia orientalis Engl.	x	x		Guttiferae
Vitex buchananii Gurke	x			Verbenaceae
Vitex doniana Sweet			x	Verbenaceae
Xylopia parviflora (A. Rich.) Benth.	x			Annonaceae
Xylotheca tettensis (Klotzch.) Gilg.	x		x	Flacourtiaceae
Zanthoxylum lindense (Engl.) Kokwaro	x			Rutaceae
Ziziphus pubescens Oliv.	x			Rhamnaceae