

COASTAL FOREST RESEARCH PROGRAMME

STATUS REPORTS FOR 11 COASTAL FORESTS

IN

COAST REGION, TANZANIA

G. P. CLARKE & A. DICKINSON

AUGUST 1995



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 University of Dar es Salaam

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 and Coastal Forests. The projects have been developed with the assistance and collaboration of Regional and District Authorities and of The Ministry of Tourism, Natural Resources and Environment. The findings of the Project are summarised in a series of reports published jointly by the University of Dar es Salaam and the Society. More formal scientific papers resulting from research are published in appropriate journals, thus ensuring wide dissemination of the information.

The Coastal Forest 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 for farmland. Their status, distribution and biological character were extremely poorly known prior to 1989 when the Frontier-Tanzania Coastal Forest Research Programme was formed with the aim of surveying these forest 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, and collects plants, vertebrates and invertebrates with studies of the ecology of key species. It is intended that this information be used by conservationists and foresters to secure a sustainable long-term development of Tanzania's Coastal Forests.

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Published by: The Society for Environmental Exploration/The University of Dar es Salaam.

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Citation: Clarke, G.P. & Dickinson, A. (1995). *Status Reports for 11 Coastal Forests in Coast Region, Tanzania*. Frontier-Tanzania Technical Report No. 17. The Society for Environmental Exploration, U.K./The University of Dar es Salaam, Tanzania.

Pbk. ISSN: 0960 - 2437

Available from: The Society for Environmental Exploration, 77 Leonard Street, London EC2A 4QS, UK
Frontier-Tanzania, P.O. Box 9473, Dar es Salaam, Tanzania.

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.

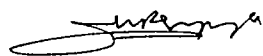
In Africa there are many areas of exceptional biological richness which have scarcely been studied. Even basic data on the status of resources may be lacking or outdated.

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.

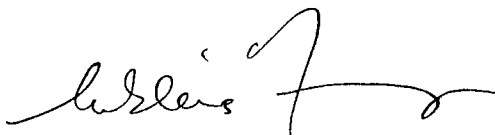
In 1989 Tanzanian scientists identified ecosystems in coastal Tanzania which were in particular need of study because of their biological richness and importance. Since that time, the Frontier-Tanzania project has provided the means and the man-power to investigate these sites, catalogue their importance 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.

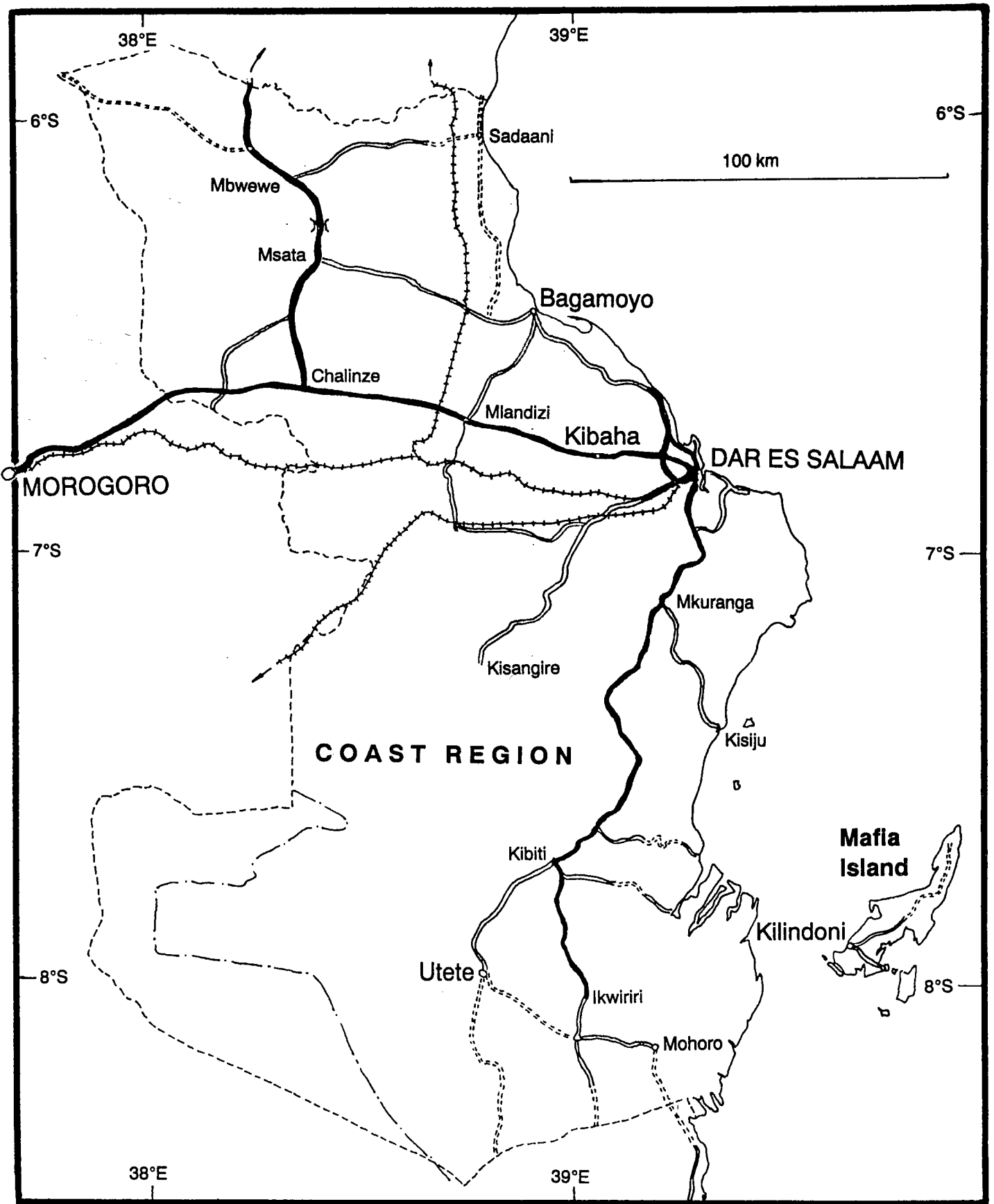
This report series forms a contribution to the Frontier-Tanzania project and to the knowledge of the biological diversity of Tanzania. We warmly endorse its publication and hope that many more reports and papers result from this collaborative project, and that they help to assure that the future of the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



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CONTENTS

	Page
INTRODUCTION	1
THE STATUS REPORT FORMAT	2
SOURCES OF ADDITIONAL INFORMATION	5
NOTES ON THE FORESTS OF COAST REGION	7
KAZIMZUMBWI FOREST RESERVE	11
KISIJU FOREST	19
KIWENGOMA FOREST RESERVE	25
MCHUNGU FOREST RESERVE	33
MRORA FOREST, MAFIA ISLAND	39
NAMAKUTWA-NYAMUETE FOREST RESERVE	47
PUGU FOREST RESERVE	53
RUVU NORTH FOREST RESERVE	63
RUVU SOUTH FOREST RESERVE	69
VIKINDU FOREST RESERVE	77
ZARANINGE (KIONO) FOREST RESERVE	83
APPENDIX : PANDE GAME RESERVE [DAR ES SALAAM REGION]	91
APPENDIX : KIMBOZA FOREST RESERVE [MOROGORO REGION]	97
BIBLIOGRAPHY	105
MAP KEY	113

INTRODUCTION

This report forms part of a set of three volumes summarising the findings of the Frontier-Tanzania Coastal Forest Research Programme during the first phase of its operations from July 1989 to April 1994. During this period visits ranging from two days to six months were made to 27 Coastal Forests, where general biological surveys were conducted and assessments made of the extent and condition of the forests. Apart from the forest on Chumbe Island (which is dealt with separately - see Stubblefield & Bayliss, 1994), all of the other forests are included in the three Status Report volumes, which cover each of the administrative regions visited - Tanga Region, Coast Region and Lindi Region, with Pande Game Reserve in Dar es Salaam Region and Kimboza Forest Reserve in Morogoro Region included as an appendix to the Coast Region volume. Some of the information for the forests presented here has been condensed from the more detailed *Site Report and Conservation Evaluation* documents produced as internal reports by the Frontier-Tanzania Coastal Forest Research Programme. Additional information from collections and visits by other scientists has been added where available.

These Status Reports are intended to present a concise summary of the key facts on the biological values, status, recent history and current management of the forests. It is hoped that these reports will be of assistance to conservationists for evaluating the importance of the forests, and to provide the necessary information for setting plans to support their future management. Final editing of the Status Reports was carried out under a separate project set up by Sarah Woodward and Jason Rubens of the Society for Environmental Exploration. Funding for the final editing and publishing of these reports was generously provided by NORAD through the Royal Norwegian Embassy of Dar es Salaam, with additional assistance from the British Council. Earlier drafts for the forests covered in this volume were produced by Clare Ansell, Michael Brewin, Anya Cockle, Paul Matthews, Paul Smith and Leigh Stubblefield as well as by the editors. A draft version of the three volumes of the Status Reports was reviewed by Prof. K.M. Howell of the Department of Zoology & Marine Biology, University of Dar es Salaam.

The Coastal Forest Research Programme has been assisted throughout its operations by a number of taxonomists who have identified the material collected. Particular thanks to Dr. D. Kock of the Forschungsinstitut Senckenburg for identifying rodent and bat specimens; to Dr. P. Jenkins of the British Museum of Natural History for identifying shrew specimens; to Dr. D.G. Broadley of the Natural History Museum of Zimbabwe for identifying reptile specimens; to Prof. J.C. Poynton of the British Museum of Natural History for identifying amphibian specimens; and to Dr. K. Vollesen of the Royal Botanic Gardens, Kew for identifying plant specimens. Notes on bird identifications were provided by N.E. Baker of BirdLife-Tanzania.

The Status Report Format

The Status Reports follow a similar format to the 'Management Summaries' (Lovett & Pocs, 1993) as used by the Catchment Forestry Project of the Forestry and Beekeeping Division, Ministry of Tourism, Natural Resources and Environment, Tanzania, but have been expanded to provide more detailed information on the biological values of the forests. In addition, the Management Proposals section has been replaced with a commentary on the Conservation Issues relevant to each forest, since the purpose of the Status Reports is to provide a source of information rather than a management formula for the forests concerned.

The biological information presented in these Status Reports is not definitive and reflects the level of collection and study carried out at each site, as well as the time of year in which the research was conducted (collections in the dry season are generally less productive than during the rainy season).

The following approach has been adopted for the Status Reports :

Description

Name of the forest/forest reserve, with name spelt as in the official gazette notice where applicable. Variations in the official spelling are indicated.

Administrative location of the forest/forest reserve by district and region.

Area of the forest reserve and/or forest.

Boundary length for forest reserves only.

Status of the site, who owns/manages the forest on it.

Declaration details of forest reserves within Tanzanian (Tanganyikan) Law. Many forest reserves originally gazetted during the German administration have had to be re-declared to introduce them into the legal framework established after 1916 by the British Administration. In practice much of this was done in 1947 under Cap 132 of the forest ordinance.

Year of establishment where available for forest reserves. Details of original gazette map or order where known.

Map information. Ordnance Survey 1:50,000 maps covering the area of the forest/forest reserve are listed. These are useful for background mapping information on features which are unmistakable from aerial photos such as topography, rivers, roads, tracks, towns, and in most cases the smaller settlements, although a few maps have not been updated following the 'Ujamaa' villagisation programme of the early 1970s during which many settlements were moved. Where applicable notes on errors in the location of the reserve boundary are mentioned. The maps used for the reports have been traced from these Ordnance Survey maps, with the forest reserve boundaries and forest cover superimposed.

Forestry Division maps with their Jb number, scale and date. It should be noted that some of the very early maps contain errors due to the chain and compass survey method used, which can induce horizontal distance errors by failing to account for hillslopes.

Location

Latitude and longitude determined from 1:50,000 Ordnance Survey maps.

A general description of the location of the forest/forest reserve in the context of the surrounding landscape with elevation/altitudinal range and rough notes on the location of forest areas within the forest reserves where applicable. Approximate distances in kilometres from the nearest towns and villages.

Information on how to reach the forest/forest reserve by road, with notes on road conditions.

Information on how to reach the forest/forest reserve by public transport.

Soils

A brief description of the soils in the forest/forest reserve using the UNESCO soil classification system where samples have been taken.

Climate

Estimates of rainfall from the nearest available rainfall station.

Vegetation

Vegetation description following the UNESCO *Vegetation of Africa* classification (White, 1983) for the main formation types such as grassland, woodland, forest etc., as well as for the formation sub-types such as scrub forest, transition woodland etc.

A brief list of tree species, with names that follow the nomenclature of the *Flora of Tropical East Africa* for those families that have been published. Tree species from published sources (where available) and from collections by the Frontier-Tanzania Coastal Forest Research Programme (specimens identified at the Royal Botanic Gardens, Kew).

Catchment Values

A brief description of the catchment values of the forest/forest reserve is given, based on qualitative observations of slopes, streams and rivers in the forest/ forest reserve.

Timber Values

A brief description of the timber values of the forest/forest reserve is given, based on the occurrence of tree species currently in demand for commercial timber.

Biodiversity

A brief note is provided on the level of biological study carried out in the forest, to give an indication of how representative the list of rare and endemic species is compared with a list that would be produced by an exhaustive biological survey. For most of the forests it is expected that further study will increase the known biological value of that forest, through the discovery of additional regional and local endemic species.

In order to keep the Status Reports as concise as possible, it has been decided to limit the cited biological values to endemic species only, since in many cases over 75% of the flora and fauna of a Coastal Forest is composed of species that are widespread in distribution. Thus records of the occurrence of such species are of little value to conservationists. Information on the endemic vertebrate species occurring in each forest is taken from draft chapters of Burgess & Clarke (ined.), Burgess & Muir (1994) as well as from the data sheets from the Frontier-Tanzania collections and of other collections managed by Prof. K.M. Howell of the Department of Zoology and Marine Biology, University of Dar es Salaam. Information on endemic plants is taken from all the hitherto published volumes of the *Flora of Tropical East*

Africa, together with more recent information from the Frontier-Tanzania botanical collections, from Robertson & Luke (1993), Bidgood & Vollesen (1991), Beentje (1988) and Luke (1988).

Endemic species are cited in order of their range; single site endemics are listed first as the most important since the loss of that particular forest would lead to the extinction of those species. Area endemics are listed for the plants section where applicable for the three areas where there appears to be a local flora that is restricted to the nearby forests - three such areas are cited for the forests around Dar es Salaam, for the forests inland of Lindi and for the forests in the lower Pangani River basin. Coastal Forest endemics are listed for species that are limited to the Coastal Forests (including those in southern Somalia, Kenya, Mozambique, southern Malawi and eastern Zimbabwe), although for the plant species this list is restricted to those species that are only known from fewer than seven Coastal Forests. An exhaustive survey of botanical records in the major herbaria of the world would be required to generate a full list of Coastal Forest plant endemics for each forest.

Specimen collection numbers/citations are listed where known. The vertebrate specimens collected by the Frontier-Tanzania Coastal Forest Research Programme have a KMH number as they form part of Prof. K.M. Howell's collection series.

Information on the biological values has been limited to the vertebrate orders and the vascular plants, since it is usually only these biological groups that are of interest to conservationists in setting priorities. Endangered and commercially threatened species that are present in the forests/forest reserves are also listed (threatened birds according to the latest BirdLife list of endangered species (Collar *et al.*, 1994); threatened mammals, reptiles and amphibians according to the latest IUCN (Groombridge, 1993) and CITES (1995) lists). Only CITES Appendix 1 species (on which there is a prohibition on international trade) are listed. CITES Appendix II species which are found in the Coastal Forests include the following :

- Mammals : All cats (Felidae), all primates, and all Pteropus bats (i.e. *Pteropus seychellensis* on Mafia Island).
- Reptiles : All tortoises (Testudinae), all pythons (Boidae), all monitor lizards (Varanidae), and the chameleon genera *Bradysiphon* and *Chamaeleo*.
- Plants : All Euphorbias (*Euphorbia* spp.), all Aloes (*Aloe* spp.), all milkweeds of the genus *Ceropegia*, and all orchids [Orchidaceae]. Refer to CITES (1995) for further details on the levels of restrictions regarding export of these plants.

Mammal names follow Wilson & Reeder (1993).

Human Impacts

A brief description of current human disturbance and pressure on the forest is given, together with notes on former disturbance where known.

Conservation Issues

A summary of the present management activities being carried out in the forest is given, together with the present and expected future threats to the forest. Although a number of conservation strategies exist which would be more or less common to all the forests (such as the provision of extra guards, clearing the boundaries, replanting cleared areas etc.) these have been omitted since the precise choice of a conservation plan for the forests is considered to be outside the scope of this report, and in any case is dependant on the level of funds available and of the conservation objective of the management body.

Literature

Literature on the biological values of the forest is listed as far as possible with a commentary summarising the content of that literature. General literature on the Tanzanian Coastal Forests, such as Burgess & Muir (1994) is omitted, as a list of these sources of information is provided in the next section.

SOURCES OF ADDITIONAL INFORMATION

Additional information on each biological group listed in the Status Reports is available from Burgess & Muir (1994) as well as from the following sources :

Birds

A full list of forest bird species found in each of the forests (with the exception of Ruawa and Ndimba) will be published under the following reference :

Mlingwa, C.O.F., Waiyaki, E., Bennun, L. & Burgess, N.D. (ined.) Birds. Chapter 8 in : Burgess, N.D. & Clarke, G.P. (eds.) *Coastal Forests of eastern Africa: status, history, biodiversity and conservation*.

Further information is available from the Tanzanian Bird Atlas database being compiled by Neil & Liz Baker, P.O. Box 23404, Dar es Salaam, Tanzania; and after 1996 from the Important Bird Areas project being carried out by the Wildlife Conservation Society of Tanzania (P.O. Box 70919, Dar es Salaam, Tanzania) in partnership with BirdLife International of Cambridge, U.K.

Mammals

A full list of mammal species found in each of the forests (with the exception of Ruawa and Ndimba) will be published under the following reference :

Burgess, N.D. & Cockle, A. (ined.) Mammals. Chapter 7 in : Burgess, N.D. & Clarke, G.P. (eds.) *Coastal Forests of eastern Africa: status, history, biodiversity and conservation*.

Data sheets of mammal specimen collections as well as of observations by the Frontier-Tanzania Coastal Forest Research Programme are available for reference at the Department of Zoology & Marine Biology, University of Dar es Salaam and at the offices of the Coastal Forest Research Programme in Dar es Salaam (Plot 709, Mfaume Road, Upanga).

In future further data will be available from a biological inventory database being set up at the Department of Zoology & Marine Biology of the University of Dar es Salaam under funding by the FAO/GEF biodiversity support project. This database will incorporate the Frontier collections as well as those by other collectors lodged at the larger museums of the world (e.g. the Museum of Comparative Zoology).

Reptiles

A full list of the forest-dependant reptile species found in each of the forests (with the exception of Ruawa and Ndimba) will be published under the following reference :

Broadley, D.G. & Howell, K.M. (ined.) Reptiles. Chapter 9 in : Burgess, N.D. & Clarke, G.P. (eds.) *Coastal Forests of eastern Africa: status, history, biodiversity and conservation*.

Data sheets of reptile specimen collections as well as of observations by the Frontier-Tanzania Coastal Forest Research Programme are available for reference at the Department of Zoology & Marine Biology, University of Dar es Salaam and at the offices of the Coastal Forest Research Programme in Dar es Salaam (Plot 709, Mfaume Road, Upanga). A further copy of these notes are lodged at the Natural History Museum of Zimbabwe, P.O. Box 240, Bulawayo, Zimbabwe.

In future further data will be available from a biological inventory database being set up at the Department of Zoology & Marine Biology of the University of Dar es Salaam under funding by the FAO/GEF biodiversity support project. This database will incorporate the Frontier collections as well as those by other collectors lodged at the larger museums of the world (e.g. the Museum of Comparative Zoology).

Amphibians

A full list of the amphibian species found in each of the forests (with the exception of Ruawa and Ndimba) will be published under the following reference :

Poynton, J. (ined.) Amphibians. Chapter 10 in : Burgess, N.D. & Clarke, G.P. (eds.) *Coastal Forests of eastern Africa: status, history, biodiversity and conservation*.

Data sheets of amphibian specimen collections by the Frontier-Tanzania Coastal Forest Research Programme are available for reference at the Department of Zoology & Marine Biology, University of Dar es Salaam and at the offices of the Coastal Forest Research Programme in Dar es Salaam (Plot 709, Mfaume Road, Upanga). A further copy of these notes are lodged at the British Museum of Natural History, Cromwell Road, London, SW7 5BD, UK.

In future further data will be available from a biological inventory database being set up at the Department of Zoology & Marine Biology of the University of Dar es Salaam under funding by the FAO/GEF biodiversity support project. This database will incorporate the Frontier collections as well as those by other collectors lodged at the larger museums of the world (e.g. the Museum of Comparative Zoology).

Vascular Plants

Further records of some of the vascular plants collected at the various forests are available from the published editions of the *Flora of Tropical East Africa (FTEA)* where type specimens and an example specimen are usually cited for each of the former administrative provinces of Tanzania. This means that in practice a lot of information is available for some of the forests from which many types have been collected (such as Litipo/Lake Lutamba and Pugu), and for certain forests which are often cited as examples of the occurrence of a species in the area (e.g. Rondo). Complete lists for each forest can however only be generated by compiling data from all plant collections ever undertaken, which would require an examination of specimens deposited at the Berlin, Kew, East African (Nairobi) and Dar es Salaam herbaria, and even then the resulting species lists would very much reflect the level of collecting intensity at each forest. Only Pugu Forest near Dar es Salaam has been studied to the level where a representative species list would be available, which would amount to some 2000 species (L.B. Mwasumbi, pers. comm.).

Copies of the FTEA are available from the Royal Botanic Garden, Kew, Richmond, Surrey.

General sources of information

The following references contain general notes on the Coastal Forests of Tanzania and information on their status and biological values :

Burgess *et al.* (1992) - General information on some Tanzanian Coastal Forests.

Burgess *et al.* (1993) - General information on some Tanzanian Coastal Forests.

Burgess & Muir (1994) - summarises the information gained on the status and biological values of the Coastal Forests from the results of a workshop on Coastal Forests held at the University of Dar es Salaam in 1993.

Hawthorne (1993) - summarises the findings of the author's PhD study on Tanzanian Coastal Forests.

Kingdon, J. (1990) - includes a chapter on the Coastal Forests which is useful background reading.

Sheil (1992) - General information on some Tanzanian Coastal Forests with a case study of Kiwengoma forest.

BACKGROUND NOTES ON THE FORESTS OF COAST REGION

Logistical considerations have meant that many more Coastal Forests have been visited by the Frontier-Tanzania Coastal Forest Research Programme in Coast Region than in other regions containing Coastal Forests, so twice as many forests are covered in this volume of the Status Reports than in the volumes on Tanga and Lindi Regions. The extra study effort in Coast Region is mirrored by work by other researchers, particularly in Pugu Forest which is only 20 km from the centre of Dar es Salaam and now just a few kilometres from the outskirts of the city.

Some areas of Coast Region are nonetheless virtually unexplored by biologists, especially in the lower Rufiji River basin and in the extreme north-west of the region, and these areas may still reveal small areas of forest that have so far eluded study. Coastal Forests and forest reserves (which may contain Coastal Forest) that are not covered in this report include the following (in approximately north to south order):

Bagamoyo District

Uzigua Forest Reserve and **Gwami Forest Reserve** in the north-east of the region. Forest may well be present on the low inselbergs within and in the vicinity of these reserves.

Pongwe Forest Reserve is known to contain Coastal Forest with *Scorodophloeus fischeri* on the large inselberg which is prominent from the main Dar es Salaam to Tanga road north of Chalinze. This forest has received some biological survey, and specimens from here are cited in the *Flora of Tropical East Africa*. Members of the Tanzania Forest Conservation Group visited the reserve in the early 1980s. The reserve was gazetted during the German administration.

Simbo Forest Reserve contains *Brachystegia* spp. (Annual Report of the Forest Department), so presumably contains miombo woodland but may also include some Coastal Forest. Plots were constructed here in 1947 to observe the effects of fire on the vegetation of the reserve.

Kikoka Forest Reserve to the west of Bagamoyo need to be investigated. A number of typical Coastal Forest plants are recorded as having been collected from Kikoka.

Kisarawe District

The **Msua Thickets** on the main road from Dar es Salaam to Chalinze contain a number of rare plant species such as *Fotoedia* and an undescribed species of *Cynometra*. The thickets are currently being intensively exploited for charcoal production, and are also the hiding place of highway robbers.

Tiny fragments of scrub forest at **Dondwe** have been found to be extremely rich in rare bird species.

Masangania Forest Reserve lies on the Pugu Hills to the south-west of Kazimzumbwi Forest Reserve, and was revoked in 1963 (Government notice 416/20/9/1963). Apparently no further forest areas exist to the south-west of Kazimzumbwi, but a visit to Masangania would still be useful to confirm this.

Kiregese Forest Reserve to the immediate west of Kisiju forest should be visited as a priority as this may contain a further area of Gum Copal forest, in which case it is likely to be similar to the forest at Kisiju. The botanist Paulo made some collections here in 1952 and recorded the presence of forest. The reserve was later revoked under the government notice 360/24/8/1962. The original German gazette map indicates that forest covered most of the reserve in 1911.

Manenda Forest Reserve is located by the main road to Lindi at the southern limit of Kisarawe District and may contain forest and/or thicket.

Rufiji District

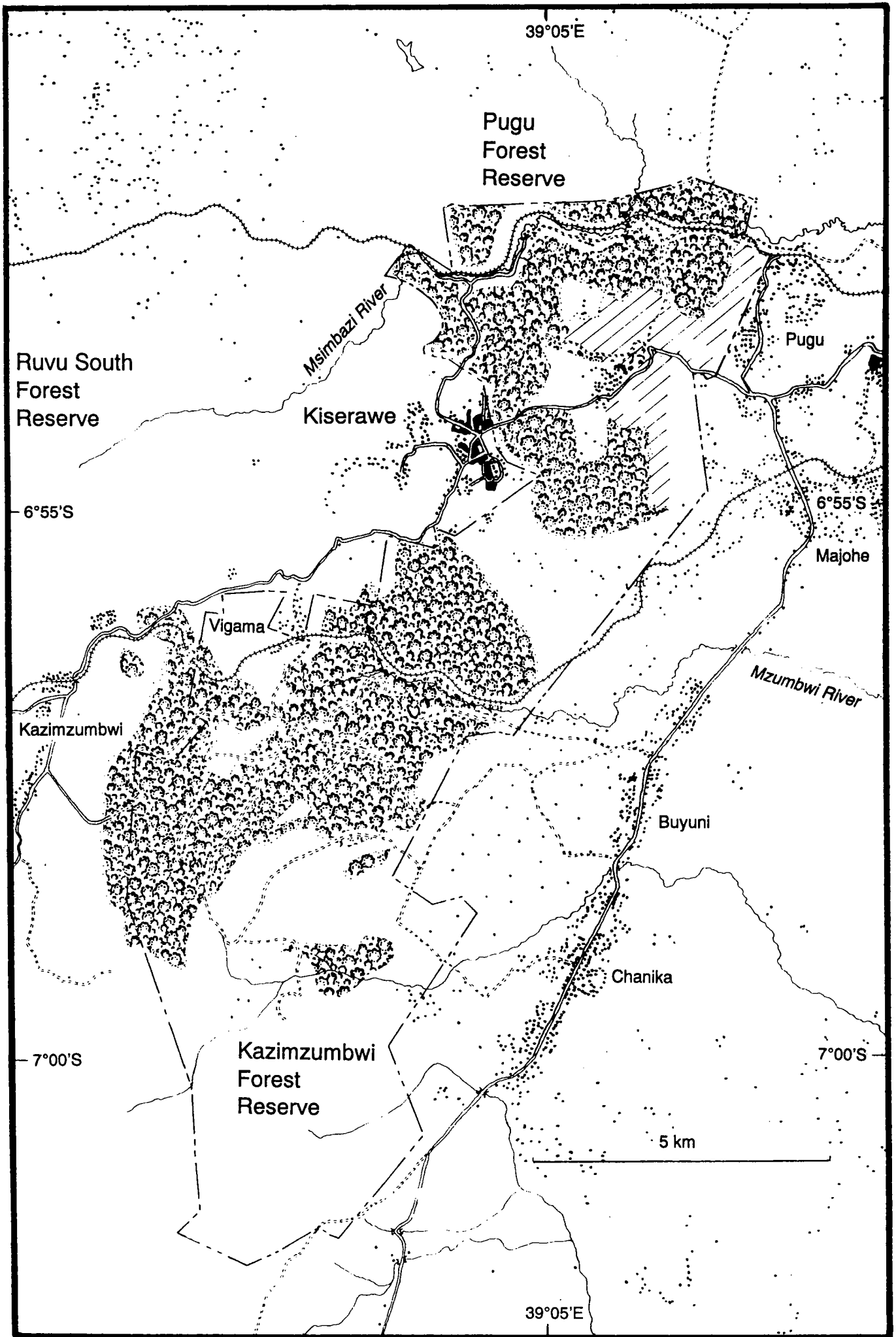
Kingoma Forest Reserve and **Mtita Forest Reserve** are located on hills near the main road from Dar es Salaam to Kibiti, and may contain forest and/or thicket.

Kikale Forest Reserve has been reported to contain many dense copses (Forest Division Records), but it is not known whether these are small patches of forest on termitaria, or whether they are remnants of a formerly larger forest. At least one small forest patch was found in 1989 (Frontier-Tanzania Coastal Forest Research Programme data).

A number of forest reserves are located in the lower Rufiji River basin and these include **Mpanga Forest Reserve**, **Mtanga Forest Reserve**, **Kipo Forest Reserve**, **Katundu Forest Reserve**, **Ngalakula Forest Reserve**, **Ruhai Forest Reserve**, **Ngumburuni Forest Reserve** and **Ruge Forest Reserve**. These forest reserves may contain riverine/swamp forest where they occur in the Rufiji floodplain, or drier forest where they occur on the escarpment edges rising above the floodplain.

Cassia and Teak plantations have been established in the **Mohoro Forest Reserve** and the **Tamburu Forest Reserve** in the extreme south-east of Coast Region. Natural forest is now regenerating underneath the exotics. The botanist Busse has collected along the Tamburu River, and Procter has collected in Mohoro forest.

The **Kichi Hills** contain a large tract of Coastal Forest that have received some botanical studies, and some of these are cited in Vollesen (1980). Similar species to those found in the Coastal Forests of the adjoining Matumbi Hills can be expected. The Kichi Hills are already known to contain the trees *Tessmannia densiflora* Harms and *Pteleopsis apetala* Vollesen, which are both restricted in distribution to the Kichi and Matumbi massif.



KAZIMZUMBWI FOREST RESERVE

DESCRIPTION

- NAME:** Kazimzumbwi Forest Reserve
Kisarawe District, Coast Region, Tanzania.
- AREA:** 4887 ha; 48.87 sq. km; 12,015 acres; 18.87 sq. miles.
- BOUNDARY LENGTH:** 38 km. Future combined Kazimzumbwi/Pugu Forest Reserve boundary length 59 km.
- STATUS:** Protective Forest Reserve.
Apparently gazetted in the 1930s (Lagerstedt, 1995).
Declaration Order 306 of 24/6/1954; superseded by Cap. 389 - supp. 59 of 1959, p. 62.
- MAPS:** Ordnance Survey topographic map 1:50 000 series Y742.
Sheet 186/3 'Kisarawe' of 1987, mapped from aerial photos of 1981.
The reserve boundary is not accurately marked on this Ordnance Survey map.
- Forest Division Boundary Map Jb 196 of 1954, 1:25,000 (two versions, 1 with vegetation)
Aerial Photo Jb 725 of 1968, 1:15,000.

LOCATION

Grid reference: 6°55'S - 7°02'S, 39°02'E - 39°04'E.

Elevation: 120 - 280 m a.s.l.

Approximately 20 km south-west of Dar es Salaam on the Pugu Hills, between 120 and 280 metres altitude. The forest reserve and the neighbouring Pugu Forest Reserve include part of what was once a much larger forest extending to within 10 km of Dar es Salaam. According to the original gazettement map, Pugu and Kazimzumbwi forests were contiguous in 1956, but had become separated by 1968 when aerial photos were taken of the area.

The TAZARA railway goes through the reserve, with a nearby station at Vigama on the western edge of the reserve.

Public transport access by bus to Chanika or Kisarawe, or by TAZARA railway to Vigama. Walk the last few km.

SOILS

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

CLIMATE

The Kazimzumbwi Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. An annual average rainfall of 1,236 mm has been recorded for Kisarawe (Howell, 1981), although the Pugu Forest Station rainfall station (6°52'S, 39°08'E, 112 m altitude) has recorded an average of 1090 mm of rainfall per year for the 31 years up to 1973, with June, July, August & September having a monthly average

of less than 50 mm rainfall during this period. A peak annual rainfall of 2385 mm and a minimum annual rainfall of 502 mm has been recorded between 1936 and 1970 from this rainfall station.

VEGETATION

The 1956 vegetation map (Forest Division Jb 196) estimates that closed forest/thicket then covered 1700 ha (17 km²) within the reserve. Present estimates from ground surveys (Frontier-Tanzania data) indicate that 23.5 km² of closed forest/thicket are now present, of which 5 km² has very few or no large trees remaining, and only 9 km² has a canopy cover of 40% or greater. A further 3 km² or more of forest lies outside the forest reserve, including some of the more intact stands (Frossling, pers. comm.).

Kazimzumbwi Forest Reserve contains four main vegetation types :

Dry Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Dry forest is present on some of the ridges and hill sides. Two distinct dry forest communities were recognised by Hawthorne (1984) in the neighbouring Pugu Forest Reserve. Tree species include *Strychnos angolensis*, *Drypetes natalensis*, *Rourea orientalis*, *Cassia petersiana*, *Zanthoxylum holtzianum*, *Cussonia zimmermannii*, *Baphia puguensis*, *Nesogordonia parvifolia*, *Vitex zanzibarensis*, *Strychnos lucens*, *Manilkara sansibarensis*, *Dichapetalum stuhlmannii*, *Cynometra* sp., *Multidentia castanae*, *Vitex buchananii*, *Pteleopsis myrtifolia*, *Grewia conocarpa*, *Pyrostria bibracteata*, *Leptactina platyphylla*, *Caesalpinia bonduc*, *Combretum pentagonum*, *Manilkara sulcata*, *Diospyros verrucosa*, *Strychnos madagascariensis*, *Salacia* sp., *Combretum apiculatum*, *Zanthoxylum holtzianum* and *Ophrypetalum odoratum*.

Two vegetation plots have been constructed on one of the ridges :

Plot 1 : Highly disturbed forest on a ridge/hilltop, 50 m x 50 m.

0.25 ha in area with 93 trees over 10 cm dbh giving an equivalent of 376 trees per ha.

Mean tree dbh 16.7 cm; mean tree height 9.9 m; mean bole height 1.8 m.

Mean basal area 8.2 m²/ha; mean stand volume 14.7 m³/ha.

Plot 2 : Highly disturbed forest on a ridge/hilltop, 150 m x 5 m.

0.075 ha in area with 40 trees over 10 cm dbh giving an equivalent of 500 trees per ha.

Mean tree dbh 20.4 cm; mean tree height 9.9 m; mean bole height 6.1 m.

Mean crown area 32.8 m²/tree; mean basal area 16.4 m²/ha; mean stand volume 99 m³/ha.

The following tree species were identified : 7 x *Mimusops* sp. (18%), 3 x *Manilkara sulcata*, *Manilkara sansibarensis* (8% each), 2 x *Grewia conocarpa*, *Millettia* sp. (5% each), 1 x *Azelia quanzensis*, *Cola* sp., *Combretum apiculatum*, *Cussonia zimmermannii*, *Ficus* sp., *Haplocoelum* sp., *Hymenocardia ulmoides*, *Salacia* sp., *Vitex buchananii*, *Zanthoxylum holtzianum*, Sapindaceae indet. (3% each). The remaining 12 trees were all different but could not be identified from sterile samples.

Riverine and Groundwater Forest [Zanzibar-Inhambane lowland rain forest (*sensu* White, 1983)]

Moist forest characteristic of conditions with an extra groundwater supply of moisture are found along the watercourses and in the steeper-sided valleys. These areas are dominated by *Antiaris toxicaria* as the most prominent emergent tree. Other trees include *Rinorea ferruginea*, *Tarenna drummondii*, *Grewia conocarpa*, *Baphia puguensis*, *Multidentia castanae*, *Trilepisium madagascariensis*, *Cussonia zimmermannii*, *Malacantha alnifolia*, *Garcinia buchananii*, *Scorodophloeus fischeri*, *Haplocoelum foliolosum*, *Azelia quanzensis*, *Vismia orientalis*, *Rauvolfia mombasiana*, *Newtonia paucijuga*, *Parkia filicoidea*, *Pachystela brevipes*, *Oxyanthus* sp. A of FTEA, *Rourea coccinea*, *Leptactina platyphylla*, *Combretum pentagonum*, *Milicia excelsa*, *Psychotria lauracea*, *Ficus sur*, *Monodora minor* and *Multidentia castanae*.

Two vegetation plots have been constructed in a valley bottom :

Plot 3 : Disturbed forest in a dry valley bottom (no running water), 50 m x 50 m.
0.25 ha in area with 148 trees over 10 cm dbh giving an equivalent of 592 trees per ha.
Mean tree dbh 16.9 cm; mean tree height 11.4 m; mean bole height 3.8 m.
Mean basal area 13.3 m²/ha; mean stand volume 50 m³/ha.

Plot 4 : Disturbed forest on the base of a hill, 50 m x 5 m.
0.025 ha in area with 11 trees over 10 cm dbh giving an equivalent of 440 trees per ha.
Mean tree dbh 24.8 cm; mean tree height 13.5 m; mean bole height 8.5 m.
Mean crown area 43.9 m²/tree; mean basal area 21.3 m²/ha; mean stand volume 181 m³/ha.
The following tree species were identified : 1 x *Albizzia* sp., *Grewia conocarpa*, *Newtonia paucijuga*,
Rinorea sp. The remaining trees could not be identified from sterile samples.

Thicket [Zanzibar-Inhambane evergreen thicket (*sensu* White, 1983)]

Dense, impenetrable thickets are present on many of the ridge tops and it is not known whether these are areas that are regenerating following intensive exploitation for fuelwood and timber, or whether they are a climax community. Tree species here include *Dichrostachys cinerea*, *Brackenridgea zanguebarica*, *Haplocoelum foliolosum*, *Bequaertiodendron magalismontanum*, *Hymenocardia ulmoides*, *Paropsia braunii*, *Keetia zanzibarica* and *Chassalia umbraticola*,

Grassland [Zanzibar-Inhambane secondary grassland (*sensu* White, 1983)]

Open grassland with a poor tree cover occurs in patches within the forest and may indicate areas that were once cleared for agriculture. These grassland areas are burnt every year. Most of the trees are small, and include 'mpingo' *Dalbergia melanoxylon*, *Canthium petersii*, *Xylothea tectensis* and *Annona senegalensis*.

TIMBER VALUES

Logging of commercial timber trees occurred up to the mid 1970s when these species became too rare to warrant further exploitation on a commercial scale. There are small trial plantations of *Cassia* and *Eucalyptus* within the forest, and there have been Rubber *Hevea brasiliensis*, teak *Tectona grandis* and pine *Pinus* 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.

BIODIVERSITY

In spite of its proximity to Dar es Salaam, Kazimzumbwi forest has received very little biological study until recently, apart from visits by the botanists Stuhlmann, Geotze, Procter, Vaughan and Wingfield. The Frontier-Tanzania Coastal Forest Research Programme conducted an ornithological survey in 1990, followed by a general biological survey in 1991.

Birds

68 bird species have been recorded (Waters & Burgess, 1990; Mlingwa *et al.*, 1993), of which 26 species are forest birds.

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.
Little Yellow Flycatcher *Erythrocerus holochlorus*.

BirdLife listed species - Southern Banded Snake-eagle *Circaetus fasciolatus* [BirdLife Near threatened].
East Coast Akalat *Sheppardia gunningi* [BirdLife Vulnerable, IUCN Rare].
Spotted Ground Thrush *Turdus fischeri* [BirdLife Endangered, IUCN Rare].

Mammals

26 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 15 bat species [18 specimens collected from 1764 net metre hours] and 3 rodent species [5 specimens collected from 1107 trap nights].

Possible Kazimzumbwi - Shrew *Crocidura* sp. ?nov. (d) det. BMNH (specimen KMH 7216 -7218?).
endemics Arboreal Dormouse *Graphiurus* sp. ?nov. det. Forschungsinstitut Senckenburg
(Germany) (specimen KMH 7215).

CITES/IUCN listed - Black-and-Rufous Elephant Shrew *Rhynchocyon petersi petersi* [IUCN Rare].
species Zanzibar Galago *Galagoides zanzibaricus* [IUCN Vulnerable].
Leopard *Panthera pardus* [CITES (1995) Appendix 1; IUCN Threatened].

Reptiles

16 forest dependant reptile species have been recorded from observations and a total collection of 28 specimens by Frontier-Tanzania.

Coastal Forest/Eastern - Bearded Pygmy-Chameleon *Rhampholeon brevicaudatus*. (Specimens KMH 7351-7353)
Arc endemics Known only from the Eastern Arc and 6 Tanzanian Coastal Forests.
Usambara Centipede-eater *Aparallactus weneri*. (Specimen KMH 7366) Known
only from the Eastern Arc and 2 Tanzanian Coastal Forests.

Amphibians

15 species are recorded by Frontier-Tanzania collections from 58 specimens.

Coastal Forest endemics - Tree toad *Mertensophryne micranotis*. (Specimens KMH 7403 etc.).
Treefrog *Africalus sylvaticus* (including intermediates with *A. brachynemis*).
Specimens KMH 7236 - 7250 etc.).
Treefrog *Leptopelis flavomaculatus*. (Specimen KMH 7231 etc.).

An experiment to determine the population density of leaf-litter frogs (*Arthroleptis* spp.) gave a preliminary estimate of 8,200 individuals per hectare in the valley bottoms and 2,500 individuals on the ridge tops (Frontier data, February 1991, from trapping out two 100 m² areas).

Plants

448 fertile botanical samples have been collected by Frontier-Tanzania from Kazimzumbwi Forest Reserve.

Possible Kazimzumbwi - *Pycneus* sp., not matched at Kew [Cyperac.] (= *Frontier* 1860)
endemics *Eragrostis* sp. ?nov., not in FTEA [Poac.] (= *Frontier* 1702 & 1887)

Kazimzumbwi area - *Tragia acalyphoides* A.R.-Sm. [Euphorbiac.] Pugu & Kazimzumbwi endemic.
endemics Cited in FTEA '2 km south of Kisarawe'.
Baphia puguensis Brummit [Fabac.] (Specimen *Frontier* 1720). Pugu.
Kazimzumbwi and Gongolamboto graveyard endemic.

Millettia puguensis Gillet [Fabac.] Pugu and Kazimzumbwi endemic. Observed to be common in the moist forest areas.

Multidentia castaneae (Robyns) Bridson and Verdc. [Rubiaceae] 2 other sites. Cited in FTEA.

Coastal Forest endemics - *Dalbergia acariiantha* Harms [Fabac.] Known only from Kazimzumbwi and 4 other sites in Tanzania. Cited in FTEA.

Canthium peteri Bridson [Rubiaceae] (Specimen *Frontier* 1718). Kazimzumbwi and 3 other sites only.

Oxyanthus sp. A of FTEA [Rubiaceae] (Specimen *Frontier* 1646). Kazimzumbwi and 3 other sites in Tanzania.

CITES listed plant - *Encephalartos hildebrandtii* A.Br. & Bouche [Zamiaceae] CITES Appendix 1.

CATCHMENT VALUES

One permanent stream arises from the forest reserve and provides a water supply for some of the 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 Dar es Salaam.

HUMAN IMPACTS

Logging

All trees of commercial timber value have been removed; according to local sources this logging finished 15 years ago.

Charcoal production

Until 1991 trees were cut 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 some areas; those sites with greater than 40% canopy cover are ones which these loggers have yet to reach. Mainly local villagers were employed to transport the charcoal to the mainroad 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 illegal loggers and charcoal burners, which has considerably reduced their activities within the forest.

Cultivation

According to local tradition, cultivation was permitted in the reserve following its gazettelement during the 1930s, when the local villagers were allowed to clear land and to farm for two seasons, probably as a cheap method for the Forest Division to clear land prior to planting exotic timber species.

The original reserve map of 1956 contained an enclave on the western side for the village of Obani, which has since been abandoned (presumably during the 'Ujamaa' villagisation programme in the 1970s). This enclave has since been incorporated into the reserve.

The forest is now under heavy pressure from agricultural encroachment into the reserve, especially from the east and the south-west. The pressure for agricultural land so close to Dar es Salaam is intense, as produce can be easily and cheaply transported to the city market. This has meant that the eviction of illegal squatters from the reserve has not

proved to be easy, and violent confrontations have taken place between the forestry officials and some of the local people in 1994 and 1995. The State Attorney is currently (1995) prosecuting some of the squatters.

Other forest products

Firewood, poles, bushmeat and minor forest products such as medicinal plants are collected from within the reserve by local people. Pole cutting on a commercial scale may have a potentially damaging effects by removing young canopy trees, and may be altering the natural composition of the forest as certain species are selected in preference to others, e.g. *Scorodophloeus fischeri*.

Forestry

A number of trial plots have been established within the natural forest areas of Kazimzumbwi forest, mainly for exotic timber species such as Teak *Tectona grandis*, *Senna siamea*, *Eucalyptus*, Rubber *Hevea brasiliensis* and the indigenous timber species *Mninga Pterocarpus angolensis*. Results from these trials indicate that Kazimzumbwi is a marginal to suitable site for pine plantations (Procter, 1966 in Somi & Nshubemuki, 1980).

CONSERVATION ISSUES

Kazimzumbwi Forest is currently one of the few forest reserves in Tanzania receiving active conservation support. In May 1991, the Wildlife Conservation Society of Tanzania (WCST) Coastal Forest Programme provided funds for 8 forest guards for the Pugu and Kazimzumbwi Forest Reserves, and since 1993 the FAO/GEF programme has also been actively involved in providing institutional support for the Regional and District Natural Resources offices. There have been a number of socio-economic surveys in the area and the Pugu and Kazimzumbwi Forest Reserves are to be re-gazetted as one forest reserve, although problems have been encountered in negotiations with the owners of the farmland that connects the two reserves. A further project is also underway which has successfully encouraged many of the local farmers to plant 10-20 seedlings on their land to provide future alternative sources of woodfuel and building timber. The WWF has provided bicycles, uniforms and housing for the forest guards.

The multitude of (often conflicting) interests for land use in the reserve, combined with the burgeoning population of Dar es Salaam means that the current level of conservation effort must be sustained or even increased if the Pugu and Kazimzumbwi Forests are to have any chance of surviving.

LITERATURE

Hanna & Anderson (1994) record the results of an expedition to assess the abundance of the Black and Rufous Elephant Shrew in Kazimzumbwi forest.

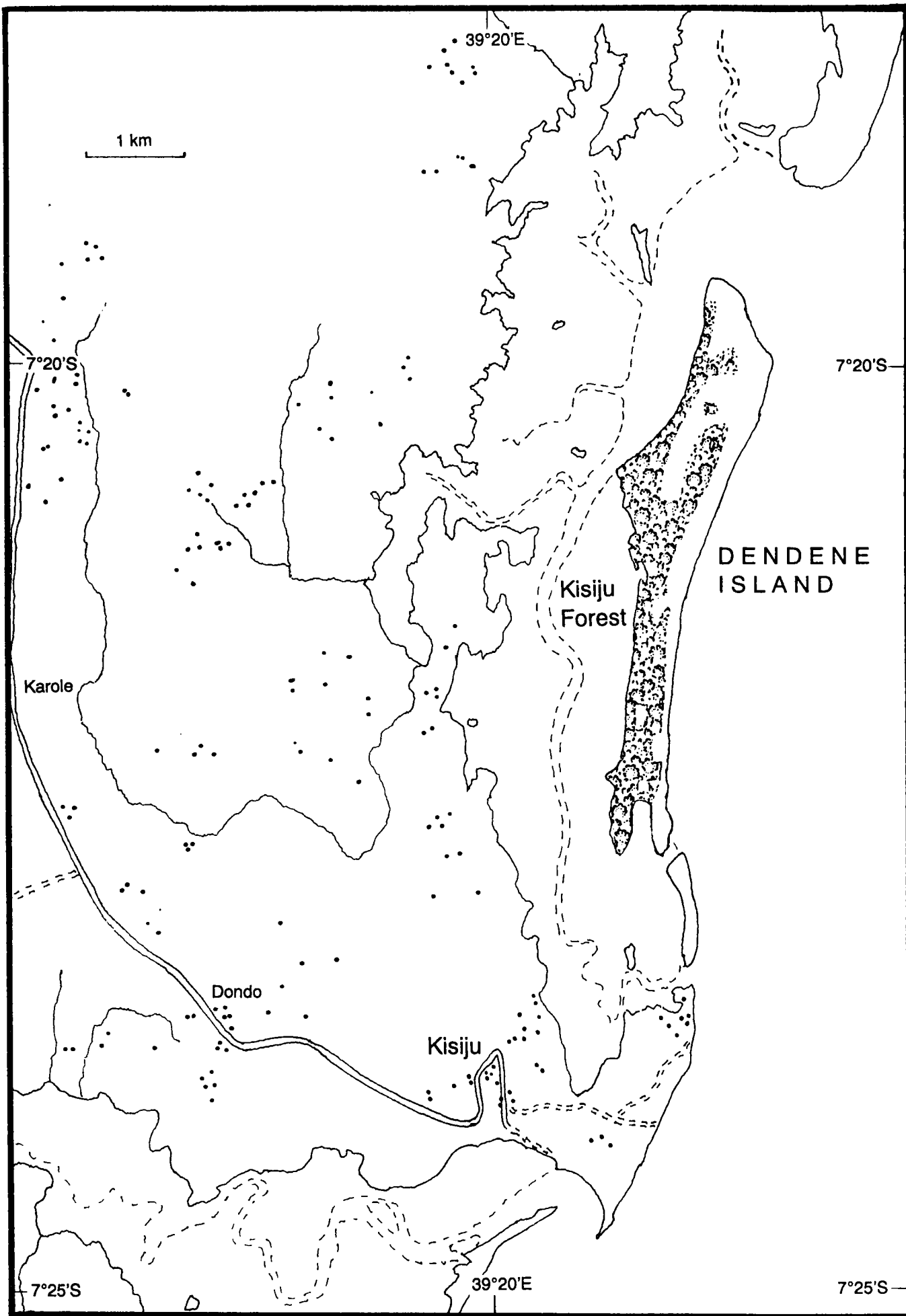
Lagerstedt (1995) studies in detail the interaction between the people of Kazimzumbwi village and Kazimzumbwi forest.

Matthews (1993) lists the medicinal plants of Kazimzumbwi along with their local name, use, preparation and Frontier collection number.

Mlingwa *et al.* (1993) describe the avifauna of Kazimzumbwi Forest Reserve.

Msonganzila *et al.* (1994) describe a short study into land-use, population and concerns in 2 villages (Vigama, next to the reserve, and Homboza, 8 km away) near Kazimzumbwi Forest Reserve.

Waters & Burgess (1990) contains a species list of birds from Kazimzumbwi.



KISIJU FOREST

DESCRIPTION

- NAME:** Kisiju Forest
Kisarawe District, Coast Region, Tanzania.
- AREA:** Approx. 200 ha; 2 sq. km; 494 acres; 0.77 sq. miles.
- STATUS:** Government land with no formal protection.
- MAPS:** Ordnance Survey Topographic Map 1:50,000 Series Y742.
Sheet 204/4 'Kisiju' of 1967, mapped from aerial photos of 1966.

LOCATION

- Grid Ref:** 7°20'S - 7°22'S, 39°20'E - 39°21'E
- Elevation:** Sea level to 20 m a.s.l.

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

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

Public transport access by regular bus to Kisiju village (which is the main port for dhows to Mafia Island).

SOILS

Pale sands overlying recent beach sand, which may be classified as Regosols. Considered geologically unstable and susceptible to erosion (Hawthorne, 1984). Forest soils have a pH of 6.8 to 7.2.

CLIMATE

Kisiju forest is influenced by tropical East African oceanic temperatures. The nearest rainfall station is at Kisiju village (7°24'S, 39°20'E, 3 m altitude) where an average of 1236 mm of rainfall per year has been recorded for the 15 years prior to 1965, with June, July, August, September & October having a monthly average of less than 50 mm rainfall during this period.

VEGETATION

Kisiju Forest contains just one vegetation type :

Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Kisiju Forest is a homogenous closed canopy forest which is classified as Zanzibar-Inhambane Undifferentiated Forest (White, 1983), with a canopy to over 20 m with a well developed shrub layer and sparse ground flora. The forest is dominated by *Hymenaea verrucosa*, *Craibia zimmermannii* and *Baphia kirkii*, though species characteristic of riverine forest, such as *Sorindeia madagascariensis* are also present..

Dense secondary vegetation is found in abandoned farm clearings within the forest, and contains *Drypetes natalensis*, *Carpolobia goetzei*, *Carissa tetramera*, *Lindackeria somalensis*, *Sideroxylon inerme* and *Manilkara sansibarensis*.

Hymenaea verrucosa and *Baphia kirkii* are estimated to have low regeneration rates within the forest (Hawthorne, 1984).

Two vegetation plots have been constructed in the dry forest area :

- Plot 1 : Closed forest at sea level, 16 subplots of 100 m².
0.16 ha in area with 49 trees over 10 cm dbh giving an equivalent of 306 trees per ha.
Mean tree dbh 28.1 cm; mean tree height 18.4 m; mean bole height 6.7 m.
Mean crown area 95.1 m²/tree; mean basal area 19.0 m²/ha; mean stand volume 127 m³/ha.
The following tree species were identified : 24 x *Hymenaea verrucosa* (46%), 16 x *Craibia zimmermannii* (31%), 5 x *Sorindeia madagascariensis* (10%), 2 x *Sideroxylon inerme* (4%), 1 x *Dracaena usambarensis* (2%). One tree could not be identified.
- Plot 2 : Disturbed forest at sea level, 16 subplots of 100 m².
0.16 ha in area with 35 trees over 10 cm dbh giving an equivalent of 219 trees per ha.
Mean tree dbh 29.5 cm; mean tree height 17.6 m; mean bole height 7.7 m.
Mean crown area 80.3 m²/tree; mean basal area 14.9 m²/ha; mean stand volume 115 m³/ha.
The following tree species were identified : 16 x *Hymenaea verrucosa* (46%), 7 x *Manilkara sansibarensis* (20%), 5 x *Sorindeia madagascariensis* (14%), 3 x *Drypetes natalensis* (9%), 2 x sp. A indet. (6%), 1 x *Cremaspora triflora*, *Dracaena usambarensis* (3% each).

TIMBER VALUES

Little information is available on the timber values of species present. No commercial logging or pole cutting is occurring, though the timber tree *Azelia quanzensis* is known to occur within the forest.

BIODIVERSITY

Kisiju forest has been received a number of short visits from biologists, including the botanists Semsei (1952), Pauloi (1953), Hawthorne (1982), Rodgers, Mwasumbi and others. The Frontier-Tanzania Coastal Forest Research Programme conducted a general biological survey in 1992.

Birds

13 bird species have been recorded (Burgess *et al.*, 1990) of which 7 are forest birds.

Coastal Forest endemic - Fischer's Greenbul *Phyllastrephus fischeri*.

Mammals

5 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 3 bat species [4 specimens collected]. No rodents were collected from 29 trap nights.

Reptiles

3 forest dependant reptile species have been recorded from observations and a total collection of 17 specimens by Frontier-Tanzania.

Coastal Forest endemic - Writhing-Skink *Lygosoma mafianum*. Endemic to Mafia and Kisiju Islands (Specimens KMH 10494 etc., cited in Broadley, 1994).

Amphibians

3 species are recorded by Frontier-Tanzania collections from 13 specimens. No rare species have yet been found.

Plants

90 plant species have been recorded from Kisiju (Rodgers *et al.*, 1984).

Tentative Kisiju endemic - *Xylopia* sp., not matched [Annonac.] Cited in Hawthorne (1984).

Coastal Forest endemics - *Tessmannia martiniana* Harms [Fabac.] Kisiju and 3 other Tanzanian sites. Cited in FTEA.

Oxyanthus sp. A of FTEA [Rubiaceae] Kisiju and 3 other Tanzanian sites. Cited in FTEA.

CITES listed plant - *Encephalartos hildebrandtii* A.Br. & Bouche [Zamiac.] Cited in Hawthorne (1984). [CITES Appendix 1].

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 by the year 2000 - 2005 (Burgess, 1990).

CONSERVATION ISSUES

Kisiju forest, together with Mchungu forest, are the last known examples of Gum Copal forest remaining in Tanzania (although other areas may still be found). Gum Copal forest may once have covered much of the coastal plain prior to arrival of the practice of cultivation in this area (at around the time of the birth of Christ), yet the total remaining area

of this forest type is now less than 5 km², so protection of the remaining forest at Kisiju is therefore an urgent conservation issue.

At the time of writing, a plan has been put forward by the Coast Region Regional Natural Resources Office to gazette the whole of Dendene Island, and to relocate all the farmers who currently have smallholdings on the island. The plans for the gazettelement have been put forward at the village, ward and district levels of local government, but difficulties are expected on the issue of compensation for the farmers, especially for the loss of cashew-nut trees. Gazettelement is unlikely to be completed before 1997 or 1998.

Disturbance to the remaining areas of natural forest could be minimised by encouraging tree planting around the local settlements to provide an alternative source of forest products.

LITERATURE

Broadley (1994) describes a new species of writhing skink from Kisiju Island.

Burgess *et al.* (1990) give a preliminary species list of the birds of Kisiju together with notes.

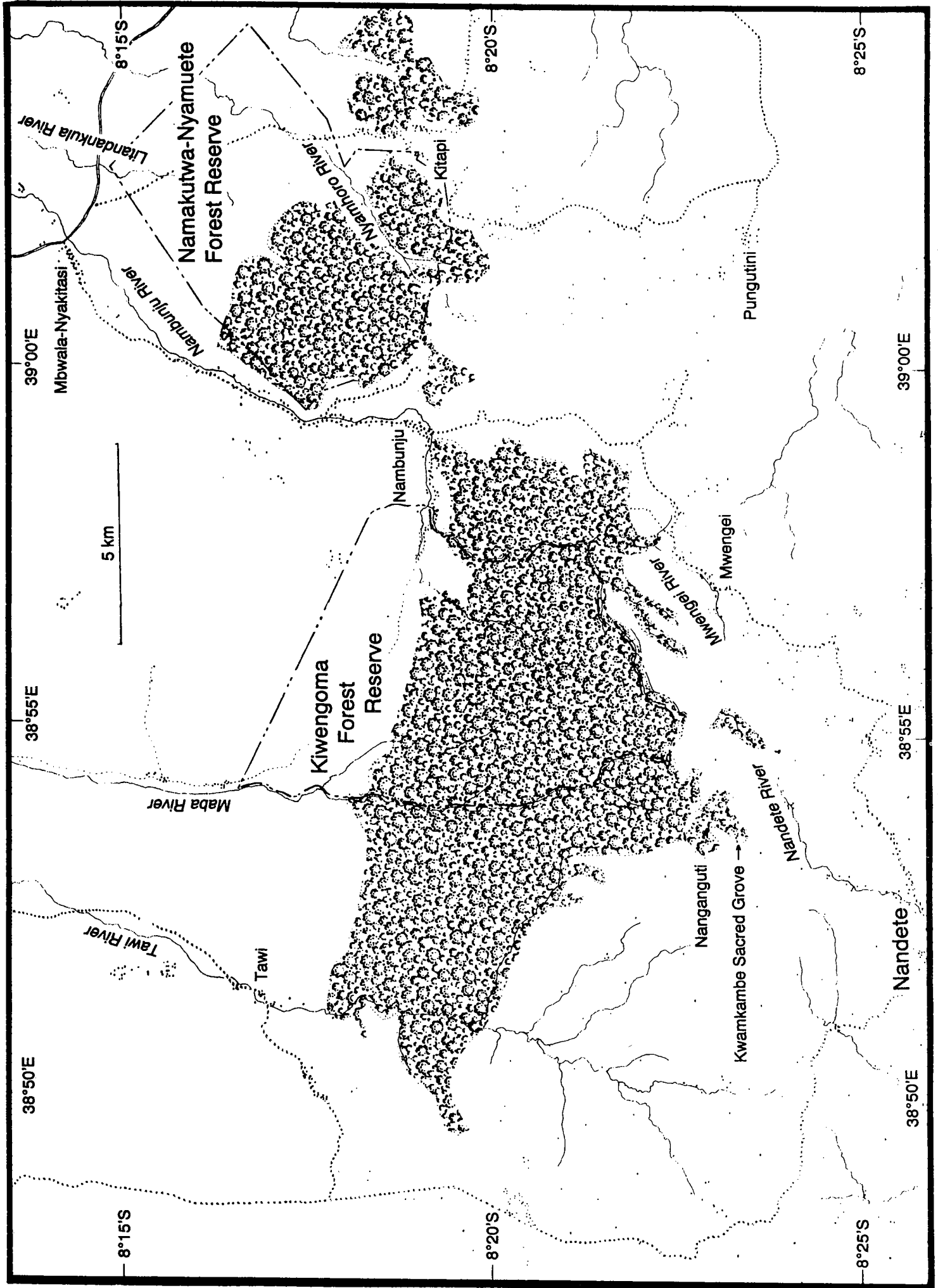
Hanna & Anderson (1994) record the results of an expedition to assess the abundance of the Black and Rufous Elephant Shrew in Kisiju forest, where none were found.

Hawthorne (1993) includes a profile diagram of Kisiju forest.

Hawthorne (1984) describes the vegetation of Kisiju in detail, including transect diagrams.

Rodgers *et al.* (1985) give a brief description of the vegetation of Kisiju forest, followed by a list of vascular plant species.

An M.Sc thesis on the Black and White Colobus monkeys in Kisiju Forest has recently been submitted to the Department of Zoology and Marine Biology of the University of Dar es Salaam by R. Banda (1995).



KIWENGOMA FOREST RESERVE

DESCRIPTION

- NAME:** Kiwengoma Forest Reserve (alternatively spelt as Kirengoma or Kireungoma)
Rufiji District, Coast Region, Tanzania.
- AREA:** 2,025 ha; 20.25 sq. km (8,645 acres according to the 1962 Forest Division map)
The Kiwengoma forest block (including areas outside the original reserve) covered 76 sq. km in 1992. Of this only 33 sq. km of forest are located within the reserve boundaries.
- BOUNDARY LENGTH:** Approximately 32 km.
- STATUS:** Formerly a forest reserve (Declaration Cap. 389 - supp. 59 of 1959, p. 118).
Revoked under Government Order no. 413/17/7/1964.
Surveyed/gazetted in 1907 according to local information.
- MAPS:** Ordnance Survey topographic maps 1:50,000 Series Y742
Sheet 239/4 'Kipatimu' of 1967, mapped from aerial photos of 1965 & 1966.
- Forest Division Rufiji District map Jb 1229 of 1962, 1:250,000 is the only Forest Division map to acknowledge the existence of the reserve (spelt as Kiwengoma). This map shows different boundaries to those recognised by the local people.

LOCATION

Grid ref: 8°20'S - 8°23'S, 38°54'E - 38°58'E (forest reserve)
8°18'S - 8°24'S, 38°49'E - 38°59'E (forest block)

Elevation: 250 - 740 m a.s.l.

Kiwengoma Forest is situated on the northern side of the Matumbi Hills massif, which rises to 740 m a.s.l. The reserve lies to the immediate north of the Rufiji/Kilwa district boundary.

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

Access is from the main Dar es Salaam to Lindi road; turn off to the south at Nya Mwage (the first village after crossing the Rufiji River) and take the track to Mbwala-Nyakitasi (4WD required in the dry season as the road goes through soft sand). Continue through Mbwala-Nyakitasi south to Nambunju village at the edge of the Matumbi Hills. From here there is an overgrown track into the north-eastern corner of the reserve.

Public transport access is by the Dar es Salaam to Lindi bus which stops in Nya Mwage. From there it is about an 18 km walk, some through soft sand. Beware of lions.

SOILS

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

CLIMATE

The Kiwengoma Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. The nearest rainfall station is at the Kipatimu Mission (8°31'S, 38°55'E, 424 m altitude), where an average of 1112 mm of rainfall per year has been recorded for the 24 years prior to 1973, with June, July, August & September having a monthly average of less than 50 mm rainfall during this period. Additional occult precipitation occurs on the hill tops.

VEGETATION

The Kiwengoma forest block comprises 76 km² of forest and transition forest woodland with the following main vegetation types :

Dry Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Approximately 56 km² of dry forest is found on the hills and ridges in the Kiwengoma forest block. Many tree species are present within this vegetation type, including *Acacia adenocalyx*, *Allophylus africanus*, *Bauhinia tomentosa*, *Bequaertiodendron magalimontanum*, *Bersama abyssinica*, *Bivinia jalbertii*, *Cassia petersiana*, *Clausena anisata*, *Craibia zimmermannii*, *Croton sylvaticus*, *Cussonia zimmermannii*, *Cynometra* sp., *Dalbergia obovata*, *Dialium holtzii*, *Diospyros verrucosa*, *Diospyros zombensis*, *Garcinia buchananii*, *Holarrhena pubescens*, *Hymenaea verrucosa*, *Hymenocardia ulmoides*, *Isolona heinsenii*, *Kigelia africana*, *Leptactina oxyloba*, *Manilkara sansibarensis*, *Markhamia obtusifolia*, *Newtonia paucijuga*, *Olex obtusifolia*, *Orphrypetalum odoratum*, *Rothmannia manganjae*, *Rothmannia ravae*, *Rourea orientalis*, *Sapium armatum*, *Suregada zanzibariensis*, *Tetrapleura tetraptera*, *Tricalysia pallens*, *Vismia orientalis*, *Vitex buchananii* and *Zanthoxylum lindense*. *Bombax rhodognaphalon* is common in some areas.

A slightly different forest is present on the slopes with *Harrisonia abyssinica*, *Pteleopsis apetala*, *Combretum adenogonium*, *Mallotus oppositifolius*, *Psychotria lauracea*, *Grewia goetzeana*, *Dialium holtzii*, *Sloetiopsis usambarensis*, *Rinorea angustifolia*, *Parkia filicoidea*, *Tessmannia densiflora*, *Albizia petersiana*, *Lanea antiscorbutica* and *Rytigynia pergracilis*.

Scrub Forest [Zanzibar-Inhambane scrub forest (*sensu* White, 1983)]

Scrub forest, which may be secondary, is present on some of the ridges and includes *Caloncoba welwitschii*, *Oxyanthus zanguebaricus*, *Pteleopsis apetala*, *Diospyros verrucosa*, *Millettia impressa*, *Rothmannia manganjae*, *Psorospermum febrifugum*, *Sorindeia madagascariensis*, *Diospyros zombensis* and *Aporrhiza paniculata*.

Moist groundwater & Riverine Forest [Zanzibar-Inhambane lowland rain forest (*sensu* White, 1983)]

Approximately 20 km² of moist forest types are found in the steep sided valley bottoms within the Kiwengoma forest block, which are dependant on the additional groundwater source of moisture from the surrounding hills. This forest type contains *Scorodophloeus fischeri* as the dominant tree in the lower canopy, with *Acridocarpus alopecurus*, *Alchornea laxiflora*, *Asteranthe lutea*, *Baphia kirkii*, *Bauhinia tomentosa*, *Bridelia atroviridis*, *Bridelia micrantha*, *Cassia abbreviata*, *Cassia burrtii*, *Cola microcarpa*, *Commiphora zimmermannii*, *Craibia zimmermannii*, *Deinbollia borbonica*, *Diospyros brucei*, *Diospyros usambarensis*, *Dracaena deremensis*, *Euphorbia tirucalli*, *Grevea eggelingii*, *Grewia goetzeana*, *Grewia monticola*, *Holarrhena pubescens*, *Hymenaea verrucosa*, *Inhambanella henriquesii*, *Isobertinia scheffleri*, *Lepisanthes senegalensis*, *Leptactina platyphylla*, *Maclura africana*, *Maerua triphylla*, *Malacantha alnifolia*, *Mallotus oppositifolius*, *Monodora junodii*, *Phyllanthus nummulariifolius*, *Polysphaeria multiflora*, *Rauvolfia mombasiana*, *Ricinodendron heudelottii*, *Rinorea elliptica*, *Rinorea* sp.A of FTEA, *Rinorea welwitschii*, *Sapium ellipticum*, *Tamarindus indica*, *Tricalysia pallens*, *Trichilia emetica*, *Uvariadendron gorgonis*, *Xylophia parviflora*, *Xylothea tettensis* and *Ziziphus pubescens*. In some valleys *Cynometra* sp. is dominant. Typical

riverine forest trees occur as emergents, e.g. *Parkia filicoidea*, *Pterocarpus tinctorius*, *Burridavya nyasica*, *Milicia excelsa*, *Khaya anthotheca*, *Sterculia appendiculata*. *Antidesma venosum* is also an occasional emergent.

Transition woodland/*Brachystegia* forest [Zanzibar-Inhambane transition woodland (*sensu* White, 1983)]

Approximately 2 km² of dry 'transition woodland' is found within Kiwengoma forest block. *Brachystegia microphylla* strongly dominates this vegetation type, forming a continuous 16 m high canopy over an 8 m subcanopy with a diverse tree assemblage including *Grewia conocarpa* and *Croton pseudopulchellus*. Saplings and shrubs are frequent, including *Tapiphyllum burnetii* and *Rytigynia decussata*. Grasses are infrequent but include *Setaria megaphylla* and *Digitaria gymnostachya*.

Woodland [Zanzibar-Inhambane woodland (*sensu* White, 1983)]

Woodland is found outside the Kiwengoma forest block in areas that have yet to be cultivated, e.g. in the northern part of the Kiwengoma forest reserve. This woodland is dominated by *Brachystegia* spp. with other trees such as *Oncoba spinosa*, *Lettowianthus stellatus*, *Dracaena usambarensis*, *Acacia sieberana*, *Stereospermum kunthianum*, *Antidesma venosum*, *Trichilia emetica*, *Ficus sycomorus*, *Tapiphyllum burnetii* and *Vangueria madagascariensis*.

TIMBER VALUES

The valleys in Kiwengoma forest contain a high proportion of commercial timber species, particularly *Khaya anthotheca*, *Pterocarpus tinctorius* and *Milicia excelsa* in the river valleys. A survey conducted in the Mwengei valley in 1990 found that 37.7% of trees over 3 m in height belonged to one of these species (119 trees enumerated in an area of 1500 m²). Most of the commercially viable trees of these species have been recently logged. A license is needed to legally extract these species.

Exotic plantation species (*Cassia* sp.) have been planted on the northern side of the forest reserve in 1932 (according to local information).

BIODIVERSITY

The Frontier-Tanzania Coastal Forest Research Programme has carried out the only known biological surveys of Kiwengoma forest, where a total of eight months have been spent collecting over three years.

Birds

43 bird species have been recorded during a brief ornithological survey (Burgess *et al.*, 1990), of which 24 species are forest birds.

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.

BirdLife listed species - Southern Banded Snake-eagle *Circaetus fasciolatus* [BirdLifeNear threatened].

Mammals

26 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 6 bat species [14 specimens from over 200 captures] and 2 rodent species [3 specimens collected].

- Possible Kiwengoma - 'Thick-tailed dwarf galago' *Galago/Otolemur* sp. 'Unnamed species seen and endemic heard (Kingdon, 1989; also cited in Kingdon & Howell, 1993).
- Coastal Forest/Eastern - East African Collared Fruit Bat *Myonycteris relicta*. (Specimen KMH 6706).
Arc endemics Known from only 8 other localities [IUCN Vulnerable].
- Other CITES/IUCN - African Elephant *Loxodonta africana* [CITES Appendix 1; IUCN Vulnerable].
listed species Leopard *Panthera pardus* [CITES Appendix 1; IUCN Threatened].
Black-and-Rufous Elephant Shrew *Rhynchocyon petersi petersi* [IUCN Rare].
Zanzibar Galago *Galagoides zanzibaricus* [IUCN Vulnerable] (cited in Kingdon, 1989).
- Other species - Free-tailed Bat *Mops brachypterus*/*Tadarida brachyptera* (SMF 75876) is a very rarely encountered species from Uganda, Tanzania and Mozambique.

Reptiles

17 forest dependent reptile species have been recorded from observations and a total collection of 63 specimens by Frontier-Tanzania.

- Coastal Forest Endemics - Dwarf Gecko *Lygodactylus viscatus*. Known only from 7 Tanzanian Coastal Forests.
Beardless Pygmy-Chameleon *Rhampholeon brachyurus*. (Specimen KMH 6461)
Known from Coastal and Riverine Forests south to southern Malawi.
Eastern Four-toed Fossorial Skink *Sepsina t. tetradactyla*. (Specimen KMH 6527).
- Coastal Forest/Eastern - Dwarf Gecko *Lygodactylus* sp. nov. B. Known only from 3 Tanzanian Coastal Forests
Arc endemics and the East Usambara Mountains. To be cited by Pasteur (in press).
Uzungwa Forest Gecko *Cnemaspis uzungwae*. (Specimen KMH 6564 etc.) Known only from the Udzungwa Mountains and the Matumbi Hills.
Bearded Pygmy-Chameleon *Rhampholeon brevicaudatus*. (Specimen KMH 6510)
Known only from the Eastern Arc and 6 Tanzanian Coastal Forests.
Usambara Centipede-eater *Aparallactus wernerii*. (Specimen KMH 6680) Known only from the Eastern Arc and 2 Tanzanian Coastal Forests.
Usambara Green Snake *Philothamnus macrops*. (Specimen KMH 6457) Known only from the Usambaras and 3 Tanzanian Coastal forests.

Amphibians

12 species are recorded by Frontier-Tanzania collections from 152 specimens.

- Coastal Forest endemics - Tree toad *Mertensophryne micranotis*. (Specimen KMH 6502 etc., cited in Poynton, 1991).
Leaf-litter toad *Stephopaedes loveridgei*. (Specimen KMH 6500, cited in Poynton, 1991). Known only from 8 sites, probably all Coastal Forests.
Treefrog *Leptopelis flavomaculatus*. (Specimen KMH 6480).

Plants

367 vascular plant species (from a collection of 742 fertile voucher specimens) have been collected from Kiwengoma by Frontier-Tanzania, and of these at least 51 species are restricted in distribution to the Zanzibar-Inhambane regional mosaic. These are the only known plant collections from the forest.

- Kiwengoma endemics - *Pavetta* sp. nov. not matched at Kew (= Frontier 668) [Rubiaceae].
Tricalysia sp. nov. not matched at Kew (= Frontier 634) [Rubiaceae].

Possible Kiwengoma - *Chlorophytum* sp. not matched at Kew (= *Frontier* 811) [Liliac].
endemics

Coastal Forest endemics - *Asteranthe lutea* Vollesen [Annonac.] (Specimen *Frontier* 857). Kiwengoma and 2 other sites only.
Uvariadendron gorgonis Verdc. [Annonac.] (Specimen *Frontier* 700).
Kiwengoma & 6 other sites only.
Pteleopsis apetala Vollesen [Combretac.] (Specimen *Frontier* 3) Kiwengoma and 2 other sites only.
Phyllanthus rhizomatosus A.R.-Sm. [Euphorbiac.] (Specimen *Frontier* 15).
Kiwengoma and 1 other site.
Tessmannia densiflora Harms [Fabac.] (Specimen *Frontier* 192). Kiwengoma Kichi Hills endemic.
Tapinanthus longipes (Bak. & Sprague) Polhill & Wiens [Loranthac.] (Specimen *Frontier* 883). Known only from Kiwengoma and Pugu forests.
Olax pentandra Sleumer [Olacac.] (Specimen *Frontier* 27). Kiwengoma, Selous and 1 other site only.
Adenia schliebenii Harms [Passiflorac.] (Specimen *Frontier* 674). Kiwengoma, Selous and 2 other sites.
Leptactina oxyloba K.Schum. [Rubiaceae] (Specimen *Frontier* 714). Kiwengoma and 5 other sites.
Rytigynia pergracilis Verdc. [Rubiaceae] (Specimen *Frontier* 43). Kiwengoma and 3 other sites in SE Tanzania.
Rinorea sp. A of FTEA [Violac.] (Specimen *Frontier* 176). Kiwengoma and Kimboza endemic.

Coastal Forest/ Eastern - *Saintpaulia ionantha* Wendl. [Gesneriac.] (Specimen *Frontier* 165 etc.).
Arc endemics
Kiwengoma, Udzungwa Mountains and Amboni Caves only.
Isobertinia scheffleri (Harms) Greenway [Fabac.] (Specimen *Frontier* 641B).

CATCHMENT VALUES

The forest reserve is drained by two major rivers (the Nambunju and the Mwengei Rivers) and by many smaller streams. Permanent water is found locally beneath the deep sand stretches of the valley bed, forming permanent pools in the Mwengei Valley.

Springs are found in the reserve.

Many of the slopes in Kiwengoma exceed 40°, so the presence of forest is required to prevent excessive soil erosion.

The local population report a significant decline in the availability of surface water and a reduction of spring water over the last 60 years (Kingdon, 1989).

HUMAN IMPACTS

Logging

Extensive logging of *Khaya anthotheca* and *Milicia excelsa* has occurred since 1986, most of it carried out illegally by timber merchants from Iringa. There was much evidence of recent pitting in the main river valleys in 1992

The high concentration of commercial timber species in the river valleys means that the forest is very susceptible to over exploitation, as this will remove a large proportion of the canopy and cause a local drying out of the understorey.

Cultivation

According to local information sources, cultivation appears to have been alternately allowed and then forbidden within the reserve since it was gazetted in 1907. Shifting cultivation was permitted between 1932 and 1940, and then permitted again after 1948 to alleviate a famine in the area. Shifting cultivation was again stopped in 1962, when the squatters were evicted from the reserve. Some farmers have recently returned.

Pole-collecting

Poles are collected by people living close to the forest for building their houses. This activity appears to be sustainable.

Other Forest Products

Harvesting of medicinal plants and honey.

Hunting

All hunting is illegal within the reserve. In spite of this, small mammals such as duiker are trapped.

Settlement

The abandoned former tribal capital of the Wamatumbi people at Kirungurungu is found within the Kiwengoma forest block.

CONSERVATION ISSUES

Kiwengoma Forest is one of the largest remaining blocks of Coastal Forest remaining in Tanzania, yet it does not appear to have any legal protection, or at best only about 35% of the forest is contained within a forest reserve. The forest is located in an area which has historically been cultivated with a dense population compared to the surrounding lowlands, but where population growth has been temporarily halted by the post Maji-Maji war famine in 1905, and by a further natural famine in 1948. These factors have reduced the extent of forest loss in the area, but the present population growth and pressure for agricultural land in the area are leading to very high rates of deforestation. Protection of the remaining Kiwengoma forest is therefore urgently required.

In addition to its value as a Coastal Forest, the Kiwengoma forest may be additionally important for its role within the Selous ecosystem. The forest contains a high elephant population and may even be on a major elephant migration route (via the Kichi Hills, Kiwengoma and Namakutwa) from the Selous Game Reserve to the sea to obtain salt. The forest may be of further importance to the elephant population as a foodsource for dry season browsing. A study of the importance of the forest to the local elephants is recommended.

A survey team is expected to resurvey the boundaries for a new Kiwengoma Forest Reserve (to include the entire forest block) later in 1995.

LITERATURE

Baker (1993) comments on the taxonomic status of one of the bird species recorded from Kiwengoma.

Boulard (1992) describes a new species of cicada from Kiwengoma forest.

Burgess *et al.* (1990) give a preliminary species list of the birds of Kiwengoma together with notes.

Hynd (1992) lists neuropteran species collected from Kiwengoma forest.

Kingdon (1989) presents the results of the first Frontier-Tanzania research visit to Kiwengoma forest.

Matthews (1993) lists the medicinal plants of Kiwengoma along with their local name, use, preparation and Frontier collection number.

Poynton (1991) lists the includes collections from Kiwengoma in the list of amphibians from SE Tanzania.

Sheil (1992) describes the conservation threats to Kiwengoma to highlight the issue of Coastal Forest conservation.

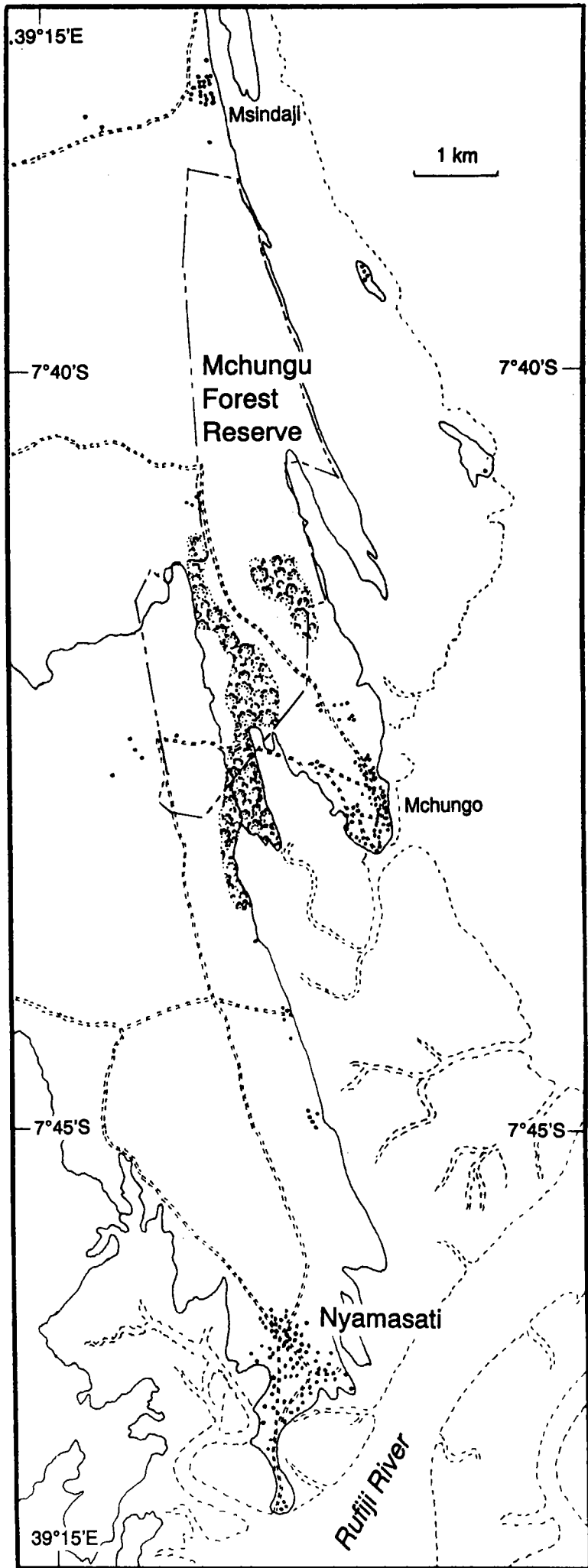
Sheil & Burgess (1990) present the results of the second Frontier-Tanzania research visit to Kiwengoma forest.

Verdcourt (1990) describes a new species of snail from Kiwengoma forest.

Waters & Burgess (1994) present further results from a brief visit to Kiwengoma by the Frontier-Tanzania programme in July 1990, including lists of reptile, amphibian, mammal and butterfly species.

ADDENDUM

Map Jb 1229 indicates three further forest reserves in the vicinity of Kiwengoma forest: Nandundu (74 acres), Nerumba (57 acres) and Kumbi (69 acres). The reserves are all productive forest reserves and are located between Kiwengoma and Namakutwa-Nyamute forest reserves. Their present status is unknown.



MCHUNGU FOREST RESERVE

DESCRIPTION

- NAME:** Mchungu Forest Reserve
Rufiji District, Coast Region, Tanzania.
- AREA:** 1,035 ha; 10.35 sq. km; 2558 acres; 4.0 sq. miles.
- BOUNDARY:
LENGTH** 18 km.
- STATUS:** Productive Forest Reserve
Declaration Order Cap. 132 of 1947, p. 1352; superseded by Cap. 389 - supp. 59 of 1959, p. 117.
Gazetted during the German administration - original map RE/R/19/1.
- MAPS:** Ordnance Survey Topographic Map 1:50,000
Series Y742 Sheet 222/2 'Mchungu' of 1965, mapped from aerial photos of 1965.

Boundary Map Jb 686 of 1968, 1:20,000

LOCATION

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

Elevation: Sea level - 15 m a.s.l.

Mchungu Forest Reserve lies on the northern edge of the Rufiji Delta, stretching some 10 km north along the coast. The whole reserve lies below 15 m asl.

The nearest village is Mchungu, located to the south-east of the reserve. Access by road is from Bungu about 30 km from the reserve on the main Dar es Salaam-Kilwa all-weather road. Take the eastward road at Bungu for Nyamasati and continue until just before Nyamasati where there is a turning to the north for Mchungu. A 4WD vehicle is sometimes required to negotiate this road.

The District Forestry office is in Utete. There is a local mangrove forestry officer is based at Nyamasati.

SOILS

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

CLIMATE

The Mchungu Forest Reserve is influenced by tropical East African oceanic temperatures. The nearest rainfall station is at Kikale (7°50'S, 39°13'E, 10 m altitude), where an average of 1182mm of rainfall per year has been recorded for the 21 years prior to 1973, with June, July, August, September & October having a monthly average of less than 50

mm rainfall during this period. A peak annual rainfall of 2098 mm and a minimum annual rainfall of 593 mm has been recorded between 1942 and 1968 from this rainfall station.

VEGETATION

The vegetation of Mchungu is highly heterogenous, reflecting the influence of environmental conditions and human disturbance. The following vegetation types occur :

Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Small patches of forest totalling about 2 km² are located amongst a complex of other vegetation types. The forest has a broken canopy of over 30 m in height with a well developed understorey and sparse herbaceous layer. Dominant species are *Hymenaea verrucosa* and *Baphia kirkii*, though *Borassus aethiopicum*, *Sideroxylon inerme*, *Afzelia quanzensis* and *Manilkara* sp. are common. Other tree species include *Craibia zimmermannii*, *Ellipanthus hemandradenioides*, *Tarenna supra-axillaris*, *Cassia zambesiaca*, *Tabernaemontana elegans*, *Lepisanthes senegalensis*, *Balanites maughamii*, *Xylothea tettensis*, *Drypetes* sp., *Diospyros* sp., *Ehretia cymosa*, *Euphorbia tirucalli*, *Hirtella zanzibarica*, *Lannea schweinfurthii*, *Salacia madagascariensis*, *Euphorbia nyikae*, *Dracaena usambarensis*, *Ficus scassellatii* and the strangling fig *Ficus lingua*.

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

Swamp Forest [Swamp forest (*sensu* White, 1983)]

Swamp forest is present at the edge of the permanent pools, as this is strongly dominated by *Barringtonia racemosa* with *Sorindeia madagascariensis*.

Scrub Forest [Zanzibar-Inhambane scrub forest (*sensu* White, 1983)]

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. Tree species include *Albizia versicolor*, *Myroxylon aethiopicum*, *Strychnos* sp., *Salacia madagascariensis* and *Garcinia livingstonei*.

Woodland [Zanzibar-Inhambane secondary wooded grassland (*sensu* White, 1983)]

Semi-natural woodland occurs in most of the reserve with naturalised cashewnut trees *Anacardium occidentale*. Other tree species include *Parinari curatellifolia*, *Acacia nilotica*, *Tamarindus indica*, *Bridelia cathartica*, *Sideroxylon inerme*, *Phyllocosmus lemairianus*, *Suregada zanzibarensis*, *Hymenaea verrucosa*, *Hymenocadia ulmoides*, *Afzelia quanzensis*, *Myroxylon aethiopicum*, *Vitex doniana*, *Gardenia ternifolia* and *Diospyros mespiliformis*.

TIMBER VALUES

The commercial timber value of Mchungu Forest is low although *Afzelia quanzensis* occurs commonly in the reserve.

The forest is important locally as a source of timber for producing dug-out canoes for which the preferred species are *Hymenaea verrucosa*, *Afzelia quanzensis* and a species known locally as 'Mtanga'. People come from Mchungu, Simba-Uranga, Kiomboni and Nyamasati villages to obtain their canoe timber from the forest.

BIODIVERSITY

Mchungu forest was visited by the botanist Harris in 1976 and subsequently has only been surveyed by the Frontier-Tanzania Coastal Forest Research Programme.

Birds

95 bird species are recorded from Mchungu Forest Reserve, including 44 species recorded in the forest itself (Waters & Burgess, 1994). Of these 15 species are forest birds.

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.

Mammals

14 mammal species are recorded from Mchungu Forest Reserve from collections and observations by Frontier-Tanzania, including 1 bat species [4 specimens] and 2 rodent species [4 specimens collected].

CITES/IUCN listed - African Elephant *Loxodonta africana* [CITES Appendix 1; IUCN Vulnerable]
species Leopard *Panthera pardus* [CITES Appendix 1; IUCN Threatened]
Black-and-Rufous Elephant Shrew *Rhynchocyon petersi petersi* [IUCN Rare]
(specimen KMH 7052).

Reptiles

5 reptile species are recorded from Mchungu Forest Reserve, of which 3 are forest dependant reptile species. A total of 9 specimens have been collected by Frontier-Tanzania.

Coastal Forest endemic - Worm-snake *Leptotyphlops* sp. nov. (Specimen KMH 7041). Known only from 5 Coastal Forests. To be cited by Broadley & Wallach (in press).

Amphibians

11 amphibian species are recorded from Mchungu Forest Reserve (Waters & Burgess, 1990) from a collection of 36 specimens. None of these are rare species.

Plants

232 fertile botanical samples have been collected from Mchungu by Frontier-Tanzania. This probably represents the largest collection from the site.

No rare plants are yet recorded from Mchungu Forest.

CATCHMENT VALUES

As a result of its coastal location the catchment value of Mchungu Forest 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. In 1990 only 6 felled trees were found in the forest.

Pole cutting

Pole cutting in Mchungu is negligible since the reserve is next to the largest mangrove forest in East Africa, where superior poles can be obtained.

Agriculture

Permission to cultivate within the forest reserve was granted by the District Commissioner in 1942 but this was later stopped. In 1969 a 10 acre (4 ha) area of the reserve that had been planted with cashew nuts was degazetted.

Large areas of the forest reserve have been cleared around the villages of Mchungu and Msindaji and replanted with cash crops of Mango and Cashewnut. The practice of shifting cultivation is little used locally. It is thought that the main block of forest has escaped clearance for cultivation due to its proximity to a permanent pool which is home to hippopotami and elephant.

CONSERVATION ISSUES

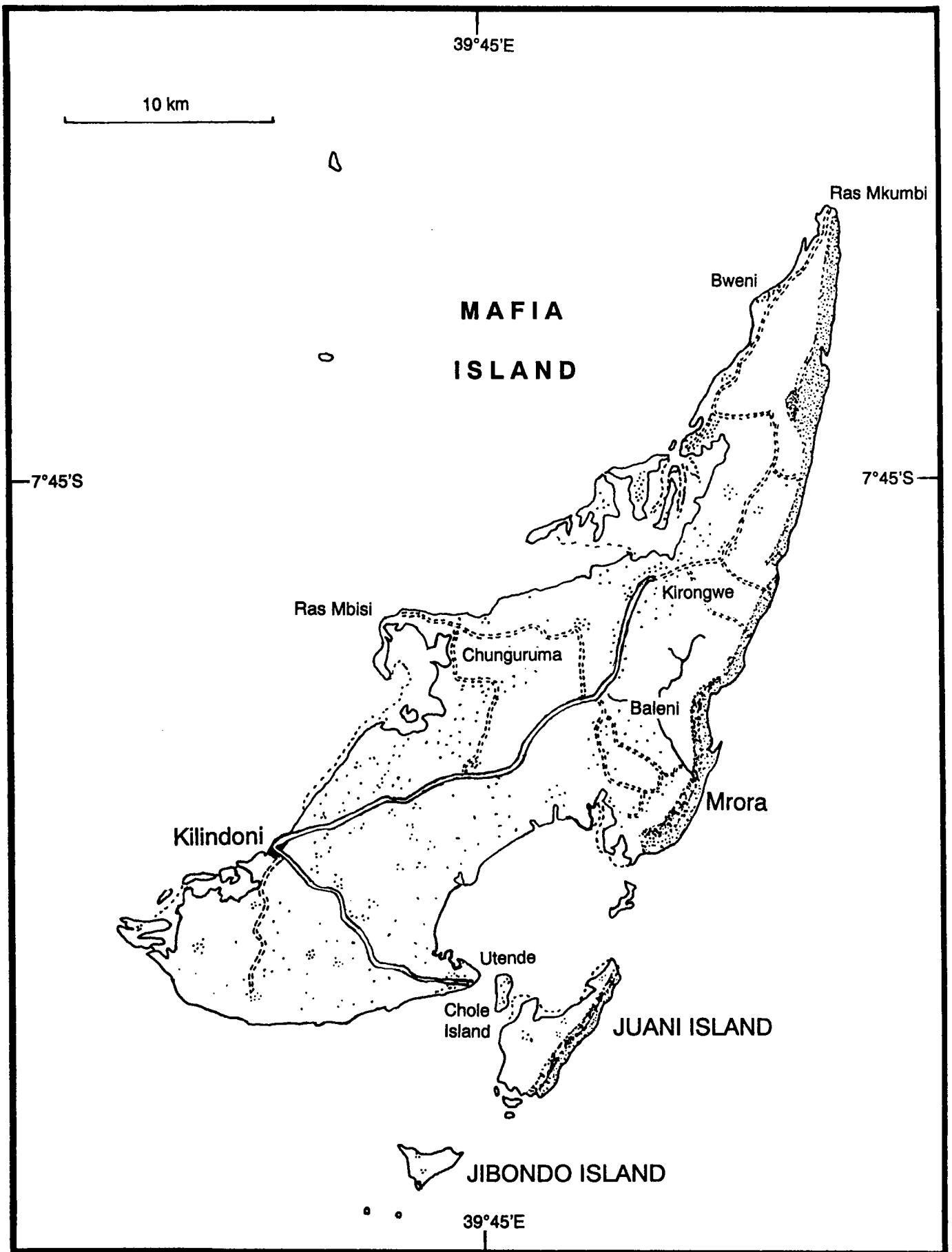
Mchungu forest, together with Kisiju forest, are the last known examples of Gum Copal forest remaining in Tanzania (although other small patches of this forest type may still exist). Gum Copal forest may once have covered much of the coastal plain prior to arrival of the practice of cultivation in the area at around the time of the birth of Christ (0 A.D.). The total remaining area of this forest type is now less than 5 km², so the protection of the remaining forest at Mchungu is now an urgent conservation issue. At present the forest does not appear to be threatened by either logging or pole-cutting, and the hinterland to the west of the forest is quite sparsely populated. The village of Mchungu is however cut-off from being able to expand by the forest reserve, and this puts localised pressure on the forest reserve for agricultural land.

While the long-term future of Kisiju is in doubt, Mchungu forest represents the best opportunity to conserve a fragment of Gum Copal forest. A greater input from the Forest Division is required to prevent any agricultural encroachment.

A scheme to plant Gum Copal *Hymenaea verrucosa* and *Azelia quanzensis* might be successful in getting local involvement if this was done to provide a long-term timber source for dug-out canoes.

LITERATURE

Waters & Burgess (1990) summarise the results of the Frontier-Tanzania biological survey of Mchungu Forest, including lists of birds, reptiles and amphibians. Transect diagrams from Mchungu forest are also presented.



MRORA FOREST, MAFIA ISLAND

INCLUDING NOTES ON THE THICKETS/FORESTS OF THE EASTERN SEABOARD OF MAFIA ISLAND.

DESCRIPTION

- NAME:** Mrora Forest, Mafia Island (Pronounced 'Mlola')
Mafia District, Coast Region, Tanzania.
- AREA:** 3,800 ha; 38 sq. km; 9,390 acres; 14.7 sq. miles
- STATUS:** Core Protection Zone of the Mafia Island Marine Park.
Gazetted 1.7.1995.
Mafia Island Marine Park declared 27.4.1995 under Resolution No. 4 of the National Assembly of Tanzania.
- Forest/thicket areas to the north of 7°48'07"S are outside the marine park and are without formal protection.
- MAPS:** Ordnance Survey topographic map 1:50,000 Series Y742
Sheet 223/1 & 2 'Mafia Island North' of 1970, mapped from aerial photos of 1966.
- Mafia Island Marine Park map 1:100,000 of 1995.

LOCATION

- Grid Ref:** 7°38'-8°02'S, 39°54'-39°47'E
- Elevation:** Sea level to 20 m a.s.l.

Eastern seaboard of Mafia Island. Mrora Forest is located to the immediate north of the main Chole Bay on the south-east side of the island.

SOILS

Coral rag overlain by sandy loam soil, pH 7.5.

CLIMATE

Temperatures along the eastern coast of Mafia Island are high and stable, and rarely exceed 33°C or fall below 20°C (Greenway with Rodgers *et al.*, 1988). The nearest rainfall station is at Kirongwe (7°49'S, 39°49'E, 10 m altitude) but no data is available from here. Kilindoni rainfall station (7°55'S, 39°40'E, 25 m altitude) has recorded an average of 1877 mm of rainfall per year for the 35 years prior to 1973, with August, September & October having a monthly average of less than 50 mm rainfall during this period. A peak annual rainfall of 2450 mm and a minimum annual rainfall of 1138 mm has been recorded between 1937 and 1970 from this rainfall station.

VEGETATION

The vegetation of the thickets along the Mafia Island eastern seaboard is described by Greenway with Rodgers *et al.* (1988) and assessed quantitatively by Hall *et al.* (1984). There is a continuous gradient of forest development from a seaward *Pemphis acidula* community, gradually changing to become more forest like further inland (the canopy height decreases steadily towards the coast due to the stunting effect of hot, saline sea breezes, and to the more rocky nature of the substrate). Where the soil level is deep enough to support trees, a forest structure is developed with a distinct shrub layer and a canopy to 20 m, e.g. 4 km east of Kanga and at Mrora. The forest on Juani Island is less well developed than that at Mrora, where the following vegetation types are present :

Dry Forest [Zanzibar-Inhambane undifferentiated forest and evergreen thicket (*sensu* White, 1983)]

In the Mrora area a rocky pavement with very thin soil extends for approximately 1 km inland from the shore, followed by a narrow band of large jagged boulders and deep pockets of soil, beyond which is a zone of deep soil. Plots constructed in the Mrora forest/thicket community by Hall *et al.* (in prep.) found *Commiphora pteleifolia*, *Diospyros consolatae*, *Manilkara sulcata* and *Sideroxylon inerme* to dominate near the coast, changing through intermediate communities to a forest assemblage of *Canthium bibractaetum*, *Diospyros greenwayi*, *Diospyros mespiliformis*, *Lecaniodiscus fraxinifolius*, *Manilkara discolor*, *Ricinodendron heudelottii*, *Sorindeia madagascariensis*, *Teclea trichocarpa* and *Ziziphus pubescens*. Other tree species include *Garcinia buchananii*, *Phoenix reclinata*, *Lepisanthes senegalensis*, *Diospyros shimbaensis*, *Teclea simplicifolia*, *Xylothea tettensis*, *Cynometra* sp., *Mkilua fragans*, *Rinorea ferruginea*, *Terminalia boivinii*, *Tarena nigrescens* and *Albizia glaberrima*.

Four plots have been constructed in different parts of the forest/thicket mosaic :

Plot 1 : Dry forest with occasional rocks, 100 m x 5 m.

0.05 ha in area with 17 trees over 10 cm dbh giving an equivalent of 340 trees per ha.

Mean tree dbh 26.9 cm; mean tree height 8.5 m; mean bole height 3.5 m.

Mean crown area 14.1 m²/tree; mean basal area 19.3 m²/ha; mean stand volume 68 m³/ha.

The following tree species were identified : 5 x *Diospyros consolatae* (29%), 3 x *Ricinodendron heudelottii*, *Tarena nigrescens*, *Xylothea tettensis* (18% each), 1 x *Cynometra* sp., *Sterculia africana*, *Sideroxylon inerme* (6% each).

Plot 2 : Dry forest/thicket on exposed coral rag, 50 m x 50 m.

0.25 ha in area with 72 trees over 10 cm dbh giving an equivalent of 288 trees per ha.

Mean tree dbh 22.2 cm; mean tree height 9.5 m; mean basal area 11.2 m²/ha.

The following tree species were identified : 22 x *Diospyros consolatae* (31%), 20 x *Lanea schweinfurthii* (28%), 5 x *Tarena nigrescens* (7%), 4 x *Vepris* sp. (6%), 3 x *Ricinodendron heudelottii*, *Sideroxylon inerme*, *Sterculia africana*, *Xylothea tettensis* (4% each), 2 x *Cynometra* sp., *Diospyros shimbaensis* (3% each), 1 x *Glennia africana*, *Manilkara sulcata*, *Memecylon sansibaricum*, *Strychnos* sp., *Terminalia boivinii* (1% each).

Plot 3 : Dry forest on deep soil, 100 m x 5 m.

0.05 ha in area with 22 trees over 10 cm dbh giving an equivalent of 440 trees per ha.

Mean tree dbh 27.7 cm; mean tree height 9.9 m; mean bole height 3.6 m.

Mean crown area 27.3 m²/tree; mean basal area 26.5 m²/ha; mean stand volume 95 m³/ha.

The following tree species were identified : 8 x *Lanea schweinfurthii* (36%), 6 x *Diospyros consolatae* (27%), 1 x *Manilkara sulcata*, *Sterculia africana*, *Tarena nigrescens*, *Teclea* sp., *Terminalia boivinii*, *Xylothea tettensis*, *Caesalpinioideae* indet., tree sp. indet. (5% each).

Plot 4 : Dry forest/thicket on soil overlying coral rag, 60 m x 40 m.

0.24 ha in area with 82 trees over 10 cm dbh giving an equivalent of 342 trees per ha.

Mean tree dbh 18.6 cm; mean tree height 9.7 m; mean basal area 9.3 m²/ha.

The following tree species were identified : 34 x *Lannea schweinfurthii* (41%), 21 x *Diospyros consolatae* (26%), 5 x *Memecylon sansibaricum* (6%), 3 x *Sterculia africana*, *Terminalia boivinii* (4% each), 2 x *Cynometra* sp., *Glennia africana*, *Manilkara sulcata*, *Strychnos* sp., *Vepris* sp., sp. indet. (2% each), 1 x *Diospyros shimbaensis*, *Mkilua fragans*, *Sideroxylon inerme*, Rubiaceae indet. (1% each).

Swamp Forest [Swamp forest (*sensu* White, 1983)]

An area of swamp forest is also present at Mrora, dominated by *Barringtonia racemosa*.

TIMBER VALUES

No commercial timber species are recorded.

BIODIVERSITY

The Mrora forest has only been briefly studied, in particular by the Frontier-Tanzania Coastal Forest Research Programme in 1990 which carried out a general biological survey over a three month period. The ornithologists Mlingwa and Msuya visited the forest during 1992. The botanist Greenway visited the forest during the 1930s followed by Hall and Mwasumbi during the 1980s.

Birds

38 bird species have been recorded from the forests/thickets of the eastern seaboard of Mafia Island (Msuya & Mlingwa, 1992). Only 3 of these are forest birds (see Mrora citations in Msuya & Mlingwa, 1992), and no Coastal Forest or threatened species have yet been found.

Mammals

11 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 4 bat species [8 specimens collected] and 5 rodent species [9 specimens collected].

Coastal Forest endemic - Duiker *Cephalophus caeruleus pembae* subspecies endemic to Mafia and Pemba Islands, in forests and thickets. Cited in Moreau & Pakenham, 1941.

CITES/IUCN listed - Black-and-Rufous elephant shrew *Rhynchocyon petersi adersi* subspecies species endemic to Mafia and Zanzibar Islands, abundant all over island (A. Dickinson, obs.). [IUCN Threatened]. Cited in Moreau & Pakenham, 1941.

Outside of Mrora forest, the following species have been recorded along the eastern seaboard of Mafia Island:

Coastal Forest endemic - Horseshoe Bat *Rhinolophus deckeni*. (Specimen KMH 7779-81) Known from just 3 other Coastal Forests. Captured from Kanga Ngome forest to the north of Mrora at 7°43'S, 39°54'E.

Other species - 'Small white very fierce pig' of Moreau & Pakenham (1941). No specimens are yet available but probably a medieval form of the European pig *Sus scrofa* introduced by the Portuguese. Limited to the thickets of Juani Island where they are an agricultural pest.

Reptiles

14 forest dependant reptile species have been recorded from observations and specimens collections by Frontier-Tanzania as well as by earlier collectors (see Moreau & Packenham, 1941).

Coastal Forest endemics - Dwarf Gecko *Lygodactylus viscatus*. (Specimen KMH 7105). Known only from 7 Tanzanian Coastal Forests.

Writhing-Skink *Lygosoma mafianum*. Known only from Mafia and Kisiju Islands (cited in Broadley, 1994).

East African Egg-eater *Dasypeltis medici* (Specimen KMH 7139).

Amphibians

7 species are recorded by Frontier-Tanzania collections from 56 specimens.

Coastal Forest endemics - Leaf-litter toad *Stephopaedes* sp. nov. det. BMNH. (Specimens KMH 7143 - 7146 etc.). Possibly also found in the lowland forests of the East Usambara Mountains (Poynton, *in litt.*). Cited in Howell, 1993.

Treefrog *Leptopelis flavomaculatus*. (A. Dickinson, pers. obs.).

Plants

115 species are recorded for Mrora forest/thicket in Hall (1985). A full list of all plant species known from Mafia Island is presented in Greenway with Rodgers *et al.* (1988), including collections from the forests/thickets of the eastern seaboard as well as from Chunguruma forest (which has since been cleared). A further 112 fertile botanical samples have subsequently been collected from Mrora by Frontier-Tanzania.

Coastal Forest endemics - *Diospyros shimbaensis* F.White [Ebenac.] (Specimen Frontier 1449).

Known only from Mrora, Zaraninge and Shimba Hills in Kenya.

Zanthoxylum lindense (Engl.) Kokwaro [Rutac.] North of Bweni & 1 other site.
Cited in FTEA.

Coffea costatifructa Bridson [Rubiaceae] (cited in *Kew Bulletin* 49, 331-342), is known only from a collection in Chunguruma forest (which has since been cleared) and the Selous Game Reserve but might still be found in the remaining areas of forest on the island, e.g. at Mrora.

Most of the endemic and rare plant species of Mafia Island are not forest or thicket species e.g. *Tristemma schliebenii* Markgraf. [Melastomaceae] which is found in the swamps of Mafia Island (including the swamp at Mrora, specimen Frontier 1512) and at 2 other sites on the mainland.

HUMAN IMPACTS

Agriculture and Pest Control

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. Mrora has been described as the 'breadbasket' of Mafia Island, and is one of the few places on the main island where conditions are suitable for orange trees. New land is free, but once cleared belongs to the clearer and can be sold on, so there is consequently a high turnover of land. Most of the farmers are

immigrants from the mainland, and many apparently intend to return to their home areas when they reach retirement age.

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.

Cattle are reported to be grazing/foraging/browsing in the forest at Kange Ngome in the north of the island (C.A. Msuya, UDSM Department of Zoology & Marine Biology, pers. comm.). This is the only known instance of domestic livestock grazing in a Tanzanian Coastal Forest, but grazing is reported to be harmful in other tropical dry forests (e.g. in Central America).

Plantations

Even land that is not directly cultivated is not allowed to return as fallow bush as coconuts are usually planted in the farmed areas and these eventually shade out the other agricultural crops after 10-15 years. These areas are then abandoned as coconut plantations and the farmers move on to clear new land.

Mining

In areas north of Mrora, 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 areas, although the threat is localised as mangrove poles from the Rufiji Delta supply the rest of the island. The mangrove poles are superior to Coastal Forest poles as they are termite resistant.

Other forest products

Hunting and collection of medicinal plants occur on a local scale.

CONSERVATION ISSUES

The forest/thicket belt along the eastern seaboard of Mafia Island is important as a windbreak to protect farmland to the west from the prevalent hot, saline and desiccating sea breezes. They may also protect the adjacent coral reefs from excessive soil run off from the eastern edge of the island. For these reasons, the remaining areas of Coastal Forest and thicket to the north of the island need to be given both legal and practical protection, either as forest reserves, or as an extension of the present marine park.

Pressure on the forest could be reduced by planting trees around the local villages to create long-term alternative sources of building materials and fuelwood. The World Wide Fund for Nature (WWF) is planning to carry out a sustainable resource utilisation project in the Mrora area in the near future (from 1996).

LITERATURE

Broadley (1994) describes a new species of writhing skink from Mafia Island.

Msuya & Mlingwa (1992) list bird species recorded from Mafia island during a visit by the two scientists.

Greenway with Rodgers *et al.* (1988) describe the vegetation of Mafia Island in great detail, although a detailed investigation of the eastern seabord of Mafia was not carried out in this study.

Hall *et al.* (1985) list species collected in the coral rag forests/thickets of the eastern seabord of Mafia Island and describes the floristics of the plots.

Howell (1993) mentions a new toad species from Mafia Island.

Hynd (1992) lists a few neuropterans collected at Mrora forest and at Kilindoni.

Kiwia & Horrill (1993) present the rationale for including Mrora within the marine park limits.

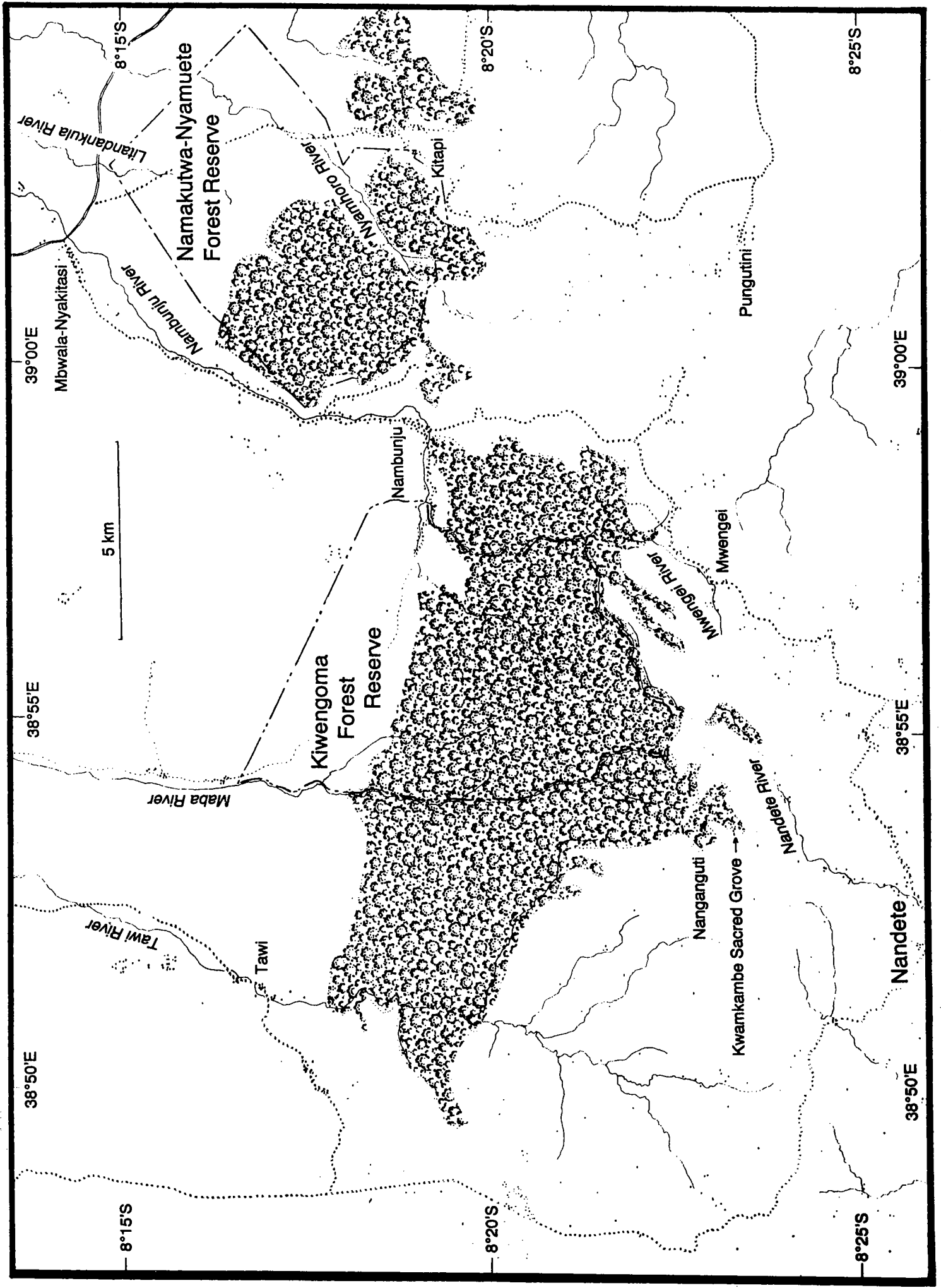
Moreau & Pakenham (1941) give a list of birds, mammals, amphibians and reptiles found on Mafia Island, summing up all previous work and giving a critical comparison with Pemba and Zanzibar Islands.

O'Hara, Weale & Allen (1990) list butterfly species collected by the authors at Kilindoni forest.

Polhill (1968) recommends protecting the *Philippia mafiensis* thickets within a nature reserve, but does not mention the other thicket/forest areas such as at Mrora.

Turlin & Lequeux (1992) describe a subspecies of Charaxes butterfly from Mrora forest.

Waters & Burgess (1994) present partial reptile, amphibian and mammal species lists for Mafia Island, generated by collections and observations by the Frontier-Tanzania Coastal Forest Research Programme.



NAMAKUTWA - NYAMUETE FOREST RESERVE

DESCRIPTION

- NAME:** Namakutwa - Nyamuete Forest Reserve (an amalgamation of the earlier Namakutwa and Nyamuete Forest Reserves).
Rufiji District, Coast Region, Tanzania.
- AREA:** 4,634 ha; 46.34 sq. km; 11,450 acres; 17.89 sq. miles
- BOUNDARY LENGTH:** 28.5 km.
- STATUS:** Productive Forest Reserve.
Designated in 1962. According to local tradition the original reserves were gazetted during the German administration.
Both of the original forest reserves are declared in Cap. 389 - supp. 59 of 1959, pp. 114 - 115.
- MAPS:** Ordnance Survey topographic maps 1:50,000 Series Y742
Sheets 240/1 'Mohoro' of 1967, mapped from aerial photos of 1965 & 1966.
240/3 'Kinjubi' of 1967, mapped from aerial photos of 1965 & 1966.
240/4 'Kipatimu' of 1967, mapped from aerial photos of 1965 & 1966.
There is a discrepancy between Forest Department boundary and the boundary shown on the Ordnance Survey maps.

Forest Division Boundary Map Jb 610 of 1965, 1:25,000.

LOCATION

Grid Ref: 8°15'S - 8°19'S, 39°00'E - 39°06'E

Elevation: 150 - 380 m a.s.l.

The reserve is located around a plateau top of Jurassic sandstone at the north-eastern edge of the Matumbi Hills. Dry Coastal Forest is found at the southern end of the plateau, surrounded by woodland and cultivation. Altitudinal range 150 - 380 m a.s.l.

Access is from the main Dar es Salaam to Lindi road; turn off to the south at Nya Mwage (the first village after crossing the Rufiji River) and take the track to Mbwala-Nyakitasi (4WD required in the dry season as the road goes through soft sand). The local road between Mbwala and Kitapi villages runs through the reserve. It is anticipated that work on the Nya Mwage to Kinjumbi road will allow 2 wheel drive access to within 2 km of the northern boundary of the reserve, and that buses will be re-routed along this road.

Public transport access is by the Dar es Salaam to Mohoro/Kilwa/Lindi bus which stops at Nya Mwage, and in future will stop at Mbwala-Nyakitasi. From Nya Mwage walk the remaining 18 km to the forest. Beware of the lions.

The District Forestry Office is at Utete, a local Forestry officer is based at Mohoro.

SOILS

A fine upland plateau catenary sequence is present on the hill tops with a thin (3-4 cm) humus layer. Soils on the hillsides are coarser, shallower 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.

CLIMATE

The Namakutwa-Nyamuede Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. October is the warmest month and June is the coolest. The nearest rainfall station is at the Mohoro Dispensary (8°08'S, 39°11'E, 20 m altitude), where an average of 1083 mm of rainfall per year has been recorded for the 27 years from 1939 to 1966, with June, July, August, September & October having a monthly average of less than 50 mm rainfall during this period. A peak annual rainfall of 1546 mm and a minimum annual rainfall of 533 mm has been recorded between 1939 and 1966 from this rainfall station.

VEGETATION

Three main vegetation types are present in the Namakutwa-Nyamuede Forest Reserve :

Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Approximately 9 km² of homogeneous semi-deciduous dry forest occupies the top of the Namakutwa plateau. Dominant small trees (to 8 m) include *Dichapetalum stuhlmannii*, *Alchornea laxiflora* and *Diospyros verrucosa*. Large individuals (to 25 m) of *Ricinodendron heudelottii*, *Dialium holtzii*, *Hymenaea verrucosa* and *Bombax rhodognaphalon* are scattered throughout the forest area.

Approximately 1 km² of moister forest is found in the gullies draining off the plateau, and is rich in species normally associated with an additional groundwater supply of moisture, including *Malcantha alnifolia* and *Milicia excelsa*. *Diospyros verrucosa*, *Deinbollia borbonica* and *Polysphaeria multiflora* are common as smaller trees. Other tree species include *Suregada zanzibariensis* and *Rothmannia macrosiphon*.

At the northern end of the Namakutwa Plateau, the forest canopy becomes progressively lower, reaching 4 m and strongly dominated by *Dichapetalum stuhlmannii*.

Three vegetation plots have been constructed in the forest area :

Plot 1 : Open/light semi-deciduous forest on the Namakutwa Plateau, 16 subplots of 100 m².
0.16 ha in area with 88 trees over 10 cm dbh giving an equivalent of 550 trees per ha.
Mean tree dbh 22.6 cm; mean tree height 15.2 m; mean bole height 3.9 m.
Mean crown area 44.7 m²/tree; mean basal area 22.0 m²/ha; mean stand volume 86 m³/ha.
The following tree species were identified : 38 x *Lettowianthus stellatus* (43%), 17 x *Ricinodendron heudelottii* (19%), 3 x *Croton sylvaticus*, *Diospyros verrucosa* (3% each), 2 x *Leptactina platyphylla*, *Markhamia obtusifolia*, *Markhamia acuminata*, sp. A indet., sp. B indet. (2% each), 1 x *Cassia burttii*, *Commiphora africana*, *Diospyros squarrosa*, *Grewia goetzeana*, *Hymenaea verrucosa*, *Sapium armatum*, *Scolopia rhamniphylla*, *Sorindeia madagascariensis*, *Vismia orientalis* (1% each). The remaining 8 trees were all different and could not be identified.

Plot 2 : Open/light semi-deciduous forest on the Namakutwa Plateau, 16 subplots of 100 m².
0.16 ha in area with 95 trees over 10 cm dbh giving an equivalent of 594 trees per ha.
Mean tree dbh 16.2 cm; mean tree height 12.7 m; mean bole height 4.0 m.
Mean crown area 26.0 m²/tree; mean basal area 12.2 m²/ha; mean stand volume 49 m³/ha.

The following tree species were identified : 38 x *Ricinodendron heudelottii* (40%), 10 x *Croton sylvaticus* (11%), 8 x *Leptactina platyphylla* (8%), 5 x *Vismia orientalis*, *Bauhinia tomentosa* (5% each), 4 x *Markhamia acuminata*, *Millettia bussei* (4% each), 3 x *Diospyros verrucosa*, *Polysphaeria multiflora*, *Caloncoba welwitschii* (3% each), 2 x *Bivinia jalbertii*, sp. C indet. (2% each), 1 x *Mallotus oppositifolius*, *Commiphora africana*, *Milicia excelsa*, *Bridelia micrantha*, *Bombax rhodognaphalon* (1% each). The remaining 2 trees were both different and could not be identified.

Plot 3 : Moist forest in a valley leading off the Namakutwa Plateau, 16 subplots of 100 m².
0.16 ha in area with 54 trees over 10 cm dbh giving an equivalent of 337 trees per ha.
Mean tree dbh 23.4 cm; mean tree height 12.7 m; mean bole height 3.4 m.
Mean crown area 57.2 m²/tree; mean basal area 14.5 m²/ha; mean stand volume 49 m³/ha.
The following tree species were identified : 15 x *Malacantha alnifolia* (28%), 7 x *Sorindeia madagascariensis* (13%), 6 x *Ricinodendron heudelottii* (11%), 4 x *Diospyros kabuyeana*, *Dialium holtzii*, *Bridelia micrantha* (7% each), 2 x sp. D indet. (4%), 1 x *Bivinia jalbertii*, *Blighia unijugata*, *Vangueria madagascariensis* (2% each). The remaining 8 trees were all different and could not be identified.

Transition woodland/*Brachystegia* forest [Zanzibar-Inhambane transition woodland (*sensu* White, 1983)]

Approximately 10 km² of dry 'transition woodland' occupies the top of the Nyamuete Hills and on a number of the ridge tops leading off the Namakutwa plateau. *Brachystegia microphylla* strongly dominates this vegetation type, forming a continuous 16 m high canopy over an 8 m subcanopy with a diverse tree assemblage including *Baikiaea ghesquiereana*, *Hymenaea verrucosa* and *Croton sylvaticus*. Small trees include *Canthium mombazense* and *Gardenia transvenulosa*. Saplings are frequent and grasses are absent.

A further 6 km² of Transition woodland/*Brachystegia* forest occurs outside the Namakutwa-Nyamuete Forest Reserve to the east on the Kitapi Hills.

Woodland [Zanzibar-Inhambane woodland (*sensu* White, 1983)]

Woodland occurs in the lowland areas, particularly the Nyamhoro Valley and at the northern end of the reserve.

TIMBER VALUES

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

BIODIVERSITY

A general biological survey of the Namakutwa-Nyamuete Forest Reserve was conducted by the Frontier-Tanzania Coastal Forest Research Programme in 1992. No other visits by scientists are known to have been carried out in this reserve.

Birds

64 bird species have so far been recorded [7 specimens collected] from Namakutwa-Nyamuete Forest Reserve. Of these, 31 species were recorded from the forest (by C. Msuya).

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.
Little Yellow Flycatcher *Erythrocerus holochlorus*.

Mammals

28 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 7 bat species [17 specimens collected from 1309 net hours] and 7 rodent species [19 specimens collected from 211 trap nights].

Coastal Forest/Eastern - Lesser Pouched Rat *Beamys hindei*. (Specimen KMH 10634) [IUCN Arc endemics Vulnerable].

Other CITES/IUCN - African Elephant *Loxodonta africana* [CITES Appendix 1; IUCN Vulnerable].
listed species Leopard *Panthera pardus* (Specimen KMH 10337) [CITES Appendix 1].
Zanzibar Galago *Galagoides zanzibaricus* [IUCN Vulnerable].

Reptiles

22 reptile species (10 forest dependant) have been recorded from observations and a total collection of 21 specimens by Frontier-Tanzania.

Coastal Forest endemics - Dwarf Gecko *Lygodactylus viscatus*. (Specimen Frontier NAMA 12) Known only from 7 Tanzanian Coastal Forests.

Rare species - Liwale Round-snouted Amphisbaenian *Loveridgea ionidesi*. (Specimens KMH 10652, 10653) Endemic to SE Tanzania.

Amphibians

7 species are recorded by Frontier-Tanzania collections from 20 specimens. No rare species have yet been found.

Plants

Possible Namakutwa - *Dicliptera* sp. not matched at Kew (= *Frontier* 3075) [Acanthac.].
- Nyamuete endemic

Matumbi Hills endemics - *Baikiaea ghesquiereana* J.Leon [Fabac.] Namakutwa-Nyamuete & Tong'omba. (Specimen *Frontier* 3089A).

An old record for *Tessmannia densiflora* Harms [Fabac.] (which is endemic to the Matumbi Hills) is cited from 'near Mohoro at 200-300 m altitude' and may be from Namakutwa - Nyamuete.

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.

Agriculture

There is a long history of cultivation alternating with periods in which cultivation was prohibited on the Namakutwa Plateau. According to local tradition, plateau-top areas have historically been cleared for rice, cowpeas ('kunde' beans) and maize, but this was stopped in 1912, probably following gazettelement by the Germans. Cultivation was then illegally resumed but was stopped in 1940 by the authorities. Cultivation on the plateau was then permitted by the forestry office in 1948 following a widespread famine in the area, but was stopped again in 1962. Recently approximately 3 ha of forest has been cleared for agriculture on the Namakutwa plateau, with a further 7 ha currently under cultivation in the woodland areas of the Nyamhoro Valley (1992).

Old mango trees in the Nyamhoro Valley are evidence of past cultivation and settlement prior to the gazettelement of the forest reserve.

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 Kitape.

Other forest products

Local villagers collect fuelwood and traditional medicines from the forest for home consumption.

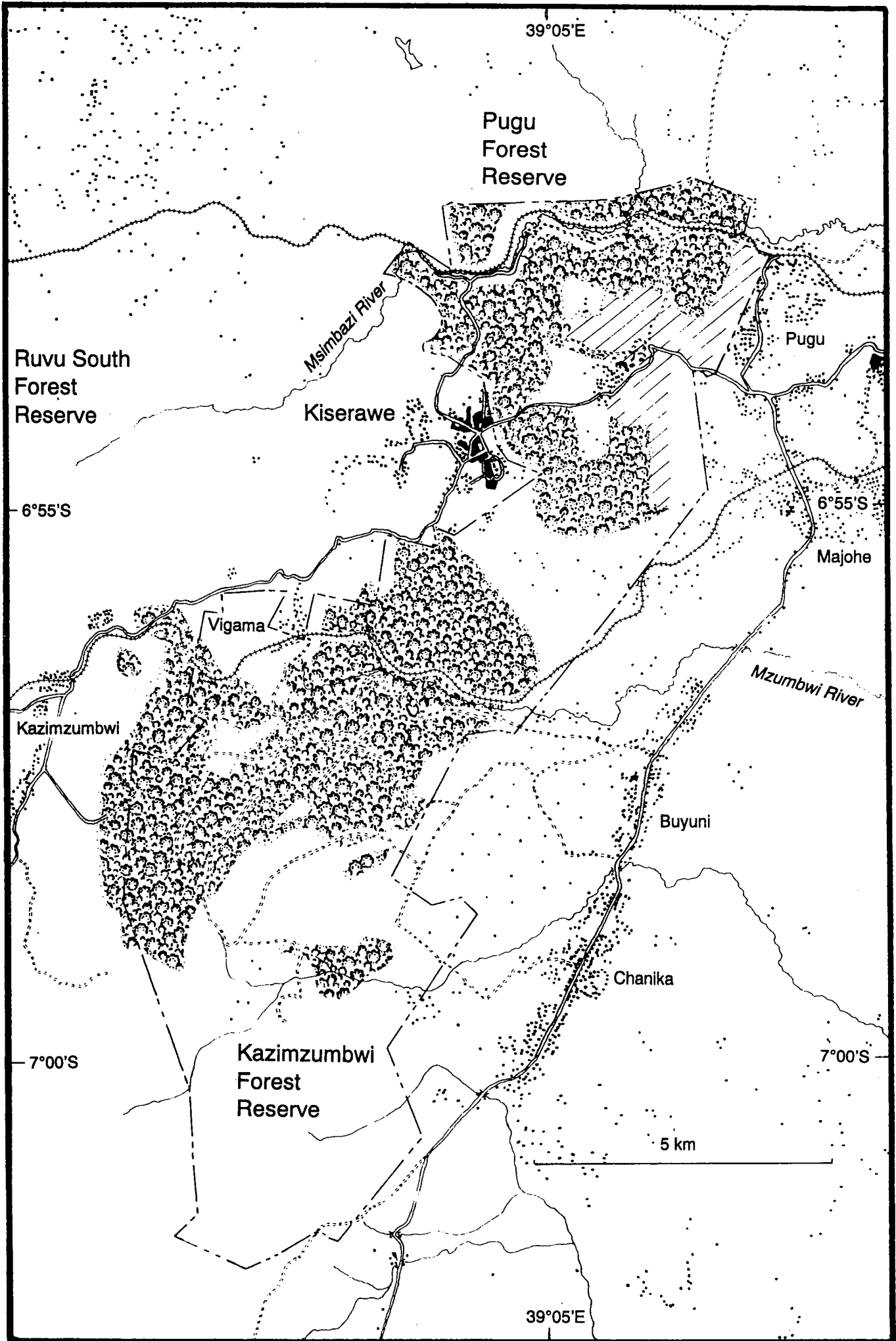
CONSERVATION ISSUES

Currently Namakutwa - Nyamuete is designated as a productive forest reserve, but this status should be reviewed as the reserve should ideally be given protective status to minimise future exploitation.

More regular visits from forest guards are required to control illegal logging and agricultural encroachment.

LITERATURE

Gould *et al.* (1994) describe how termite preferences for different tree species appears to have an influence in determining the species composition of part of Namakutwa forest.



PUGU FOREST RESERVE

DESCRIPTION

- NAME:** Pugu Forest Reserve
Kisarawe District, Coast Region, Tanzania.
- AREA:** Approx. 2,179 ha; 21.79 sq. km; 5,384 acres; 8.41 sq. miles.
- BOUNDARY:** 22 km. Future combined Kazimzumbwi/Pugu Forest Reserve boundary length 59 km.
LENGTH Reclearing of the boundaries started in September 1994. *Eucalyptus* sp. and Madras thorn are currently being planted as boundary trees.
- STATUS:** Protective Forest Reserve.
Declaration Order Cap. 132 of 1947, p. 1348; superseded by Cap. 389 - supp. 59 of 1959, p. 60.
- MAPS:** Ordnance Survey topographic map 1:50,000 Series Y742
Sheet 186/3 'Kisarawe' of 1987, mapped from aerial photos of 1981.
The Ordnance Survey map shows a slightly incorrect forest reserve boundary.
- Forest Division Boundary Map Jb 606 of 1967, 1:10,000
Management Map Jb 683 of 1968, 1:10,000
- Future map Jb 2242 of 1994 shows the proposed combined Kazimzumbwi/Pugu Forest Reserve
The boundary shape depicted on this map is somewhat inaccurate.

LOCATION

Grid Ref: 6°52'S - 6°55'S, 39°04'E - 39°07'E

Elevation: 100 - 305 m a.s.l.

Pugu Forest Reserve is located approximately 25 km south-south-west of Dar es Salaam and 20 km inland from the Indian Ocean. The forest reserve overlies the north-eastern end of the Pugu Hills, a dissected range of kaolinitic sandstones with an altitudinal range 100 - 305m a.s.l.

The District Forest Division HQ is at Kisarawe, which is also the nearest town and is located immediately to the west of the reserve.

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

Public transport access is by the frequent bus service from Dar es Salaam to Pugu village (to the east of the reserve), or by bus to Kisarawe, which goes through the forest reserve.

SOILS

Thick-mantled Arenosols (UNESCO/FAO) occur on the ridgetops 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 (Howell, 1981).

CLIMATE

Pugu Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. Temperatures range from 24 - 31°C. The area experiences a bimodal rainfall pattern with an annual average recorded for Kisarawe of 1,236 mm (Howell, 1981), although the Pugu Forest Station rainfall station (6°52'S, 39°08'E, 112 m altitude) has recorded an average of 1090 mm of rainfall per year for the 31 years up to 1973, with June, July, August & September having a monthly average of less than 50 mm rainfall during this period. A peak annual rainfall of 2385 mm and a minimum annual rainfall of 502 mm has been recorded between 1936 and 1970 from this rainfall station.

VEGETATION

Three main vegetation types occur within the Pugu Forest Reserve :

Forest [Zanzibar-Inhambane undifferentiated forest and lowland rain forest (*sensu* White, 1983)]

The extremely heterogenous forest vegetation of Pugu has a characteristic ridgetop, valley slope and valley bottom variation which is further complicated by intensive human disturbance.

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

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

In 1981 an estimated 10 km² of natural forest remained in the reserve (Howell, 1981), most of which is now so severely degraded that only some 4 km² remains in reasonable condition (F. Ismail, pers. comm., 1995).

Thicket [Zanzibar-Inhambane evergreen thicket (*sensu* White, 1983)]

Heavily disturbed forest areas have effectively become thickets. Other areas formerly supporting plantation forest, but since cleared (especially to the north and north-west of the Minaki enclave) have regenerated to thicket. Approximately 6 km² of thicket is present in the reserve.

Plantation Forest

Plantations of *Cassia siamea*, *Eucalyptus* sp., *Grevillea robusta* with small experimental plots of teak (*Tectona grandis*) exist in the reserve. The older plantations (particularly the *Eucalyptus*) are being vigorously recolonised by indigenous species, such that the plantation areas are developing into thickets with exotic tree species as emergents. In some of the plantations the stumps left from the original forest have also produced coppice and/or sucker shoots.

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 *Tectona grandis*. Since then the Forest Department has cleared a further 36 hectares of natural vegetation and replanted with exotic species, a policy that was being pursued as recently as 1982 (Burgess, 1990).

BIODIVERSITY

Pugu is the best studied Coastal Forest in Tanzania and has been visited by many biologists, including the botanists Holtz, Wingfield, Mwasumbi, Vaughan, Harris, Walker, Hawthorne; the ornithologists Moreau, Fuggles-Couchman, Stjernstedt, Howell, Gerhardt, Turner, Stuart, van Willigen, Baker & Baker and Kiure etc. General herpetological and small mammal collections have been conducted by Howell. The forest was ranked the equal 32nd most important forest in the top 75 forests for bird conservation in Africa (Collar & Stuart, 1988).

Birds

Pugu Forest is the most intensively surveyed Coastal Forest in eastern Africa, where bird-netting and ringing have been conducted covering all months from May 1981 to December 1994, with more than 500 captures during each visit (by N.E. Baker & E.M. Baker).

83 bird species have been recorded, of which 32 species are forest birds.

- | | |
|---------------------------------|--|
| Pugu endemic - | Pale-breasted Illadopsis <i>Trichastoma rufipennis puguensis</i> . Subspecies endemic to Pugu Forest (Grant & Mackworth-Praed, 1940). |
| Coastal Forest endemics - | Fischer's Greenbul <i>Phyllastrephus fischeri</i> .
Little Yellow Flycatcher <i>Erythrocerus holochlorus</i> .
Sokoce Pipit <i>Anthus sokokensis</i> [BirdLife Vulnerable; IUCN Vulnerable]. |
| Other BirdLife listed - species | Southern Banded Snake-eagle <i>Circaetus fasciolatus</i> [BirdLife Near threatened].
East Coast Akalat <i>Sheppardia gunningi</i> [BirdLife Vulnerable; IUCN Rare].
Spotted Ground Thrush <i>Turdus fischeri</i> [BirdLife Endangered; IUCN Rare]. |

Mammals

25 mammal species have been recorded from collections and observations (Howell, 1981), including 7 bat species and 5 rodent species.

- | | |
|-----------------------------|---|
| CITES/IUCN listed - species | Black-and-Rufous Elephant Shrew <i>Rhynchocyon petersi petersi</i> . (Specimen UDSM 158) [IUCN Rare]. |
|-----------------------------|---|

Reptiles

Five reptile species are recorded in Howell (1981) for the Pugu Forest Reserve. None of these are rare species, although the southernmost record for the Neumann's Sand-Lizard *Heliobolus neumanni* is recorded from Pugu (Broadley & Howell, 1991; Howell, 1981).

- | | |
|--------------------------|--|
| Coastal Forest endemic - | East African Egg Eater <i>Dasypeltis medici</i> . (Specimen KMH 2623). |
|--------------------------|--|

Amphibians

11 species are recorded by Prof. K.M. Howell's collections from 66 specimens.

Coastal Forest endemics - Toad *Bufo lindneri*. (Specimens KMH 2767 - 2769 etc.).
Tree toad *Mertensophryne micranotis*. (Specimens KMH 3820 - 3827 etc.).

Plants

Pugu endemics - *Rhynchosia holtzii* Harms [Fabac.] Cited in FTEA.
Humbertochloa greenwayi C.E. Hubbard [Poac.] Cited in FTEA.
Lasiodiscus holtzii Engl. [Rhamnac.] Cited in FTEA.
Grumilea rufescens K.Krause [Rubiace.] Cited in FTEA.

Possible Pugu endemics - Annonac., indet. (= *Ismail & Ndangalasi* s.n.) [specimen sent to Kew].
Aspilia sp. not matched (= *Harris* 5368) [Asteraceae].
Euphorbiac., indet. (= *Ismail & Ndangalasi* s.n.) [specimen sent to Kew].

Pugu Area endemics - *Uvaria pandensis* Verdc. [Annonac.] Pugu, Kibaha & Pande endemic. Cited in *Kew Bulletin* 43, 1.
Xylopi sp. B of FTEA [Annonac.] Pugu & possibly also Pande only. Cited in FTEA.
Combretum harrisii Wickens [Combretac.] (Specimen *Harris* 4659) Pugu, Pande and 4 sites nearby. Cited in FTEA as *Combretum* sp. A.
Tragia acalyphoides A.R.-Sm. [Euphorbiac.] Pugu & Kazimzumbwi endemic. Cited in FTEA.
Baphia puguensis Brummit [Fabac.] Pugu & Kazimzumbwi endemic. Cited in FTEA.
Millettia puguensis Gillet [Fabac.] Pugu & Kazimzumbwi endemic. Cited in FTEA.

Coastal Forest endemics - *Uvaria* sp. nov. [Annonac.] (Specimen *Mwasumbi* 12532). Known only from Pugu and 4 other Tanzanian Coastal Forests.
Garcinia acutifolia N.Robson [Clusiace.] Endemic to Pugu and Mozambique. Cited in FTEA.
Coccinia sp. B of FTEA [Cucurbitac.] Pugu and a few sites along the Kenyan Coast only. Cited in FTEA.
Diospyros capricornuta F.White [Ebenace.] Endemic to Pugu and 1 other site in Tanzania. Cited in White (1988).
Sapium trilochulare Pax & K. Hoffm. [Euphorbiac.] Known only from Pugu and 3 other sites. Cited in FTEA.
Tessmannia martiniana Harms [Fabac.] (Specimen *Ndangalasi & Ismail* 1). Known only from Pugu and 3 other Tanzanian Coastal Forests.
Tapinanthus longipes (Bak. & Sprague) Polhill & Wiens [Loranthac.] (Specimen *Wingfield* 1757). Known only from Pugu and Kiwengoma.
Acridocarpus pauciglandulosus Launert [Malpigiace.] Pugu and 2 sites in SE Tanzania only. Cited in FTEA.
Brachiaria lindiensis (Pilg.) W.D. Clayton [Poac.] Pugu and 3 other sites only. Cited in FTEA.
Rytigynia binata (Schum.) Robyns [Rubiace.] Pugu, Kimboza and Selous only. Cited in FTEA.
Tricalysia allocalyx Robbrecht [Rubiace.] Known only from Pugu, Pande and 2 other sites. Cited in FTEA.
Afroseralisia kassneri (Engl.) J.H. Hemsl. [Sapotac.] (Specimen *Hawthorne* 1089). Known only from Pugu and 4 other sites.

Other species - *Indigofera sutherlandioides* Bak. [Fabac.] Pugu and Angola, Zambia & Zaire.
Cited in FTEA.

CITES listed plant - *Encephalartos hildebrandtii* A.Br. & Bouche [Zamiac.] CITES Appendix 1.

Three further rare species are known from Pugu but have not been recently located despite intensive surveys during 1993-1995. These are *Cynometra longipedicellata* Harms, known only from the East Usambaras, a single sterile specimen from Pugu (Holtz 971) and possibly also from Tong'omba; *Cynometra suaheliensis* (Taub.) Bak.f., known from SE Kenya and NE Tanzania and a single sterile specimen from Pugu (Holtz 6955). There is also species of orchid which has only been found in Pugu (L. Mwasumbi, pers. comm.).

CATCHMENT VALUES

The Pugu and Kazimzumbwi forests were formerly important for protecting the catchment of the streams on which Dar es Salaam depended for its water supply. This importance has since been superseded by the development of a water pumping station on the Ruvu River (which is fed by rainfall from the Uluguru mountains).

There is a reservoir in the south of Pugu Forest Reserve and 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. The forest is still important for protecting the local water catchment.

HUMAN IMPACTS

Pugu Forest is one of the most heavily disturbed Coastal Forests in Tanzania, and is subject to the greatest variety of land-use pressures.

School

An enclave exists within the forest reserve around the Minaki Secondary School, including an area where the school cultivates its own crops.

Communications & Infrastructure

A swathe of forest was cleared in 1877 for the Mackinnon Road which passed through the present reserve. This road is reported to have increased the level of exploitation of forest products such as Gum Copal and Landolphia rubber in the areas close to it.

There is a radio communication mast located within the reserve. Electrical power lines, water mains and a new road were constructed through the reserve in 1964 & 1965, leading to some loss of forest.

Military

Parts of Pugu Forest are occupied as military training areas.

Industry

Some forest has been cut in connection with a brick and tile factory that is located within the reserve, and forest has been cleared to provide workers accommodation and also for agricultural land for these workers (Howell, 1981). In 1968 approximately 88 ha of the former forest reserve was de-gazetted to allow these operations to continue.

Mining

The presence of one of the world's largest kaolin deposits has resulted in a long history of mining operations at the site, which started in the 1950s (Richards, 1988). These operations were initially limited to drift mining, but open cast mining was adopted from 1973. There are proposals to increase the rate of extraction to 100,000 tons of raw kaolin per year, which would mean scraping away the Pugu Hills and the forest that overlies them.

Logging

See timber values section.

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

Charcoal production is practiced illegally on both a local and commercial scale (sold to Dar es Salaam). There are indications that the employment of extra forest guards by the WCST has reduced the scale of this activity.

Agriculture

The forest is under heavy pressure from agricultural encroachment into the reserve. There is intense pressure for agricultural land close to Dar es Salaam, as produce can easily and cheaply be transported to the city market.

Forestry

Plantations of *Eucalyptus* and *Cassia* have been established in Pugu Forest Reserve from the early 1950s until the end of the 1970s. The last plantation was of *Grevillea robusta* in February 1982, which is deemed to have been unsuccessful. All the plantation involved clearing areas of natural forest.

CONSERVATION ISSUES

Pugu Forest is currently one of the few forest reserves in Tanzania receiving active conservation support. In May 1991, the Wildlife Conservation Society of Tanzania (WCST) Coastal Forest Programme provided funds for 8 forest guards for the Pugu and Kazimzumbwi Forest Reserves, and since 1993 the FAO/GEF programme has also been actively involved in providing institutional support for the Regional and District Natural Resources offices. There have been a number of socio-economic surveys in the area and the Pugu and Kazimzumbwi Forest Reserves are to be re-gazetted as one forest reserve, although problems have been encountered in negotiations with the owners of the farmland that connects the two reserves. A further project is also underway which has successfully encouraged many of the local farmers to plant 10-20 seedlings on their land to provide future alternative sources of woodfuel and building timber.

The multitude of (often conflicting) interests for land use in the reserve, combined with the burgeoning population of Dar es Salaam means that the current level of conservation effort must be sustained if Pugu and Kazimzumbwi Forests are to have any chance of surviving.

Pugu Forest was ranked the equal 32nd most important forest in the tropical African and Malagasy region for threatened bird species conservation (Collar & Stuart, 1988).

LITERATURE

Baker (1983) records aspects of the behaviour of a bird species in Pugu.

Baker (1984) mentions a species record from Pugu.

Baker (1993) discusses an aspect of the taxonomy of one of the bird species found in Pugu.

Baker & Baker (1992) record a mite infestation among four bird species in Pugu and discuss its implications.

Baker & Howell (1992) record details about some of the migratory birds that are found in Pugu.

Benoit (1978) describes a new spider species from Pugu.

Cilek (1977) describes the origins of the Pugu kaolin.

Collar and Stuart (1988) compare the avifauna of Pugu with that of other forests in tropical Africa and Madagascar.

Evers (1994) presents the results of a socio-economic survey in the villages to the east of Pugu forest.

Fuggles-Couchman (1939) lists bird species collected by the author.

Gerhardt (1977) lists bird species seen by the author in the Pugu Forest Reserve.

Gentry (1991) compares the characteristics of the liana community in Pugu forest with other forests in the world. This paper lists Pugu as having the highest recorded density of liana individuals in the world, although a subsequent study in Litipo has found a higher figure.

Grant & Mackworth-Præd (1940) describe a new bird subspecies from Pugu forest.

Hall & Rodgers (1986) enumerate the extent of pole-cutting damage in Pugu forest.

Hanna & Anderson (1994) record the results of an expedition to assess the abundance of the Black and Rufous Elephant Shrew in Pugu forest.

Haule *et al.* (1995) present results from a series of vegetation plots constructed in Pugu forest.

Hawthorne (1984) gives detailed descriptions of the vegetation of Pugu.

Harvey & Howell (1987) list a number of the rarer bird species from Pugu forest with notes on their status.

Howell (1976, 1977 & 1979) describes the results of studies of bat species in Pugu.

Howell (1981) is the first comprehensive paper covering the biological values of a single Coastal Forest in Tanzania. Describes the rare species and conservation issues for Pugu Forest Reserve.

Khalil (1973 & 1975) describes new endo-parasite species from Pugu.

Moreau (1966) lists the rare bird species found in Pugu.

Mwasumbi & Middleton (1992) note that disturbance in Pugu forest has increased the short-term species richness of its flora, especially in terms of alpha diversity.

Polhill (1968) highlights the botanical importance of the Pugu Hills, and recommends upgrading the site to a nature reserve.

Richards (1988) discusses the issues concerning a decision on whether or not to continue/expand the kaolin mining operation at Pugu.

Ripley & Heinrich (1966) list bird species collected by the authors in Pugu.

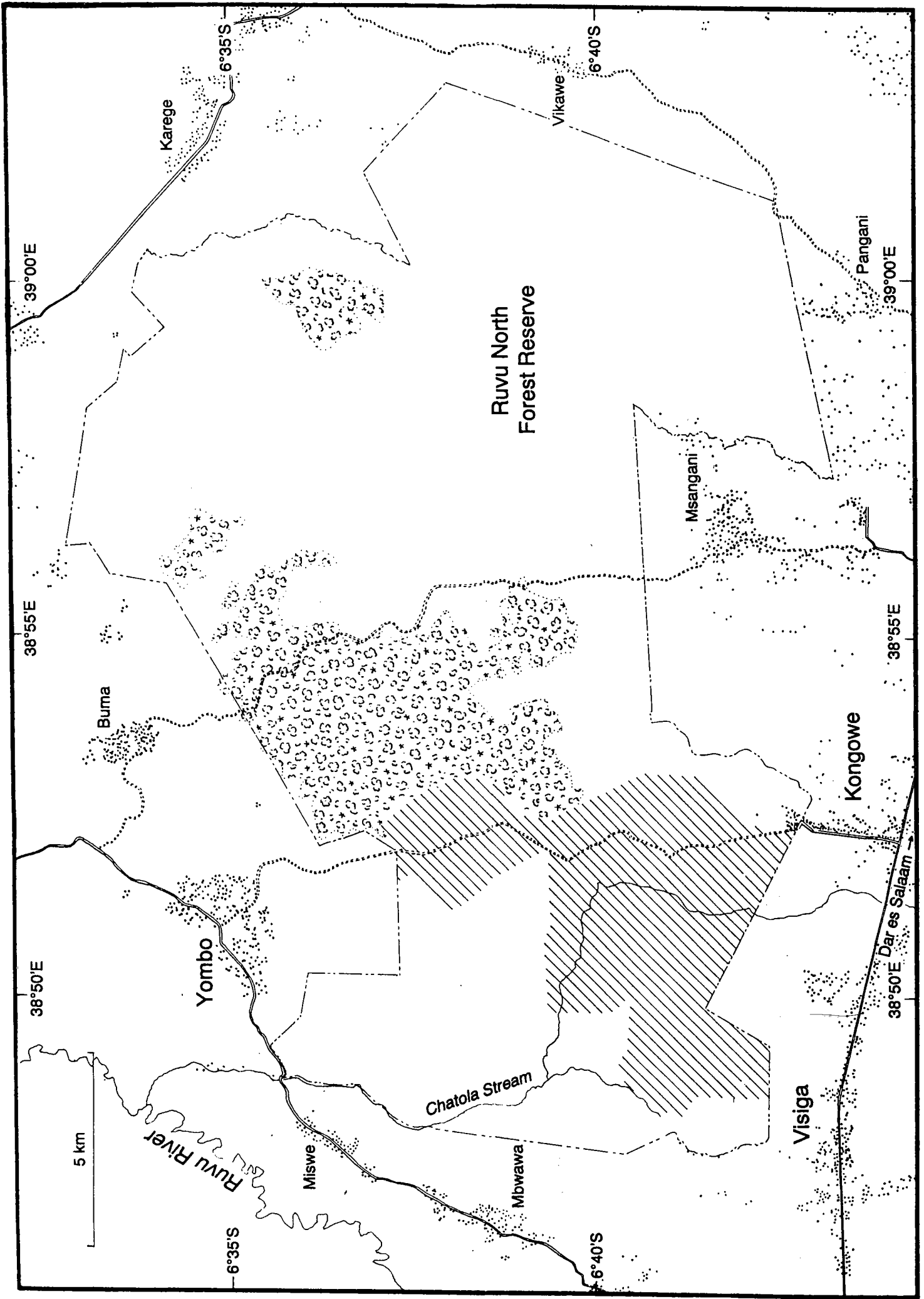
Somi & Nshubemuki (1990) summarise the results of the various silvicultural experiments associated with the plantations at Pugu.

Stuart (1978) lists bird species seen by the author at Pugu and these are then used to compare the avifauna of Pugu with the Arabuko-Sokoke forest and the Eastern Arc forests in Stuart (1981) and again with other forests in east and south-east Africa in Stuart & Jensen (1985).

Swynnerton & Hayman (1951) list some of the mammals found in Pugu Forest.

Wingfield (1976 & 1977) describes the vegetation and lists the plants of Pugu Forest.

Pugu Forest is furthermore mentioned in the majority of the general references on Tanzanian Coastal Forests.



RUVU NORTH FOREST RESERVE

DESCRIPTION

- NAME:** Ruvu North Forest Reserve (incorporating the former Bana Forest Reserve)
Kibaha District, Coast Region, Tanzania.
- AREA:** 40,468 ha; 405 sq. km; 100,000 acres; 156 sq. miles.
- BOUNDARY:** 98.5 km
LENGTH
- STATUS:** Productive Forest Reserve
Declaration Order 309/13/9/1959 for Bana Forest Reserve, with a Variation Order 128/8/9/1978 for enlarging the reserve to the present Ruvu North Forest Reserve. Gazetted 1967 (Bana Forest Reserve gazetted 1956, original map Jb 281 of 1956)
- MAPS:** Ordnance Survey Topographic Maps 1:50,000 Series Y742
Sheets 185/2 'Yombo' of 1987, mapped from aerial photos of 1981.
186/1 & part of 186/2 'Kawe' of 1987, mapped from aerial photos of 1981.

Forest Division maps: Boundary Map Jb 665 of 1967, 1:50,000
Aerial photos Jb 702

LOCATION

- Grid Ref:** 6°33'16" - 6°43'00" S, 38°47'00" - 39°02'00" E
- Elevation:** 40 - 140 m a.s.l.

Ruvu North Forest Reserve is situated on the coastal plain, about 16 km west of the Indian Ocean. The topography is relatively even and ranges from 40-140 metres a.s.l. The reserve lies about 70 km by road north west of Dar es Salaam.

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.

Access to the areas of natural forest by the main Dar es Salaam to Morogoro road. Turn to the north 50 km from Dar es Salaam at Kongowe on the track to the Ruvu Forest Project office, which is reached after 3 km. Continue north until reaching the Mlandizi to Bagamoyo road at Yombo. Follow this road to the north-east (towards Bagamoyo) for about 10 km until reaching a turning due south. Take the small track to Buma village (3 km) and from there continue south for a further 5 km until the forest and forest reserve are reached.

Public transport access by the many buses which take the Morogoro road out of Dar es Salaam. All will stop if requested at Kongowe and from there is about a 12km walk to the natural forest areas (ask for directions at the Ruvu Forest Project office).

SOILS

Coarse or loamy sands of low organic matter content and poor nutrient status. Small patches of clay soils are also present. Soil maps of parts of the reserve have been produced by the Forest Division (maps Jb 1944 of 1976, 1:25,000 and Jb 1945 of 1976, 1:50,000). Soils in the natural forest areas are acid with a pH range of 5.3 - 5.9.

CLIMATE

Ruvu North Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. Annual rainfall is often below 1000 mm (Forest Division records). The nearest rainfall station is at the Chambezi Coast Agricultural Station (6°35'S, 38°55'E, 50 m altitude), where an average of 1153 mm of rainfall per year has been recorded for the 20 years up to 1973, with June, July, August & September having a monthly average of less than 50 mm rainfall during this period.

VEGETATION

Ruvu North Forest Reserve contains a complex mosaic of five main vegetation types :

Disturbed Dry Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Heavily disturbed/secondary forest is present in small patches surrounded by woodland. Small patches of forest covering termite mounds are also abundant in the grassland and thicket vegetation types, possibly limited by frequent bushfires. The margins of the forest patches are dense, with much liane and shrub growth, resulting from encroachment by bushfires. Where disturbance has been less severe, closed canopy forest with *Hymenaea verrucosa* and *Baphia kirkii* is present. Other tree species found in the forest include *Cola clavata*, *Azelia quanzensis*, *Combretum illairii*, *Dovyalis hispidula*, *Diospyros squarrosa*, *Vitex* sp., *Monodora minor* and *Lobelia fervens*.

A single vegetation plot has been constructed in the forest area :

Plot : Degraded forest at 90 m altitude, 16 subplots of 100 m².
0.16 ha in area with 47 trees over 10 cm dbh giving an equivalent of 294 trees per ha.
Mean tree dbh 22.2 cm; mean tree height 14.1 m; mean bole height 5.6 m.
Mean crown area 49.3 m²/tree; mean basal area 11.4 m²/ha; mean stand volume 64 m³/ha.
The following tree species were identified : 9 x *Haplocoelum* sp. (19%), 5 x *Dialium holtzii* (11%), 4 x *Azelia quanzensis* (9%), 3 x *Cola clavata* (6%), 2 x *Dovyalis hispidula*, *Paropsia braunii*, *Baphia kirkii* (4% each), 1 x *Combretum* sp., *Diospyros squarrosa*, *Hymenaea verrucosa*, *Landolphia kirkii*, *Monodora minor*, *Rinorea* sp., *Vitex* sp. (2% each). The remaining 14 trees were all different and could not be identified.

Riverine Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

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 and this disturbance is resulting in the development of dense secondary vegetation. Tree species include *Sorindeia madagascariensis*.

Thicket [Zanzibar-Inhambane evergreen thicket (*sensu* White, 1983)]

Thicket areas are often dense with a low diversity of species, generally with some *Dalbergia*, *Julbernardia*, *Haplocoelum* and *Acacia* species.

Woodland [Zanzibar-Inhambane secondary wooded grassland (*sensu* White, 1983)]

The majority of the reserve is covered by woodland with *Pterocarpus angolensis*, *Brachystegia spiciformis*, *Dalbergia melanoxylon*, *Combretum schumannii*, *Kigelia africana*, *Cassia abbreviata*, *Albizia versicolor*, *Julbernardia* and *Acacia* species. A survey of tree species for a charcoal inventory carried out in 1971 identified 23 other tree species within the reserve.

Grassland [Zanzibar-Inhambane secondary grassland (*sensu* White, 1983)]

Grassland with scattered trees is present in the reserve, and is a fire climax community that contains tree species that are resistant to burning e.g. *Dalbergia melanoxylon*.

The 1971 charcoal inventory calculated the following areas for the above vegetation types - forest (presumably including woodland and hardwood plantation) 101 km²; thicket 21 km²; grassland 165 km²; softwood plantation 9 km²; cultivation 2 km².

TIMBER VALUES

Ruvu North is run on a productive basis with licenses issued for tree felling and other exploitation of forest products. *Khaya anthotheca*, *Dalbergia melanoxylon*, *Pterocarpus angolensis*, and *Azelia 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 2000 ha and are presently concerned with exotic species, e.g. *Pinus* sp. including *P. caribaea*, *Eucalyptus* sp. such as *E. tereticornis* and *E. hybrid zanzibaris* and also *Gmelina arborea*.

The objective of these trial plots is to determine the potential of these species at this site. To date *E. tereticornis* has proved the most successful, though generally the trial plots have had unsatisfactory results and Ruvu North is considered marginal for the successful growth of *Pinus caribaea*. The last plot was established in 1981 with 2 ha of the exotic species *Acacia mangium*.

BIODIVERSITY

In spite of its proximity to Dar es Salaam, Ruvu North Forest Reserve has received scant biological survey. The Frontier-Tanzania Coastal Forest Research Programme visited the reserve briefly in 1992.

Birds

No bird surveys are known to have been undertaken.

Mammals

10 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 1 bat species [specimen collected] and 3 rodent species [8 specimens collected from 20 trap nights].

Reptiles

1 forest dependant reptile species has been recorded from a collection of a single specimen by Frontier-Tanzania.

Amphibians

2 species are recorded by Frontier-Tanzania collections from 15 specimens. No rare species have yet been found.

Plants

No rare plants are yet recorded from Ruvu North.

CATCHMENT VALUES

The OS map (185/1) shows two watercourses within the reserve, the Chatota Stream (a tributary of the Ruvu River which flows within 2 km north-west of the reserve boundary), and the Mkuza River; which is seasonal.

The reserve itself lies between the Ruvu River to the north-west and the Mpiji River 2 km to the south-east, and gives rise to seasonal tributaries of these watercourses.

HUMAN IMPACTS

Logging

Logging has been intense such that most large trees have now gone.

Charcoal Production

Much timber has been removed to produce charcoal.

Fires

Uncontrolled bushfires are frequent within the reserve, and these threaten the remaining areas of forest.

Cultivation and Settlement

During the early 1960s parts of the existing reserve were cultivated and settled. These farmers were re-located when the Bana Forest Reserve was enlarged to create Ruvu North Forest Reserve.

Forestry

Approximately 20 km² of the reserve has been planted with exotic species. The majority of the planted area lies outside the extent of the former Bana Forest Reserve, so little of the natural forest vegetation has been affected by the plantation.

CONSERVATION ISSUES

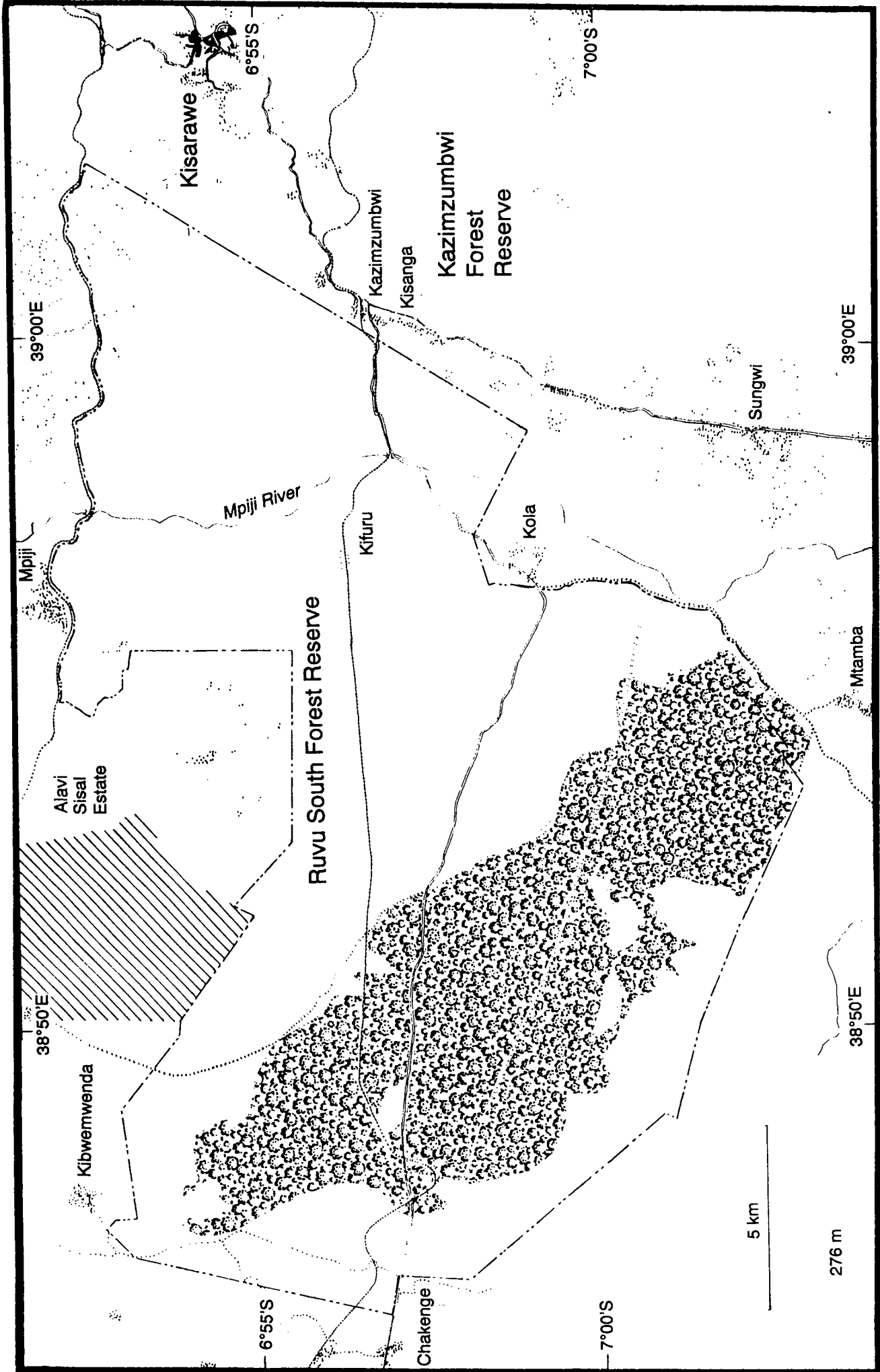
Preliminary biological surveys in the forested areas of Ruvu North would indicate that these are not particularly rich in rare species. The reserve is nonetheless important for protecting a large area of natural and semi-natural vegetation close to Dar es Salaam. In future years this may prove to have a high amenity value, perhaps as an urban park.

The Coastal Forest in Ruvu North is also unusual in being one of the last remaining areas of forest on the coastal plain at some distance from the shore and not located on a hill.

Ruvu North is located close to a large and rapidly expanding urban population with good road access. The existing reserve boundaries were determined in 1967 by gazetting all the remaining uncultivated land in the area, thereby preventing any future agricultural expansion. The pressure for encroaching into the reserve where only a small fraction is being actively managed is therefore set to increase.

LITERATURE

Somi & Nshubemuki (1990) summarise the results of the various silvicultural experiments associated with the plantations at Ruvu North.



Kisarawe

6°55'S

7°00'S

39°00'E

39°00'E

Alavi
Sisal
Estate

Ruvu South Forest Reserve

Kazimzumbwi
Forest
Reserve

Mpiji

Mpiji River

Kifuru

Kola

Sungwi

Mtamba

38°50'E

38°50'E

Kibwemwenda

6°55'S

7°00'S

Chakenge

5 km

276 m

RUVU SOUTH FOREST RESERVE

DESCRIPTION

- NAME:** Ruvu South Forest Reserve (incorporating the former Banda and Kola Forest Reserves) Kisarawe & Kibaha Districts, Coast Region, Tanzania.
- AREA:** Approx. 35,000 ha; 350 sq. km; 86,487 acres; 126.4 sq. miles.
- BOUNDARY:** 100 km.
LENGTH
- STATUS:** Protective Forest Reserve
Original Banda and Kola Forest Reserves designated under notice no. 158 & 159 of 1958. Variation Order 81/29/6/1979 to incorporate the two former reserves into the new Ruvu South Forest Reserve.
- MAPS:** Ordnance Survey topographic map 1:50,000 Series Y742
Sheets 185/4 'Soga' of 1987, mapped from aerial photos of 1981.
186/3 'Kisarawe' of 1987, mapped from aerial photos of 1981.
203/2 'Maneromango' of 1987, mapped from aerial photos of 1981.
- Forest Division Boundary Map: Jb 1460 of 1968, 1:50,000
Aerial photos: Jb 702 of 1969
Fuelwood areas: Jb 2144 of 1988, 1:25,000 (not seen)
Superceded maps: Jb 331 'Kola' and Jb 332 'Banda' of 1956, 1: 50,000

LOCATION

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

Elevation: 120 - 260 m a.s.l.

Ruvu South Forest Reserve overlies gentle topography with no distinct features, with an altitudinal range of 120 - 260 m a.s.l. , approximately 30 km south-west of Dar es Salaam and 3 km east of Kazimzumbwi Forest Reserve. The villages of Kola and Kifuru are located at the edge of the reserve but lie some 8 km from the main forest block. This main block of forest is located on a low hill at the western end of the reserve.

District Forestry Division HQ at Kisarawe. Local forestry office at Mzenga.

The TAZARA railway line runs through the reserve and the Central Railway forms part of the north-eastern boundary.

All weather access from Kisarawe on unsurfaced roads; first take the road to Kisarawe and then take a westward turning to Mzenga. This road runs through the reserve and the forest itself.

Public transport access by TAZARA railway to Mzenga station. Walk about 10 km to the forest on the road to Kazimzumbwi. Alternative access from Kifuru station in the reserve.

SOILS

Red-brown soils pH 5.1 - 5.3.

CLIMATE

Ruvu South Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. The nearest rainfall station is at the Alavi Sisal Estate (6°50'S, 38°52'E, 152 m altitude), where an average of 967 mm of rainfall per year has been recorded from 1931-1960, with June, July, August, September & October having a monthly average of less than 50 mm rainfall during this period.

VEGETATION

Ruvu South Forest Reserve contains one of the largest blocks of Coastal Forest yet known in Tanzania. The canopy of this forest block is generally low and uneven with scattered tall trees, and is thought to be natural Zanzibar-Inhambane scrub forest. Within the scrub forest, small patches of true dry forest are also present, and the two vegetation types cover approximately 98 km².

The following vegetation types are present in the reserve :

Dry Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Small patches of dry forest are present on the main ridge in the west of the reserve. Tree species include *Acacia* sp., *Dialium holtzii*, *Sterculia appendiculata*, *Millettia usaramensis*, *Mostuea microphylla*, *Oldfieldia somalensis*, *Memecylon melindense*, *Cola* sp., *Drypetes arguta* and *Ficus tremula*.

A single vegetation plot has been constructed in a small area of dry forest :

Plot : Dry forest on flat ground, 100 m x 5 m.

0.05 ha in area with 18 trees over 10 cm dbh giving an equivalent of 360 trees per ha.

The following tree species were identified : 6 x *Dialium holtzii* (33%), 3 x *Mostuea microphylla*, *Millettia* sp. (3% each), 2 x *Markhamia obtusifolia* (11%), 1 x *Acacia* sp., *Drypetes arguta*, *Ficus tremula*, *Oldfieldia somalensis* (6% each).

Scrub Forest [Zanzibar-Inhambane scrub forest (*sensu* White, 1983)]

The majority of the closed canopy vegetation in the west of the reserve comprises scrub forest. Tree species here include *Grewia conocarpa*, *Salacia erecta*, *Hymenocardia ulmoides*, *Zanthoxylum holtzianum*, *Haplocoelum* sp., *Drypetes arguta*, *Heinsia crinita*, *Rourea coccinea*, *Combretum illairii*, *Combretum apiculatum*, *Keetia zanzibarica*, *Grewia holstii*, *Erythroxylum emarginatum*, *Hugonia castaneifolia*, *Acacia adenocalyx*, *Ritchiea capparoides* and *Gardenia transvenulosa*.

A single vegetation plot has been constructed in the scrub forest area :

Plot 1 : Scrub forest near a track running through the southern part of the forest, 50 m x 50 m plot.

0.25 ha in area with 49 trees over 10 cm dbh giving an equivalent of 200 trees per ha.

Mean tree dbh 23.8 cm; mean tree height 10.7 m; mean bole height 6.2 m.

Mean basal area 8.9 m²/ha; mean stand volume 55 m³/ha.

Woodland [Zanzibar-Inhambane secondary wooded grassland (*sensu* White, 1983)]

Wooded grassland covers the majority of the reserve, especially to the east.

Swamps

Permanent swamps are present in the centre of the reserve. These swamps were formerly gazetted within the Kola Forest Reserve.

Riverine Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

The Kola Forest Reserve map of 1956 (Jb 331) indicates that 946 ha of high [riverine] forest was present at that time. This riverine forest is still reported to be in good condition (N. Baker, pers. comm.). A further area of riverine forest occurs within the present reserve boundaries along the Kipgea river.

TIMBER VALUES

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

A survey in 1970 estimated that 20,000 m³ of exploitable timber was available in the Kola Forest Reserve (Forest Division data).

BIODIVERSITY

Ruvu South forest has not been biologically surveyed in great detail, although botanical collections have been made by Procter, Shabani, Vaughan and Busse. The ornithologist Fuggles-Couchman collected there in 1955 (see note below). The Frontier-Tanzania Coastal Forest Research Programme visited the reserve in 1991. A number of ornithological surveys have been carried out by N.E. & E.M. Baker since the mid 1980s.

Birds

Extensive bird surveys have been carried out in the woodland areas to the north-east of the reserve, but the main forest block to the west has only been briefly surveyed (by N.E. & E.M. Baker, important records cited below). Some of the earlier collectors (e.g. Fuggles-Couchman) have also collected in the reserve area.

Coastal Forest endemics - Little Yellow Flycatcher *Erythrocerus holochlorus*.
Sokoke Pipit¹ *Anthus sokokensis* [Birdlife Vulnerable; IUCN Vulnerable].

Other BirdLife listed - Southern Banded Snake-eagle *Circaetus fasciolatus* [BirdLife Near Threatened].
species East Coast Akalat *Sheppardia gunningi* [BirdLife Vulnerable].

¹Fuggles-Couchman's record of the Sokoke Pipit from the 'old Morogoro road, 56 km from Dar es Salaam is from the Ruvu South Forest Reserve (cited in Harvey & Howell, 1987).

Mammals

12 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 5 bat species [5 specimens collected] and 2 rodent species [2 specimens collected from 604 trap nights].

- Coastal Forest/Eastern - East African Collared Fruit Bat *Myonycteris relicta*. (Specimen KMH 7321).
Arc endemics Known from only 8 other localities [IUCN Vulnerable].
Lesser Pouched Rat *Beamys hindei*. (Specimen KMH 7223) [IUCN Vulnerable].
- Other CITES/IUCN - African Elephant *Loxodonta africana* [CITES Appendix 1; IUCN Vulnerable].
listed species Black-and-Rufous Elephant Shrew *Rhynchocyon petersi petersi*. (Photograph of specimen in Hanna & Anderson, 1994). [IUCN Rare].
Zanzibar Galago *Galagoides zanzibaricus* (Specimen captured and released, Frontier data) [IUCN Vulnerable].

Reptiles

7 forest dependent reptile species have been recorded from observations and a total collection of 8 specimens by Frontier-Tanzania. No rare species have yet been recorded.

Amphibians

3 species are recorded by Frontier-Tanzania collections from 17 specimens. No rare species have yet been found.

Plants

151 fertile botanical samples have been collected from Ruvu South by Frontier-Tanzania. Other collections include those by Harris.

- Coastal Forest Endemics - *Combretum harrisii* Wickens [Combretac.] (Specimen *Wingfield* 4297). Ruvu South and 5 sites nearby.
Leptactina oxyloba Schum. [Rubiaceae] Ruvu South and 4 other sites only. Cited in FTEA.
- Other species - *Croton steenkampianus* Gerstener [Euphorbiaceae] Ruvu South and South Africa only. Cited in FTEA.

CATCHMENT VALUES

The River Banda and associated tributaries run alongside the western margin of the forest where a small permanent swamp is found close to the Mzenga-Kazimzumbwi road. Swamps are also found in the centre of the Reserve which give rise to a number of water courses such as the Kipega and Kola rivers.

HUMAN IMPACTS

Logging

Logging continues despite the low density of suitable trees. Logging may be legally carried out provided permission is obtained from the Forestry Division (at District and Regional levels).

Pole cutting

Pole cutting is carried out illegally, but damage appears to be slight.

Charcoal Production

Not yet perceived as a major threat to the forest. Charcoal is produced for the local market and for sale in Dar es Salaam but activities are generally concentrated around roads and in the woodland areas.

Hunting

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

Cultivation

There is no agricultural 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.

Ordnance Survey maps indicate that a lot of agricultural encroachment is taking place in the north-east corner of the forest reserve. This area is not known to contain forest and was not included in either of the earlier Banda or Kola Forest Reserves.

Forestry

Trial plots have been established in the forest reserve. Results from these plots indicate that Ruvu South is a suitable site for pine plantations (Procter, 1966 in Somi & Nshubemuki, 1980).

CONSERVATION ISSUES

In spite of its proximity to Dar es Salaam, the scale of land use and natural resource pressure on Ruvu South Forest Reserve is much less than in the other Coastal Forests located close to the capital (e.g. Pugu, Pande, Kazimzumbwi, Vikindu and Ruvu North). Ruvu South forest is unusual in that there are no villages or settlements adjoining the forest itself, and the absence of cultivation pressure on the forest considerably eases its conservation. The greatest threat to the forest in the short term is from charcoal burning and logging.

Although Ruvu South is a productive reserve, a ban on tree felling for a period of 10 - 15 years is advisable to enable the natural forest to recover.

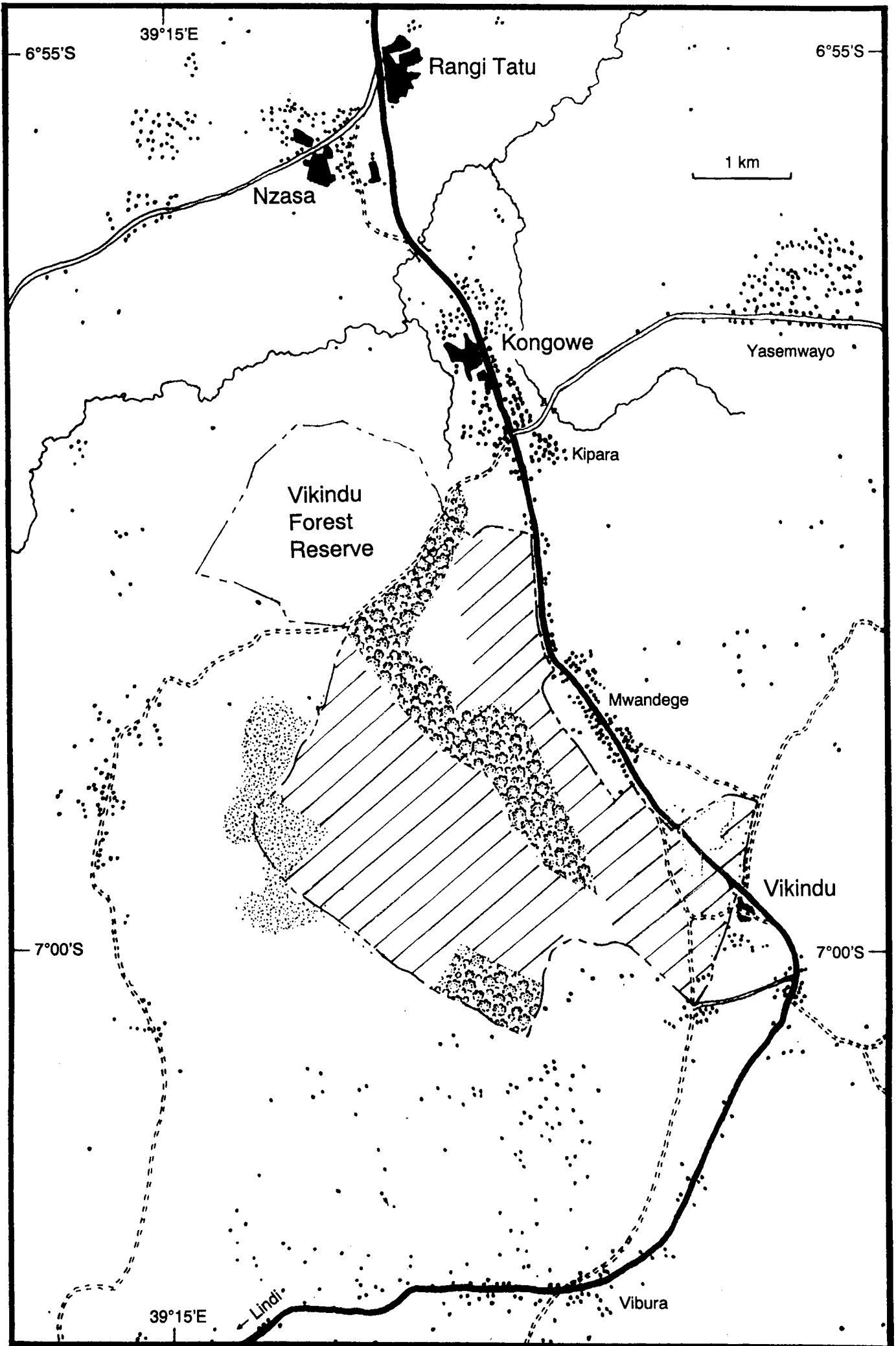
The conservation value of Ruvu South Forest Reserve from a wildlife viewpoint may exceed those from a biodiversity viewpoint, especially given the population of 100 elephants occurring within 30 km of Dar es Salaam. A case may exist for transferring management of the reserve from the Forest Division to the Wildlife Division, and for re-designating the area as a Game Reserve.

LITERATURE

Baker & Baker (1994) note the presence of a quail species from Ruvu South.

Hanna & Anderson (1994) record the results of an expedition to assess the abundance of the Black and Rufous Elephant Shrew in Ruvu South forest.

Matthews (1993) lists the medicinal plants of Ruvu South along with their local name, use, preparation and Frontier collection number.



VIKINDU FOREST RESERVE

DESCRIPTION

- NAME:** Vikindu Forest Reserve
Kisarawe District, Coast Region, Tanzania.
- AREA:** 1,796 ha; 17.96 sq. km; 4438 acre; 6.93 sq. miles.
- BOUNDARY:** 22.45 km.
LENGTH Boundary currently being cleared (May 1995), with plans to plant teak on the boundary.
- STATUS:** Productive Forest Reserve.
Declaration Order Cap. 132 of 1947, p. 1347; superseded by Cap. 389 - supp. 59 of 1959, p. 59.
Gazetted during the German administration - original map RE/K/4/1.
- MAPS:** Ordnance Survey topographic map 1:50,000 Series Y742
Sheets 186/4 & part of 186E/3 'Dar es Salaam' of 1987, mapped from 1981 aerial photos.
204/2 & part of 204E/2 'Shungubweni' of 1987, mapped from 1981 aerial photos.
- Boundary Map Jb 601 of 1964, 1:10,000 (shows plantation areas)
One version of Jb 601 shows vegetation types.

LOCATION

Grid Ref: 6°57'S - 7°00'S, 39°15'E - 39°18'E

Elevation: 40 - 80 m a.s.l.

Vikindu Forest is located on relatively flat land between 40 - 80 m a.s.l., approximately 15 km inland from the Indian Ocean, approximately 17 km south of Dar es Salaam on the main road to Kilwa. The majority of the reserve is now planted with exotic tree species.

There is all-weather access by the main tarmac Dar es Salaam to Kilwa road (which forms part of the eastern boundary of the forest reserve). The village of Vikindu (on the main road) lies to the immediate south of the forest reserve.

The District Forestry Office is at Kisarawe, local forestry officers are based at Vikindu.

Public transport access is via the numerous buses which travel alongside the reserve, e.g. buses from Dar es Salaam to Mtwara, Lindi, Kilwa, Mohoro, Ikwiriri, Kibiti, Nyamasati, Mkuranga, Kisiju etc. Many of these buses depart from the Temeke suburb of Dar es Salaam.

SOILS

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

CLIMATE

Vikindu Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. The nearest rainfall station is at the Vikindu Forest Station (7°20'S, 39°18'E, 91m altitude), where an average of 1223 mm of rainfall per year has been recorded for the 16 years prior to 1973, with June, August, September & October having a monthly average of less than 50 mm rainfall during this period.

VEGETATION

The following vegetation types occur in Vikindu Forest Reserve :

Plantation Forest

The majority (75%) of the Vikindu Forest Reserve has been clear-felled and planted with exotic plantation species. Insufficient cleaning of the plantations has subsequently allowed indigenous species to regenerate beneath the exotics, leading to the development of a semi-natural scrub forest with the exotic plantation trees as emergents above a secondary thicket.

Riverine Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

A small area of natural forest remains along the Binguni watercourse (Hawthorne, 1984), and also in the extreme south of the forest reserve. The collection notes for *Warburgia elongata* describe a canopy composition of *Khaya anthotheca*, *Azelia quanzensis*, *Parkia filicoidea*, *Barringtonia racemosa*, *Hymenaea verrucosa* and also 'Uapaca' (which might be a mistake for *Bridelia micrantha* ?).

Swamp Forest [Swamp forest (*sensu* White, 1983)]

The collection notes for *Warburgia elongata* cite a collection from an area of *Pandanus rabaiensis*/'*Raphia*' (possibly meaning *Elaeis guineensis*), which would indicate that swamp forest exists in the reserve.

Grassland [Zanzibar-Inhambane secondary grassland (*sensu* White, 1983)]

A small area of grassland remains in the east of the reserve where *Diospyros mafiensis* is recorded as "a very common tree" (Hawthorne, 1984).

Cultivation

The northern block of the forest reserve north of the main track has been completely encroached by illegal cultivation. The original German gazettelement map, together with the forest division vegetation map indicates that this part of the forest reserve was formerly covered in scrub forest with *Dobera loranthifolia* and *Strychnos madagascariensis*. Large emergent trees such as *Sterculia appendiculata*, *Milicia excelsa*, *Baphia kirkii* and *Pterocarpus angolensis* were also present, and some of these were used as the original boundary markers for the north western border of the reserve.

Thicket [Zanzibar-Inhambane evergreen thicket (*sensu* White, 1983)]

Thicket occurs at the extreme west of the reserve.

TIMBER VALUES

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

In 1978 a further 20 hectares were planted with *Pinus carribea*. Results from earlier trials suggest that Vikindu is a marginal to suitable site for pine plantations (Procter, 1966 in Somi & Nshubemuki, 1980).

BIODIVERSITY

In spite of its easy access and proximity to Dar es Salaam, Vikindu has largely escaped scientific study. The botanist Hawthorne visited the reserve in 1982. The ornithologist Mlingwa has netted in the forest during the late 1980s and early 1990s. The Frontier-Tanzania Coastal Forest Research programme briefly visited in 1992.

Birds

42 bird species have been recorded of which 16 are forest birds (C. Mlingwa data). Other records may exist from earlier collections deposited in Britain and/or Germany as one citation is given by Fuggles-Couchman (1939).

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.
Sokoke Pipit *Anthus sokokensis* [BirdLife Vulnerable; IUCN Vulnerable].

Mammals

2 mammal species have been recorded from observations by Frontier-Tanzania [no rodent specimens were captured from 30 trap nights].

Reptiles

2 forest dependant reptile species have been recorded from observations and a total collection of 2 specimens by Frontier-Tanzania. No rare species have yet been recorded.

Amphibians

5 species are recorded by Frontier-Tanzania collections from 19 specimens. No rare species have yet been found in the forest itself, although a specimen of a small toad (KMH 10530) might prove to be an interesting find. A rare Caecilian (probably *Boulengerula* sp., specimen KMH 10487) has been collected nearby in the farm of Mr. Hamid Bharmal (to the north-east of the reserve).

Plants

- Vikindu endemic - *Warburgia elongata* Verdc. [Canellaceae]. Cited in FTEA.
- Coastal Forest area - *Tristemma schliebenii* Markgraf [Melastomac.] (Specimen UDSM herbarium).
endemics Vikindu & 2 other sites only. Limited to swampland.
- Other species - *Triraphis schinzii* Hack. [Poac.] Vikindu, South Africa and Namibia. Cited in FTEA.

Strychnos xylophylla Gilg. [Loganiac.] is recorded from 'riverine forest 16km from Dar es Salaam on the Utete road' in the FTEA, which corresponds to Vikindu. This tree species is only known from 2 other sites.

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

Forestry

From 1946 there has been a project in the Vikindu Forest Reserve for increasing fuel supplies for Dar es Salaam, with the aim of exploiting exotic woodfuel plantations over a 10 year rotation. Natural forest (termed 'indigenous fuel' in the Forest Department Annual Reports) was cleared by fuel contractors and local people then cultivated for one season before exotic species were planted, beginning with 235 acres of *Cassia siamea* planted prior to 1950 (Annual Report of the Forest Department, 1949). By 1964, 75% of the forest reserve had been replanted with exotic species (*Eucalyptus saligna*, *Eucalyptus camaldulensis*, *Casuarina*, *Gmelina arborea*). Commercial logging of these species is currently taking place.

The remaining area of natural forest was selectively logged for trees of commercial value prior to independence in 1961.

Agriculture

The northern block of the forest reserve has been illegally encroached up to the track that bisects the reserve. Licenses permitting cultivation in this area had apparently been issued by officials in Dar es Salaam, but this practice has now stopped and there are plans to prosecute the cultivators.

An enclave for cultivation formerly existed in the centre of the forest reserve.

Pole-Cutting

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

CONSERVATION ISSUES

Vikindu Forest Reserve is located in a densely populated agricultural area close to Dar es Salaam, beside a main road. Pressures on the site are high and will grow as the population of Dar es Salaam burgeons. A quarter of the forest reserve has already been lost to illegal cultivation, and the areas of natural forest have also suffered from illegal charcoal burning. The Wildlife Conservation Society of Tanzania currently provides the funds to the Forest Division for three extra forest guards for Vikindu Forest Reserve, and such support is essential to sustain the future of the forest.

Since 1992 Vikindu Forest Reserve has been further supported by the WWF Coastal Forest project, which has provided bicycles, uniforms and housing to the forest guards, and is involved in getting the reserve boundaries cleared. Local Community Extension work includes providing seedlings to the local villagers and schools for planting either as part of agroforestry programmes or in pure woodlots. The major issue of providing alternative sources of timber is therefore being addressed.

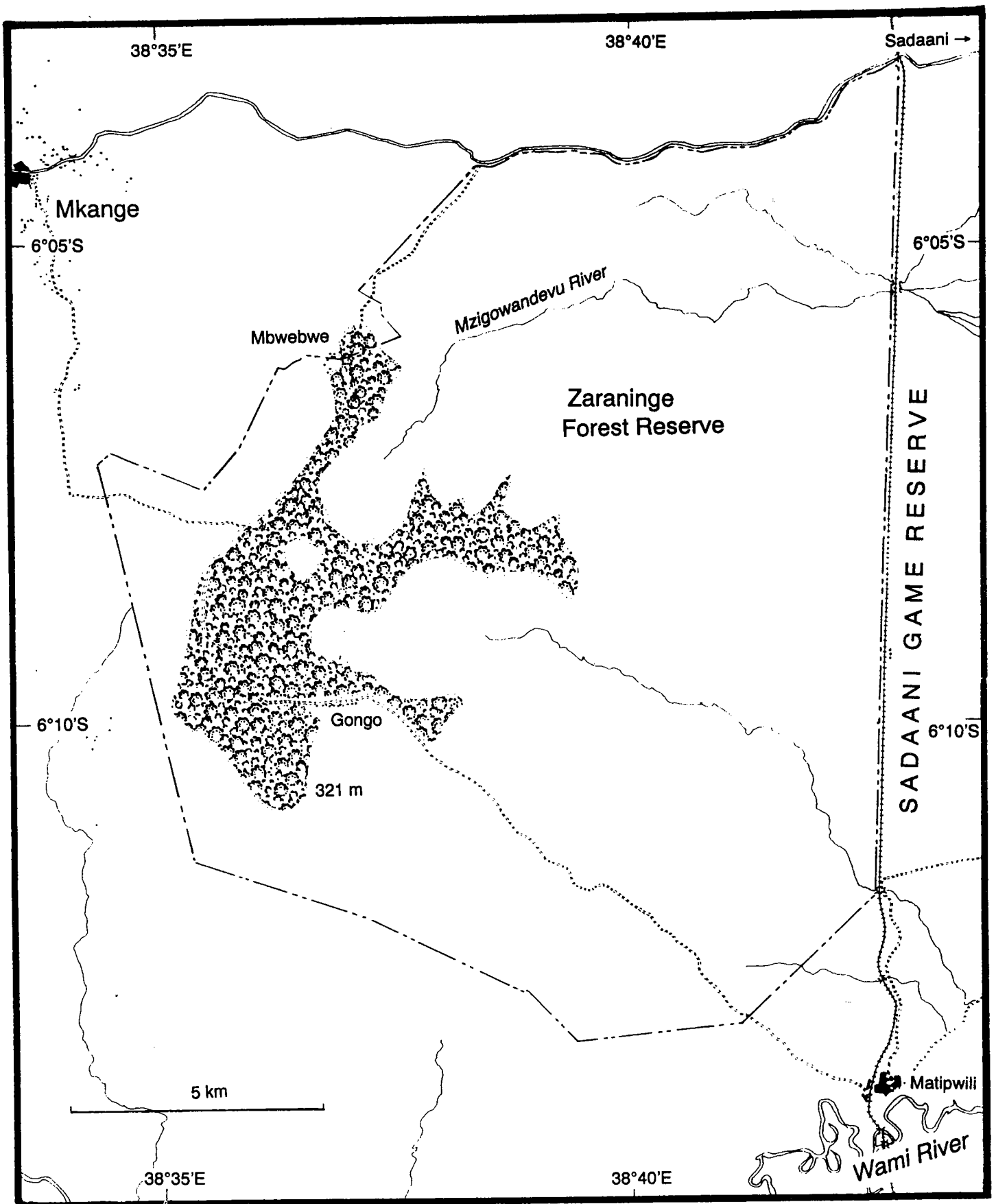
Further biological inventory of the natural forest areas is required to better gauge the importance of Vikindu forest.

LITERATURE

Hawthorne (1984) briefly describes the vegetation of Vikindu.

Meraki *et al.* (1992) provide more background information on Vikindu. Available from the WWF office, Dar es Salaam.

Mlingwa (1990) records the discovery of the rare Sokoke Pipit in Vikindu Forest.



ZARANINGE (KIONO) FOREST RESERVE

DESCRIPTION

- NAME:** Zaraninge Forest Reserve (also known as Kiono, Kiona, Mkange, Miono forest).
Bagamoyo District, Coast Region, Tanzania.
- AREA:** Approx. 2,100 ha (21 sq. km). This figure will be reduced following expected boundary changes to provide a 'migration corridor' to the villages of Gongo and Tumbili.
- BOUNDARY:** 60 km, to increase following boundary changes.
LENGTH About half of the boundary has been recently cleared (1995). Further boundary clearance will follow once the new boundary has been surveyed.
- STATUS:** Lies within Zaraninge Proposed Forest Reserve (Designated in 1958). Proposed for gazettelement under Government notice 426/8/88.
Gazettelement pending approval by parliament (expected early 1996). Meetings have been held and plans for the reserve approved at the village, ward, district and regional levels.
- MAPS:** Ordnance Survey Topographic Map 1:50,000 Series Y742
Sheet 168/1 'Mkange' of 1987, mapped from aerial photos of 1981-82.
(Shows incorrect Proposed Reserve boundaries)
- Forest Division Boundary Map Jb 2140 of 1987, 1:25,000 ; further amendments expected.
Jb 600 of 1965, 1:50,000 shows the boundary of the older proposed 'Kiono Forest Reserve'.

LOCATION

Grid Ref: 6°04'S - 6°13'S, 38°35'E - 38°42'E

Elevation: 100 - 300 m a.s.l.

The forest covers a plateau rising above the coastal plain with an altitudinal range of 100 m to 300 m, approximately 50 km north of Bagamoyo, 20 km southwest of Sadaani and 20 km northwest of Wami (see map).

Access is by road via the Miono-Sadaani road. Some 30 km 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.

Public transport access by bus from Dar es Salaam to Miono, or by northern railway line to the stations at Matipwilli (Wami) and Sadaani (Mvavi). Walk the remaining 10-20 km to the forest.

District Forestry Officer in Miono. Forestry Office in Bagamoyo.

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 soils 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 frequently containing carbon from past fires.

CLIMATE

The Zaraninge Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. The nearest rainfall station is at the Wami Railway Station (6°14'S, 38°42'E, approx. 100 m altitude), where an average of 822 mm of rainfall per year has been recorded for the 6 years up to 1973, with February, June, July, August, September & November having a monthly average of less than 50 mm rainfall during this period. A higher rainfall can be expected on the Kiono plateau, due to orographic precipitation at the higher altitude, and a more representative rainfall might be from that at the Mandera Mission (6°13'S, 38°23'E, 212 m altitude), where an average of 1053 mm of rainfall per year has been recorded for the 38 years up to 1973, with June, July, August & September having a monthly average of less than 50 mm rainfall during this period. A peak annual rainfall of 2099 mm and a minimum annual rainfall of 644 mm has been recorded between 1934 and 1970 from this rainfall station.

VEGETATION

The following vegetation types are present in the Zaraninge Forest Reserve :

Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Forest is present on the Kiono Plateau, and has a fairly closed (80% cover) 15 m canopy with a distinct understorey layer at 10 m and a shrub layer at 3 m. Deadwood accounts for approximately 15% of all the wood present.

A TWINSPAN analysis of the vegetation of Zaraninge (Kiono) Forest identified six tree assemblages :

1. *Haplocoelopsis africana*, *Brachylaena huillensis*, *Bombax rhodognaphalon* and *Tarenna drummondii* in disturbed areas of the forest.
2. *Scorodophloeus fischeri* dominating in undisturbed forest on the valley sides..
3. *Manilkara sulcata* dominating in undisturbed forest on the ridge tops.
4. *Baphia kirkii* and *Manilkara sansibarensis* in undisturbed areas.
5. *Cynometra webberi*, *Angylocalyx braunii*, *Sideroxylon inerme* and *Diospyros verrucosa* in undisturbed areas of forest on the plateau.
6. *Cynometra suaheliensis*, *Garcinia buchananii* and *Drypetes arguta* in steeply sloping areas where there may have been considerable disturbance in the past.

Other tree species present in Zaraninge forest include *Vitex doniana*, *Hymenaea verrucosa*, *Gardenia transvenulosa*, *Cola microcarpa*, *Tamarindus indica*, *Lannea schweinfurthii*, *Pycnocomma littoralis*, *Drypetes parvifolia*, *Acalypha neptunica*, *Vismia orientalis*, *Ochna mossambicensis*, *Diospyros shimbaensis* and *Canthium mombazense*.

A vegetation plot has been constructed from the edge of the marsh area into the forest :

Plot 1 : Closed Forest on the Zaraninge Plateau at 300 m altitude, 105 m x 5 m plot.
0.053 ha in area with 28 trees over 10 cm dbh giving an equivalent of 560 trees per ha.
Mean tree dbh 26.7 cm; mean tree height 15.4 m; mean bole height 6.4 m.
Mean crown area 31 m²/tree; mean basal area 31.3 m²/ha; mean stand volume 199 m³/ha.

On the edge of the plateau a slightly different forest type is present including *Vitex ferruginea*, *Uvaria pandensis*, *Ludia mauritiana*, *Allophylus africanus*, *Ficus tremula*, *Toddaliopsis sansibarensis*,

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

Woodland [Zanzibar-Inhambane secondary grassland and wooded grassland (sensu White, 1983)]

Woodland and wooded grassland are present on the coastal plain surrounding the Kiono Plateau, with tree species that include *Terminalia boivinii*, *Diospyros consolatae*, *Albizia petersiana*, *Mallotus oppositifolius*, *Grewia microcarpa*, *Mystroxyton aethiopicum*, *Sterculia africana* and *Meyna tetraphylla*.

An area of woodland on the eastern edge of the forest appears to be in the process of undergoing a succession to forest, and contains trees such as *Suregada zanzibarensis*, *Albizia petersiana*, *Zanthoxylum chalybeum* and *Cassia abbreviata*.

Woodland is also present between the swamp and forest, containing trees that include *Strychnos madagascariensis*, *Thespesia danis*, *Markhamia obtusifolia*, *Apodytes dimidiata*, *Hyphaene coriacea*, *Margaritaria discoidea*, *Brackenridgea zanguebarica*, *Grewia lepidopetala*, *Clausena anisata*, *Bourreria nemoralis*, *Acacia adenocalyx* and *Vitex payos*.

Swamp

The forest holds a small depression containing wetland vegetation, with a diverse sedge and grass flora.

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 forest has only recently been studied, beginning with botanical collections by Procter and later by Wingfield. Brief visits were made during the 1980s by scientists from the University of Dar es Salaam. Ornithological surveys have been carried out by Baker since 1985. The Frontier-Tanzania Coastal Forest Research Programme carried out general biological surveys in 1989, 1990 and 1991. A Danish ICBP expedition carried out an ornithological survey of the forest in 1990.

Birds

57 bird species have been recorded (Burgess *et al.*, 1990 with subsequent records by Faldborg *et al.*, 1990), of which 26 are forest birds.

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.
Little Yellow Flycatcher *Erythrocerus holochlorus*.
Sokoke Pipit *Anthus sokokensis* [BirdLife Vulnerable; IUCN Vulnerable].

Other BirdLife listed - Southern Banded Snake-eagle *Circaetus fasciolatus* [BirdLife Near threatened].
species Plain-backed Sunbird *Anthreptes reichenowi* [BirdLife Near threatened].

Mammals

27 mammal species have been recorded from collections and observations by Frontier-Tanzania, including 7 bat species [9 specimens collected] and 8 rodent species [16 specimens collected from 522 trap nights].

- Possible Zaraninge - Shrew *Crocidura* unidentified sp. (c) Specimen deposited at the British Museum
endemics of Natural History.
- Coastal Forest/Eastern - East African Collared Fruit Bat *Myonycteris relicta*. (Specimen KMH 6474a)
Arc endemics Known from only 8 other localities [IUCN Vulnerable].
Lesser Pouched Rat *Beamys hindei*. (Specimen KMH 6628) [IUCN Vulnerable].
- Other CITES/IUCN - African Elephant *Loxodonta africana* [CITES Appendix 1; IUCN Vulnerable].
listed species Leopard *Panthera pardus* [CITES Appendix 1; IUCN Threatened].
Black and Rufous Elephant Shrew *Rhynchocyon petersi petersi*. (Specimen
UDSM 326). [IUCN Rare].
Zanzibar Galago *Galagoides zanzibaricus* [IUCN Vulnerable].

Reptiles

17 forest dependant reptile species have been recorded from observations and a total collection of 56 specimens by Frontier-Tanzania.

- Coastal Forest endemics - Dwarf Gecko *Lygodactylus viscatus*. Known only from 7 Tanzanian Coastal
Forests. To be cited by Pasteur (in press).
Green Keel-bellied Lizard *Gastropholis prasina*. Coastal Forests of SE
Kenya and NE Tanzania only. (Cited in Broadley & Howell, 1991).
- Coastal Forest/Eastern - Dwarf Gecko *Lygodactylus* sp. nov. B. Known only from 3 Tanzanian Coastal Forests
Arc endemics and Amani, East Usambara Mountains. To be cited by Pasteur (in press).
Bearded Pygmy-Chameleon *Rhampholeon brevicaudatus*. (Specimen KMH
6897) Known only from the Eastern Arc and 6 Tanzanian Coastal Forests.

Amphibians

Zaraninge forest is currently the best studied Coastal Forest in Tanzania for its amphibian fauna. 10 species were recorded from the 247 specimens collected by Frontier-Tanzania and Prof. K.M. Howell (University of Dar es Salaam), and further collections have raised this to 29 species. A full species list, together with annotated notes, is being prepared for a Ph.D thesis on the amphibians of Zaraninge by C.A. Msuya of the Department of Zoology and Marine Biology, University of Dar es Salaam.

Coastal Forest endemic - Treefrog *Leptopelis flavomaculatus*. (Specimen CAM 421).

Plants

288 fertile botanical samples have been collected from Zaraninge forest by Frontier-Tanzania.

- Zaraninge endemic - *Pancovia* sp. nov., not matched at Kew (= Frontier 413 & 522) [Sapindac.].
- Possible Zaraninge - *Cyperus*, not matched at Kew (= Frontier 458 & 921) [Cyperac.].
endemic
- Coastal Forest endemics - *Uvaria pandensis* Verdc. [Annonac.] (Specimen Frontier 486 etc.). Zaraninge
and 3 other sites only.

Uvaria sp. nov. A = *Mwasumbi* 12532 [Annonac.] (Zaranninge specimen *Wingfield* 3257). Zaranninge and 4 other sites in Tanzania only.

Uvaria sp. nov. B = *Mwasumbi* 13858 [Annonac.] Zaranninge and Pande only. Cited in *Mwasumbi et al.* (1994).

Diospyros shimbaensis F.White [Ebenac.] (Specimen *Frontier* 498). Zaranninge and 2 other sites only.

Croton jatrophoides Pax. [Euphorbiac.] Zaranninge and 4 other sites only. Cited in FTEA.

Aidia sp. of FTEA [Rubiaceae] Zaranninge and 3 other sites only. Cited in *Mwasumbi et al.* (1994).

Tricalysia allocalyx Robbrecht [Rubiaceae] Pande and 2 other Coastal Forests. Cited in *Mwasumbi et al.*, 1994.

CITES listed plant - *Encephalartos hildebrandtii* A.Br. & Bouche [Zamiaceae] Cited in *Mwasumbi et al.* (1994). [CITES Appendix 1].

CATCHMENT VALUES

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

HUMAN IMPACTS

Logging

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.

Cultivation

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. However, some families in Gongo resisted and remained in the village. Since 1980 and the relaxation of the "Ujamaa" programme other families have also moved into the Gongo and Mbwebwe areas. Recent (1991) encroachment into the forest has taken place at Gongo where approximately 100 ha of forest have been cleared.

Pole Collection

The local villagers collect building materials (poles and lianas). Pole removal around Mbwebwe appears to be intensive.

Collection of Forest Products

Fuelwood, traditional medicines, and "Sandarusi" gum [from the Gum Copal tree *Hymenaea verrucosa*] are collected from the forest but all appear to be exploited for local use alone.

CONSERVATION ISSUES

The Wildlife Conservation Society of Tanzania has provided the necessary funds to employ 4 forest guards.

WWF is providing bicycles, uniforms and houses for the forest guards, together with institutional support and the lobbying of parliament to get the reserve gazetted.

Since the villages of Gongo and Tumbili lie within the borders of the current proposed reserve boundaries, their presence in the area has been reviewed a second time, but relocation of the villagers has not been possible since neither WWF nor the government could find the necessary funds to provide adequate compensation to the villagers (the cost of which would have amounted to some \$2 million). A new forest reserve boundary has since been determined by representatives from all levels of administration (region, district, ward and village) which enables the villages to remain at their present locations. A survey team from the Ministry of the Natural Resources, Forestry and Beekeeping is expected to survey a new boundary later in 1995.

Nurseries have been established at Mkange, Mbwebwe, Matapili (Wami) and Sadaani. Seedlings have been provided (approximately 100,000 trees) to enable local villagers to establish woodlots and to encourage agroforestry practices. The majority of these trees are exotics (e.g. teak *Tectona grandis*, neem *Azadirachta indica*, *Albizia lebbek*, *Pterocarpum pteraforum*, *Leucena leucocephala*, oranges *Citrus sinensis*, *Sesbania sesban*) but indigenous species such as *Azalia quanzensis*, *Tamarindus indica* and *Scorodophloeus fischeri* are also being planted using seedlings from the forest. This project is addressing the long-term need for an alternative to the forest for timber products.

LITERATURE

Ansell & Dickinson (1994) provide a detailed management document for Zaraninge forest.

Burgess *et al.* (1990) give a preliminary species list of the birds of Zaraninge (Kiono) together with notes.

Cockle & Dickinson (1992) summarise the results of the third visit to Zaraninge Forest by the Frontier-Tanzania Coastal Forest Research Programme.

Faldborg *et al.* (1990) list bird and mammal species observed by the 1990 Danish ICBP expedition.

Hanna & Anderson (1994) record the results of an expedition to assess the abundance of the Black and Rufous Elephant Shrew in Kiono forest.

Matthews (1993) lists the medicinal plants collected in Kiono/Zaraninge along with their local name, use, preparation and Frontier collection number.

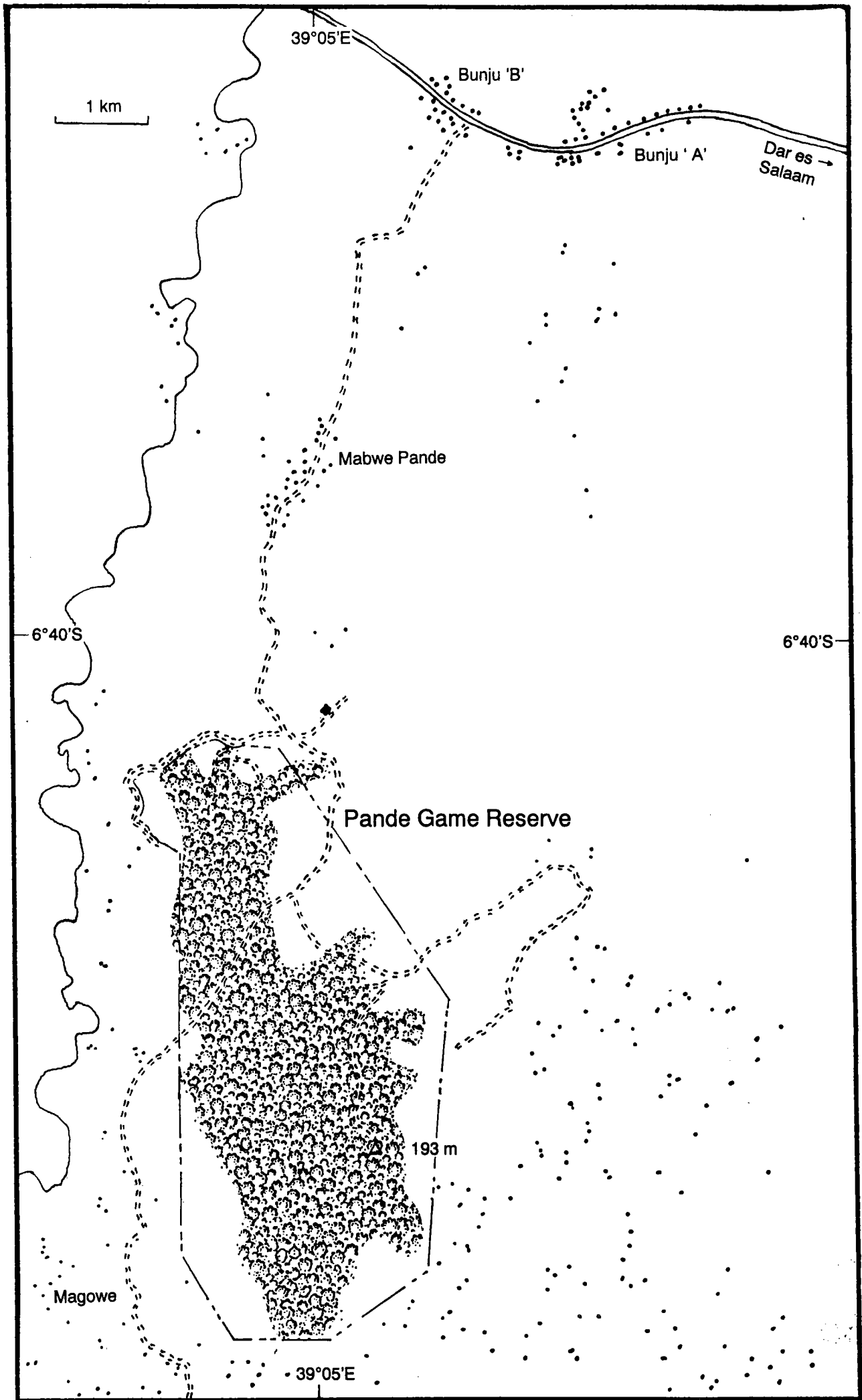
Mwasumbi *et al.* (1994) describe a vegetation comparison between Pande and Kiono forests.

O'Hara, Weale & Allen (1990) list butterfly species collected by the authors in Kiono forest.

Polhill (1968) is the first paper to mention the importance of Zaraninge forest, which is proposed as a possible site for a nature reserve.

Sheil and Burgess (1990) summarise the results of the first visit to Zaraninge Forest by the Frontier-Tanzania Coastal Forest Research Programme.

Verdcourt (1992) describes a rare snail that has been rediscovered in Zaraninge forest.



PANDE GAME RESERVE [DAR ES SALAAM REGION]

DESCRIPTION

- NAME:** Pande Game Reserve
Kinondoni District, Dar es Salaam Region, Tanzania.
- AREA:** 1226 ha; 12.3 sq. km; 3030 acres; 4.73 sq. miles.
- BOUNDARY:** 15 km.
LENGTH Wildlife Division staff currently clearing the reserve boundary (May 1995).
- STATUS:** Game Reserve under Game Division management.
Formerly designated as a Protective Forest Reserve in 1947, revoked in October 1988.
Privately managed as the Pande Game Reserve Ltd. to develop a zoo at the site until 1994.
Designated as a Game Sanctuary under Declaration Order 862/25/11/1988.
- MAPS:** Ordnance Survey topographic map 1:50,000 Series Y742
Sheet 186/1 & part of 186/2 'Kawe' of 1987, mapped from aerial photos of 1981.

Old Forest Division map Jb 133 of 1952, 1:2,500

LOCATION

Grid Ref: 6°41'S - 6°44'S, 39°04'E - 39°06'E

Elevation: 100 - 200 m a.s.l.

Pande forest covers a gently rounded ridge of sandstone ranging from 100 - 200 m a.s.l., approximately 25 km north-west of Dar es Salaam and 16 km inland from the Indian Ocean. The nearest village is Mabwe-Pande, 2.5 km north of the game reserve.

Access is by the main Dar es Salaam to Bagamoyo road (B1212). Turn off at Bunju taking a dirt track to the south-west. Continue for about 7 km, passing through Mabwe-Pande until the reserve is reached. A 4WD vehicle is required during wet weather for the last section of the journey.

Public transport access by Dar es Salaam to Kawe bus, which stops at Bunju. Walk the remaining distance to Pande Forest.

SOILS

Ridgetop soils are red sandy loams of Miocene age which have been subject to heavy leaching in the past. These soils can be classified as Relict Latosols (UNESCO/FAO). Below these soils are white gritty kaolin soils of different properties (Masongo, 1984).

Gully erosion is evident where soils are exposed by vegetation clearance (Hawthorne, 1984).

CLIMATE

The Pande Game Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. Temperature ranges from 24 - 31°C (Forest Department records). The nearest rainfall station is at Wazo Hill (6°40'S, 39°10'E, 110 m altitude), where an average of 931 mm of rainfall per year has been recorded for the 8 years up to 1973, with June, July, August, September & October having a monthly average of less than 50 mm rainfall during this period. International standard climate data is available from the Dar es Salaam Laboratory (6°49'S, 39°18'E, 9 m altitude), where an average of 1041mm of rainfall per year has been recorded from 1931-1960, with June, July, August, September & October having a monthly average of less than 50 mm rainfall during this period. A peak annual rainfall of 1531 mm and a minimum annual rainfall of 438 mm has been recorded between 1893 and 1970 from this rainfall station.

VEGETATION

The vegetation at Pande is extremely heterogenous, largely as a result of anthropogenic disturbance. Three main vegetation types are present :

Forest [Zanzibar-Inhambane undifferentiated forest (*sensu* White, 1983)]

Pande contains dry evergreen forest which is characteristically around 15m in height. Dominant species are *Scorodophloeus fischeri*, *Cynometra webberi*, *Schefflerodendron usambarense*, *Manilkara sulcata* and *Manilkara discolor* (Hawthorne, 1984). Other tree species include *Mystroxydon aethiopicum*, *Ozoroa* sp., *Olex dissitiflora*, *Albizia adianthifolia*, *Terminalia boivinii*, *Crossopteryx febrifuga*, *Deinbollia borbonica*, *Baphia kirkii*, *Cordyla africana*, *Combretum molle*, *Vitex doniana*, *Ochna pseudoprocera*, *Croton pseudopulchellus*, *Tabernaemontana elegans*, *Rothmannia macrosiphon*, *Manilkara sulcata*, *Craibia* sp., *Trema orientalis*, *Millettia usaramensis* and *Hymenaea verrucosa*. Cycads *Encephalartos hildebrandtii* and baobabs *Adansonia digitata* are also present.

A TWINSPLAN analysis of the vegetation of Pande Forest found four distinct tree species assemblages :

1. *Haplocoelopsis africana*, *Brachylaena huillensis*, *Bombax rhodognaphalon* and *Tarenna drummondii* in disturbed areas of the forest.
2. *Scorodophloeus fischeri* dominating in undisturbed forest on the valley sides..
3. *Manilkara sulcata* dominating in undisturbed forest on the ridge tops.
4. *Baphia kirkii* and *Manilkara sansibarensis* in undisturbed areas.

Thicket [Zanzibar-Inhambane evergreen thicket (*sensu* White, 1983)]

The forest margin is surrounded by dense thicket. Trees/shrubs include *Polysphaeria parvifolia* and *Xylothea tettensis*.

Woodland [Zanzibar-Inhambane secondary wooded grassland (*sensu* White, 1983)]

The outer edge of the game reserve consists of Zanzibar-Inhambane Woodland (White, 1983), dominated by *Brachystegia* sp. and *Azelia quanzenis*. Other trees include *Lamprothamnus zanguebaricus*, *Cadaba carneo-viridis*, *Ximenia caffra*, *Cassipourea celastroides*, *Vitex payos* and *Catunaregam spinosa*. This secondary vegetation pattern results from destruction and re-establishment with successive bush fires (Hawthorne, 1984).

TIMBER VALUES

Commercial timber trees such as *Milicia excelsa* occur at low densities in Pande forest. The forest has a further timber value as fuelwood, especially as potential charcoal for sale in nearby Dar es Salaam.

BIODIVERSITY

Pande forest has been quite well studied for its biological values due to its proximity to Dar es Salaam. The botanists Leopold, Wingfield, Mwasumbi and Hawthorne have collected there, and the Bakers have visited to collect ornithological data on 10 occasions during the late 1980s and the early 1990s. The Frontier-Tanzania Coastal Forest Research Programme visited the forest in 1989.

Birds

43 bird species have been recorded (Burgess *et al.*, 1990 with additional records from N.E. & E.M. Baker), of which 20 are forest birds.

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.
Little Yellow Flycatcher *Erythrocerus holochlorus*.

BirdLife listed species - Southern Banded Snake-eagle *Circaetus fasciolatus* [BirdLife Near threatened].
Plain-backed Sunbird *Anthreptes reichenowi* [BirdLife Near threatened].

Mammals

No mammal species are yet known to have been recorded from Pande forest.

Reptiles

Only 2 reptile species are known to have been recorded from Pande Forest Reserve [2 specimens collected].

Amphibians

Only 2 amphibian specimen has so far been recorded to have been collected from Pande Forest [2 specimens collected].

Plants

161 plant species have so far been recorded from Pande Forest (Rulangaranga, 1993), excluding further species that may be recorded from the 173 fertile botanical samples collected by Frontier-Tanzania.

Pande endemics - *Sapium* sp. of FTEA A.R.-Sm. [Euphorbiac.]. Cited in FTEA.
Leptactina sp. A of FTEA [Rubiaceae]. Cited in FTEA.
Vitex sp. B of FTEA [Verbenaceae]. Cited in FTEA.

Pande area endemics - *Xylopia* sp. B of FTEA [Annonaceae] (specimen Wingfield 3311). Known only from Pugu and Pande.
Combretum harrisii Wickens [Combretaceae] Pugu, Pande and 4 sites nearby.
Cited in *Kew Bulletin* 31: 154.

Coastal Forest endemics - *Uvaria pandensis* Verdc. [Annonac.] Pande & 3 other sites only. Cited in *Kew Bulletin* 43, 1.
Uvaria sp. nov. = *Mwasumbi* 12532 [Annonac.] (Pande specimen *Mwasumbi* 14705). Pande and 4 other sites in Tanzania only.
Uvaria sp. = *Mwasumbi* 13858 [Annonac.] Pande and Kiono only. Cited in *Mwasumbi* (1994).
Acalypha gillmanii A.R.-Sm. [Euphorbiac.] Pande, Kichi Hills and Liwengula Forest Reserve only (see notes on Lindi Region). Cited in FTEA.
Croton jatrophoides Pax. [Euphorbiac.] Pande and 4 other sites in Tanzania only. Cited in Hawthorne (1984).
Tessmannia martiniana Harms [Fabac.] (Specimen *Hawthorne* 1468). Pande and 3 other sites in Tanzania only.
Brachiaria lindiensis (Pilg.) W.D. Clayton [Poac.] Pande and 3 other sites only. Cited in FTEA.
Tricalysia allocalyx Robbrecht [Rubiace.] Pande and 2 other Coastal Forests. Cited in *Mwasumbi et al.* (1994) and in FTEA.
Sterculia schliebenii Mildbr. [Sterculiac.] (Specimen *Hawthorne* 1280). Pande and 3 other Coastal Forests.

CITES listed plant - *Encephalartos hildebrandtii* A.Br. & Bouche [Zamiac.] CITES Appendix 1.

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

Pande Game Reserve is located within Dar es Salaam Region, and was heavily disturbed during the 1980s.

Logging

Following its degazettement in 1988, extensive timber removal for commercial purposes has occurred. Large areas of Pande Forest were clear-felled and burnt for charcoal to supply markets in Dar es Salaam. *Manilkara* sp., *Milletia usaramensis*, *Vitex* and *Scorodophloeus fischeri* were favoured for charcoal burning. This activity has since ceased, following the redesignation of the area as a Game Reserve.

Pole cutting

Local people used to 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 had been removed from forest margins (Hall & Rodgers, 1986). Under Game Division laws this practice is now illegal.

Firewood

Collection occurs on a local scale, though the army have been observed removing dead logs by truck (Mwakamela, 1991).

Charcoal

Large scale charcoal production took place on a commercial scale in Pande forest during the 1980s. A resumption of this activity remains a threat to the forest if protection is stopped.

Settlement

A 'derelict village' called Vikonge formerly existed in the SE of the reserve according to the original 1952 map.

CONSERVATION ISSUES

Pande Forest is surrounded by densely populated farmland and will soon become engulfed by the burgeoning population of Dar es Salaam. Intensive patrolling by Game Guards from the Wildlife Division will need to be continued to assure the future survival of the forest.

Tree planting in the villages surrounding Pande Forest should be promoted to create alternative sources of fuel and timber. Seedlings from indigenous species could come from the reserve itself if this activity can be controlled.

LITERATURE

Burgess *et al.* (1990) give a preliminary species list of the birds of Pande together with notes.

Hall & Rodgers (1986) enumerate the extent of pole-cutting damage in Pande forest.

Hawthorne (1993) includes a profile diagram of part of Pande forest.

Hawthorne (1984) describes the vegetation of Pande forest in detail, as well as of forest developed on termite mounds outside the main forest block.

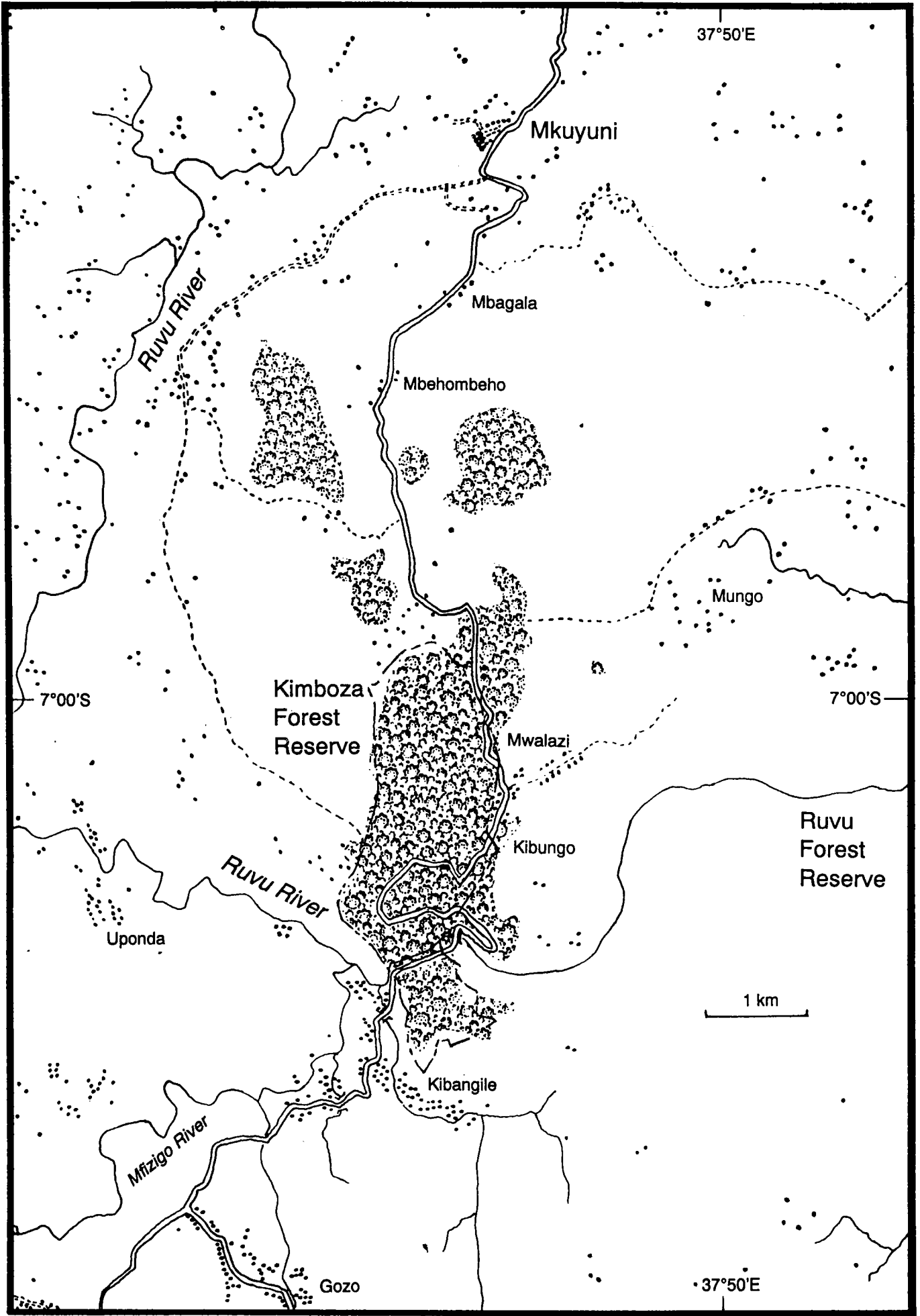
Masongo (1984) reports on the status of the forest reserve.

Mwasumbi *et al.* (1994) describe a vegetation comparison between Pande and Kiono forests.

O'Hara, Weale & Allen (1990) list butterfly species collected by the authors in Pande forest.

Polhill (1968) mentions Pande as a possible site for a Nature Reserve.

Rulangaranga (1993) describes the results of a vegetation comparison between Pande and Pugu forests.



KIMBOZA FOREST RESERVE [MOROGORO REGION]

DESCRIPTION

- NAME :** Kimboza Forest Reserve
Morogoro District, Morogoro Region.
- AREA :** 405 ha; 4.05 sq. km; 1001 acres; 1.56 sq. miles.
- BOUNDARY :** 15.6 km.
LENGTH Boundary demarcated by beacons for most of the reserve.
Clearing and marking of the boundaries carried out during 1983.
- STATUS :** Catchment Forest Reserve (Protective).
Declaration Cap. 389 - supp. 59 of 1959; Variation Order 417/17/7/1964.
Gazetted during the German Administration, possibly in 1912.
Original gazettelement map RE/M/25/1.
- MAPS :** Ordnance Survey topographic maps:
Seires Y742 sheets 183/4 'Kingolwira' of 1970, mapped from aerial photos of 1964.
201/2 'Matombo' of 1982, mapped from aerial photos of 1978.
The 1:50 000 OS map shows the reserve to cover a larger area than demarcated.

Forestry Division boundary map: Jb 2073 of 1982, 1: 10,000.

LOCATION

Grid reference: 37°48'E - 37°49'E, 7°00'S - 7°02'S

Elevation: 200 - 540 m a.s.l.

Kimboza Forest Reserve is located within the edge of the eastern foothills of the Uluguru mountains, eastern Tanzania, approximately 50 km south-east of Morogoro.

Access by road is good as the reserve is crossed by the main Morogoro-Kisaki road. The dirt road is regularly graded but requires a 4WD vehicle during the rainy season.

Public transport access by the regular Morogoro to Kisaki buses which pass through the reserve.

SOILS

Analysis of samples taken from 15 sites around the reserve showed slightly acidic pH levels ranging from 5.25 to 7.18 (Frontier data). Profiles were weakly developed, which is considered to be typical of East African mountainous areas 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 *et al.* (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. Calcite deposits have been found in the soil which indicate a high degree of alkaline precipitation in this area.

It is possible that there is seasonal fluctuation in soil pH caused by the interaction of the humic decomposition of organic matter with the basic nature of the bedrock, and that this fluctuation is dependent on rainfall levels.

The soils in the Kimboza area have been described as being moderately good for agriculture (Rodgers *et al.*, 1983).

CLIMATE

The Kimboza Forest Reserve is influenced by tropical East African oceanic temperatures that are slightly modified by the altitude. Rainfall is higher than average for a Coastal Forest at 1683 mm per annum, due to the area receiving additional orographic rainfall from the nearby Uluguru Mountains. The nearest rainfall station is at Kibungo (7°01'S, 37°48'E, 273 m altitude) where only June, July and August receive less than 50 mm rainfall during the 13 years from which data are recorded up to 1973. 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

Three main vegetation types exist in Kimboza Forest Reserve :

Forest [Zanzibar-Inhambane undifferentiated forest and lowland rain forest (*sensu* White, 1983)]

Kimboza Forest Reserve is comprised predominantly of lowland forest that is classified as 'Coastal Forest/Eastern Arc Transition Forest' in Clarke (ined.).

The canopy is closed to 20 m, reaching 30 m in some places with a few emergent trees up to 40 m. A distinct middle storey exists at 10-15 m with a shrub layer from 2-5 m. The forest is heterogeneous with some logged areas, cleared glades and plantations of exotic species existing within the reserve boundary.

Trees of the Leguminosae (Fabaceae), Moraceae and Sapotaceae dominate the canopy layer. Major emergent species include *Antiaris toxicaria*, *Aningeria pseudo-racemosa*, *Milicia excelsa*, *Cordyla africana*, *Ficus* spp, *Parkia filicoidea*, *Bombax rhodognaphalon*, *Ricinodendron heudelottii* and *Sterculia appendiculata*. The main canopy comprises *Cussonia zimmermannii*, *Dialium holtzii*, *Newtonia paucijuga*, *Scorodophleus fischeri* and *Tessmania* sp.

Scorodophloeus fischeri and *Sorindeia madagascariensis* dominate the middle storey, with other major components including *Bequartiodendron natalense*, *Diospyros kabuyana* and *D. verrucosa*, *Drypetes natalense*, *Funtumia africana*, *Lanea antiscorbutica*, *Lettowianthus stellatus*, *Rauvolfia mombasiana*, *Pandanus rabaiensis* and *Uvarioidendron gorgonis*.

Swamp Forest [Swamp forest (*sensu* White, 1983)]

Small areas of swamp forest dominated by *Pandanus rabaiensis* with *Cussonia zimmermannii* and containing the Kimboza endemic *Aerisilvaea sylvatica* are found on rocky areas that are seasonally flooded. This community is similar to that found in Jozani Forest in Zanzibar.

Plantation Forest

Small plantations of the exotic tree species teak *Tectona grandis* and *Cedrella* sp. as well as the native 'Mkangazi' *Khaya anthotheca* have been established near the road. Indigenous herbs and shrubs occur in these plantations.

TIMBER VALUES

Kimboza forest has been intensively logged for *Aningera pseudo-racemosa*, *Milicia excelsa*, *Khaya anthotheca*, *Pterocarpus tinctorius* and *Vitex doniana* (Rodgers *et al.*, 1983). *Bombax rhodognaphalon* was being logged in 1983.

BIODIVERSITY

Kimboza has been well surveyed for its biological values compared to most other Coastal Forests in Tanzania. Plants have been collected by the German botanists Stuhlmann in 1894 and by Rupprecht in 1913 who both cited the 'Uluguru foothills' as their collection locality (which Rodgers *et al.* consider to mean Kimboza). Further botanical collections include those of Greenway in 1930, Paulo, Parry and Padwa in the 1950s and a major collection by Semsei in 1952. More recently collections include those by Harris, Wingfield, Mwasumbi, Pocs, Kabuye, Rodgers, Hall, Luke, Lovett and the Frontier-Tanzania Coastal Forest Research Programme.

Bird specimens were first collected during German times, then by Fuggles-Couchman in the 1930s, followed by a major bird survey by Stuart during the early 1980s. Butterflies have been intensively collected by Kielland during 1982 and 1983. General biological surveys have been conducted by Rodgers *et al.* (1983) and by the Frontier-Tanzania Coastal Forest Research Programme in 1994.

Birds

At least 79 bird species have so far been recorded for Kimboza forest, of which 7 are not forest birds. 9 bird species normally considered to be montane species have also been recorded, and Kimboza may be important as a winter refuge for these species. See Rodgers *et al.*, 1983 for the full species list.

Coastal Forest endemics - Fischer's Greenbul *Phyllastrephus fischeri*.
Little Yellow Flycatcher *Erythrocerus holochlorus*.

BirdLife listed species - Southern Banded Snake-eagle *Circaetus fasciolatus* [BirdLife Near threatened].

Rare species - Purple-throated Cuckoo Shrike *Campephaga quiscalina muenzneri*. Isolated subspecies that is otherwise limited to the forests of West and Central Africa. Also recorded from Mahenge and Mwanihana.

Mammals

At least 21 mammal species are recorded for Kimboza forest, and specimens of 15 mammal species have been collected (Bayliss, 1994) including 9 rodent specimens. No rare species have yet been recorded.

Reptiles

At least 20 species of reptile have been recorded for Kimboza forest (Bayliss, 1994) from a collection of 27 specimens.

Kimboza endemic - Turquoise Dwarf Gecko *Lygodactylus williamsi* (cited in Broadley & Howell, 1991).

Coastal Forest/Eastern - Bearded Pigmy-Chameleon *Rhampholeon brevicaudatus*. (Specimen KMH 10219) Known only from the Eastern Arc Mountains and 6 Tanzanian Coastal Forests.

Black Centipede-eater *Apparallactus guentheri*. (Specimen KMH 10211) Submontane and lowland forests from Kenya to E. Zimbabwe.

Eastern Arc endemic - Uluguru One-horned Chameleon *Bradypodion oxyrhinum*. (Specimen KMH 10221) Known only from the Uluguru and Udzungwa Mountains.

Amphibians

25 specimens have been collected by Frontier-Tanzania. Identifications are still awaited.

Plants

364 vascular plant species have been recorded so far from the Kimboza Forest Reserve (see Rodgers *et al.*, 1983), as well as 18 species of fern.

- Kimboza strict - *Adhatoda* sp. nov. (= *Mwasumbi* 12420) [Acanthaceae]
 endemics *Asystasia* sp. nov. I (= *Rodgers* 2512) [Acanthac.]
Asystasia sp. nov. II (= *Mwasumbi* 12358) [Acanthac.]
 gen. indet. of FTEA (= *Semsei* 810) [Annonac.]
Impatiens cinnabarina Grey-Wilson. [Balsaminac.] Cited in *Kew Bull.* 33, 4.
Garcinia bifasciculata N.Robson [Clusiaceae] Cited in FTEA.
Aerisilvaea sylvestris A.R.-Sm. [Euphorbiaceae] Cited in *Kew Bull.* 45, 1.
Baphia pauloi Brummit [Fabaceae] Cited in *Kew Bull.* 40, 1.
Cynometra ulugurensis Harms [Fabaceae] Cited in FTEA.
Tessmania sp. nov. (= *Rodgers* 2499) [Fabaceae]
Streptocarpus kimbozensis B.L.Burtt [Gesneriaceae] Cited in Rodgers *et al.* (1983).
Turraea kimbozensis Cheek [Meliaceae] Cited in *Kew Bull.* 44, 3.
Coffea kimbozensis Bridson [Rubiaceae] Cited in *Kew Bull.* 49: 331-342.
Vitex sp.A. of FTEA [Verbenaceae].
- Possible Kimboza - *Cynometra* sp., not in FTEA (= *Rodgers* 2586) [Fabaceae].
 endemic
- Coastal Forest endemics - *Notobuxus cordata* A.R.-Sm. [Buxaceae] (Specimen *Mwasumbi* 2505). Kimboza
 and the East Usambara lowland forests only.
Micrococca scariosa Prain [Euphorbiaceae] Kimboza & 5 other sites. Cited in
 Beentje (1988).
Cynometra sp. A of FTEA [Fabaceae] Kimboza and E. Usambara Mountains.
 Cited in Rodgers *et al.* (1983).
Zenkerella egregia J.Leon [Fabaceae] Kimboza and 2 other sites in Tanzania.
 Cited in Rodgers *et al.* (1983).
Rytigynia binata (Schum.) Robyns [Rubiaceae] Kimboza and 2 other sites in TZ.
 Cited in Rodgers *et al.* (1983).
Tricalysia acidophylla Robbrecht [Rubiaceae] Kimboza and 2 other sites in TZ.
 Cited in Rodgers *et al.* (1983).
Afrosersalisia kassneri (Engl.) J.H. Hemsl. [Sapotaceae] (Specimen *Rodgers* 2609).
 Known only from Kimboza and 4 other sites.
Cola stelecantha Brenan [Sterculiaceae] Kimboza and 2 other sites in Tanzania.
 Cited in Rodgers *et al.* (1983).
Rinorea sp. A of FTEA [Violaceae] Kimboza and Kiwengoma endemic.
- Coastal Forest/Eastern - *Uvariadendron gorgonis* Verdc. [Annonaceae] 7 other sites. Cited in Rodgers
 Arc endemics *et al.* (1983).
Millettia elongistyla Gillet [Fabaceae] Known only from Kimboza and 3 other sites.
 Cited in FTEA.
Ixora tanzaniensis Bridon [Rubiaceae] Known only from Kimboza and 3 other sites.
 Cited in FTEA.

Other species - *Illingera madagascariensis* Perrier [Hernandiac.] Uluguru Mts & Madagascar.
Cited in FTEA.

CATCHMENT VALUES

The catchment role of Kimboza is of minor national importance, since the reserve is very small. The reserve does however receive a high rainfall by national standards (exceeding 1600 mm), and all streamflow arising from the reserve is channelled into the Ruvu river which supplies the majority of Dar es Salaam's water requirement.

The Kimboza forest reserve contains many steep slopes of over 40% and the presence of a forest canopy is important in preventing soil erosion, which has not been observed within the reserve itself, except along footpaths. However, clearance of parts of the forest outside the reserve boundary has resulted in areas of serious erosion and landslips, especially to the south-east.

HUMAN IMPACTS

Kimboza forest occurs in a densely populated agricultural area. The presence of a major road through the reserve (and earlier a major caravan route) have long opened the forest to exploitation.

Logging

Until 1993 licences were available for felling "over-mature" trees for timber, and additional illegal logging was also taking place (Rodgers *et al.*, 1983). Prime commercial timber stocks of *Aningeria pseudo-racemosa*, *Milicia excelsa* and *Khaya nyasica* have become severely depleted in Kimboza.

Logging/pitsawing is now illegal - bar felling for scientific purposes (12 trees were felled in 1993 for a study conducted by Sokoine University, Morogoro). Disturbance transects measured in 1994 found that a mean of 0.85% of all trees with a DBH greater than 10 cm had been cut. This result may appear to be insignificant but as timber trees are carefully selected by species then the chances of survival for the remaining timber trees, especially *Bombax rhodognaphalon* are not good. Several illegal logging sites - both old and new - were located by random observations in 1994.

A saw mill was in operation in the 1950s for the processing of *Vitex doniana* (Rodgers *et al.*, 1983), but is no longer operational.

Pole Cutting

Legal limits are set for the number of poles an individual can collect from the reserve each year. Interviews carried out with local villagers by Frontier-Tanzania in 1994 found that all interviewees had built their houses with poles from the reserve.

Disturbance transects have been carried in 1983 (Rodgers *et al.*) and in 1994 (Frontier-Tanzania) in the same areas of Kimboza forest. These show no change in the rate of pole cutting at 10% of trees with stems below 10 cm dbh, together with no change in the proportion of saplings to mature trees (85% saplings [DBH less than 10 cm], 15% bigger trees [DBH greater than 10cm]). The results suggest that 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 was cleared in the process.

Plantations comprise the exotic tree species teak *Tectona grandis* and *Cedrella* as well as the native 'Mkangazi' *Khaya anthotheca*. Although the development of planted areas is no longer current practice, it is estimated that such plantations now extend over 11 ha or 3% of the total reserve area. Opportunistic invasion of the *Cedrella* into the natural forest areas is now a serious problem; in addition other exotic tree species such as mango, banana, citrus and kapok trees are establishing in the forest.

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 have admitted to taking dead firewood from the reserve itself.

Fire

The threat from fires arising during preparation of areas of cultivation surrounding the reserve is minimal due to the high annual rainfall; no fires have ever been recorded in the reserve.

Cultivation

Cultivation reached up to the northern and western limits of the forest reserve in 1956. Now the entire boundary except for about 1 km on the eastern side is bordered by cultivation, which occasionally encroaches into the forest reserve where rice and citrus trees have been observed (Rodgers *et al.*, 1983).

Roads and Paths

Some erosion of forest is being caused by the numerous and well used paths which traverse the reserve. The Morogoro-Kisaki road which cuts through the reserve has created an additional source of forest loss since the forest has been cut back some 5 m from either side of the road.

Other

11 hectares of the forest reserve were degazetted during the German administration to provide space for the Harranani Leprosarium (between Gumba and Kikoka hills).

CONSERVATION ISSUES

The conservation of Kimboza forest is important both for protecting its endemic species as well as to preserve one of the last remaining samples of forest remaining on the lower slopes and foothills of the Uluguru Mountains (below 1500 m).

Kimboza is already surrounded by densely populated and intensively farmed areas, and human pressure on the reserve is already very high when compared to most of the other Coastal Forest reserves. This pressure is set to increase as the local population increases, so current levels of forestry guards must be maintained to prevent possible agricultural encroachment into the reserve.

Future illegal fuelwood and building pole extraction are set to increase beyond the sustainable limit. Experience in Pugu Forest indicates that this is much harder to control than agricultural encroachment, and is likely to be the greatest long-term threat to effective conservation of Kimboza forest.

The exotic *Cedrella* is vigorously establishing itself throughout the reserve and poses a serious threat to the natural forest. This species should be clear-felled and seedlings and shrubs of the species cleared before the problem becomes any worse. In the long term the other areas of exotic plantation species could be allowed to regenerate as natural forest. This could be encouraged by replanting clearfelled areas with native tree species.

LITERATURE

Bayliss (1994) summarises the results of the biological surveys conducted by the Frontier-Tanzania Coastal Forest Research Programme in 1994.

Lambert (1985) contains notes on the ecology of the endemic *Lygodactylus* gecko in Kimboza.

Polhill (1968) highlights the importance of Kimboza forest for its endemic plants.

Rodgers *et al.* (1983) describe the biological values and conservation issues in Kimboza forest in great detail, including lists of bird, plant and butterfly species.

Stuart (1983) lists the birds species recorded from Kimboza. Notes on the occurrence of these species in Kimboza as well as the other forests in the Uluguru Mountains are given in Stuart & Jensen (1985).

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MAP KEY

Vegetation



Forest (Closed canopy).



Forest/Woodland mosaic (Ruvu North map only).



Thicket (Mafia Island and Kilulu Hill maps only).



Plantation (Forest plantation within forest reserve boundaries, sisal plantation outside reserve boundaries).

Natural Features



River/Stream.



Plateau Escarpment Edge (Lindi Region maps).



Lake.

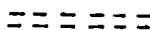
Human Features



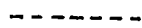
Tarmac Road (may contain potholes).



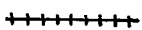
All-Weather/Graded Road.



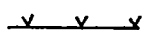
Dirt Road.



Footpath.



Railway.



Telegraph Line (Ruawa Forest Reserve map only).



Rural Settlement (number of dots indicates population size).



Urban Settlement.



Forest/Game Reserve Boundary.

