

COASTAL FOREST RESEARCH PROGRAMME

Management Summaries for 25 Coastal Forests in Tanzania

L.K. STUBBLEFIELD (Editor)

AUGUST 1994



THE SOCIETY FOR ENVIRONMENTAL EXPLORATION
AND
THE UNIVERSITY OF DAR ES SALAAM



The Society for Environmental Exploration

The Society is a non-profit making company limited by guarantee and was formed in 1989. The Society's objectives are to advance field research into environmental issues and implement practical projects contributing to the conservation of natural resources. Projects organised by The Society are joint initiatives developed in collaboration with national research agencies in cooperating countries. The Society also promotes cooperation between scientists and technical officers from collaborating institutions and counterparts in the UK and elsewhere.

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The University of Dar es Salaam was established in July 1970 as a centre for learning and research in the arts and the physical, natural, earth, marine, medical and human sciences. The University is surveying and mapping the flora and fauna of Tanzania and is conducting research into the maintenance and improvement of the environment and the sustainable exploitation of Tanzania's natural resources.

The FRONTIER TANZANIA Project and Series of Reports

The Society and the University have been conducting collaborative research into environmental issues since July 1989, under the title of the Frontier Tanzania Project. The Project has to-date involved over 500 people from both Tanzania and overseas. Field research is being undertaken on a variety of habitats in Tanzania's coastal zone, chosen for their high biological interest and conservation value. Habitats under study include mangroves, coral reefs, coastal forests and savanna. The projects have been developed with the assistance and collaboration of Regional and District Authorities, the Ministry of Tourism, Natural Resources and Environment, Tanzania National Parks and Tanzania Fisheries Research Institute. The findings of the Project are summarised in a series of reports published by the University of Dar es Salaam. More formal scientific papers resulting from research are published in appropriate journals thus ensuring wide dissemination of the information.

The Coastal Forests Research Programme

The coastal forests of Tanzania comprise small and geographically isolated forest remnants supporting large numbers of endemic and near-endemic plants and animals. The forests were once extensive but have been largely removed to provide timber and farmland. Their status, distribution and biological character were extremely poorly known. The Frontier-Tanzania Coastal Forest Research Programme was formed in 1989 with the aim of surveying these forests and describing their conservation importance. To date over 70 sites have been identified of which 15 have been studied in depth. For each study site the project produces vegetation maps, species lists of the plants, vertebrates and invertebrates, and studies of the ecology of key species. It is intended this information be used in the production of management plans to secure the sustainable future development of Tanzania's coastal forests.

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Foreword to the Frontier Tanzania series of reports.

Global concern over the conservation of the world's biological diversity reached a new peak in June 1992, when many of the world's Heads of State signed the Biodiversity Convention in Rio de Janeiro at the Earth Summit (UNCED).

However, an accurate knowledge of the earth's biological richness is lacking in many countries. Without detailed information on the flora and fauna of a region its importance for the conservation of biological diversity remain undefined.

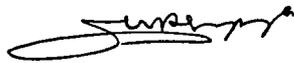
In Africa there are many areas of exceptional biological richness which have scarcely been studied. Even basic data on the status of resources may be lacking or outdated.

The Frontier-Tanzania project, a collaborative venture of the Society for Environmental Exploration and the Faculty of Science of the University of Dar es Salaam is tackling this problem head on.

In 1989 Tanzanian scientists identified ecosystems in coastal Tanzania which were in particular need of study because of their biological richness and importance. Since that time, the Frontier-Tanzania project has provided the means and the man-power to investigate these sites, catalogue their importance and suggest management strategies for their conservation. Coastal monsoon forests, the coral reefs of Mafia Island, the mangroves and sediments of the Rufiji Delta, and the vegetation of the Mikumi National Park have been investigated over the past three years.

All of these projects have generated large quantities of new data on the biological importance of the sites and their place alongside similar systems elsewhere in Africa. This research has allowed biological-diversity priorities to be better determined and management actions to be suggested. Many of the recommendations are under consideration by the Tanzanian Government.

This report series forms a contribution to the Frontier-Tanzania project and to the knowledge of the biological diversity of Tanzania. We warmly endorse its publication and hope that many more reports and papers result from this collaborative project, and that they help to assure that the future of the biological heritage of these strategic sites is conserved.



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INTRODUCTION

This report presents short summaries of the physical, biological and geographical data collected on 25 of Tanzania Coastal Forests. The summaries are in the 'Management Summary' format used by the Catchment Forestry Project of the Forestry and Beekeeping Division, Ministry of Tourism, Natural Resources and Environment in Tanzania. Most of the data has been collected by the Frontier-Tanzania Coastal Forest Research Programme, with the addition of other relevant information from the Forestry Division archives and other sources.

These summaries have been produced to make the large amount of information now collected on these forests accessible to interested bodies.

A total of 77 coastal forests have been identified in Tanzania, of which 39 carry forest reserve status. At the time of publication, the Frontier-Tanzania programme has gathered information on the 25 coastal forests presented in this document. 19 of the sites surveyed are forest reserves. The information for many of the forests presented here, has been condensed from considerably more detailed *Site Report and Conservation Evaluation* documents produced by the Frontier-Tanzania programme. The sites surveyed by the programme were selected on the basis of their reported size and condition, and time spent in each forest was proportional to apparent importance in terms of biological diversity and perceived threat. Other logistical factors such as location and weather conditions also affected the programme. The level of detail between the management summaries presented here therefore varies in accordance with the length of time the programme was able to spend on each site.

The biological information given in the summaries should not be considered as definitive; a comprehensive inventory of all animal and plant groups in a forest is, in practice, impossible. Even in regard to specimens already collected in the forests presented here, identification of selected invertebrate groups, in particular, is ongoing. As significant further information becomes available, it is intended that revised editions of this document will be produced and distributed to relevant parties.

Nonetheless, it is believed that sufficient information exists for most of the forests presented here to determine relative conservation priorities with reasonable accuracy. For more detailed information on a particular site, the reader is referred to the bibliography.

**MANAGEMENT
SUMMARIES**

CHITOA FOREST RESERVE

DESCRIPTION

NAME:	Chittoa Forest Reserve, Lindi Region.
AREA:	4 km ²
BOUNDARY LENGTH:	8 km
STATUS:	Protected & Productive Forest Reserve
MANAGEMENT OFFICER:	District Forestry Officer, Lindi District Council
MAPS:	Ordnance Survey Maps, Scale 1:50,000 Series Y742, Sheet 283/4 Nangaru, Sheet 294/2 Rondo

LOCATION

Grid Reference: 9°59' S, 39°27' E

Chittoa Forest Reserve is located approximately 45 km from the Indian Ocean, west from the coastal town of Lindi. It is 3 km north east of Nampawara village but only accessible by footpath (there is no vehicular access). The reserve's northern boundary is the Mkomove River. The forest is situated on a plateau 1000 - 1250 ft above sea level, north west of Lake Lutamba. The reserve is incorrectly located on the Ordnance Survey Map.

GEOLOGY

The plateau is Jurassic Sandstone of terrestrial origin.

CLIMATE

A tropical East African Climate influenced by location near the coast. There is a well defined dry season between May and October when the lowest monthly temperatures are recorded. The mean annual temperature is 26.1°C and the mean annual precipitation 936 mm.

VEGETATION

The forest is classified as Dry Coastal Forest on a plateau. It is dominated by *Newtonia* species, *Scorodophloeus fischerii* and *Cola* spp.

BIODIVERSITY

The reserve contains a bird otherwise only found at much higher altitudes (Danish ICBP Expedition Report, 1993). Lions, elephants and leopards are known to occur in the forest. The forest has an endemic tree *Sterculia schliebenii*.

HUMAN IMPACT

There is no evidence of major human interference threatening the forest presently. Timber trees are infrequent. Disturbance observed is the felling of small trees for house building poles. Uncontrolled fires have been seen on the borders of the forest, which could encroach into the forest.

MANAGEMENT RECOMMENDATIONS

At present Chitoo Forest Reserve is not threatened by human interference to a destructive degree.

The boundaries of the reserve were last cleared in June 1983 (requiring 200 man days) and need re-clearing. Uncontrollable fires are presently the worst threat to the forest; restrictions or controls would need to be enforced for future protection. The escarpment area is not under the threat of fire. The wooded area could be encouraged by controlled burning to revert to forest. Early burning would prevent further damaging fires in the dry season.

There are shambas by the river at the northern edge of the forest reserve and these need to be monitored in case there is encroachment on the forest.

THE GENDAGENDA FORESTS

(Incorporating Gendagenda North & South)

DESCRIPTION

- NAME:** Gendagenda South Forest Reserve
Gendagenda North Forest Reserve
Handeni & Pangani Districts, Tanga Region
- AREA:** 2,800ha (28.0km²)
- BOUNDARY LENGTH:** Gendagenda South: 18km
Gendagenda North: not known.
- STATUS:** Central Government Protective Reserves.
Catchment Forestry Reserves.
Constituted Cap 132 of 1947 Tanganyika Laws
Gendagenda South Gazetted 1910
- MAPS:** Ordnance Survey Topographic maps:
1:50,000 Series Y742 Sheets 149/1;130/3
Forestry Department Maps:
1:10,000 JB 785 (1910) & JB 526
(Both show incorrect location of forest reserve boundaries)

LOCATION

Grid ref: Gendagenda South 5 34'S, 38 38'E
Gendagenda North 5 32'S, 38 39'E

40km South-south-west of Pangani, 35km inland from the Indian Ocean. Nearest village is Gendagenda, on the South-eastern edge of Gendagenda South Forest Reserve.

District Forestry Office in Handeni, 75km to the west (100km by road).

Access by road from Mwera (3km south of Pangani) to Kabuku (on the Dar es Salaam - Moshi Highway). Road goes through Gendagenda South Forest Reserve (21km of overgrown road from Kabuku but passable for 4WD vehicles, except in wet season).

Northern railway line has a station at Gendagenda.

Forest covers fault line escarpment to 280m, including the twin peaks of Gendagenda hill which rise to 545m and dominate the coastal plain to the east at 80-100m altitude.

SOILS

Derived from Neogene deposits and underlying marine clays and mudstones of Miocene to Pleistocene age on lower slopes of escarpment (Hawthorne, 1984). Soil tests carried out by Frontier recorded loamy soils with pH between 6.3 and 6.83. Riverine soils were sandy loams with pH of 6.1-6.5. The organic matter content was comparatively high for both soil types. Surrounding woodland soils contained less organic matter with a pH of 6.4 to 6.6.

CLIMATE

Generally a tropical East African oceanic temperature with oceanic climate. Subject to orographic rainfall from westward moving moist sea air, particularly on the peaks, as well as a possible mist effect.

Estimated rainfall 1500mm/yr on peaks, 1300mm/yr on escarpment edge and 1000mm/yr over woodlands, with 4 months dry season (Jun-Sept). Estimated temperatures: 28°C max (Feb); 24°C min (Aug). All climate data are for Pangani.

VEGETATION

The forest reserves incorporate some 13km² of dry evergreen and semi-evergreen forest of the Zanzibar-Inhambane undifferentiated forest type and 5km² of thicket with close affinities to Zanzibar-Inhambane scrub forest (White, 1983). A further 20 km² of undifferentiated forest and 10km² of scrub forest lie outside the two Gendagenda Forest Reserves.

The undifferentiated forest area within Gendagenda South Forest Reserve has an even canopy varying from 12 to 25m in height, with dominance shifting between *Craibia brevicaudata*, *Diospyros brucei*, *Lecaniodiscus fraxinifolius*, *Combretum schumanii*, *Scorodophloeus fischeri* and *Manilkara sulcata*. Within Gendagenda North, and in the areas outside, the forest is strongly dominated by *Cynometra* cf. *alexandrii*, with *Scorodophloeus fischeri* and *Pandanus* sp. dominating in the riverine forest areas. *Strychnos henningsii* is common in small stands throughout all areas of the forest.

The Scrub Forest is dominated by *Grewia holstii*, *Dobera loranthifolia* and *Teclea nobilis*, forming a canopy to 8m with occasional emergents to 15m.

To the west of both reserves (on the escarpment) closed *Combretum/Terminalia/Brachystegia* woodland is present, contrasting with White's Zanzibar-Inhambane Evergreen and semi-evergreen bushland and thicket on the coastal plain to the east.

TIMBER VALUES

Pit-sawing is carried out on a small scale, especially for *Milicia excelsa* (Mvule) and *Azelia quanzensis*.

BIODIVERSITY

The Gendagenda forests are known to comprise some 5% of the total known area of Zanzibar-Inhambane undifferentiated forest in Tanzania, which are known to be important centres of biodiversity. The Gendagenda Forests contain plant species of restricted distribution especially in riverine areas including *Saintpaulia* sp. The wild coffee (*Coffea* sp.) populations are of potential economic value.

Faunal diversity is high, especially with regard to birds and bats. 7 new genera of millipede have been recorded for these forests.

CATCHMENT VALUES

Numerous small seasonal streams drain off the escarpment edge, along with the perennial Msilwa River, all within the Pangani river basin. In addition, the hills are composed of

porous rock which provides an important source of ground-water to feed wells in the area.

Steep slopes on hills and escarpment edge.

HUMAN IMPACTS

Logging: One villager in Gendagenda is actively logging, apparently under license, and is employing six people. Disturbance presently slight as logs cut and transported by hand, and preferred tree species (*Milicia excelsa* and *Azelia quanzensis*) occur in low concentrations in the forest. Quantitative assessment of logging found that an average of 2.9% of trees over 10cm diameter have been cut on the hill.

Pole cutting: Quantitative assessment of poling activity on the hill found that 12.3% of saplings under 10cm diameter had been cut, with disturbance density being concentrated about the paths in the forest.

Firewood: The villages of both Gendagenda and Kwedihwawala collect firewood from the forest but the effects of this are limited to areas close to human habitation. Much firewood is also collected from surrounding woodland. The scale of firewood collection is not thought to be detrimental to the forest.

Agriculture: Areas within the forest (and reserve) being cleared for cultivation, along with encroachment of forest areas surrounding Gendagenda and Kwedihwawala. Bush fires (caused as a result of uncontrolled shamba burning) in the woodland adjacent to the forest poses a threat to the forest itself through border encroachment.

Hunting: Practised locally with both snare and gun. This activity is carried out predominantly in the savannah and woodland areas surrounding the reserves and forest. Shots are heard daily but no snares have been found in the forest.

Potential future threat from charcoal production (to supply Dar es Salaam/Tanga by rail) and fuel wood collecting by coastal salt producers.

MANAGEMENT RECOMMENDATIONS

Boundary clearing and planting with *Cassia siamea* currently being undertaken by Catchment Forestry Project, though discussions with village and district authorities will be needed to deal firmly with the encroachment problem.

Re-gazettement of entire area to bring all areas of forest under the protection of just one reserve.

Logging to be strictly controlled, and zones within the reserve defined in which no logging is permitted (on steep slopes and important areas of endemism/biodiversity).

Early burning programme of woodlands surrounding the forest to minimise bush fire damage.

Education programme to inform local people of importance of forest, with particular emphasis on implications for water supply.

Funding for a visitors centre at Gendagenda to be sought.

Extra patrolling by Game Department to stop illegal hunting.

JOZANI FOREST RESERVE

DESCRIPTION

NAME:	Jozani Forest Reserve, Unguja.
AREA:	300ha (3.0km ²): high forest
BOUNDARY LENGTH:	Not known.
STATUS:	Forest Reserve,(under Zanzibar Forestry Department authority).
MAPS:	Ordnance Survey Topographic Map 1:50,000 Series Y742 Sheet 19.

LOCATION

Grid Ref: 6 15'S, 39 24'E

Jozani Forest lies c.35km south-east of Zanzibar town. A grid of foresters' paths facilitate access to all parts of the reserve.

SOILS

The forest soil is rich, black and highly organic; beyond forest margins (except in the south) shallow pockets of light, red-brown sandy soils are found in broken coral rag outcrops (Robins, 1976).

CLIMATE

Zanzibar experiences a tropical equatorial climate with a bi-modal rainfall pattern; heavy rains from March to the end of May and short rains during November. From December to March weather is hot and relatively dry becoming cooler between June and October (average temperatures 25°C). Humidity averages 77% (Camerapix, 1992).

VEGETATION

Beentje (1990a), estimates the area of high forest to be 300ha (3.0km²), situated in a trough between higher land to the east and west. The forest is surrounded by coastal evergreen bushland (5km²), saline water swamp forest to the west (2km²) and plantation.

Jozani is defined by Greenway (1973) as a freshwater swamp forest with a canopy to 25m. The dominant canopy tree in the south-eastern part of the reserve is *Calophyllum inophyllum* (Beentje, 1990a), which together with *Eugenia sp.* comprises 56% of the forest, with *Pandanus rabaiensis* (to 12m), *Vitex doniana* and *Elaeis guineensis* (to 15m) as sub-dominants (Robins, 1976).

The forest is not of uniform composition: Several factors influence species distribution, including human disturbance and water availability. Beentje (1990a) suggests that much *Calophyllum* has been planted since Greenway, who visited Jozani in the late 1920's, stated that the main vegetation type was Elais-Pandanus forest.

TIMBER VALUES

Calophyllum inophyllum is the favoured timber for boat building and is still harvested (Beentje, 1990a). *Afzelia quanzensis*, a commercial timber species, is also present within the reserve.

BIODIVERSITY

Botanically this forest is unlike those of the mainland as *Calophyllum inophyllum* and *Eugenia sp.* dominate the canopy, with *Pandanus sp.*, *Vitex doniana* and *Elaeis guineensis* as sub-dominants (Robins, 1976; Beentje, 1990a). Jozani is mainly noted as the stronghold for the endemic subspecies of red colobus monkey, *Colobus badius kirkii*, (Zanzibar red colobus), but is also the only known site for Ader's duiker, *Cephalophus adersi*, other than the Arabuko-Sokoke Forest in Kenya. Beentje (1990a) presents preliminary details of an additional 28km² area of forest and thicket at Muyuni (6o20'S, 39o25'E), and Stuart et al. (1990) mention smaller forests at Muungwi, Mapopwe and Uzi Island (Burgess et al, 1992).

CATCHMENT VALUES

Probably none.

HUMAN IMPACTS

Logging: Beentje (1990a) reports harvesting of *Calophyllum inophyllum* to provide timber for local boat building.

Pole cutting: Evidence is abundant, exacerbated by the easy access to and within the reserve. The favoured species for poles and firewood is *Olea woodiana*.

Tourism: To see Zanzibar red colobus.

MANAGEMENT RECOMMENDATIONS

Designate Nature Reserve or National Park Status to the remaining area of coastal forest.

Establish and clearly demarcate reserve boundary.

Encourage silvicultural research to establish alternative sources of firewood and poles. Beentje (1990a) suggests planting small wood lots of indigenous species close to threatened areas of natural vegetation.

Prevent any further damaging activities by employing on-site forest guards.

Repair human disturbance within the reserve and stimulate regeneration of natural vegetation.

The research and education potential of the site must be sustainably developed and tourism actively encouraged to increase awareness of forest conservation and its importance. Investigate the possibility of establishing a study centre for the area.

KAZIMZUMBWI FOREST

DESCRIPTION

NAME: Kazimzumbwi Forest, Kisarawe District, Coast Region

AREA: Approximately 3,550ha (35.5km²)

BOUNDARY LENGTH: 28.75km

STATUS: Protective Forest Reserve

MAPS: Ordnance Survey topographic map 1:50 000 series Y74
2, sheet 186/3.

LOCATION

Grid reference: 6 55'-7 02' S and 39 02'-39 04' E.
Approximately 20km south-west of Dar es Salaam on the Pugu Hills, between 120 and 280 metres altitude. The forest reserve covers 35.5km² and with the neighbouring Pugu Forest Reserve (24km²), includes part of what was once a much larger forest extending to within 10km of Dar es Salaam. The Pugu hills are kaolinitic sandstone overlain by red sandy-clay soils and receive an average of 1,236mm of rain annually at Kisarawe. The District Forestry office is based at Kisarawe.

There is a discrepancy in the reserve boundary position between the OS map and the 1976 Forestry Department map. TAZARA railway goes through the reserve, with nearby station at Uogama.

SOILS

Red to brown soils of pH range 5-6 predominate.

CLIMATE

Generally an East African tropical oceanic climate with corresponding temperatures and rainfall patterns. Rain falls principally in the months of March to June with some rainfall in the autumn, and showers at other times of the year. July to October is the relatively cool period when deciduous trees lose their leaves.

VEGETATION

A variety of vegetation types have been recognised in the Pugu Hills, probably a result of the varied topography of the range. These have been well described for Pugu Forest Reserve, and are also present at Kazimzumbwi. Distinct "wet" valley bottom, "dry" ridge-top and "intermediate" valley side communities are recognised within the undisturbed forest. There are also vegetation types corresponding to the intensity of forest disturbance, with evergreen thicket being present in the most disturbed areas. Savannah woodland and swamp vegetation are also present within the Forest Reserve.

Within the reserve 23.5km² of forest vegetation remains, of which 5km² has very few or no

trees remaining, and only 9km² has a canopy cover of 40% or greater. By comparison with a Forestry Division map of 1976, it is evident that 3km² of savannah woodland within the reserve was forest less than 15 years ago. A further 3km² or more of forest lies outside the forest reserve area, including some of the most intact stands.

11 species and sub-species of plant are recognised as being endemic or potential endemic to the Pugu Hills. Some of these species have been recorded from Kazimzumbwi, and it is possible that all are present on this site.

TIMBER VALUES

Logging of commercial timber trees occurred up until 15 years ago, when these species became too rare to warrant further exploration. There are small plantations of *Cassia* and *Eucalyptus* within the forest, and there have been rubber, teak and pine plantations in the past. These plantations, run by the Kisarawe Forestry Office, have received minimal management over the past 15 years and are consequently of poor commercial value.

BIO-DIVERSITY

Kazimzumbwi Forest Reserve supports a very high diversity of plant species, and various rare and threatened plants and animals. Notable species include the Usambara centipede eater (snake), the *Afrivalus sylvaticus* (tree-frog) and the East Coast akalat (bird).

CATCHMENT VALUE

One possibly permanent stream arising from the forest reserve provides a water supply for local people. In the past, when forest was more extensive on the Pugu Hills, streams arising from the area used to supply all the water needed in the capital, Dar es salaam.

HUMAN IMPACTS

Logging/Charcoal production: All trees of commercial timber value have been removed; according to local sources this logging finished 15 years ago. Until recently, cutting trees continued to provide material for charcoal production. Trees were felled by handsaws, and transported to charcoal pits by tractor or lorry. An extensive network of logging trails, old and new, covers the forest. Logging for the production of charcoal, possibly combined with logging for firewood, removed virtually all trees from an area; those sites with greater than 40% canopy cover are ones which these loggers had yet to reach. Mainly local villagers were employed to transport the charcoal to the main road where it was sold to licensed charcoal operators who took it to the capital for resale. However, since early 1991 forest guards employed by the Wildlife Conservation Society of Tanzania have arrested these illegally operating loggers and charcoal burners, which has reduced their activities within the forest considerably.

Firewood, poles, bush-meat and minor forest products such as medicinal plants are collected from within the reserve by local people. However, it is unlikely that any of these pose a severe threat to the forest. Pole cutting on a commercial scale may have potentially damaging effects by removing young canopy trees.

MANAGEMENT RECOMMENDATIONS

Continue the conservation efforts of the Wildlife Conservation Society of Tanzania; including protection of existing forest, and re-planting and social forestry initiatives surrounding the forest. An investigation of the true extent and position of reserve boundaries might be justified.

Join up to Pugu, create one large forest reserve and regenerate intermediate zone to link forest blocks.

KILULU HILL

DESCRIPTION

NAME: Kilulu Hill Forest, Muheza District, Tanga Region

AREA: 160ha (0.16km²)

BOUNDARY LENGTH: 2.4km

STATUS: Proposed Forest Reserve

MAPS: Ordnance Survey Topographic Maps 1:50,000
Series Y742 Sheet 111/3 Moa 1986/7

LOCATION

Grid ref: 4 46'S, 39 07'E

30km north of Tanga, 5km inland from the Indian Ocean. Nearest village is Kilulu, 0.5km to the north.

District Forestry Office is in Muheza

Access by road from Tanga on the main Tanga-Mombasa road to Makobeni. Local track from Makobeni leads to summit of the hill, used as a service road for the Posta Na Simu radio mast on the hill.

Nearest railway station is in Tanga.

Forest and thicket covers a small hill rising to 267m a.s.l.

SOILS

Sandy soils derived from the underlying parent rock of Mesozoic sandstones and siltstones.

Laterite developed on roads.

CLIMATE

Generally oceanic temperature with oceanic climate. Subject to orographic rainfall from westward moving sea air. Vegetation on the hill suffers from high desiccation pressure due to strong onshore/off-shore breeze regime. Two wet seasons (December-January and April-June). Rainfall is similar to levels experienced in Mombasa (1200mm pa).

VEGETATION

The site incorporates 160ha of dry semi-evergreen forest of the Zanzibar-Inhambane Undifferentiated Forest Type (White, 1983). Dominant species include *Cynometra webberi*, *Scorodophloeus fischeri* and *Manilkara sulcata*. A continuous canopy of 15-18m is present, except in highly disturbed areas.

Four other broad vegetation types, ranging from woodland to semi arid scrub, exist on the site, mainly on the slopes and around the base of the hill. Bush fires and firewood collection are the main factors of disturbance to these vegetation types.

TIMBER VALUES

The small area of forest on Kilulu Hill has been logged for most of its valuable timber species; mainly *Milicia excelsa* and *Bombax rhodognaphylon*. A few adult specimens of these species remain in the least accessible places.

BIODIVERSITY

The Zanzibar-Inhambane Undifferentiated Forests are known to be important centres of biodiversity. Studies carried out to date at the Kilulu Hill site have indicated that biodiversity levels, especially of fauna species, are high when compared to other forests of the same type. The site is home to at least one globally threatened species of amphibian (*Mertensophryne micranotis*) and one globally threatened bird species (*Anthus sokokensis*). Diversity is perhaps enhanced by the presence of large areas of scrub and savannah around the hill.

CATCHMENT VALUES

No permanent water courses are present on the site. Slopes only exceed 40 degrees locally, and are on average less than 30 degrees.

HUMAN IMPACTS

The extent of the forest has been dramatically reduced over the past 50 years, mostly through clearance for sisal plantations. Logging and further clearance for shambas has reduced the forest down to its present size. Only small areas of undisturbed forest remain.

The woodland and scrub areas are used by the locals as a source of firewood for home use and for salt boiling.

Hunting activities are widespread on the site; snares are set to catch duiker, suni and bushpig, the favoured site being around the clearing on the peak of the hill. As the site is not yet officially gazetted the legality of such activities is ambiguous.

The use of fire to clear scrubland poses a threat to the forest as fires are often left to spread unchecked. The clearance of 2.3ha of forest for a shamba on the summit of the hill has caused a large amount of disturbance and the risk of a forest fire has been increased by the consequent drying of the surrounding forest that this will cause.

Disturbance connected with the operation of the radio mast on the summit has not been quantified but paths have been cleared through the forest to permit the installation of electricity cables, and a track cleared to permit vehicle access. Further disturbance is probably unlikely.

As the site has no official boundaries yet, it is impossible to talk about squatting activities as such. However, it is unlikely that any future reserve boundaries would include current settlements.

MANAGEMENT RECOMMENDATIONS

The gazettement of the site and demarcation of its boundaries as soon as possible.

Strict enforcement of a ban on future logging and poling.

A ban on hunting activities in the forest area.

Ensure that any future reserve boundaries include an amenity zone allowing the locals access to firewood and possible hunting grounds.

The encouragement of more environmentally sensitive farming techniques.

Re-planting of the clearing on the summit of the hill to encourage forest regeneration.

Execute a feasibility study into the possibility of using the site for tourism/education purposes.

Inform the local people of the value of the forest as a monitor of climate and habitat for important flora and fauna.

KIMBOZA FOREST RESERVE

DESCRIPTION

NAME: Kimboza Forest Reserve
Morogoro District, Morogoro Region.

AREA: 385ha, 3.85km².

RESERVE BOUNDARY LENGTH: 15.6 km.

STATUS: Catchment reserve.
(Gazetted in 1964 by Government notice GN No 417.)

MAPS: Ordnance Survey topographic map: 183/4 (Kingolwira) & 201/2 (Matombo).
Forestry department map: Kimboza Forest reserve - JB.504

FORESTRY PROJECT OFFICER: Mr Njana.

ASSISTANT OFFICERS: Mr Tindekale (resident), Mr Mkiyama.

LOCATION

Grid reference 37°48'E 7°01'S.

The Kimboza Forest Reserve is located very close to the eastern foothills of the Uluguru mountains, S.E Tanzania, approximately 50km south-east of Morogoro. The 1:50 000 OS map shows the reserve to cover a wider area than demarcated.

Access by road is good as the reserve is crossed by the main Morogoro-Kisaki road. The dirt road is serviceable all year round but requires a 4wd vehicle.

Water is plentiful and easily obtainable, supplied by the Ruvu river which the reserve itself traverses.

SOILS

Analysis of samples taken from 15 sites around the reserve showed slightly acidic pH levels ranging from 5.25 to 7.18. Profiles were weakly developed - typical of East African mountainous areas and due to the removal of weathered products from parent rocks by gravity.

It is suggested that the weakly acidic soil pH observed resulted from a high proportion of organic matter in the soil itself, coupled with the acidic nature of the rainwater (pH 6.75). The heavy rains which fell prior to sampling may well have produced a seasonally biased result since Lovett and Pocs (1992) reported soils of a basic nature in the Kimboza Forest Reserve which they claimed was due to the metamorphosed limestone upon which it is based. Certainly calcite deposits found would seem to indicate a high degree of alkaline precipitation in this area.

It is therefore concluded that there is seasonal fluctuation in soil pH resulting from the interaction of the humid decomposition of organic matter with the basic nature of the bed-rock, and dependent on rainfall levels.

On a more general note, little soil erosion was observed within the reserve itself. However, clearance of parts of forest outside the reserve boundary has produced areas where serious erosion occurs with each rainfall. Perhaps the most obvious indicator of this fact is that the Ruvu river turns brown with the influx of migrating soil as a consequence of heavy rains.

CLIMATE

Kimboza has a Tropical East African oceanic climate subject to orographic rainfall from prevailing easterly winds. The area experiences one main rainy season with two peaks; "short rains" in December and "major rains" between March and May. Rainfall is higher than average for a coastal forest at 1633mm per annum. There is high humidity all year round and temperatures range between 22°C and 35°C with the coolest period being between May and August.

VEGETATION

The reserve is virtually all deciduous lowland forest; the canopy is closed to 20m, 30m in some places with a few emergent species up to 40m. A distinct middle storey exists at 10-15m with a shrub layer from 2-5m. Vegetation is a mixture of primary disturbed. It is fairly heterogeneous with some logged areas, cleared glades and plantations of exotic species existing within the reserve boundary.

Trees of the *Leguminaceae*, *Moraceae* and *Sapotaceae* dominate the canopy layer, with individual trees reaching a 1m diameter frequent and buttressing commonplace.

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

In addition to the above the main canopy comprises *Cussonia zimmermannii*, *Dialium holtzii*, *Newtonia paucijuga*, *Scorodophleus fischeri* and *Tessmania* spp. *Scorodophleus* and *Sorindela madagascariensis* dominate the middle storey, with other major components including *Bequartiodendron natalense*, *Diospyros brucei* and *verrucosa*, *Drypetes natalense*, *Funtumia africana*, *Lannea antiscorbutica*, *Lettowianthus stellatus*, *Rauvolfia mombasiana*, *Pandanus goetzei* and *Uvarioidendron gorgonis*.

TIMBER VALUES

See Human Impacts; Logging.

BIODIVERSITY

Kimboza was observed to be a particularly good example of a species - rich lowland forest. 364 Angiosperm and 18 Pteridophyte species were recorded. 13 full species and 4 subspecies ie. 4.6% of the total flora were found to be endemic; including all vegetation types from small succulent herbs to canopy trees.

Invertebrates, reptiles, birds, mammals and amphibians have been extensively collected many of which still await formal identification (at time of press). Those already identified include at least one possible new subspecies of *Acomys* (Spiny mouse).

At least 79 resident bird species have been reported; 7 of which are considered non-forest dependent and 3 species types considered endemic or rare; the purple-throated cuckoo shrike,

the white-eared barbet and the lesser seed cracker (Stuart 1983).

Due to hunting pressures forest ungulates are rare but are thought to include red and blue duiker and bushpig. Resident diurnal primates consist of the Syke's monkey *Cercopithecus mitis* and Pied colobus *Colobus angolensis angolensis*. Lizard species collected include the endemic turquoise dwarf gecko *Lygodactylus williamsii* in addition to *Cordylus t. tropidosterum* and *Holaspis guentheri laevis*.

For the invertebrates, butterfly specimens from 213 taxa have been collected, they include 3 rare species - *Acraea punctimarginea*, *Spindasis nyassae* and *Hypolimnas misippus*, 1 rare endemic; *Celaenorrhinus kimboza*, 2 new *Etesidaus* and *Salia* species and 2 new *Eresinopsides bichroma* and *Charaxes lasti* subspecies (Kielland 1982).

At least 25 distinct millipede species have been collected 4 of which are considered new species; a *Pseudotibiozus* spp and 3 species as yet unidentified. One endemic species is present - *Rhododesmus c.f. planus* (Hoffman 1983).

CATCHMENT VALUES

The Eastern arc mountains, of which the Kimboza Forest Reserve forms a part, act as efficient condensers of moisture originating in the Indian Ocean. The catchment role of Kimboza is of minor national importance, but when the size of the reserve is taken into account its value is markedly increased. The reserve annual rainfall is in excess of 1600mm. All the water is channelled into the Ruvu river and is classified as an important part of Dar Es Salaam's water supply.

HUMAN IMPACTS

Logging: Until 1993 licences were available for the felling of "over-mature" trees for timber. As a result of this it appears Kimboza has now lost most of its prime timber; *Aningeria pseudo racemosa* was taken in the past and more recently *Chlorophora excelsa* and *Khaya nyasica* stocks have been severely depleted. This practice is now illegal, except for felling for scientific purposes (12 trees were felled in 1993 for a study conducted by Sokoine University, Morogoro) and forestry officers appeared confident that the future of the forest is now secure. This view would seem to be supported by the results of systematic disturbance transect surveys carried out to reveal the impact of logging on the forest. It was found that 15% total forest area consisted of mature trees (DBH greater than 10cm), and that the number of cut trees was negligible. However, several illegal logging sites, both old and new, were located by random observations. In reality, it would appear therefore that the chances of the survival for the remaining timber trees, especially, *Rhodognaphalon schumannianum*, should be a major source of concern.

Pole Cutting: Legal limits are set for the number of poles an individual can collect from the reserve each year. Disturbance transects were carried out to reveal the intensity of pole-cutting in the area. 85% of total forest surveyed consisted of saplings (DBH less than 10cm), with 10% of these cut for poles. This result compares well with the results obtained from a similar survey carried out by Rodgers *et al*, 1983 and suggests the existing pole cutting yield of 10% may well be sustainable.

Plantations: From the 1950s to the late 1970s several plantations of varying sizes were established within the reserve boundary and substantial amounts of natural vegetation cleared in the process. Plantations comprise exotic tree species including teak, cedar and a third species known locally as Mkongazi. Although the development of planted areas is no longer current practice, it is estimated such plantations now extend over 11ha or 3% of the total reserve area. Subsequent opportunistic invasion of forest areas is now a problem; mango,

banana, citrus and kapok trees are commonplace.

Charcoal Production: Some illegal charcoal burning is carried out by members of the local community. However, this is minimal due to the high levels of dead wood available in forest located outside the reserve. Live trees from the forest are not generally cut for firewood, although some locals did admit to taking dead firewood from the reserve itself.

Fire and shambas: The threat from fires arising during shamba preparation in the area of cultivation surrounding the reserve is minimal due to the high annual rainfall; none have ever been recorded in the reserve. A more serious threat to the forest results from the presence of shamba in such close proximity to the reserve itself.

For the most part the forest edge remains unmarked. Land is farmed right up to the boundary edge, often encroaching on the forest itself. Footpaths, notably on the western boundary and those actually running through the forest, are well worn. Secondary growth is evident, indicating the resultant occurrence of erosion.

Erosion probably only occurs at the rate of a few square metres per annum, however, on such a widespread scale this has serious implications for the preservation of forest sanctity. On the subject of erosion, it should be noted that the Morogora-Kisaki road which cuts through the reserve creates an additional source. It too bears secondary growth where the vegetation has been cut back some 5m from either side.

MANAGEMENT RECOMMENDATIONS

Further development of local awareness of forest conservation importance in real terms ie. water catchment value and prevention of soil erosion.

Encourage replacement of exotic species and replanting of clear-felled areas with native tree species.

Enforce reserve status and regulate existing utilisation of forest products by employing more forestry officers with increased resources.

Provide alternatives to utilisation of forest products by creating a buffer zone around the entire reserve planted with species such as eucalyptus and teak which could:

- i) supply locals with an alternative source of poles and fuel,
- ii) additionally act as marker trees along the forest edge maintaining the integrity of the reserve boundary and preventing influx of opportunist tree species.

Ultimately create a higher reserve grade and promote Kimboza to the level of, for example, a National nature/scientific reserve, making utilisation of/damage to any part of the reserve illegal and affording proper protection of this extraordinary ecosystem.

KISIJU FOREST

DESCRIPTION

NAME:	Kisiju Forest, Kisarawe District, Coast Region.
AREA:	Approx. 200ha (2km ²)
STATUS:	Government land with no formal protection
MAPS:	Ordnance Survey Topographic Map 1:50,000 Series Y742 Sheet 204/4 1967

LOCATION

Grid Ref: 7 24'S, 39 20'E

Kisiju forest is located approximately 5km north of the coastal village of the same name. The forest lies about 30km east of the Kilwa road, and can be reached by local road from Mkaranga.

Kisiju Forest lies only a few metres above sea-level, it is enclosed by mangrove swamp and salt flats and is effectively an island, known locally as Dendene.

SOILS

Pale loamy sands overlying recent beach sand, may be classified as Regosols. Considered geologically unstable and susceptible to erosion (Hawthorne, 1984).

CLIMATE

Generally a tropical East African climate, strongly influenced by its coastal location. Subject to prevailing easterly winds. No annual rainfall or temperature figures are available for Kisiju.

VEGETATION

The vegetation of Kisiju is homogeneous closed canopy forest to over 20m with a well developed shrub layer and sparse ground flora. Dense secondary vegetation is found in abandoned farm clearings within the forest (Burgess, 1990).

The dry evergreen forest may be classified as Zanzibar-Inhambane Undifferentiated Forest (White, 1983), and is dominated by *Hymenaea verrucosa*, *Azelia quanzensis* and *Baphia kirkii*, though species characteristic of riverine forest, such as *Sorindeia madagascarensis* are also present. *Hymenaea* and *Baphia* species are estimated to have low regeneration rates within the forest (Hawthorne, 1984).

TIMBER VALUES

Little information is available on the timber values of species present. No commercial

logging or pole cutting is occurring, though *Azelia quanzensis* is known to occur within the forest.

BIODIVERSITY

No endemic plant species are recorded for Kisiju but rare species of interest include *Oxanthus sp. nov. B*, known from only one other site near Dar es Salaam, and *Xylopiia sp. nov.* (Hawthorne, 1984). Preliminary ornithological investigations identified at least 13 species of forest bird as present, with no rarities (Burgess, 1990). Little information is available for other fauna. More detailed studies of the site are required to determine its true conservation value.

CATCHMENT VALUES

Due to its coastal location the catchment value of Kisiju Forest is negligible.

HUMAN IMPACTS

Prior to 1982, human influence was minimal and restricted to areas surrounding the islands' only settlement. Disturbance has since increased. Large areas of the forest have been clear-felled and burnt to provide poor quality agricultural land for shifting cultivation. Pole cutting to provide building materials is occurring on a local scale. It is estimated that if destruction continues unchecked, all primary forest at Kisiju will be lost in 10 - 15 years time (Burgess, 1990).

MANAGEMENT RECOMMENDATIONS

Gazette the site as a Protective Forest Reserve as soon as possible, with a clear policy from government to village level.

A detailed study of remaining natural forest to determine extent, species composition and conservation value.

Reduce the land requirement by developing sustainable land use projects through agricultural extension schemes.

Minimise disturbance of remaining natural forest by encouraging tree planting around settlements as an alternative source of forest products. Increase conservation awareness via local education programmes.

KIWENGOMA FOREST RESERVE

DESCRIPTION

NAME: Kiwengoma Forest Reserve, Rufiji District, Coast Region

AREA: 2,025ha (20.25km²)

BOUNDARY LENGTH: Not known

STATUS: Central Government Productive Reserve: Gazetted 1962

MAPS: Ordnance Survey Topographic maps 1:50,000 - Series Y742

LOCATION

Grid ref: 8 22'S, 38 56'E

District Forestry office is in Utete - local Forest Office in Mohoro.

Access by road to Nambunju village, immediately to the north of the reserve.

Forest sited on the Matumbi Hills massif, composed of Jurassic sandstones and shales which rise to 900m a.s.l. The reserve lies on the Rufiji/Kilwa district borders. The local forestry office enforce forest reserve boundaries 4km further south than are shown on OS maps. All published maps referred to, depict the forested area outside reserve boundaries in Kilwa District. However, it is this area of forest that is afforded reserve status and protected accordingly by the local forestry office.

SOILS

Predominantly sandy soils varying in redness, with deep humus soils in riverine forest areas, and homogeneous clay soils in woodland areas.

CLIMATE

Generally a tropical East African climate with corresponding rainfall and temperature patterns. The Matumbi Massif is Subject to orographic rainfall from westward moving moist sea air. Significant 'mist effect' precipitation occurs on hill tops.

VEGETATION

The forest reserve includes between 20 and 25km² of closed forest classified as Zanzibar-Inhambane Undifferentiated Forest (White, 1983). The canopy is dominated by *Khaya anthotheca*, (*milicia*) *excelsa* and *Scorodophloeus fischeri*. The forest is part of a 98km² block of forest and transition forest/woodland.

TIMBER VALUES

The dominant tree species *Khaya anthotheca* and (*Milicia*) *excelsa* have been extensively

logged. Plantations of exotic species surround the forest.

BIODIVERSITY

The Kiwengoma Forest comprises some 25-30% of the total known area of the Zanzibar-Inhambane Undifferentiated forests in Tanzania, which are known to be important centres of biodiversity and endemism.

Rare species include an 7 endemic millipede genera and 16 endemic species; 2 near-endemic species of toad (*Stephopaede sp.*); 4 vascular plant endemics (*Tricalysia sp.*, *Pavetta sp.* [*Rubiaceae*] & *Chlorophytum sp.* [*Liliaceae*]); one possible endemic fern (*Nephroleptis sp.*); an endemic sub-species of gecko; a rare toad known only from five other locations (*Mertensophryne micranotis*) and a number of rare/threatened bird species.

CATCHMENT VALUES

The forest reserve is drained by two major rivers (the Nambunju and the Mwengei) and many smaller streams.

HUMAN IMPACTS

Flatter areas planted with exotic timber trees.

Extensive logging of *Anthothea nyasica* and *Milicia excelsa* since 1986.

Shifting cultivation within forest until 1962, when squatters were evicted. Some farmers have recently returned.

Harvesting of medicinal plants, honey and poles for building.

Illegal trapping of small mammals.

MANAGEMENT RECOMMENDATIONS

Suspend all legal logging in order to allow the forest to recover from over-exploitation.

Increase patrolling of the forest to discourage illegal logging.

Expand the reserve to incorporate areas of forest not currently protected under reserve status.

Relocate all illegal farmers and settlers from the reserve, and prevent agricultural encroachment at the forest borders.

Investigate the possibility of attracting visitors to the Selous Game Reserve.
Discontinue monoculture forestry practices in favour of indigenous forest.

Demarcate true location of forest reserve boundary with respect to actual forest area.

LITIPO FOREST RESERVE

DESCRIPTION

NAME: Litipo Forest Reserve, Lindi District.

AREA: 9.4 km².

BOUNDARY LENGTH: 14.5km.

STATUS: Protective and productive forest reserve.

MAPS: Ordnance Survey Topography maps 1:50,000
Series Y742, sheet 294/2-Rondo.
Forestry department map JB 488 of June 1959.
The reserve boundary is not accurately delineated
on the Ordnance Survey Map.

LOCATION

Grid reference: 10° 02' S 39° 29' E.

The reserve lies approx. 35km inland from the Indian Ocean, 39 km. west of Lindi by road. To gain access to it by road, drive west out of Lindi on the road to Mtwara and turn off right after approx 10km, towards Ngapa and Rutamba. Access to the forest can be gained by following one of several paths which leave the road on the right and enter the reserve in the area between the villages of Tondangogoro and Rutamba.

The forest reserve lies between Lake Tondangogoro and the south-easterly end of Lake Lutamba. The closest villages are Rutamba, (approx. 2km. to the west) and Tandangogoro. The reserve has an altitude range of between 500 and 750 feet. The District Forestry Office is based in Lindi, with a local forest officer living in Rutamba.

SOILS

The soil profiles dug in the forest show the pH to be typical of dry coastal forest, generally slightly acidic/neutral. The profiles texture is sandy and the moisture content low. The leaf litter is fairly shallow and there is no fermentation layer due to the quick turnover of minerals and ions. The soils may be classed by the FAO/UNESCO soils Map of the World as arenosols, (possibly ferralitic arenosols). The soil profiles done elsewhere eg. in riverine forest show more of a mineral horizon.

CLIMATE

A tropical East African climate influenced by the proximity to the coast. There is a well defined dry season between May and October when the lowest mean monthly temperatures are recorded. The annual rainfall is 936mm and the average temperature is 26.1.

VEGETATION

The vegetation varies within the forest but mainly consists of low trees with very many climbers and here and there larger trees such as *Azelia*. The northern part is fairly open but

towards the southern boundary, near the river, the forest is denser and higher, strongly dominated by *Berlinia orientalis*.

Overall the range of different vegetation types follows the pattern laid down by White (1983) for the Zanzibar-Inhambane regional mosaic, with at least 5 of the 11 types being present. Dry undifferentiated forest with a very regular structure (12-20m canopy) occurs on many of the slopes rising above Lake Lutamba and in other patchy areas.

Moist undifferentiated forest occurs in the riverine areas and around parts of both lakes. Scrub woodland occurs in extensive patches mostly on the ridge-tops. Evergreen thicket occurs in large areas on the slopes towards Lake Tandangogoro and in places on the ridge-tops. Wooded grassland also occurs in patches at higher altitudes throughout the reserve.

There is a high level of diversity in the forest vegetation, 117 plant species have been recorded including 20 plants with a distribution restricted to the coastal forests of south east Tanzania and at least 5 endemic plants including *Pavetta lutambensis*.

Natural disturbance to the vegetation includes extensive elephant damage during the dry season particularly along the north and east boundaries and the ridge-top.

BIODIVERSITY

The reserve supports a rich avifauna. 94 species of bird have been identified, many of which are forest dependant, including the East Coast Akalat (*Sheppardia gunningi* ssp. *sokokensis*) and the Plainbacked Sunbird (*Anthreptes reichenowi* ssp. *yokanae*), both of which are endemic to coastal forests of East Africa (J. Faldborg et. al. 1990).

3 species of monkey, the Sykes blue monkey (*Cercopithecus mitis* ssp. *moloneyi*), the black faced vervet (*Cercopithecus aethiops*), and the baboon (*Papio cynocephalus*), have been observed and at least 11 species of bat have been found in the area. Other small mammals of particular importance which have been trapped include the Lesser Pouched Rat (*Beamys hindei*).

The river and lake bordering the reserve support the Nile crocodile which has been identified as seriously depleted in recent years (IUCN Report) and the Nile monitor which is a C.I.T.E.S. protected species.

Although studies are yet to be completed there is expected to be a high level of diversity among the invertebrate population including many species endemic to coastal forests and possibly several new to science.

The presence at Litipo of so many rare and endangered species ranks it amongst the most important of Tanzania's coastal forests.

CATCHMENT VALUE

The low hills in Litipo Forest may be a source of orographic rainfall that may feed additional water to Lakes Lutamba and Tandangogoro.

HUMAN IMPACTS

There are major settlements in the area and the reserve over much of its area shows signs of

prolonged and regular human disturbance.

Logging: although logging in the area is prohibited, fuel wood is collected in the reserve and there is evidence of a high degree of small scale logging by the local inhabitants in particular areas. Sapling cutting for building purposes is common. Valuable timber species are rare within the reserve however, so there is little danger of intensive commercial logging or other major damage occurring.

Agriculture: The land bordering the reserve is heavily farmed for the production of crops such as coconuts, bananas, cassava and spinach. There appears to have been little recent encroachment into the reserve area and clearing for new shambas is discouraged by the presence of a forestry officer. There is evidence however, that during the past 50 years some of the forest area outside the reserve boundary has disappeared, particularly around the lake. Recent sightings of areas of burnt vegetation on the shores of the lake also indicate that there may still be some danger of encroachment.

Hunting: Snares have been found within the forest and it is clear that hunting of forest animals such as bush pig and the blue monkey does occur on a small scale. Occasionally hunting provides food but is usually used to reduce the numbers of agricultural pests.

Other forest uses: On a small scale local inhabitants also collect honey, forest fruits, mushrooms and medicinal plants from the forest.

According to previous reports the local forester patrols the reserve boundary every so often and illegal acts are dealt with in co-operation with the local authorities.

MANAGEMENT RECOMMENDATIONS

Stricter enforcement of the ban on logging and pole cutting to maintain a stable and healthy flora and fauna. Encourage tree planting around villages to create alternative sources of fuel and timber ie an amenity zone to reduce local pressure on the forest.

Create a buffer zone in parts of the reserve to prevent further agricultural encroachment at the forest borders

Protection, regeneration and control of natural species by re-planting of cleared areas and stimulated regeneration of natural vegetation.

Further study of the reserve to fully determine its species composition and conservation value.

Tightening of hunting restrictions.

Control of the lighting and spread of bush fires.

Encourage the participation of the local population in the running of the area via education programmes.

MCHUNGU FOREST RESERVE

DESCRIPTION

NAME: Mchungu Forest Reserve, Rufiji District, Coast Region

AREA: Approx. 1,036ha (10.36km²)

BOUNDARY LENGTH: Approx. 18.40km

STATUS: Protective Forest Reserve, (Designated in 1947)

MAPS: Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 222/2 1968
Boundary Map 1:20,000 JB686 1968

LOCATION

Grid Ref: 39 15'E- 39 18'E, 7 46'S-7 42'S

Mchungu Forest Reserve lies just north of the Rufiji Delta, stretching some 10km north along the coast. The whole reserve lies at less than 15m a.s.l.

The nearest village is Mchungu, located in the south-west of the reserve. Access by road is from Bungu about 30km from the reserve on the main Dar es Salaam to Kilwa all-weather road.

District Forestry office HQ at Utete.

SOILS

Deep undifferentiated sands, with occasional thin (2-20cm) mud lenses, by Quadrennia sand terraces running parallel to the coast.

CLIMATE

Generally a tropical East African climate with oceanic temperatures, strongly influenced by coastal location. Subject to prevailing easterly winds. No annual rainfall or temperature figures are recorded for Mchungu.

VEGETATION

The vegetation of Mchungu is highly heterogeneous, reflecting the influence of environmental conditions and human disturbance.

Small patches of Zanzibar-Inhambane Undifferentiated Forest (White, 1983) totalling about 2km² are located amongst a complex of other vegetation types. Generally, the forest has a broken canopy of over 30m in height with a well developed understorey and sparse herbaceous layer. Dominant species are *Hymenaea verrucosa* and *Baphia* sp., though *Borassus* sp., *Sideroxylon* sp., *Azelia quanzensis* and *Manilkara* sp. are common.

Elements of moist semi-evergreen forest occur, such as *Syzygium sp.* with characteristic buttress roots and an abundance of *Ficus sp.* The predominantly evergreen canopy is dominated by *Polysphaeria sp.* and *Chassilia sp.*

Areas cleared for cultivation in 1974 and since abandoned have regenerated to scrub forest with a broken canopy up to 15m and dense evergreen understorey.

Forest damage from hippo and elephant is evident throughout the forested areas (Waters et al. in press).

TIMBER VALUES

Little information is available on the potential timber values of Mchungu Forest although *Azelia quanzensis* occurs commonly in the reserve.

BIODIVERSITY

Mchungu apparently has a low biodiversity in comparison with some of the more ancient coastal forests; to date no endemic plant species are recorded for the reserve. Further study is required before the biological importance of the area can be fully evaluated. However, one of only five known sites for the tree *Diospyros shimbaensis* (*Ebenaceae*).

CATCHMENT VALUES

As a result of its coastal location the catchment value of the reserve is negligible.

HUMAN IMPACTS

Logging: Permission for the removal of forest and mangrove species is granted locally by a forest ranger, whose jurisdiction includes Mchungu. No annual limit exists for local demands. Selective logging of some species, including *Azelia quanzensis*, is carried out by villagers from Mchungu and nearby Simba Uranga, Kiomboni and Nyamasati to make dug-out canoes.

Pole cutting: Generally confined to mangroves around the island of Simba Uranga.

Agriculture: Large areas of the forest reserve have been cleared around the villages of Mchungu and Msindaji and re-planted with cash crops of mango and cashew. The practice of shifting cultivation is little used locally.

MANAGEMENT RECOMMENDATIONS

To further study and determine the species composition of the remaining areas of natural forest and fully assess the scientific importance of the site.

To develop a clear management policy for the site from government to village level encompassing protection; regeneration and control of natural species detailing both immediate and long-term proposals.

To create a buffer zone in parts of the reserve disturbed by plantations to reduce pressure on the forest. Encourage tree planting around villages to create sources of fuel and timber.

MKULUMUZI (INCLUDING AMBONI CAVES) FOREST

DESCRIPTION

NAME:	Mkulumuzi gorge (& Amboni Caves) forest Tanga municipality, Tanga Region
AREA:	Approx. 350ha (3.5km ²): forest and evergreen thicket
STATUS:	Unprotected (Except Caves Conservation Area)
MAPS:	Ordnance Survey Topographic Map 1:50,000 Series Y742 Sheet 130E/1

LOCATION

Grid Ref: 5 04' - 5 06'S; 39 00' - 39 03'E

Access by road via Tanga - Mombasa road. For access to main forest block turn left 5km after Tanga onto B121 (to Mjessani). Park vehicle 5.5km along this road and walk south along paths for 2 km to reach river. For access to Amboni caves forest patches turn left 1 km earlier to Kiomoni village. Road runs through village and down to caves. Park and proceed on foot along river.

The forest exists as patches along the Mkulumuzi river valley, becoming more extensive further east where it extends onto the limestone plateau (to the north of the former Steinbruch Forest Reserve).

SOILS

Shallow reddish-brown sandy clays. High nutrient content where covered by vegetation. Hard and susceptible to erosion in exposed areas.

CLIMATE

Tropical East African climate with corresponding temperature and rainfall patterns. The site receives an average annual rainfall of 1337mm dispersed over 126 rain-days, though primarily during the long rainy season (March-May). January and February are the driest months. Average annual temperature is 26°C, no month having a mean below 23.5°C. It is coolest between July and September, when average temperatures can be up to 5°C cooler than at other times.

VEGETATION

Mainly dry evergreen forest dominated by *Scorodophloeus fischeri* and *Cynometra webberi*. Rather moister vegetation types are found in the river valley with *Barringtonia racemosa* and *Ficus spp.*

Cleared and previously disturbed areas are now under secondary thicket with the occasional relict forest patch and scattered *Adansonia digitata*.

TIMBER VALUES

Few or no commercially valuable timber species are found in the remaining patches of forest. Most trees are currently only exploited for charcoal.

BIODIVERSITY

There remains a high level of diversity in the forest vegetation, due to the range of exploitable micro-habitats created by rock outcrops and the decreasing moisture gradient from the valley bottom to the ridge-top. 89 species of plant have been recorded (Hawthorne, 1983; Verdcourt 1952) including two species of endangered African violet (*Saintpaulia sp.*), found along the river valley and 5 plant species known only from a few other sites.

Three species of monkey and 7 species of cave - dwelling bat are found in the river valley.

The valley has a rich avifauna; 46 species of bird have been identified. Many of these are forest dependent.

The river contains Nile crocodile, which have been identified as seriously depleted in recent years (IUCN report)

CATCHMENT VALUES

The forest has a fairly low catchment value as the main catchment for the Mkulumuzi is Mount Mlinga in the East Usambaras. Forest cover along the river valley, however, fulfils an important role in preventing erosion which could lead to the siltation of the river.

HUMAN IMPACTS

Charcoal Production: Tree felling for charcoal production is widespread in the main forest block. Removal and burning of trees also leads to considerable secondary damage to vegetation and associated micro-habitats. Current levels of exploitation negate the long-term sustainability of this practice.

Firewood: Fire wood removal is common (bundles are sold along the Mjessani road) and is rarely all dead wood.

Pole Cutting: A high level of sapling cutting for building poles has also been noted.

Agriculture: Clearance along the river banks for the planting of spinach, maize and bananas is common all along the river. The forest is surrounded by shambas and is thus threatened by clearance for cultivation.

Pit-sawing: Pitsawyers' pits have been found on the north bank of the river about 2.5km from the caves. It is not known at what frequency pit-sawing is practiced.

MANAGEMENT RECOMMENDATIONS

Inclusion of the forest patches near the Amboni caves in the Caves Conservation Area.

Proper demarcation of this area and the relocation of farmers cultivating within the Caves Conservation boundary. Re-planting of degraded areas with indigenous species raised from seed on site. Improved tourist and education facilities, including a strong natural resources component.

Monitoring of charcoal making at the main forest block. Controlling charcoal burning by licence.

MKWAJA COASTAL MOSAIC

DESCRIPTION

NAME: Mkwaja Coastal Mosaic
Pangani District, Tanga Region

AREA: 24,600ha (246Km²)

BOUNDARY LENGTH: 70Km

STATUS: Main body is private land
North-eastern zone without status

MAPS: Ordnance Survey 1:50,000
Series Y742 (D.O.S.422); Edition 3-TSD/OSD 1987
Sheets 149/3 Kwamsisi; 149/4 Mkwaja
Mkwaja Ranch Boundary Map 1:62,500, Amboni Ltd, 1961.

LOCATION

Grid Ref: 5 46'40''-5 58'S, 38 34'40''-38 49'48''E

50Km south of Pangani and 10km north of Sadaani, on the coast, between the main roads Mkwaja-Mkata and Pangani-Sadaani, the Dar-Korogwe railway track, the Msingazi river (also called Msangazi, Mbuvinini or Mligazi) and the coast. Altitude ranges from 0 to 100m a.s.l.

The nearest villages are Mkwaja, 5km to the north-east, and Mkalamu, 5km to the north-west. The nearest town is Pangani, 50km to the north.

The District Forestry Office is in Pangani. The local Forestry Officer is based in Mkwaja.

Access by road from Mkata (on the main Chalinze-Tanga all-weather road) and Kwamsisi to Mkalamu and Mkwaja. An alternative is access by Miono and Sadaani to Mkwaja. From Tanga: down along the coast road through Pangani to Mkwaja. All roads and tracks are locally bad in wet conditions.

Access by rail by the Dar-Korogwe railway track, station at Mkalamu.

SOILS

"Black cotton" vertisol on the grassy lowlands, reddish soil on higher grounds, on coraliferous limestone.

CLIMATE

Generally tropical East African, with two rainy seasons occurring in October-December (short rains) and March-May (long rains) and a four months dry season in June-September (average yearly rainfall on 25 years from 1955 to 1979 recorded at the nearest station: 1000mm).

Total precipitations estimated at 1100mm yearly.

Nearest private rainfall station at the Mkwaja Ranch's headquarters, 8km north-north-east.
Nearest national rainfall station in Pangani.

Temperature maxima vary from 28.5°C in August to 32.5°C in March. Minima vary from 20.5°C in August to 24°C in February-March (monthly averages on 20 years from 1959 to 1979).

VEGETATION

The vegetation of the area falls into White's (1983) Zanzibar-Inhambane coastal mosaic, with six of the eleven types distinguished by this author.

Dry undifferentiated forest with a very regular structure (12-20m canopy) occurs in small patches on hilltops.

Moist undifferentiated forest occurs in riverine areas of the Madete, the Mafui, and especially the Sima rivers.

Transition woodland occurs locally on the northern site of the Sima valley.

Scrub woodland occurs in the drier areas of the western hills.

Evergreen thicket occurs extensively on the grounds above the low grasslands, on shallow soils over coral limestone - considered a climax vegetation by Birch (1963).

Edaphic grassland studded with thickets occurs in large areas of lowland where black cotton soil prevails.

Wooded grassland covers extensive well drained areas to the south.

Mangroves (5m canopy) occur at the estuaries of the rivers and along the coast just behind the sand shelf of the beach.

Open wetlands dot the area around man-made dams.

Natural disturbance factors include seasonal water-flow on the riparian vegetation and minor elephant damage.

TIMBER VALUES

The timber value of the area is negligible, timber trees being present but scattered and in small numbers.

BIODIVERSITY

The area includes 9 vegetation types following White's (1983) classification. If more detailed distinctions are made, up to 16 habitat units can be discerned. Each can potentially harbour different faunistic communities.

To date, one new bat species for Tanzania and a new species of thread snake have been recorded from this site.

CATCHMENT VALUES

No permanent river runs through or along the area, but many seasonal water courses originate from the shallow hills and feed into the lowlands and mangroves.

Dams have been built across minor tributary valleys to catch the water run-off during the rainy seasons. These catchment dams generally hold free water throughout the dry season.

No slope reaches 40% anywhere in the area.

HUMAN IMPACTS

No major settlements or cultivations are present within the area.

The area shows signs of ancient and regular human impact ("fire-generated" landscape).

The land lying to the north and west is subject to light cattle grazing.

Riverine and riparian vegetation along the Mafui and Sima, as well as the thicket clumps occurring in this same area, are heavily exploited for fuel wood. Mangroves are lightly exploited for construction poles.

The southern zone and the hilltop dry forests are virtually untouched, the former being under the sole disturbance of bushfires.

Hunting and poaching were relatively heavy until 1988, but have recently been kept in check for the recovery of the game population.

MANAGEMENT RECOMMENDATIONS

To modify the area's status to enable joint management of private and public land zones.

To organize a joint management committee between the Mkwaja Ranch managers and representatives of the Mkwaja, Mbuyuni Mkuu and Mbuyuni Kitubeni villages.

Within the area:

- To define, mark and maintain clear boundaries,
- To define relevant management zones,
- To stop and prevent all forms of logging,
- To prevent any further human settlements,
- To control the lighting and spreading of bushfires,
- To regulate the land uses such as cattle grazing and hunting in order to maintain a healthy and stable fauna,
- To stimulate natural regeneration on the logged sites,
- To extend the current ranch guard's role to that of park warden.

To promote plantations of timber, fuel wood and construction wood species, especially that of mangrove species, around the villages.

To promote the organisation of the salt works into a medium scale salt pan industry and gradually eliminate the small scale and fuel wood demanding salt boilers.

To encourage the participation of the local population in the running of the area via education programmes and direct and equitable benefits.

MRORA FOREST

DESCRIPTION

NAME: Mrora Forest, Mafia Island

AREA: 3,800ha (38km²)

STATUS: Government land, no formal protective status.

MAPS: Ordnance Survey Topographic Map:
1:50,000 Series Y742 Sheet 19.

LOCATION

Grid Ref: 7°38'-8°02'S, 39°54'-39°47'E

Eastern seaboard of Mafia Island

SOILS

Coral rag overlain by sandy loam soil, pH 7.5

CLIMATE

Elevation 10m a.s.l. Temperatures high and stable; rarely exceed 33°C or fall below 20°C (Greenway et al. 1988). Rainfall approximately 2000mm per annum, 85% falling from December to May; July to October is the dry season.

VEGETATION

Described by Greenway et al. (1988) and assessed quantitatively by Rodgers et al. (1986). There is a continuous gradient of forest development from a seaward *Pemphis acidula* community: where the thicket reaches far enough inland and the soil level is deep enough to support trees, a forest structure is achieved with a distinct shrub layer and a canopy to 20m. Leaf litter is dry and shallow. Canopy height decreases steadily towards the coast due to the stunting effect of hot, saline sea breezes.

TIMBER VALUES

No commercial timber species are recorded.

BIODIVERSITY

Preliminary results suggest that the thicket invertebrate community is distinctive and important. Frontier-Tanzania collected two new genera and three new species of millipede and one new or very rare snail and two new species and one new sub-species of butterfly (JP). The herpetological component includes one endemic and one near endemic species of lizard and a new location for *Stephopaede sp. nov.* Mafia supports a large population of the

Comoros flying fox (*Pteropus comoroensis seychellensis*), listed in CITES Appendix 1.

The intrinsic value of the remnant forest is not clear, but the practical value of these coral rag forests is in their protective capacity from the desiccating and erosive effects of the sea wind. There are 5 possible endemic plant species, and the tree species *Diospyros shimbaensis*.

HUMAN IMPACTS

Agriculture: Clearance of forest and thicket for farmland is the major threat to these vegetation types. The coral rag soil is comparatively fertile and consequently land prices are high. Subsistence and cash crops are both grown in the area and the demand for land is increasing. Forest and thicket areas bordering farmland are seen as harbouring agricultural pests, such as bushpig (*Potamochoerus porcus*) and Sykes' monkey (*Cercopithecus mitis*). Farmers are clearing vegetation from even hopelessly rocky land to combat this threat.

Mining: In areas north of Mrorra, the coral rag is being mined for cement production. The surrounding thicket vegetation is used as fuel to burn coral down to lime.

Pole-cutting: Damage from pole cutting is severe in some regions (mangrove poles from the Rufiji Delta supply the rest of the island). Hunting and collection of medicinal plants occur on a local scale.

MANAGEMENT RECOMMENDATIONS

Designate formal forest reserve status to the remaining area of coastal forest, establishing both legal and practical protection.

Develop a clear management policy for the site from government to village level encompassing protection; regeneration and control of natural species detailing both immediate and long-term proposals.

Establish and clearly demarcate reserve boundary.

Reduce local pressure on the forest by encouraging sustainable agricultural practices. Develop local tree planting around villages to create sources of building materials and fuel wood.

Prevent any further damaging activities by employing on-site forest guards.

Repair human disturbance within the reserve and stimulate regeneration of natural vegetation. Further research to fully evaluate the conservation value of the site.

Encourage socio-economic programmes to determine the local status of the forest, and increase awareness of its conservation value.

MSUBUGWE/GARAFUNO FOREST

DESCRIPTION

NAME: Msubugwe Forest Reserve
Pangani District, Tanga Region

AREA: 4,408ha (44.08km²)

BOUNDARY LENGTH: 28.33km

STATUS: Protective Forest Reserve and partly C.S.I, Gazetted 1947. Re-surveyed & Enlarged to include Garafuno Forest Reserve in 1966.

MAPS: Ordnance Survey Topographic Maps 1:50,000
Series Y742 Sheets 149/1;149/2;130/3;130/4.
Shows incorrect forest reserve boundary.
Forestry Department Map JB 692.

LOCATION

Grid ref: 5°32'S 38°45'E

24km South-south-west of Pangani, 15km inland from the Indian Ocean. Nearest village is Mtango, 5km to the south-south-west.

District Forestry Office in Pangani. Msubugwe is the only forest reserve in the district which contains neither mangroves nor plantation forest.

Access by road from Mwera (3km south of Pangani) to Kabuku (on the Dar es Salaam - Moshi Highway). Road bisects forest reserve.

Northern railway line has a station at Gendagenda, 10km to the SW.

Forest covers a small hill at 120m altitude.

SOILS

'Black-cotton' vertisol or Mbuga soil in woodland areas.

Laterite developed on road in forest areas only. Sandy, red soils on higher ground, e.g. in forest.

CLIMATE

Generally tropical East African climate with corresponding temperatures. Subject to slight orographic rainfall from westward moving moist sea air. Rainfall pattern will closely match that of nearby Pangani (1300mm per annum). Dry season lasts 4 months (June-September).

VEGETATION

Forest reserve incorporates some 17km² of dry evergreen forest of the Zanzibar-Inhambane Undifferentiated Forest Type (White, 1983). A further 13 km lie outside the reserve boundary (areas taken from the 1988 Ordnance Survey Maps using aerial photographs from 1982).

The forest is dominated by *Scorodophloeus fischeri*, *Cynometra webberi* and *Manilkara sulcata*. In undisturbed areas, an even 20m closed canopy is present.

The remaining 27km² of the reserve are thicket savannah, classified by White as Zanzibar-Inhambane evergreen and semi-evergreen bushland and thicket. Apart from fires, human impact in this vegetation type is currently minimal.

TIMBER VALUES

The forested areas of Msubugwe have been extensively logged for *Brachylaena huillensis*. The timber trees *Azelia quanzensis* and *Bombax rhodognaphalon* are also present.

BIODIVERSITY

The Zanzibar-Inhambane Undifferentiated Forests are known to be important centres of biodiversity. Msubugwe has yet to be studied in sufficient detail to allow a comparison with other forests of the same type. However, it does contain *Stuhlmannia moavi*, a species and genus endemic to four coastal forests in Pangani River Basin.

CATCHMENT VALUES

No permanent water courses are present in the forest, although it is the source of a number of seasonal streams. A permanent pool exists on the eastern boundary of the reserve (outside the forest), which is an important watering hole for game animals.

There are no steep slopes in Msubugwe.

HUMAN IMPACTS

Logging: The forested areas have been extensively logged for *Brachylaena huillensis*, and logging trails criss-cross the forest. Disturbance is extremely heavy, and shrubs have been seen to be wilting due to the altered micro-climate. The risk of a forest fire will be increased by the subsequent drying out of the forest.

Hunting: Illegal hunting often takes place in or near the reserve; hunters camp at the water hole, targeting large game animals e.g. buffalo.

Agriculture: A village marked on the 1963 Ordnance Survey map (from aerial photos taken in 1957) is no longer in existence, perhaps following relocation under the 'Ujamaa' villagisation programme. There is currently no threat from clearing/encroachment from agriculture.

Exploitation for the production of charcoal remains a future threat.

MANAGEMENT RECOMMENDATIONS

Strict enforcement of ban on future logging.

Patrolling to discourage future fuel wood collecting for salt production and/or charcoal making.

Early burning around forest edges to reduce fire damage/encroachment.

Extra patrolling by Game Department to stop illegal hunting.

NAMAKUTWA - NYAMUETE FOREST RESERVE

DESCRIPTION

NAME: Namakutwa - Nyamuete Forest Reserve
Rufiji District, Coast Region

AREA: 4,634ha (46.34km²)

BOUNDARY LENGTH: 28.5km

STATUS: Productive Forest Reserve
(Designated in 1962)

MAPS: Ordnance Survey Topographic Maps:
1:50,000 Series Y742 Sheet 240/1; 240/3 & 240/4
Forestry Department map: Boundary Map 1:25,000 JBXX 19XX

Discrepancy between Forest Department boundary and the boundary shown on O.S. maps.

LOCATION

Grid Ref: 8°23'S, 39°00'E

The reserve comprises a plateau top of Jurassic sandstone supporting dry Coastal forest, surrounded by woodland and cultivation. Altitudinal range 150 - 380m a.s.l.

Access: The local road between Mbwala and Kitapi villages runs through the reserve. It is anticipated that work on the Nyamwage to Kinjumbi road will allow 2 wheel drive access to within 2km of the northern boundary of the reserve, and that buses will be re-routed along this road. Improvements are expected to be completed for 1995.

The District Forestry Office is at Utete, local Forestry office is at Mohoro.

SOILS

Fine upland plateau catenary sequence present on the hill tops with a thin (3-4cm) humus layer. Soils on the hillside are coarser, more shallow and better aerated, with the depth of humus related to the level of anthropogenic disturbance. Valley bottoms contain deep loamy soils underlain by fine clays which retain water. Degradation of soils following land clearance for agriculture is rapid, taking place within 15 years (Lowe & Ponder, unpublished).

CLIMATE

Generally tropical East African climate with corresponding temperature and rainfall patterns. Namakutwa is subject to orographic rain from westward moving moist sea air. The area experiences a six month dry season (mid-May to mid-November) and a corresponding six month wet season, during which rainfall is comparatively low. October is the warmest month and June the coolest.

VEGETATION

Homogeneous semi-deciduous dry forest occupies the plateau-top, rich in *Euphorbiaceae* and *Ebenaceae* spp. Dominant small trees (to 8m) include *Alchornea laxiflora*, *Diospyros brucei* and *Dioscorea sansibariensis*. Large individuals (to 25m) of *Dialium holtzii*, *Hymenaea verrucosa* and *Bombax rhodognaphalon* are scattered throughout the forest area.

Riparian forest is found in gullies draining the plateau, rich in species normally associated with ground water, including *Malcantha alnifolia*, *Chlorophora excelsa* and *Diospyros sp.*

Dry transition woodland occupies the top of the Nyamuete Hills and woodland occurs in the lowland areas, particularly the Nyamhoru Valley and at the northern end of the reserve.

TIMBER VALUES

Past extraction of selected timber species, primarily *Milicia excelsa* and *Pterocarpus angolensis*, has reduced the economic value of the reserve and rendered further logging ventures commercially unviable.

BIODIVERSITY

Two true Coastal Forest types are present, together with a transition woodland forest type. Namakutwa Forest Reserve supports a high diversity of flora and fauna, including several species of national and international importance.

Further identification of plant and animal specimens is required before the full conservation value of this site can be determined.

CATCHMENT VALUES

Namakutwa-Nyamuete Forest Reserve lies within the catchment of the Rufiji River. No permanent running water course are present, although many seasonal channels exist. Perennial pools are found in the Nyamhoru Valley. The site can be considered an important seasonal watershed.

HUMAN IMPACTS

Logging: Selective logging activities have concentrated along the moist riverine areas. Most mature timber trees have been harvested, primarily *Milicia excelsa*, reducing the commercial potential of the reserve. *Pterocarpus angolensis* has been removed from woodland areas to the north of the reserve. It is believed that all such logging activities are illegal.

Agriculture: Approximately 3ha of forest has been cleared for agriculture on the Namakutwa plateau, with a further 7ha currently under cultivation in the woodland areas of the Nyamhoru Valley. Plateau-top areas have historically been cleared for rice, kunde beans and maize. Agriculture is concentrated in lowland valleys, with old mango trees as evidence of past cultivation and settlement.

Pole cutting: Building materials (poles and lianes) are principally collected from the riverine forest areas, in woodland along the Mbwala-Kitape road and in the forest near Kitapi. Local villagers collect fuel wood and traditional medicines from the forest for home consumption.

MANAGEMENT RECOMMENDATIONS

Review status as a Productive Forest Reserve, clarify policy from government to village level on sustainable extraction of forest products. Ideally afford the reserve protective status and minimise future exploitation.

Repair human modifications to the site: re-plant native tree species to encourage forest regeneration, check further development of roads and tracks within the reserve and control land clearance for agriculture.

Encourage local projects to develop alternative sources for forest products. Increase local understanding of forest conservation and develop knowledge of sustainable agricultural practices.

Employ forest guards, if feasible, to control illegal logging and poaching.

Carry out further research to fully evaluate the conservation value of this forest

NGEZI FOREST RESERVE

DESCRIPTION

NAME: Ngezi Forest Reserve, Pemba Island
Micheweni district, northern Region

AREA: 1440ha (14.4km²)

RESERVE BOUNDARY LENGTH: Not known.

STATUS: Forest Reserve
(Gazetted in 1923)

MAPS: Ordnance Survey Topographic Map: 1:50,000 Series Y742 Sheet 19.
Boundary Map 1:XX,000 JB 19.

LOCATION

Grid Ref: 40°55'S, 39°42'E

Ngezi Forest is located at the base of the Kingomasha peninsula in north-west Pemba, astride the Konde to Ras Kigomasha vehicle track. Forest vegetation lies on rich alluvium and sands of c.20m elevation above sea level.

Smaller areas of forest on Pemba are located at Mwituu Mkuu (4°55'S, 39°48'E), Ras Kiuyu (4°52'S, 39°50'E) and on certain islands off the coast. The largest of these occupy between 2 and 3km². No scientific data are available (Burgess et al, 1992).

SOILS

The soils of the main part of the forest are recent alluvial sands, but in the southern half there are stands of *Philippia* heath land on white and red loam sands (these are very leached and thus poor in minerals); the ground water table is low. On the western side of the reserve (Tondooni peninsula) the soils are of the so-called "coral rag" type - thin sandy soil over coral, with many coral outcrops (Beentje, 1990a).

CLIMATE

Pemba Island generally experiences a tropical East African climate with prevailing easterly winds. Temperatures range from 21 - 34°C. The mean rainfall of 1860mm follows a bi-modal pattern concentrated between March-May and November-December, averaging 175mm per month (Beentje, 1990a).

VEGETATION

Beentje (1990b) identified 6 vegetation types, including 3 forest types: Moist forest (to 40m) in the central/eastern part of the reserve, dominated by *Antiaris toxicaria*, *Odyndea zimmermannii*, *Bombax schumannianum*, *Blihia unijugata*, *Erythrophloeum suaveolens*, *Croton sylvaticus*, *Macaranga capensis*, *Majidea zanguibarica* and *Terminalia sambesiaca*. A lower canopy layer comprises *Upaca guineensis*, *syzygium cordatum* and *Pachystela spp.*

(Burgess et al, 1992). Riverine swamp forest (to 20m) is primarily composed of *Barringtonia racemosa* and *Samadera indica*. The coastal thicket and dry evergreen forest is confined to the coral rag on the Toondoni peninsula. Dominant species are *Diospyros consolatae* and *Sorindea madagascariensis*.

TIMBER VALUES

Commercial timber species including *Milicia excelsa*, *Calophyllum inophyllum*, *Terminalia catappa*, *Cordia alliodora*, *Khaya authothea*, *Tabebina pentaphylla* and *Grevillia robusta* were planted in 1964 after natural species were harvested. Similarly, *Milicia*, *Calophyllum*, *Cordia*, *Terminalia ivorensis* and *Maesopsis eminii* were re-planted in 1978.

BIODIVERSITY

The moist forest is dominated by *Odyndea zimmermannii*, classified as globally rare. Furthermore, the assemblage of species in this vegetation type is not known to occur in any other East African forest. The reserve comprises montane elements (*Cassipourea*, *Philippia*); eastern Indian species (*Samadera*, *Chrysophyllum lanceolatum*) and Madagascan links (*Chrysalidocarpus*, *Typhonodorum*) which Beentje (1990b) describes as "unique in a global sense".

Ngezi Forest supports two endemic plants *Chrysalidocarpus pembanus* and *Ensete proboscoideum*, as well as the near-endemic *Philippia mafiensis* and *Typhonodorum lindlyanum*.

The faunal component further increases the conservation value of the reserve: including the endemic Pemba flying fox (*Pteropus voeltzkowi*); the near endemic Pemba vervet monkey (*Cercopithecus aethiops nesiotes schwartz*) and the possibly endemic Pemba Blue Duiker (*Cephalophus monticola pembae Kershaw*). It is possible that the endemic Pemba Scops Owl (subspecies) occurs in the reserve. Little invertebrate study has occurred though an endemic subspecies of the swallowtail butterfly *Graphium leonidas* has been collected.

CATCHMENT VALUES

Probably none.

HUMAN IMPACTS

Beentje (1990b) details the effects of exploitation and the introduction of exotic species on the different vegetation types and determines the impact of a proposed hotel development in the north of the reserve..

Logging: There appears to be none at present.

Pole cutting: Local scale pole cutting and firewood collection affects all sites (Rodgers et al., 1986)

MANAGEMENT RECOMMENDATIONS

Designate Nature Reserve Status to the remaining area of coastal forest, establishing both legal and practical protection for a small but strictly controlled area.

Develop a clear management policy for the site from government to village level encompassing protection, regeneration and control of natural species, detailing both immediate and long-term proposals.

Establish and clearly demarcate reserve boundary.

Create a buffer zone in parts of the reserve disturbed by plantations or industry to reduce local pressure on the forest. Encourage tree planting around villages to create sources of fuel and timber.

Prevent any further damaging activities by employing on-site forest guards. In May 1991, the Wildlife Conservation Society of Tanzania (WCST) Coastal Forest Programme provided funds for a number of forest attendants in Pugu Reserve.

Repair human disturbance within the reserve and stimulate regeneration of natural vegetation. The WCST Coastal Forest Programme have a budget of Tsh. 50,000 per month to develop nurseries, collect seeds and seedlings and to liaise with government forestry officers. Pugu Forest should be a priority.

Pugu Forest is easily accessible to a large centre of population. The research and education potential of the site must be sustainably developed and tourism actively encouraged to increase awareness of forest conservation and its importance. Investigate the possibility of establishing a study centre for the area.

PANDE FOREST RESERVE

DESCRIPTION

NAME: Pande Forest Reserve
Kinondoni District, Coast Region

AREA: Approx. 1,100ha (11km²)

BOUNDARY LENGTH: Not known.

STATUS: Designated Protective Forest Reserve in 1947, revocation order October 1988; currently in private ownership under the name Pande Game Reserve Ltd.

MAPS: Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 186/1 & 186/2 1987

LOCATION

Grid Ref: 39°05'E, 6°42'S

Approximately 25km north-west of Dar es Salaam and 16km inland from the Indian Ocean. The nearest village is Mabwe-Pande, 2.5km north of the reserve boundary.

District Forestry Division HQ is at Kiserawe, local forestry officer based in local village.

Access by road from Bunju, approximately 7km north of the reserve boundary, on the Dar es Salaam-Bagamoyo road (B1212).

Pande Forest covers a gently rounded ridge of sandstone ranging from 100 - 200m a.s.l.

SOILS

Ridge top soils are red sandy loams of Miocene age subject to heavy leaching in the past, - they may be classified as Relict Latosols (UNESCO/FAO). Gully erosion is evident where soils are exposed by vegetation clearance (Hawthorne, 1984).

CLIMATE

Generally a tropical East African climate, subject to orographic rainfall from prevailing easterly winds. The area experiences a bi-modal rainfall pattern with rainy periods between October - December and in April. Temperature ranges from 24 - 31°C (Matui, 1991).

VEGETATION

The vegetation at Pande is extremely heterogeneous, largely as a result of anthropogenic disturbance.

Pande is a dry evergreen forest of the Zanzibar-Inhambane Undifferentiated Forest type (White, 1983). Reported areas of closed-canopy forest in the reserve interior (Burgess, 1990) are characteristically around 15m in height. Dominant species are *Scorodophloeus fischeri*,

Cynometra webberi, *Schefflerodendron usambarense*, *Manilkara sulkata* and *Manilkara discolor* (Hawthorne, 1984).

The convoluted forest margin is surrounded by dense thicket and Zanzibar-Inhambane Transition Woodland (White, 1983), dominated by *Brachystegia sp.* and *Azelia quanzensis*. This secondary vegetation pattern results from destruction and re-establishment with successive bush fires (Hawthorne, 1984). Numerous tracks made by small game, such as bush pig (*Potamochoerus porcus*), are evident in the woodland area.

TIMBER VALUES

All timber has gone; trees cut for fuel wood and especially for charcoal on a very large scale.

BIODIVERSITY

Three plant species are believed to be endemic to Pande; *Tricalysia bridsonia var. Pandensis*, *Uvaria pandensis* and *Leptactina sp. A.* Moreover, *Uvaria sp. nov.*, *Nesogordonia holtzii* and *Ecbolium umbrossus* are known from only a few other coastal forest sites (Hawthorne, 1984).

At least 37 species of forest bird have been identified within the reserve, including one near-threatened species (Burgess, 1990). Little information is available on other fauna of Pande.

CATCHMENT VALUES

Pande Forest acts as a catchment for the Mpiji River which runs west of the reserve, and gives rise to a number of seasonal watercourses.

HUMAN IMPACTS

Logging: Since de-gazettement in 1988, extensive timber removal for commercial purposes has occurred. Large areas of Pande Forest are being clear-felled and burnt for charcoal to supply markets in Dar es Salaam. *Manilkara sp.*, *Milletia usaramensis*, *Vitex* and *Scorodolpheus sp.* are favoured for charcoal burning.

Pole cutting: Local people cut poles for building materials and tool handles. *Diospyros sp.*, *Drypetes sp.* and *Haplocoleum sp.* are preferred (Burgess, 1990). Up to 70% of available poles have been removed from forest margins (Hall & Rodgers, 1986).

Firewood: Fire wood collection occurs on a local scale, though the army have been observed removing dead logs by truck (Mwakamela, 1991).

MANAGEMENT RECOMMENDATIONS

Reverse the revocation order and re-establish the area as a Protective Forest Reserve. Establish and clearly demarcate reserve boundary.

Undertake a comprehensive study of Pande Forest to determine the extent of disturbance and assess the remaining species composition.

Develop a clear management policy for the site from government to village level

encompassing protection; regeneration and control of natural species detailing both immediate and long-term proposals.

Create a buffer zone in disturbed parts of the reserve to reduce local pressure on the forest. Encourage tree planting around villages to create sources of fuel and timber.

~~Prevent any further damaging activities by employing on-site forest guards. In May 1991, the Wildlife Conservation Society of Tanzania (WCST) Coastal Forest Programme provided funds for a number of forest attendants in Pande Reserve.~~

Repair human disturbance within the reserve and stimulate regeneration of natural vegetation. The WCST Coastal Forest Programme have a budget of Tsh. 50,000 per month to develop nurseries, collect seeds and seedlings and to liaise with government forestry officers. Pande Forest should be a considered as part of this scheme.

Pande Forest is accessible to a large centre of population. The research and education potential of the site must be sustainably developed and tourism actively encouraged to increase awareness of forest conservation and its importance.

PUGU FOREST RESERVE

DESCRIPTION

NAME: Pugu Forest Reserve
Kisarawe District, Coast Region

AREA: Approx. 2,179ha (21.79sq.km)

RESERVE BOUNDARY LENGTH: Approx. 23km

STATUS: Protective Forest Reserve
(Designated in 1947)

MAPS: Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 186/3 1987
Shows slightly incorrect Forest Reserve boundary
Boundary Map 1:10,000 JB606 1967
Management Map 1:10,000 JB683 1968

LOCATION

Grid Ref: 39°05'E, 6°54'S

Approximately 25km south-south-west of Dar es Salaam and 20km inland from the Indian Ocean. District Forestry Division HQ at Kisarawe: the nearest settlement, located immediately south-west of the reserve boundary.

The main Dar es Salaam - Kisarawe road virtually bisects the reserve, which lies approximately 14km beyond Dar es Salaam International Airport. Pugu station lies immediately north-east of the forest boundary and the central railway line runs through the north of the reserve.

The forest reserve overlies the Pugu Hills, a dissected range of kaolinitic sandstones with an altitudinal range 100-305m a.s.l.

SOILS

Thick-mantled Arenosols (UNESCO/FAO) occur on the ridge-tops but are replaced by gravels, clayey sands, marls and clays where the slopes run through different underlying strata (Hawthorne, 1984).

The area encompasses one of the worlds largest kaolin deposits.

CLIMATE

Generally a tropical East African climate with oceanic temperatures. Subject to orographic rainfall from prevailing easterly winds. The area experiences a bi-modal rainfall pattern with an annual average recorded for Kisarawe of approximately 1,250mm (Howell, 1981). Rainy periods are between October - December and April - June. Temperature ranges from 24 - 31°C (Matui, 1991).

VEGETATION

The extremely heterogeneous vegetation of Pugu has a characteristic ridged, valley slope and valley bottom variation.

Ridge-tops and steeper slopes support dry evergreen forest, average canopy height 10m, often finely intermixed with thicket vegetation. Dominant tree species are *Scorodophloeus fishery* and *Manilkara sulcata*.

Moist forest stands with an average canopy height of 35m occur on gentler slopes, dominated by *Antiaris toxicaria* and *Dialium holtzii*.

Both vegetation types may be classified as Zanzibar-Inhambane Undifferentiated Forest (White, 1983).

Zanzibar-Inhambane transition woodland (White, 1983) predominates on lower slopes grading to wetland species in the valley bottom.

TIMBER VALUES

Most trees of commercial value were removed during the colonial era including *Milicia exelsa*, *Brachylaena huillensis*, *Hymenaena verrucosa*, *Newtonia paucijuga*, *Khaya nyasica* and *Baphia kirkii*. Between 1952-1961 472 hectares were replanted with exotic species such as *Cassia siamea*, *Eucalyptus sp.*, *Grevillea robusta* and *Tectonia grandis*. Since then the Forest Department has cleared a further 36 hectares of natural vegetation and replanted with exotic species, a policy being pursued as recently as 1982 (Burgess, 1990).

BIODIVERSITY

Pugu is the best studied coastal forest in Tanzania and has a notably high biodiversity.

Botanical collection has identified 1 endemic plant genus and 14 plant species believed to be endemic or near-endemic to the forest. However, the taxonomic status of some of these species requires final confirmation and some may prove conspecific with other named taxa. Furthermore, 4 rare plant species, also known from coastal forests in Kenya, have been recorded for Pugu (Burgess, 1990).

At least 65 species of forest bird have been identified for this site including 1 threatened species; one threatened sub-species and 6 species considered to be near-threatened. This forest ranks equal 32 in the top 75 forests for bird conservation in Africa (Collar & Stuart, 1988).

Two endemic or near-endemic species of reptile are recorded and invertebrate study at Pugu has identified several species new to science (Howell, 1981).

This considerable diversity indicates the high scientific potential of Pugu Forest and its significant conservation value.

CATCHMENT VALUES

As a Protective Forest Reserve Pugu is recognised as important in protecting part of Dar es Salaam's water supply. There is a reservoir in the south of the reserve. Pugu Forest acts as a catchment for the Msimbazi River, which runs through the north of the reserve, and gives

rise to a number of seasonal watercourses.

HUMAN IMPACTS

In 1970 Pugu Forest Reserve covered some 22 km² (Howell, 1981). As a result of strong anthropogenic disturbance the Natural forest currently occupies less than half this area.

Logging: (See timber values)

Pole cutting: Local people remove poles for building materials. About 50% of the available poles have been taken in accessible areas, with less than 20% removed from the forest interior (Hall & Rodgers, 1986).

Charcoal production: Practiced on a local and commercial scale (sold to Dar es Salaam).

Mining: Pugu Forest Reserve contains the largest deposits of Kaolin in the world (Howell, 1981). Kaolin mining and the development of a brick and tile factory within the reserve has resulted in forest clearance for fuel wood and the associated smallholdings of workers in these industries. In 1968 approximately 88ha of the former forest reserve had been de-gazetted to allow these operations to continue. The Forest is threatened by the expansion of the mining project.

Agriculture: The forest is under heavy pressure from agricultural encroachment outside reserve boundaries.

MANAGEMENT RECOMMENDATIONS

Designate nature reserve status to the remaining area of coastal forest, establishing both legal and practical protection for a small but strictly controlled area.

Develop a clear management policy for the site from government to village level encompassing protection, regeneration and control of natural species detailing both immediate and long-term proposals.

Establish and clearly demarcate reserve boundary.

Create a buffer zone in parts of the reserve disturbed by plantations or industry to reduce local pressure on the forest. Encourage tree planting around villages to create sources of fuel and timber.

Prevent any further damaging activities by employing on-site forest guards. In May 1991, the Wildlife Conservation Society of Tanzania (WCST) Coastal Forest Programme provided funds for a number of forest attendants in Pugu Reserve.

Repair human disturbance within the reserve and stimulate regeneration of natural vegetation. The WCST Coastal Forest Programme have a budget of Tsh. 50,000 per month to develop nurseries, collect seeds and seedlings and to liaise with government forestry officers. Pugu Forest should be a priority.

Pugu Forest is easily accessible to a large centre of population. The research and education potential of the site must be sustainably developed and tourism actively encouraged to increase awareness of forest conservation and its importance. Investigate the possibility of establishing a study centre for the area.

RONDO FOREST RESERVE

DESCRIPTION

NAME: Rondo Forest Reserve
Lindi District, Lindi Region

AREA: 146 km² (some disagreement)

RESERVE BOUNDARY LENGTH: 117km

STATUS: Protective Forest Reserve
(Designated in 1959)

MAPS: Ordnance Survey Topographic Map:
1:50,000 Series Y742 Sheet 249/1 Edition 1-TSD 1967
Forestry department map: Boundary Map JB 464, 1969

FOREST PROJECT OFFICER: Ruben Kirenga

LOCATION

Grid Ref: 10°08'S, 39°12'E

The forest is located on the Rondo plateau around 870m a.s.l, and in the Mchindiji Valley. The plateau is about 4km from Rondo village, itself approximately 60km west of Lindi. The Rondo Forestry Project (TAFORI) is situated 80km west-south-west of Lindi (Burgess et al, 1992).

SOILS

Sandy soils derived from terrestrial sands, gravels, calcretes and laterites of Miocene to Pleistocene age. Bhatia (1990) observed severe erosion where trees had been cleared on forest boundaries.

CLIMATE

Generally a tropical East African oceanic climate, subject to orographic rainfall from prevailing easterly winds. The area experiences one rainy season (November-June), with an average annual rainfall of 1088mm (1951-1979). Temperatures rarely exceed 30°C; the coolest period between June and August, with temperatures as low as 11°C.

VEGETATION

The forest vegetation is heterogeneous with logged areas, plantations, cleared glades and some stands in almost primary condition.

Bhatia (1990) identified two distinct natural forest types within the reserve: Closed high forest dominated by *Chlorophora excelsa*, *Rhicinodendron gracilor*, *Bombax rhodognaphalon* and *Azelia quanzensis*; and secondly Miombo forest dominated by *Pteleopsis*, *Julbernardia*, *Isobertinia* and *Brachystegia*. *Caloncoba welwitschii*, a tree species typical of sub-montane

forest, is also present in the forest. There are also large areas of plantation, particularly of *Pinus* species, teak, *Grevillea* and *Cupressus*, some within the natural forest (Burgess et al. 1992).

TIMBER VALUES

See Human Impacts: logging.

BIODIVERSITY

Polhill (1968) presents a list of the plants which are believed to be endemic to this forest and the surrounding area, these are *Ipomoea consimilis*, *Xylopi collina*, *X. latipetala*, *Warburgia ugandensis* ssp. *longifolia*, *Dichapetalum macrocarpum*, *Vismianthus punctatus*, *Ipomoea flavivillosa*, *Diospyros eggelingii*, *Zimmermannia grandiflora*, *Homalium elegantulum*, *Vismia pauciflora*, *Bussea eggelingii*, *Mimosa busseana*, *Erythrina schliebenii*, *Millettia makondensis*, *Paropsia schleibeniana*, *Cuviera semsei*, *Heinsia bussei*, *H. parviflora*, *Leptactina bussei*, *Pavetta lutambensis*, *P. schliebenii*, *Vepris schliebenii*, *Solanum lamprocarpum*, *Cola discoglypsemnophylla*, *Grewia meizophylla*. However, it is not known how many of these are present in the forest itself. Further preliminary collections by staff from Kew Gardens in 1988 and 1991 have recorded additional new species indicating the area warrants considerable further botanical attention (Burgess et al., 1992).

Recent work on the avifauna (Bagger et al., 1989; Faldborg et al., 1991; Holsten et al. 1991) shows that at least 55 species of forest bird are present, including the rare east coast akalat and spotted ground thrush, an endemic subspecies of green barbet *Stactolaema olivacea woodwardi*, and the near-threatened Uluguru violet-backed sunbird, plain-backed sunbird and southern banded snake eagle. The amphibians and reptiles have also received some study (Howell, 1981), an undescribed species of frog (*stephopaede* sp.) is present, and a rare *mertensophryne* species.

CATCHMENT VALUES

See O.S. map.

HUMAN IMPACTS

Logging: This was the finest *Chlorophora excelsa* forest in East Africa before it was logged in the late 1940s and 1950s. A sawmill was established at Ngala processing large quantities of *Chlorophora* and *Pterocarpus angolensis*, primarily for export. The remaining high forest is coppice regeneration of *Chlorophora*. In 1952 the Rondo Forest Project was initiated which planted over 1100ha of hardwoods and 1700ha of pine, some at the expense of the natural forest (Procter, 1968). Planting was stopped in 1982 as the exotic trees were growing poorly. The Mtandi nursery was disbanded in 1986 as tree planting was stopped. The current policy in planted areas is to clear-fell and plant with *Chlorophora* and Teak.

A recent plan was to establish a mobile sawmill in the nearby Ntene Ujamaa village to start processing the planted timber (palettes for fork-lift trucks). Timber is removed under licence, though the money is administered by the Treasury and may not be used to fund local projects.

Pole cutting: Local people can obtain permits (20 Tsh. per headload) to collect hardwood

building poles.

Charcoal production: Some illegal charcoal burning takes place by local people. Teak off-cuts are available for fuel wood.

The most serious threat is from fires arising during shamba preparation in the area of cultivation within the reserve. Peak periods are between July and November. In 1981 334.6ha was burnt (Bhatia, 1990).

MANAGEMENT RECOMMENDATIONS

Determine a clear policy for the reserve from government to local level. Review licensing system to ensure sustainable levels of exploitation. Ideally suspend all timber extraction to enable natural forest regeneration.

Enforce protective forest reserve status using existing forestry officers.

Relocate settlements outside of reserve boundaries to prevent uncontrolled bush fires.

Encourage re-planting of native tree species in clear-felled areas, re-establish the Mtandi nursery to provide tree seedlings.

Carry out further research at this site to fully evaluate the conservation potential of the reserve.

Develop local awareness of forest conservation and its significance in terms of water catchment effects.

RUVU NORTH FOREST RESERVE

DESCRIPTION

- NAME: Ruvu North (Bana) Forest Reserve
Kibaha District, Coast Region
- AREA: 35,000ha (350Km²)
- BOUNDARY LENGTH: 98.5km
- STATUS: Productive Forest Reserve
(gazetted in 1967)
- MAPS: Ordnance Survey Topographic Maps:
1:50,000 Series Y742 Sheet 185/2, 186/1 & 186/2 (1987)
Forestry Department map:
Boundary Map 1:X,000 Jb665 (1967)

LOCATION

Grid Ref: 6°33'16"-6°43'00" S, 38°47'00"-39°02'00" E

The reserve lies about 100km by road north west of Dar es Salaam and 16km west of the Indian Ocean.

Ruvu North supports a mosaic of natural vegetation types including small areas of Zanzibar-Inhambane Undifferentiated Forest (White, 1983), which are subject to high levels of anthropogenic disturbance. Approximately 20km² of the reserve has been planted with exotic species.

The reserve is situated on Miocene to Pleistocene deposits of the coastal plain, giving rise to a relatively even topography ranging between 40-140 metres a.s.l.

District Forestry Division HQ at Kibaha, local Forestry Office at Kongowe. Tanzanian Forestry Research Institute (TAFORI) also have an office at Kongowe and operate trial forestry plots within the reserve. There is a nursery of *Cassia siamea* at Kongowe.

SOILS

Coarse or loamy sands of low organic matter content and poor nutrient status.

CLIMATE

A tropical East African oceanic climate with oceanic temperatures, subject to prevailing easterly winds. The area experiences a bi-modal rainfall pattern with rainy periods between October-December and April-June.

VEGETATION

Preliminary investigations identified 4 distinct vegetation types: Secondary forest, woodland, grassland (with scattered trees) and thicket. However, these vegetation types were often blended into a complex mosaic making accurate classification difficult.

The secondary forest was generally reduced to small patches surrounded by woodland. Common trees in the reserve include *Pterocarpus angolensis*, *Brachystegia spiciformis*, *Dalbergia melanoxylon*, *Combretum schumannii*, *Albizia versicolor*, *Julbernardia* and *Acacia* species. The diversity of trees in both forest and woodland was high, a survey of tree species for a charcoal inventory carried out in 1971 identified 23 other tree species within the reserve. It was observed that small patches of forest covering termite mounds were abundant in the grassland and thicket vegetation types, possibly limited by frequent bushfires. The grassland with scattered trees was a fire climax community, the tree species being resistant to burning. The margins of the forest patches are dense, with much liana and shrub growth, resulting from encroachment by bush fires. Thicket areas were often dense with a low diversity of species, generally with some *Dalbergia*, *Julbernardia* and *Acacia* species.

The Mkuza River in the east of the reserve is shown on the OS map (185/1) to support a continuous strip, 200m wide, of riverine forest. Remnant patches of riparian forest were found, bordered by thicket. The larger trees had been selectively felled, this disturbance resulting in dense secondary vegetation.

TIMBER VALUES

Ruvu North is run on a Productive basis with licenses issued for tree felling and other exploitation of forest products. *Khaya nyasica*, *Dalbergia melanoxylon*, *Pterocarpus angolensis*, and *Azalia quanzensis* are among timber species recorded for the reserve. However, levels of exploitation are high and few trees of commercial value remain.

The trial plots established at Ruvu North cover 2000ha and are presently concerned with exotic species, namely *Pinus sp.* including *P. caribaea*, *Eucalyptus sp.* such as *E. tereticornis* and *E. zanzibaris* and also *Gmelina arborea*.

The objective of these trial plots is to determine the potential of these species in Tanzania. To date *E. tereticornis* has proved the most successful, though generally the trial plots have had unsatisfactory results. The last plot was established in 1981: 2ha of the exotic species *Acacia mangium*.

BIODIVERSITY

Not well known.

CATCHMENT VALUES

The OS map (185/1) shows two water courses within the reserve: the Chatota, a tributary of the Ruvu River which flows within 2km NW of the reserve boundary, and the Mkuza River; which is seasonal in nature.

The reserve itself lies between the Ruvu River to the north-west and the Mpiji River 2km to the south-east, and gives rise to seasonal tributaries of these watercourses. Thus it can be seen that Ruvu North has a significant catchment effect which is directly threatened by the high levels of anthropogenic disturbance within the reserve.

HUMAN IMPACTS

Logging: Intense - most large trees have gone.

Charcoal Production: A problem facing the reserve is that of uncontrolled bush fires. Burning greatly reduces the supply of nitrogen, adversely affecting plant growth and thus species distribution.

MANAGEMENT RECOMMENDATIONS

Designate nature reserve status to the remaining area of coastal forest, establishing both legal and practical protection for a small but strictly controlled area.

Develop a clear management policy for the site from government to village level encompassing protection; regeneration and control of natural species detailing both immediate and long-term proposals.

Establish and clearly demarcate reserve boundary.

Create a buffer zone in parts of the reserve disturbed by plantations or industry to reduce local pressure on the forest. Encourage tree planting around villages to create sources of fuel and timber.

Prevent any further damaging activities by employing on-site forest guards. In May 1991, the Wildlife Conservation Society of Tanzania (WCST) Coastal Forest Programme provided funds for a number of forest attendants in Pugu Reserve.

Repair human disturbance within the reserve and stimulate regeneration of natural vegetation. The WCST Coastal Forest Programme have a budget of Tsh. 50,000 per month to develop nurseries, collect seeds and seedlings and to liaise with government forestry officers. Pugu Forest should be a priority.

Pugu Forest is easily accessible to a large centre of population. The research and education potential of the site must be sustainably developed and tourism encouraged to increase awareness of forest conservation and its importance. Investigate the possibility of establishing a study centre for the area.

RUVU SOUTH FOREST RESERVE

DESCRIPTION

- NAME: Ruvu South Forest Reserve
Kisarawe & Kibaha Districts, Coast Region
- AREA: Approx. 32000ha (320km²)
- BOUNDARY LENGTH: Not known.
- STATUS: Protective Forest Reserve
(Designated in 1967)
- MAPS: Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 185/4, 186/3 & 203/2 1987

LOCATION

Grid Ref: 6°53'-7°03'S, 38°46'-39°02'E

Approximately 30km south-west of Dar es Salaam and 3km east of Kazimzumbwi Forest Reserve. The villages of Kola and Kifuru are located within the reserve but lie some 8km from the forest. District forestry Division HQ at Kisarawe. Local forestry office at Mzenga.

The central railway line virtually bisects the reserve and an un-surfaced road runs through the forest from Kazimzumbwi to Mzenga.

The reserve overlies gentle topography with no distinct features, altitudinal range 120-260m.

SOILS

Red-brown soils pH 5.1 - 5.3.

CLIMATE

Generally a tropical East African oceanic climate with corresponding temperatures. No rainfall data are available for the reserve, though an annual average of 1,236mm is recorded for Kisarawe (Howell,1981). Ruvu South lies in the rainshadow of the Pugu Hills and is of lower altitude, consequently it supports a dry form of coastal forest.

Seasonal patterns are similar to those of Pugu Forest Reserve, though the modifying effect of the Ocean is somewhat lessened by the more inland location of Ruvu South.

VEGETATION

Ruvu South Forest Reserve contains the largest single area of Coastal Forest yet known in Tanzania. Adding to the value of the forest is its unusually dry climate and the fact that it is comparatively intact.

The canopy in Ruvu South Forest is generally low and uneven. However, there are scattered

areas of tall trees. This heterogeneous vegetation type covers approximately 98km². Kisarawe District Forest Department recognises only 20km² of high canopy forest within the reserve. The low canopy of the forest is thought to be a natural feature.

The forest is surrounded by wooded grassland, much of it secondary growth, with swamps to the north-east of the reserve.

TIMBER VALUES

Past logging of commercial timber species, for example *Brachylaena huillensis*, has occurred within the reserve and suitable trees are now scarce.

BIODIVERSITY

The forest reserve supports a large diversity of mammals, including elephant, plants and invertebrates.

CATCHMENT VALUES

The River Banda and associated tributaries run alongside the western margin of the forest. Riverine forest follows the course of the Kiegia River in the centre of the reserve. Swamps occur in the east of the reserve giving rise to a number of water courses.

HUMAN IMPACTS

Logging: Continues despite the apparent natural scarcity of suitable trees. Logging is legal provided permission is obtained from the Forestry Division (district and regional levels).

Pole cutting: Carried out illegally, but damage appears slight.

Charcoal Production: Not yet perceived as a major threat to the forest. Collected for the local market and for sale in Dar es Salaam but generally concentrated around roads.

Hunting: Animal populations within the forest are said to be increasing due to government restrictions on hunting. The area is relatively well policed.

Agriculture: There is no farming encroachment on the forest itself although conflict between cultivation and wildlife management exists in the form of agricultural pests such as Sykes' Monkey, baboons and elephants which raid crops with increasing frequency.

MANAGEMENT RECOMMENDATIONS

Immediate threats are small therefore suitable preventative action may conserve the forest in its present state.

Enforce reserve status: ban tree felling for a period of 10 - 15 years.

Survey the large mammal population in the reserve to enable changes to be monitored.

Determine the rate of human population growth within the reserve and the corresponding pressure on resources.

TONG'OMBA FOREST RESERVE

DESCRIPTION

NAME: Tong'omba Forest Reserve
Kilwa District, Lindi Region

AREA: 2510ha (25.1km²)

RESERVE BOUNDARY LENGTH: 23km

STATUS: Protective Forest Reserve
(Designated in 1961)

MAPS: Ordnance Survey Topographic Maps:
1:50,000 Series Y742 Sheets 239/4 & 240/3
Forestry Department map:
Boundary Map 1:25,000 JB451 (1959)

LOCATION

Grid Ref: 8°25'S, 39°01'E

The nearest village is Kibata, situated south of the reserve. Kibata can be reached by local road from Kipatimu, approximately 40km west of the Kilwa road. Tong'omba is only accessible between June and December due to seasonal flooding of the Rufiji River, and then only by 4WD vehicle.

The reserve is underlain by Jurassic sediments giving rise to a highly dissected topography between 150-540m a.s.l. Tong'omba is characterised by sinuous forested ridges and steep sided, narrow valleys naturally supporting moister riparian forest.

District Forestry Office in Kilwa Masoko, Local Forestry Officer in Kipatimu.

SOILS

Sandy loams on ridge-tops and upper slopes derived from superficial red Neogene sands and underlying parent sandstone. Where exposed these soils are rapidly eroded and subject to laterisation. Black cotton Vertisols (FAO/UNESCO) are found in some valley bottoms (Moore, 1961). Sandy soils predominate in Riparian forest areas, partly derived from alluvial deposits.

CLIMATE

Generally a tropical East African oceanic climate, subject to orographic rainfall from westward moving moist sea air. Tong'omba experiences a 6 month dry season (mid-May to mid-December) and corresponding 6 month wet season. October is the warmest month, and June is the coolest.

VEGETATION

Tong'omba contains three true Coastal Forest types, combined with a variety of other vegetation types; these merge in places, resulting in a range of indeterminate forms.

Hill species; *Tabernaemontana pachysuohou* and typical groundwater *ssp. Khaya anthotheca* and *Milicia excelsa*.

River species; Moist riverine characteristic *spp. sterculia appendiculata, Milicia excelsa*.

Ridge-top ground water forest (to 30m) has affinities to Zanzibar-Inhambane Lowland Rainforest (White, 1983). At lower altitudes dry evergreen forest with a lower canopy (15m) merges with scrub forest (to 7m). These may be considered a mosaic of Zanzibar-Inhambane Undifferentiated Forest. High canopy riparian forest (30m) follows the watercourses. In all types of forest epiphytes are found and creepers are abundant, especially in naturally disturbed areas.

TIMBER VALUES

Numbers of commercial timber trees such as *Pterocarpus angolensis* and *Milicia excelsa*, have been reduced by locally based logging operations. Mature specimens of hardwood species do still exist within the reserve but their scattered distribution and relative inaccessibility renders removal commercially unviable.

The southern areas of the reserve, around Kibata, have been planted with the introduced species Mpili.

BIODIVERSITY

Tong'omba supports three coastal forest vegetation types, which along with the variety of other vegetation types provide a wide range of exploitable habitats. The low level of anthropogenic disturbance suggests a habitat stability, reinforced by the high level of faunal diversity within the reserve.

Further identifications are awaited on plant, vertebrate and invertebrate specimens to fully determine the conservation value of this reserve.

CATCHMENT VALUES

Tong'omba Forest Reserve gives rise to two perennial tributaries of the Hanga River and several seasonal streams, which supply water to surrounding villages. The forest blankets slopes of over 40°. This site can be considered as having a significant catchment effect.

HUMAN IMPACTS

Logging: Legal logging activities were suspended after the forest was gazetted in 1953. In 1987, Kilwa District forestry office granted permission to the chairmen of Mwenge and Pungutini CCM to authorise logging of 50 trees each year. The chairman of Kibata CCM was granted similar permission in 1989 and selective logging began in 1991. Levels of extraction are low, with *Milicia excelsa* being the favoured species. However exploitation is likely to increase with the completion of the Lindi road (1993/5), improving access to the area.

Agriculture: Local people in the Kibata area are primarily subsistence farmers, though some cash crops are grown. According to local sources cotton and coffee were grown during German colonial times. Some agricultural encroachment is occurring along the north-west and southern edges. Local information suggests that there is much fertile land available outside the reserve.

Hunting: All hunting activities are illegal within the reserve and the local game officer is responsible for the extermination of game animals deemed to be a threat. A charge of 10,000 Tsh. is made for this service and this makes it too expensive for local villagers. Some evidence of hunting was seen within the reserve, mainly snares set for bushpig and small antelopes. Rock Hyrax (*Heterohyrax brucei*) are trapped as a local delicacy and Sykes' Blue Monkey are occasionally hunted as an agricultural pest.

Game numbers within the reserve used to be higher but poaching has reduced populations of leopard and buffalo to minimal levels. Kipatimu is recognised as one of the forwarding posts of illicit game produce from the Selous Game Reserve and surrounding areas. The proximity of Tong'omba to this village results in a higher hunting pressure.

Pole cutting: Some pole cutting along forest paths was evident, apparently carried out by those living on the forest edge. No significant damage has resulted from this small scale exploitation.

Local people collect bark, honey, rubber, incense, traditional medicines and some fruit from the forest.

MANAGEMENT RECOMMENDATIONS

Clearly demarcate the reserve boundary and ensure it is printed on the next publication of the Ordnance Survey topographical map of the Kipatimu area.

Employ permanent forest guard(s) to enforce reserve boundaries, deter illegal logging and poaching. This should be carried out in conjunction with the development of local projects to increase the awareness of forest conservation.

Investigate the feasibility of hardwood/exotic plantations outside the reserve to provide local villages with an alternative source of income and timber. Possibly create a buffer zone in the reserve for sustainable extraction of forest products for local use.

Check any further development of tracks or roads within the forest boundaries.

Review and enforce the timber licensing and land acquisition system: and ensure there is a clear policy from government to village level.

Execute a public awareness programme to increase local understanding of forest conservation and catchment effects. Combine with local schemes to develop sustainable agricultural systems and possibly a tree seedling nursery.

Encourage and facilitate further scientific research at the site.

Investigate the viability of game corridors linking the reserve with the game rich areas to the South.

TONGWE FOREST RESERVE

DESCRIPTION

NAME: Tongwe Forest Reserve
Muheza District, Tanga Region

AREA: 7,467ha (74.67km²)

BOUNDARY LENGTH: 15km

STATUS: Catchment Forest Reserve

MAPS: Ordnance Survey Topographic Maps:
1:50,000 Series Y742 Sheet 130/3 Hale
Shows incorrect Forest Reserve boundary
Boundary Map JB 271

LOCATION

Grid ref: 5°18'S, 38°44'E

15km west-south-west of Muheza, 30km inland from the Indian Ocean. Nearest village is Kwabada, 2km to the south.

District Forestry Office is in Muheza. District Catchment Forestry Office is in Amani.

Access by dirt track from Muheza or from main Dar es Salaam-Tanga road, through the Kwafungo Sisal Estate. Loggers tracks lead from Kwabada to base of the hill. All tracks are bad in wet weather.

Nearest railway station is in Muheza.

The reserve covers the isolated peak of Mount Tongwe, an outlier from the main East Usambara block, with an altitude in the range of 220-648m (Lovett & Pocs, 1992).

SOILS

Reddish brown soils, can be classified under the FAO/UNESCO system as ferralsols. "Black Cotton" soil on the lowlands.

CLIMATE

Tropical East African oceanic climate with two wet seasons (December-January and April-June). Annual rainfall reaches approximately 1300mm but, according to local sources, this figure used to be higher until the early 1980's with the area previously experiencing three rainy seasons.

VEGETATION

The site incorporates 3km² of forest, some of which can be classified as Zanzibar-Inhambane Undifferentiated Forest Type (White, 1983) and some as Lowland Rainforest. Within these, three distinct forest vegetation communities can be identified, these being: Dry Evergreen Forest, predominant below 400m, Semi-Evergreen Forest, predominant from 450-550m, and Moist Evergreen Forest, predominant at altitudes over 550m. Forest is surrounded by woodland (to 10m tall) and wooded grassland. The south western peak is grassland.

Canopy height varies from 15 to 20m, with emergents to 30m. Trees include *Aningeria pseudoracemosa*, *Antiaris*, *Barringtonia*, *Bequaertiodendron natalense*, *Bombax*, *Cola scheffleri*, *Dryptes usambarica*, *Isobertinia scheffleri*, *Macphersonia*, *Pachystela msolo*, *Pandanus*, *Parkia*, *Pterocarpus mildbraedii*, *Sorindeia*, *Scorodophloeus*, *Sterculia appendiculata*, *Tabernaemontana pachysiphon*, *Terminalia sambesica* and *Trilepisium*. A shrub layer of varying density and height contains *Cycads*, *Crotonognopsis* and *Draceana deremense*. Herbs include *Olyra latifolia* and *Saintpaulia sp.*

TIMBER VALUES

Mount Tongwe has been logged extensively in the past, mostly for the species *Milicia excelsa* and *Bombax rhodognaphylon*. *Pterocarpus mildbraedii*, *Isobertinia scheffleri* and *Sterculia appendiculata* are also felled for timber. Few examples of commercial species remain in the forest, rendering its value as a source of timber low.

BIODIVERSITY

Zanzibar-Inhambane Undifferentiated forests are known to be important centres of biodiversity. However, studies carried out on Mt. Tongwe to date indicate that species diversity is not as high as might be expected. This may be due to heavy human disturbance of the reserve in the past and its isolation from similar sites which would provide a source of regeneration for plant and animal species.

Mt. Tongwe's position between the East Usambara forests and the larger Coastal Forests further south means that it contains examples of both vegetation types. Species of restricted distribution include *Cola scheffleri*, *Crotonognopsis usambarensis* and *Saintpaulia tongwensis*.

CATCHMENT VALUES

The reserve became part of the NORAD/FBD Catchment Forestry Plan in 1990; a scheme under which all forests close to streams or on slopes of over 40° are protected from over exploitation. Several seasonal water courses arise from the site. The reserve supplies surrounding villages and Kwafungo Sisal Estate with ground-water.

HUMAN IMPACTS

Logging and fires have reduced the size of both the forest and woodland within the reserve.

Fire used to be a common method of flushing game animals out of the bush. The dense, convoluted boundary of the forest and lack of woodland in some areas may suggest past uncontrolled burning.

No logging licences have been issued since 1990 but there is evidence that illegal tree felling and pit sawing has subsequently taken place.

The woodland is used by locals as a source of firewood and medicinal plants.

There is no human settlement within the reserve boundaries but part of the Kwafungo sisal estate encroaches into the northern part of the reserve.

There is a danger that agricultural land shortages in the area may force locals to encroach on reserve land.

MANAGEMENT RECOMMENDATIONS

Re-plant the woodland buffer zone in areas where it is lacking (especially on the northern side of the mountain).

Provide local people with an alternative source of land for agriculture, firewood and building materials.

Investigate the feasibility of using the woodland within the reserve for some form of mutually beneficial agricultural activity.

Ensure the continued integration of the forest reserve within the NORAD Catchment Forestry Plan.

Ensure, through education and public awareness programmes, that the locals are aware of the role that the forest plays in climate regulation and water supply.

Employ a guard to ensure the locals recognise and respect the reserve boundary and enforce the ban on logging, hunting and cultivation.

Encourage the re-integration of game animals into the area through the creation of corridors linking Tongwe with the Pangani River area. This would mean an indirect link with the East Usambaras which would benefit the biodiversity of the area.

Construct more dams around the reserve both to satisfy local water needs and to encourage game back to the area.

Monitor the status of the reserve and keep the D.F.O informed of its condition and needs.

Promote scientific research on the site.

VIKINDU FOREST RESERVE

DESCRIPTION

NAME: Vikindu Forest Reserve
Kisarawe District, Coast Region

AREA: Approx. 1,796ha (17.96km²)

BOUNDARY LENGTH: Approx. 22.45km

STATUS: Productive Forest Reserve
(Designated in 1947)

MAPS: Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 186/4 & 186E/3 1987
Boundary Map 1:10,000 JB601 1964

LOCATION

Grid Ref: 39°17'E, 6°59'S

Approximately 17km south-south-west of Dar es Salaam and 0.5km north-west of the village of Vikindu.

District forestry Division HQ at Kisarawe, local forestry officer based at Vikindu.

The main Dar es Salaam-Kilwa road passes through the east of the reserve.

Vikindu Forest is located on relatively flat land between 40-80 m a.s.l, approximately 15 km inland from the Indian Ocean.

SOILS

Clay bound sands and gravels over parent materials of Miocene to Pliocene age.

CLIMATE

Generally a tropical East African oceanic climate with oceanic temperatures. Subject to prevailing easterly winds. No annual rainfall or temperature figures are recorded for Vikindu. Rainy periods are between October - December and April - June.

VEGETATION

Vikindu Forest Reserve has been largely converted to plantation, though native trees and shrubs remain along water courses (Hawthorne, 1984). Surviving areas of natural forest are regenerating and if left, high forest will be re-established as agricultural encroachment is minimal (Burgess, 1990). Little information is available on species composition of the remaining areas of natural forest, though *Diospyros mafiensis* is recorded from open grassland as "a very common tree" (Hawthorne, 1984).

TIMBER VALUES

Between 1948 - 1962, approximately 1,366ha (75%) of the forest area was re-planted with exotic species; primarily *Cassia siamea* but also the Eucalyptus species *E. saligna* and *E. camaldulensis* and to a lesser extent *Tectona grandis*. These re-planted areas were logged during the late 1980's, and the current timber values of the remaining stands are low.

BIODIVERSITY

There has been no detailed study of the birds and fauna of Vikindu, hence it is difficult to fully assess its scientific importance. However, the possibly endemic *Warburgia elongata* and the rare *Tristemma schliebenii* have been recorded for the site. At least 28 species of forest bird have been identified including the threatened Sokoke pippit.

CATCHMENT VALUES

Vikindu acts as a catchment for the Bunguni River, a tributary of the Mzinga River, and a number of permanent water courses arise within the reserve.

HUMAN IMPACTS

The entire forest was selectively logged for trees of commercial value prior to independence. By 1964, 75% of the forest reserve had been re-planted with exotic species to establish fuel supplies for Dar es Salaam, commercial logging is currently taking place.

The remaining patches of natural forest are concentrated along water courses and exploited by local people for timber, poles and charcoal (Burgess, 1990).

MANAGEMENT RECOMMENDATIONS

A quantitative study to assess the current extent and species composition of plantation areas.

Regulate all logging to ensure it is licensed and that licenses are appropriate for species being felled.

A detailed study of remaining natural forest to determine extent, species composition and conservation value.

Minimise disturbance of remaining natural forest by encouraging tree planting around villages as alternative sources of wood for local requirements. Increase conservation awareness via local education programmes.

ZARANINGE FOREST

DESCRIPTION

NAME: Zaraninge Forest (also Kiono, Kiona, Mkange, Miono).
Bagamoyo District, Coast Region

AREA: Approx. 2,100ha (21km²)

BOUNDARY LENGTH: Approx. 58km

STATUS: Lies within Zaraninge Proposed Forest Reserve
(Designated in 1958)

MAPS: Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 168/1 1986/7
(Shows incorrect proposed reserve boundaries)
Boundary Map 1:25,000 JB2140 1987

LOCATION

Grid Ref: 6°9'S 38°36'E

Approximately 50km north of Bagamoyo, 20km southwest of Sadaani and 20km northwest of Wami (see Map 1).

Forestry Officer in Miono. District Forestry Office in Bagamoyo.

Access by road via Miono-Sadaani road. Some 30km after Miono a minor track to the right leads to Mbwebwe village and Zaraninge Forest. The forest can also be reached by road from Wami.

The Northern Railway line has stations at Matipwili (Wami) and 10km inland of Sadaani (Mvavi), however there is no public transport to the forest itself.

The forest covers a plateau on the edge of the coastal plain with an altitudinal range of 100m to 300m.

The proposed boundaries are currently marked by frequent trenches along the southern and western boundaries while the Miono-Sadaani road marks the northern boundary and a stretch of the Northern Railway line forms the eastern boundary.

SOILS

Plateau: Fairly homogenous sandy soil present in all areas with a thin dark humus layer.

Wetland: Similar, although underlying peaty clay exposed in areas where pools have formed.

Lower Plateau Slopes: Sandy soil with numerous small quartz pebbles and frequent carbon fragments from past fires.

CLIMATE

Generally a tropical East African oceanic climate with oceanic temperatures. Subject to orographic rainfall from westward moving moist sea air with a four month dry season (June - September). No average yearly rainfall figures known, however, only 29.5mm of rain were recorded between 28 July and 18 August (dry season) (Cockle and Dickinson, 1992). Mean maximum temperature was 26.5°C during the same period with an average minimum temperature of 20.8°C.

VEGETATION

Homogeneous semi-deciduous coastal monsoon forest found on plateau with a different forest type growing on plateau sides. This gives way to lowland wooded grassland in the surrounding coastal plain (see Map 3). The forest holds a small depression containing wetland vegetation. This displays an interesting ecotone with succession from open sedge wetland vegetation through woodland to forest vegetation.

The forest has a fairly closed (80% cover) 20m canopy with two distinct understorey layers at 10-15m and 3m. Dead wood accounts for approximately 15% of all wood present.

Much of the woodland linked to the eastern edge of the forest appears to be undergoing succession to forest.

There is an area of high treefall density to the east of the wetlands where many trees have fallen and this is thought to be the result of a prolonged drought period in the 1970s which weakened certain species, these were then brought down in a later cyclone/storm.

Substantial buffalo and warthog disturbance has been observed in the wetlands.

TIMBER VALUES

Due to selective logging in the past, few large commercially valuable trees remain and there appears to be little scope for future exploitation.

BIODIVERSITY

Zaraninge has a high level of biodiversity in comparison to other coastal forests and contains 3 endemic plant species. It is one of the larger coastal forests currently known in Tanzania, containing approximately 10% of the country's total known area of coastal forest. The forest supports at least 12 globally scarce species and many species of national interest. Thus as a typical example of its vegetation type along with the fauna this holds, Zaraninge is a valuable pool of genetic resources and a site of great scientific interest.

CATCHMENT VALUES

The forest lies within the catchment of the Wami River. No permanent running water courses present, although a few small seasonal channels exist. The site is an important seasonal watershed. Several permanent ponds are found in the wetland depression. The water table in the depression appears to lie beneath an impermeable layer of clay with pools forming on top of this. Two permanent water-holes exist just outside the forest close to Gongo and Mbwebwe, providing water for local use.

HUMAN IMPACTS

The vast majority of the forest appears almost natural, although there has been logging activity in the past. Selective logging was carried out between the 1950s and 1985. This began after the completion of the Miono-Gongo-Wami road through the forest. Legal logging activities have been suspended since 1985 but some timber removal has taken place since then.

The forest edges are known to have been cultivated in the Gongo and Mbwebwe areas since the early twentieth century. There was a move to relocate all inhabitants from these areas during the Government-backed "Ujamaa" villagisation programme in 1976. However, some families in Gongo resisted and remained in the village. Since 1980 and the relaxation of "Ujamaa", other families have also moved into the Gongo and Mbwebwe areas. Since Gongo lies within the current proposed reserve boundaries their presence in the area is currently under review for a second time.

Recent encroachment for cultivation is focused on Gongo where approximately 100ha of former forest have been cleared.

The local villagers collect building materials (poles and lianas), fuel wood, traditional medicines, and "Sandarusi" gum from the forest - all appear to be exploited for local use alone. However, pole removal around Mbwebwe is significant and possibly abundant.

MANAGEMENT RECOMMENDATIONS

To clarify the reserve status (ie. gazettelement) and preserve the site as one of the best of its type remaining in Tanzania.

To manage the forest under a modified version of the zonation system prescribed for catchment forests (see Akitanda, 1991). Map 5 shows proposed management zones for the reserve.

To remove the inhabitants of Gongo from within the proposed boundaries; either through relocation or by re-drawing the boundaries to exclude the village.

To clarify the reserve boundary and complete boundary demarcation; possibly by clearing and tree planting.

To repair any human modifications to the site and control any further damaging activities by establishing on-site forest guards. Cleared and disturbed areas may either be re-planted or encouraged to regenerate through weeding.

To carry out and foster research on the site, to encourage visitors and tourists to the site to increase awareness of the importance of conserving such forests, and to investigate the possibility of establishing a Study Centre on the site with educational, recreational and research facilities.

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