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Mpanga Village Forest Reserve

A biodiversity survey

**Frontier Tanzania
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East Usambara Catchment Forest Project

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Mpanga Village Forest Reserve

A biodiversity survey

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East Usambara Conservation Area Management Programme (EUCAMP)

The East Usambara rain forests are one of the most valuable areas for biodiversity conservation in Africa. Several plant and animal species are found only in the East Usambara mountains. The rain forests secure the water supply of 200,000 people and the local people in the mountains depend on these forests. The East Usambara Conservation Area Management Programme has established the Amani Nature Reserve and aims at protecting water sources; establishing and protecting forest reserves; sustaining villager's benefits from the forest; and rehabilitating the Amani Botanical Garden. The programme is implemented by the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism with financial support from the Government of Finland, and implementation support from the Metsähallitus Consulting. To monitor the impact of the project, both baseline biodiversity assessments and development of a monitoring system are needed. The present activity is aimed at establishing baseline information on biological diversity in the East Usambara forests.

The University of Dar es Salaam (UDSM)

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.

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Frontier Tanzania Forest Research Programme (FT FRP)

The Society for Environmental Exploration and the University of Dar es Salaam have been conducting collaborative research into environmental issues since July 1989 under the title of the Frontier Tanzania Forest Research Programme (FT FRP). Since July 1994, the FT FRP has been working in the forests of the East Usambara mountains in collaboration with the East Usambara Conservation Area Management Programme (EUCAMP). This survey of selected forests collects baseline biodiversity data and assists the EUCAMP in the management of the East Usambara forests.

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EXECUTIVE SUMMARY

Mpanga Village Forest Reserve, in the East Usambara mountains in north-east Tanzania was gazetted in 1998. It is situated in Muheza District, Tanga Region and covers 24 ha between 650 – 920 m asl, encompassing lowland and submontane forest.

As part of the East Usambara Conservation Area Management Programme, EUCAMP (formerly the East Usambara Catchment Forest Project EUCFP), Frontier-Tanzania conducted a biological survey of Mpanga Forest Reserve in November 1999 for a total of 12 research-days. The survey covered systematically all parts of the reserve with a higher than normal sampling intensity of 2.5 % for the vegetation survey and one zoological trapping site. This report provides an inventory of the selected flora and fauna recorded during the survey. The report also describes patterns of human disturbance within the reserve. The species richness, endemism and ecological affinities of the taxa recorded are summarised as Table 1.

Table 1. Summary of biodiversity of taxa surveyed.

Taxon	Total no. of species	% forest dependent	No. of non-forest species	No. of endemics	No. of near-endemics	No. of forest dependent endemics and near-endemics
Trees and shrubs ^a	144 (73)	34 % (46%)	10 (7)	8 (4)	24 (16)	22 (16)
Mammals	8	12.5 %	1	0	0	0
Birds	3*	0	1	0	0	0
Reptiles	11	63.6 %	0	0	4	4
Amphibians	14	64.3 %	0	0	7	7
Butterflies	17	64.7 %	0	0	1	1
Total						

^a Includes vegetation plot data (table 3) and opportunistic collections data (table 5).

() Numbers in brackets refer to systematic survey data only.

* Does not represent all species in reserve

Mpanga Village Forest Reserve is a small isolated forest block. In terms of conservation it is significant as habitat for a number of endemic and threatened species including the East Usambara endemic plants *Memecylon microphyllum* Gilg, *Cola usambarensis* Engl. and *Cola scheffleri* K. Schum. Relative to other reserves surveyed by Frontier-Tanzania it has a just below average botanical species richness.

In terms of fauna, the reserve is home to 7 vulnerable species according to IUCN categories and 3 near threatened species.

The measures put in place in 1995 by the village committee have not fully succeeded in protecting Mpanga Village Forest Reserve. Approximately one fifth of the reserve area has been deforested and no longer supports any forest. In parts this cleared area is being used for cultivation, although there is some debate as to whether these areas were cleared before gazettement. This is in direct contract to the agreements made with participating villages and is a matter of high priority. Poles continue to be taken illegally from the reserve. Evidence of old pitsawing was observed throughout the reserve on three of the four transects, although no active pitsawing was observed during this survey.

The information collected will be used for management planning by the villages with the support from the EUCAMP. The survey results are also available as a baseline for monitoring. The data is stored on a Microsoft Access database and will be available on the Internet at the address: www.usambara.com

FOREWORD

The East Usambara forests in north-eastern Tanzania are part of the Eastern Arc mountains. More than one hundred years of biological interest and research have shown that these forests have a unique diversity of flora and fauna, and an exceptionally high degree of endemism. They have gained global recognition as being part of a Biodiversity Hotspot (Conservation International), an Endemic Bird Area (BirdLife), a Centre of Plant Diversity (WWF and IUCN) and a Globally Important Eco-region (WWF). Since 1990, the East Usambara Conservation Area Management Programme (EUCAMP) (formerly known as the East Usambara Catchment Forest Project (EUCFP)) has worked in the East Usambara Mountains with the mission to protect these natural forests. The project is implemented by the Forestry and Beekeeping Division (FBD) of the Ministry of Natural Resources and Tourism (MNRT) with financial support from the Government of Finland and the European Union, and technical support from the Metsähallitus Consulting - Finnish Forest and Park Service.

Although a considerable amount of biological information exists from the East Usambaras much of this is restricted to the Amani area and systematic surveys are few. In order to glean comprehensive information on the forests, biodiversity surveys were initiated and contracted in July 1995. The surveys are conducted by Frontier Tanzania, a joint venture between the University of Dar es Salaam and the Society for Environmental Exploration, together with EUCAMP. The aim of the surveys is to provide systematic baseline information on the biological values of different forests as a basis for management planning and long-term monitoring, as well as training forestry staff in the use of biological inventory techniques. They will also help setting of priorities in the conservation of this valuable area.

The survey programme involves local people, permanent EUCAMP, Frontier-Tanzania, University of Dar es Salaam, and Tanzania Forestry Research Institute staff, as well as an international network of taxonomists and other experts. The surveys have become progressively more systematic and quantitative, and have already resulted in the discovery of several previously unknown taxa. This will further raise awareness of the unique conservation values of the East Usambaras. EUCAMP has also commissioned the development of a biodiversity database, a work which also contributed the maps to these reports. All data collected during the surveys is entered in this database, which will be linked to the national biodiversity database.

The reports are the result of the work of many people – too many to be listed here. We would like to thank all of them for their invaluable effort. We hope that the surveys will make yet another contribution to the long historic chain of efforts to study and understand these unique forests. Perhaps even more than that we hope that this information will contribute to a better management and conservation of the East Usambaras so that the beauty of the area will continue to amaze coming generations and that the light in the tunnel will become the bright future.

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Editorial Comments: Veli Pohjonen, Chief Technical Adviser for the East Usambara Conservation Area Management Programme; Damon Stanwell-Smith, SEE; Prof. K. Howell, University of Dar es Salaam.

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1.0 INTRODUCTION

1.1 The East Usambara mountains and forest diversity

The East Usambara mountains support ancient and unique forests rich in endemic species (Hamilton, 1989). Their old age, isolation and role as condensers of the moisture from the Indian Ocean make them an important conservation resource. The mountains are situated in north-east Tanzania within 40 km of the coastal town of Tanga between 4°48'-5°13'S and 38°32'-38°48'E. These mountains form part of a chain known as the Eastern Arc that stretches down the coast of East Africa from southern Kenya to southern Tanzania. This is a chain of isolated mountains composed of Precambrian rock exposed by block faulting and slow uprising (Griffiths, 1993). Being adjacent to the Indian Ocean, considerable orographic rainfall occurs in this area. The rainfall distribution is bi-modal, peaking between March and May and between September and December. The dry seasons are from June to August and January to March. However precipitation occurs in all months. Rainfall is greatest at higher altitudes and in the south-east of the mountains, increasing from 1,200 mm annually in the foothills to over 2,200 mm at higher altitudes. Because of the topographical and climatic interactions, the west-facing slopes of the mountains are drier compared to the east-facing slopes.

Research in the East Usambara mountains began in the late 1890s with substantial botanical collections being undertaken. Later, in 1928, surveys were undertaken on amphibians and by the 1930s detailed ornithological work had begun. Since these early studies biological research in the mountains has steadily increased. Recently, work in the area has also included an attempt to understand the drainage and catchment value of the mountain's forests (Bruen, 1989; Litterick, 1989).

The East Usambara forests have been likened to the African equivalent of the Galapagos Islands in terms of their endemism and biodiversity (Rodgers & Homewood, 1982; Howell, 1989). They are considered to be one of the most important forest blocks in Africa, if not the most important (Tye, 1994). Currently, at least 3450 species of vascular plants have been recorded in the EAST Usambaras of which it is suggested that over one quarter are endemic or near-endemic (Iversen, 1991a). Many are threatened (Rodgers, 1996).

The forests of the East Usambaras are not only important for their biodiversity, they also play an important role in maintaining the hydrological cycle which feeds the Sigi river. The Sigi river is a vital water source for the local communities as well as supplying water for the large coastal town of Tanga. Deforestation in the area will lead to increased soil erosion particularly from the steeper slopes. Soil erosion is liable to result in more irregular run off and in a deterioration in water quality due to siltation.

The latest survey of the East Usambaras, shows that approximately 45,137 ha of the East Usambaras remain as natural forest Johansson & Sandy (1996). This can be divided into two types: submontane rain forest and lowland forest. Altitude is the factor differentiating these two forest types (Hamilton, 1989), with submontane forest generally occurring above 850 m. The area recorded as forest in the East Usambaras according to these categories is described in Table 2.

Table 2 Forest area in the East Usambaras (based on Johansson and Sandy 1996).

Forest type	Area	% of area
Lowland forest	29497.4	62.9
Submontane forest	12916.6	30.6
Forest plantation	2723.6	6.5
TOTAL	45137.6	100

The mammals of the East Usambaras show limited endemism (Kingdon and Howell 1993). However, there are several species of special interest. These include: the restricted Zanj elephant shrew, *Rhynchocyon petersi*, which is common in the Usambaras (Collar & Stuart, 1987) yet listed as globally ‘Endangered’ by IUCN due to a decline in habitat extent and quality; Eastern tree hyrax, *Dendrohyrax validus*, listed as ‘Vulnerable’ by IUCN (1996) and the Lesser pouched rat, *Beamys hindei* which is considered ‘Vulnerable by IUCN (1996).

There are at least 11 species of reptiles and amphibians endemic to the East and West Usambaras (Howell, 1993). The East Usambara Biodiversity Surveys provide further information on new species and species’ range extensions. A new species of snake, *Prosymna semifasciata*, was recently found in Kwangumi Forest Reserve (Broadley, 1995) and an undescribed species of *Stephopaedes* sp. nov. has been recorded by the surveys in Mtai and Kwangumi Forest Reserves.

The forest avifauna of the East Usambaras has a high diversity with at least 110 species (Stuart, 1989). Six species occurring in the lowland forests are considered ‘Vulnerable’ to global extinction: Sokoke scops owl, *Otus ireneae*; the endemic Usambara eagle owl, *Bubo vosseleri*; Swynnerton’s robin, *Swynnertonia swynnertoni*; East coast akalat, *Sheppardia gunningi*; Amani sunbird, *Anthreptes pallidigaster* and the Banded green sunbird, *Anthreptes rubritorques* (IUCN, 1996).

The East Usambaras are essentially forest ‘islands’ (Lovett, 1989). There has been natural forest in the area for several million years. The Usambaras harbour many species that have been geographically separated from their closest relatives for long periods. They also serve as a refuge for formerly widespread flora and fauna that have become extinct over much of their former area (Iversen, 1991).

These forests have been under continuous exploitative human pressure for at least 2,000 years (Schmidt, 1989). Until recently, especially before the past 50 years, (Kikula, 1989), this pressure was sustainable. However, the growing human population in the area is leading to increased pressure on the remaining natural forest, and represents the main threat to their survival.

1.2 Report structure

This report provides a floral and faunal inventory of Mpanga Village Forest Reserve. Each species is described in terms of its ecological requirements and its endemic status.

Ecological requirements are defined in terms of:

- **Forest dependent species (F):** Species dependent on primary forest only. It does not include forest edge or secondary forest species;
- **Forest non-dependent species (f):** Forest dwelling but not dependent on primary forest: species occurring in primary forest as defined above as well as other vegetation types. It should be emphasised that many of these species are still dependent on a forest habitat albeit forest edge or disturbed forest. Most species in this category will still be adversely affected by forest destruction.
- **Non-forest species (O):** These are species that do not normally occur in primary or secondary forest or forest edge.

Levels of endemism are defined in terms of:

- **Endemic (E):** Occurring only in the Usambara Mountains;
- **Near-endemic (N):** Species with ranges restricted to the Eastern Arc Mountains and / or the East African lowland forests;
- **Widespread (W):** Species with ranges extending beyond the Eastern Arc and East African lowland forests.

The typical habitat association of plant species is categorised as either:

- **Lowland (L):** Species occurring at altitudes of <850 m.
- **Submontane (S):** Species occurring at altitudes of >850 m.

This refers to the habitat in which they are typically found in East Africa rather than to where they have been recorded in the reserve.

These three criteria are used to analyse the uniqueness of the biodiversity of the reserve and its vulnerability to disturbance.

The categories are based on information from various sources. For plants the ecological type and endemic status are primarily based on Iversen (1991a). Forest dependent species refers to those species listed as being exclusively associated with Iversen's categories 1a (wet evergreen forest), 1b (dry evergreen forest) and / or 1c (riverine forest). Forest dwelling also includes other habitats.

The habitat type is based on Hamilton (1989). For those species not listed by Iversen or Hamilton, the information is taken from the Flora of Tropical East Africa.

For the animals, the following references were used (in order of priority):

Mammals:	Kingdon (1997), Kingdon (1989) and Kingdon (1974)
Birds:	Zimmerman et al. (1996)
Reptiles:	Howell (1993) and Broadley and Howell (1991).
Amphibians:	Howell (1993)
Butterflies:	Kielland (1990) and Larsen (1996)

The IUCN category of threat is cited for those animals listed in the 1996 IUCN red data books. However many Tanzanian species are not included in the 1996 IUCN red data book as insufficient data was available at the time of its publication. The IUCN status listed for the amphibians and reptiles is based on the National Biodiversity Database. The status of these species is undergoing national and international evaluation.

1.3 Maps

The distribution of species within the reserve is presented as a series of maps. These are thematic maps where the size of each spot is directly proportional to the value which they represent. In those plots where no spot is shown, the relevant taxa was not surveyed.

1.4 Data and monitoring

Data are stored in a Microsoft Access database currently held at the East Usambara Conservation Area Management Programme, Frontier-Tanzania and at the University of Dar es Salaam. Parts of it are available on the Internet, www.usambara.com. Zoological data is also stored on the National Biodiversity Database at the University of Dar es Salaam. This is also a Microsoft Access database. The data are geographically referenced and so can be used as a baseline for biodiversity monitoring.

1.5 Survey period and personnel

The survey of Mpanga Village Forest Reserve was conducted in November 1999 for a total of 12 research-days. The survey was conducted by Frontier-Tanzania staff, Catchment Forest Officers, Frontier Tanzania field assistants from Maramba, Amani and Tanga, and local people of Vuga and Hemsambia villages.

2.0 AIMS OF THE SURVEY

The specific aims of the survey as outlined in the Terms of Reference between the Frontier Tanzania Forest Research Programme and the East Usambara Conservation Area Management Programme are:

- to conduct biological baseline surveys in selected gazetted forests and in forests which are proposed for gazettelement;
- to provide information on the biological value and importance of these forests in order to assist in the development of management plans and practices for these forests;
- to develop a system for monitoring aspects of forest biodiversity, both on a general as well as a forest-specific level.

Furthermore, the aims of the survey methods applied are:

- to sample the vegetation and tree species composition of selected forests of the East Usambaras using systematic sampling techniques along systematically located vegetation transects, which sample approximately 0.25% of the area of each forest reserve (Mpanga Village Forest Reserve being an exception with a sampling intensity of 2.5 %);
- to assess levels of disturbance by systematically sampling the incidence of tree cutting, animal trapping and other illegal activities along the vegetation transects;
- to use standardised and repeatable methods to record biodiversity values of the forest in terms of small mammal, reptile, amphibian, and invertebrate species;
- to collect opportunistic data on all other groups of vertebrate and invertebrates. Species lists resulting from this will be compared against IUCN categories of threat and other conservation criteria in order to assess the overall biodiversity values of each forest;

By using standardised and repeatable methods these surveys provide an assessment of the biodiversity value of the forests enabling their importance to be determined and their biodiversity value to be monitored in future.

3.0 GENERAL DESCRIPTION

3.1 Description

Name:	Mpanga Village Forest Reserve Muheza District, Tanga Region, Tanzania.
Area:	24 hectares
Status:	Village Forest Reserve Gazetted 1998, Gazettement notice 542 of the 28/8/98
Maps:	Ordnance Survey topographic maps 1: 50 000 Series Y742 Sheet 110/3 'Hemagoma' of 1988 and Sheet 110/4 'Gombero' of 1989 Forest Division map: Jb 220

3.2 Location

Grid reference:	38° 47' 30''E 04° 47' 30''S
Elevation	650 – 920 m a.s.l.

Mpanga Village Forest Reserve (also referred to as Mpanga) is situated in Tanga Region (approximately 75 km from Tanga) on the north eastern area of the East Usambaras lying on northern side of Mtai Forest Reserve (see Figure 1). The reserve falls into Muheza district, Maramba division at Kingongoi ward. This reserve is a very small isolated forest block, surrounded by cultivated land. Mpanga is surrounded by two villages Vuga and Hemsambia.

3.3 Topography

This small forest encompasses a ridge running south west to north east rising to a centrally located peak at about 920 m asl.

3.4 Land use

The latest survey of the area was carried out by Hyytiäinen (1995), and updated by Johansson & Sandy (1996) does not include survey data for Mpanga. However from observation the majority of the forest is previously disturbed / poorly stocked forest. Mpanga is an important water catchment forest for Vuga, Hemsambia, as well as for population centres at the foot of the northern section of the East Usambaras (Ellman, 1996).

3.5 History and Status

There have been settlements in the East Usambara mountains for at least 2000 years. In the 19th century it appears populations were markedly lower in the East Usambaras relative to the West Usambaras with much of the area remaining forested. Mpanga is a small fragment of forest that previously covered much of the East Usambara mountains and has a significant cultural importance. It is reported that during the Kilindi wars in the 19th century Mpanga was used as a lookout point from which approaching enemies could be approached and

attacked. Clan elders were buried in the forest and it became an important sacrificial site for rainmakers as well as a source of traditional medicines (Ellman, 1996).

Village elders believe that from pre-colonial days the forest has been their main source of rainfall and that misfortune will come to the area if trees in Mpanga are cut. Despite its cultural importance the forest was heavily disturbed in the early 1990's by pit-sawing and excessive extraction of wood for fuel and building purposes. Traditional controls, where people cutting trees in Mpanga would have been required to provide a black sheep for sacrifice to appease the ancestors, have lost their strength since many people who cut trees did not perform this sacrifice and apparently suffered no ill effects (Ellman, 1996).

Government sanctions have also been ineffective since Mpanga is on public land, and is therefore subject to rules protecting certain tree species which may not be felled without a permit, and forbidding cultivation within a certain distance of a watercourse. These rules however are not rigorously enforced (Ellman, 1996).

Concerned about the forest degradation the Chairman of Hemsambia Village Government requested in June 1994 that EUCAMP (or EUCFP as it was then) gazette Mpanga as a State Forest Reserve. However, an alternative approach of participatory forest management was introduced by EUCAMP. The aim was to assist the two village governments draw up a conservation plan for their forest reserve, to establish a management institution and agree a set of rules governing the use of the forest. The first meeting to discuss and agree principles was held in April 1994. The forest boundary was surveyed and demarcated in August 1995 by EUCAMP staff and village members. A series of further visits by EUCAMP staff followed, in which a closed forest management strategy of the forest was decided. No use of the forest except for sacrifice and collection of traditional medicines was permitted from the end of 1995 to the end of 2000 (Ellman, 1996).

A strict by-law regarding natural resource use within Mpanga VFR was drawn up at the end of 1995 by the village forest committee, to last for 5 years. The committee decided to forbid most forest uses in order to let the forest recover from previous degradation. With a permit either from the village, sub-village government or from the forest committee the following was permitted:

- collection of dry firewood;
- collection of traditional medicines;
- to guide visitors into the forest.

Villagers from Hemsambia and Vuga were also allowed to without a permit to fetch water, sacrifice and gather vegetables and mushrooms (Veltheim, pers.comm.).

Approval for the collection of traditional medicines and sacrificing according to traditional procedures was given by the Chairman and Secretary of the Mpanga Forest Conservation Committee together with the Chairmen of Vuga and Hemsambia Village (Ellman, 1996). For further details regarding the problems encountered during the decision making process please refer to Ellman 1996. The written by law is held at the EUCAMP office and the relevant village and government committees.

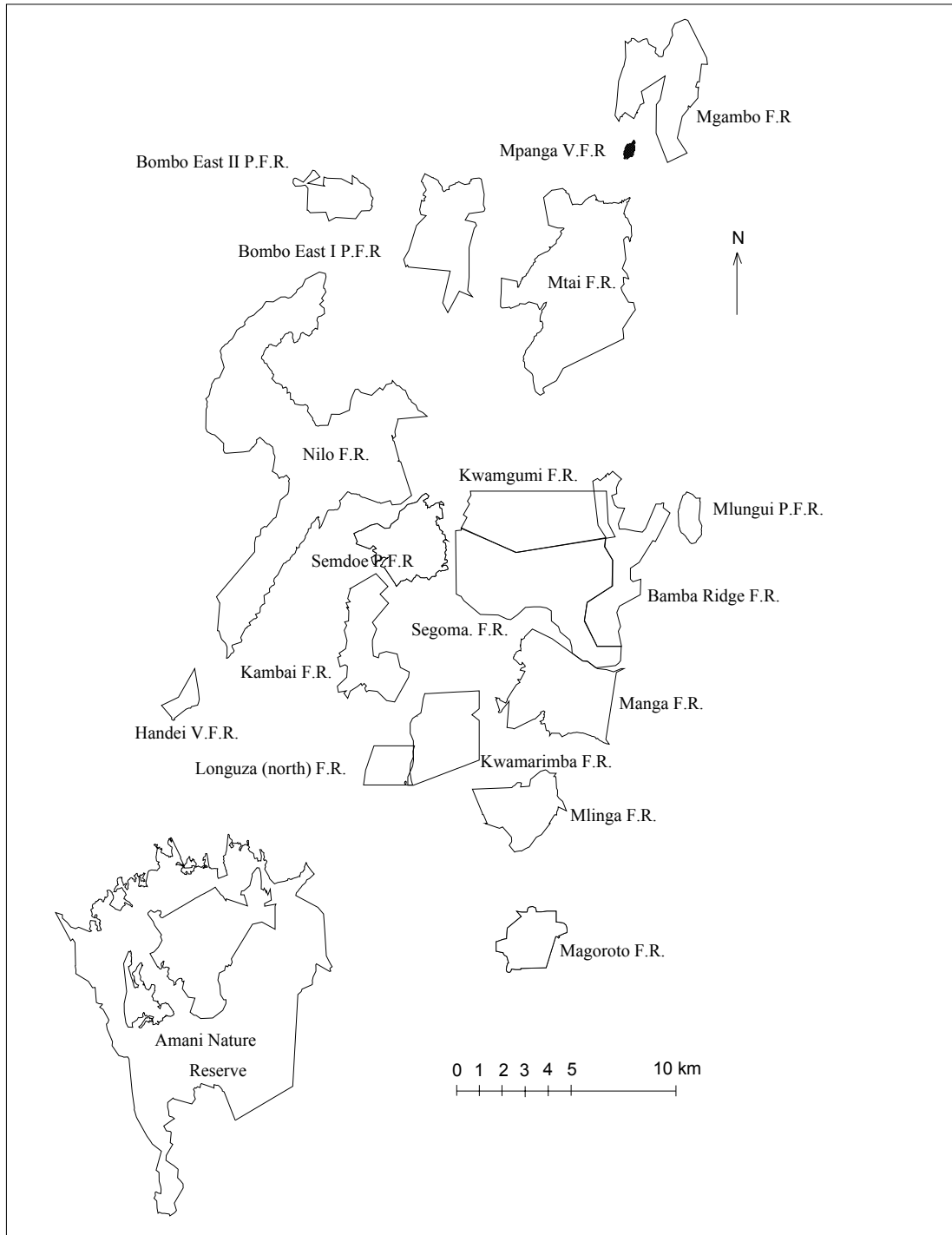


Figure 1 The location of Mpanga Village Forest Reserve in relation to other East Usambara forests.

4.0 VEGETATION

Authors: Doody, K. Z., Ntemi, A., Killenga, R. & Beharrell N. K. pp 9-39.

4.1 Introduction

An inventory was conducted of the trees and shrubs found within the reserve. Simple, quantitative and repeatable methods were employed similar to other forest surveys undertaken by FT FRP. Human disturbance within the forest was also studied. Botanical and disturbance data collected by this survey has been entered onto the EUCAMP database.

4.2 Methods

The forest block was first divided into a grid. This grid was marked in the field by tagged transects. All methods were based on this grid system. The methods used during this survey are based on the FT FRP methodologies report (SEE, 1998). A brief description is presented below and any alteration to the standard methods are noted. The location of vegetation plots and disturbance transects are illustrated in Figure 2.

4.2.1 Forest structure

Two methods were used to analyse forest structure: (1) quantitative vegetation analysis; (2) disturbance transects.

4.2.1.1 *Quantitative vegetation analysis*

The botanical survey was based on a 200 m x 200 m grid (instead of the usual 450 m x 900 m grid) marked in the field using tagged transect lines. A plot 50 m x 20 m was sampled in the south east corner of each grid square, giving an approximate sampling intensity of 2.5%. This is higher than the standard sampling intensity of 0.25 %, this alteration was made because of the exceptionally small size of the reserve and on request by EUCAMP. Within each sample plot, every tree with a dbh (diameter at breast height) of 5 cm and over was recorded, tagged and identified. This is smaller than standard >10 cm dbh used. This change was made to attempt to record most of the tree species present in the reserve despite there being few survey plots due to the small size of the reserve, again at the request of EUCAMP. Botanists from the Tanzanian Forestry Research Institute (TAFORI) and from the UDSM provided the field identification of plant species.

The regeneration layer was recorded within 3 x 3 m, and then 6 x 6 m plots (encompassing the original smaller plot) at the centre of each vegetation plot. All plants with a dbh below 10 cm were recorded in these plots, including herbs.

4.2.1.2 *Opportunistic observations*

Other botanical records were made on an opportunistic basis throughout the survey.

4.2.1.3 *Disturbance transects*

Disturbance transects were used to record the intensity of pole cutting and logging in a forest block. The disturbance transects were based on the 200 m x 200 m grid prepared for the vegetation plots. Each transect running east-west was sampled from border to border. Disturbance was recorded by 50 m section along each transect.

Every self-standing tree and sapling (i.e. not lianas or creepers) above 5 cm dbh was measured within an area 5 m either side of each transect line. Each plant was recorded under one of three categories: live, cut or naturally fallen. Within these categories a distinction was made between poles and timbers. Poles were classified by dbh, between 5 cm and 15 cm DBH and a minimum of 2 m relatively straight trunk. Timber was classified by dbh, > 15 cm DBH with a minimum 3 m relatively straight trunk. These divisions were based on differences in use. Data was presented as a total and as a rate per hectare.

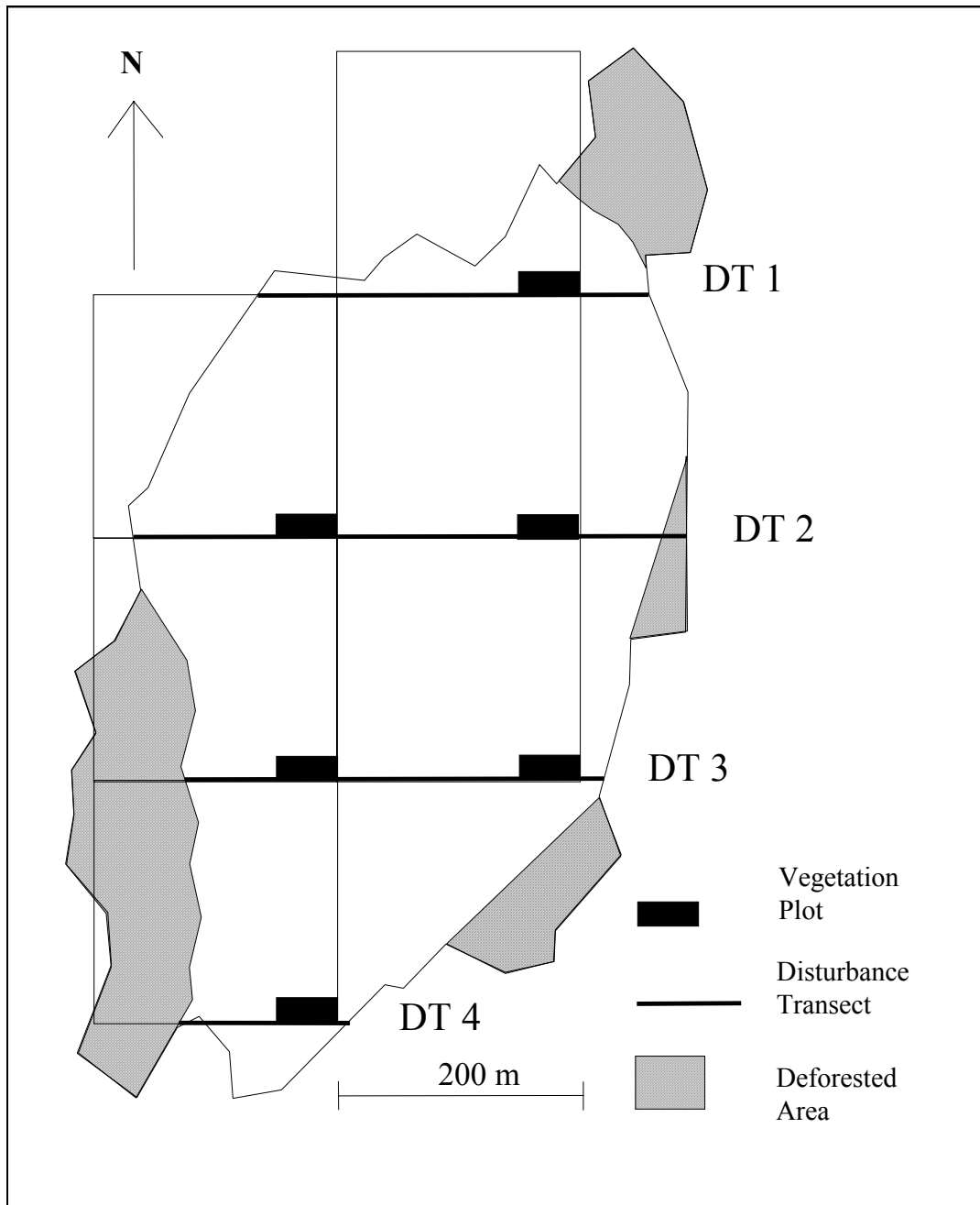


Figure 2 Location of vegetation plots and disturbance transects.

4.3 Results

4.3.1 Quantitative vegetation analysis

Table 3 presents a checklist of the tree and shrub species recorded in the 20 m x 50 m vegetation plots. Species are described, where adequate information exists, in terms of their ecological type, their habitat and their endemic status. Nomenclature follows Iversen (1991b), the Flora of Tropical East Africa and the LEAP database (Knox, 2000) and summary information has been gathered from these sources.

A total of 502 individuals, representing 73 species from 25 families were recorded in the vegetation plots.

Table 3. Checklist of trees and shrubs Mpanga Village Forest Reserve

Species	Ecological type	Habitat	Endemic status
ANACARDIACEAE			
<i>Lannea welwitschii</i> (Hiern) Engl.	F	L	W
<i>Sorindeia madagascariensis</i> Thouars ex DC. *	f	S&L	W
ANISOPHYLLEACEAE			
<i>Anisophyllea obtusifolia</i> Engl. & Brehm ^{1,2}	F	S	N
APOCYNACEAE			
<i>Funtumia africana</i> (Benth.) Stapf	F	L&S	W
<i>Tabernaemontana pachysiphon</i> Stapf *	F	S	W
CECROPIACEAE			
<i>Myrianthus holstii</i> Engl.	f	S	W
COMPOSITAE			
<i>Vernonia colorata</i> (Willd.) Drake	O	?	W
EBENACEAE			
<i>Diospyros squarrosa</i> Klotzsch ¹	F	L	W
EUPHORBIACEAE			
<i>Alchornea hirtella</i> Benth. *	f	S (forest gaps)	W
<i>Antidesma membranaceum</i> Müll. Arg.	f	L&S	W
<i>Bridelia micrantha</i> (Hochst.) Baill.	f	L&S	W
<i>Croton sylvaticus</i> Hochst.	f	L	W
<i>Drypetes usambarica</i> (Pax) Hutch.	f	S	N
<i>Macaranga capensis</i> (Baill.) Benth. Ex Sim *	F	L&S (forest gaps)	W
<i>Ricinodendron heudelotii</i> (Baill.) Pierre ex Pax	f	L	W
<i>Sapium ellipticum</i> (Hochst.) Pax	f	L & S	W
<i>Suregada zanzibariense</i> Baill.	f	L	W
GUTTIFERAE			
<i>Allanblackia stuhlmannii</i> (Engl.) Engl. *	F	S	N
<i>Harungana madagascariensis</i> Lam. Ex Poir. *	F	S	W
ICACINACEAE			
<i>Alsodeiopsis schumannii</i> (Engl.) Engl.	F	S	N
LEGUMINOSAE: CAESALPINIACEAE			
<i>Cynometra</i> L. sp. *	?	?	?
<i>Englerodendron usambarensense</i> Harms *	F	S	E (EU&WU)
<i>Erythrophleum suaveolens</i> (Guill. & Perr.) Brenan *	F	L	W
<i>Isobertlinia scheffleri</i> (Harms ex Engl.) Greenway *	F	S	N
LEGUMINOSAE: MIMOSACEAE			
<i>Albizia gummifera</i> (J.F. Gmel.) C.A. Sm.	f	L&S	W
<i>Newtonia buchananii</i> (Baker f.) G.C.C. Gilbert & Boutique *	F	S	W

Table 3 cont.

Species	Ecological type	Habitat ²	Endemic status
LOGANIACEAE			
<i>Anthocleista grandiflora</i> Gilg	f	S	W
MELASTOMATACEAE			
<i>Memecylon microphyllum</i> Gilg	F	?	E (EU)
MELIACEAE			
<i>Trichilia emetica</i> Vahl	f	L&S	W
MELIANTHACAEAE			
<i>Bersama abyssinica</i> var. <i>holstii</i> (Guerke) Verdc.	f	S (forest gaps)	N
MORACEAE			
<i>Antiaris toxicaria</i> Lesch.	f	S&L	W
<i>Ficus exasperata</i> Vahl	f	S&L	W
<i>Ficus lutea</i> Vahl	f	L	W
<i>Ficus natalensis</i> Hochst.	f	L	W
<i>Ficus sycomorus</i> L.	F	L	W
<i>Mesogyne insignis</i> Engl. *	F	S	N
<i>Milicia excelsa</i> (Welw.) C.C. Berg	f	S&L	W
<i>Trilepisium madagascariense</i> Thouars ex DC.	f	L&S	W
OLACACEAE			
<i>Strombosia scheffleri</i> Engl.	F	S	W
RUBIACEAE			
<i>Aورانthe penduliflora</i> (K. Schum.) Robbr. *	F	L&S	N
<i>Chazaliella abrupta</i> (Hiern) E.M.A. Petit & Verdc. (var. <i>abrupta</i>)	f	?	W
<i>Coffea robusta</i> Linden * ¹	O	L&S	W
<i>Keetia venosa</i> (Oliv.) Bridson	O	?	W
<i>Oxyanthus pyriformis</i> (Hochst.) Skeels	F	S (forest gaps)	W
<i>Psychotria peteri</i> E.M.A. Petit	F	?	N
<i>Rothmannia manganjae</i> (Hiern) Keay	F	S&L	W
<i>Rytigynia flavida</i> Robyns	F	?	N
<i>Tarennia nigrescens</i> (Hook. F.) Hiern *	f	L	W
<i>Tricalysia anomala</i> E.A. Bruce	F	S	N
RUTACEAE			
<i>Citrus aurantium</i> L.	O	?	W
<i>Citrus sinensis</i> (L.) Osbeck	O	?	W
<i>Vepris nobilis</i> (Delile) Mziray *	f	S	W
SAPINDACEAE			
<i>Allophylus callophylus</i> * ¹	?	?	?
<i>Allophylus melliodorus</i> Gilg ex Radlk.	f	?	N
<i>Blighia unijugata</i> Baker (Syn. <i>Phialodiscus unijugatus</i>)	F	L&S	W
<i>Deinbollia kilimandscharica</i> Taub.	?	?	W
<i>Pancovia holtzii</i> Gilg ex Radlk.	F	?	N
<i>Zanha golungensis</i> Hiern	F	L&S	W
SAPOTACEAE			
<i>Chrysophyllum perpulchrum</i> Mildbr. Ex Hutch. & Dalziel	F	S	W
<i>Synsepalum cerasiferum</i> (Welw.) T.D. Penn. * ¹ (Syn. <i>Pouteria cerasifera</i>)	?	?	?
<i>Manilkara obovata</i> (Sabine & G. Don) J.H. Hemsl.	F	S	W
<i>Synsepalum msolo</i> (Engl.) T.D. Penn. * (Syn. <i>Pachystela msolo</i> (Engl.) Engl.)	F	L&S	W

Table 3 continued.

Species	Ecological type	Habitat ²	Endemic status
SIMAROUBACEAE			
<i>Odyendea zimmermannii</i> Engl.	F	S	N
STERCULIACEAE			
<i>Cola scheffleri</i> K. Schum.	F	L	E (EU)
<i>Cola usambarensis</i> Engl. *	F	S	E (EU)
<i>Leptonychia usambariensis</i> K. Schum. *	F	L&S	N
ULMACEAE			
<i>Celtis africana</i> Burm. f.	F	L	W
<i>Celtis gomphophylla</i> Baker *	F	L	W
<i>Celtis mildbraedii</i> Engl. *	F	L&S	W
<i>Trema orientalis</i> (L.) Blume	f	L&S (forest gaps)	W
VERBENACEAE			
<i>Clerodendrum scheffleri</i> Gürke ¹	?	?	W
<i>Lantana camara</i> L. (exotic)	O	?	W
<i>Vitex amaniensis</i> W. Piep.	F	S&L	N

¹Species which do not appear in Iversen (1991b).

KEY TO ABBREVIATIONS FOR TABLE 3 and 4

Ecological type: (based on Iversen, 1991b)

- F - Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest;
- f - Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species; and
- O - Non-forest species: These are species that do not occur in primary or secondary forest or forest edge.

Habitat: (based on Hamilton, 1989)

- L - Lowland: Species occurring at altitudes of <850 m;
- L&S: species which mainly occur in Lowland forest and occur occasionally in submontane forest
- S&L: species which mainly occur in submontane forest and occur occasionally in lowland forest.
- S - Submontane: Species occurring at altitudes of >850 m.

In the case where species occur in both lowland and submontane habitats (L&S, S&L), the most common habitat is be listed first. If a species is common in forest gaps, rather than in the forest proper, this will also be noted.

Endemic status: (based on Iversen, 1991b):

- E - Endemic: Occurring only in the Usambara mountains; (EU) - Range limited to the East Usambaras; (WU) - Range limited to the West Usambaras, (EU&WU) occurs within East & West Usambaras.
- N - Near endemic: Species with limited ranges in the Eastern Arc mountains and/or the East African lowland forests;
- W - Widespread distribution.

? Insufficient data

Regeneration Layer

* : species recorded in the regeneration layer are marked with an asterisk.

In Table 4, four species are listed. These were recorded in the regeneration layer but not in the larger vegetation plots.

Table 4. Species recorded exclusively in the regeneration layer.

Species	Ecological type	Habitat	Endemic status
APOCYNACEAE			
<i>Rauvolfia mombasiana</i> Stapf	f	L	N
LEGUMINOSAE: PAPILIONACEAE			
<i>Pterocarpus tinctorius</i> Welw.	F	S&L	W
MYRISTICACEAE			
<i>Cephalosphaera usambarensis</i> (Warb.) Warb.	F	S	N
RUBIACEAE			
<i>Psychotria</i> L. sp.	?	?	?

Table 5. Summary of opportunistic botanical records.

Species	Ecological type	Habitat	Endemic status
ACANTHATHEAE			
<i>Justicia flava</i> (Vahl) Vahl ^a	O	L&S	W
<i>Whitfieldia elongata</i> (P. Beauv.) De Wild. & T. Durand ^a	f	?	W
ANACARDIACEAE			
<i>Lannea schweinfurthii</i> (Engl.) Engl.	f	L&S	W
<i>Ozoroa insignis</i> Delile	f	L&S	W
<i>Rhus natalensis</i> Bernh.	f	L&S	W
<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	O	L&S	W
ANNONACEAE			
<i>Annickia kummeriae</i> (Engler & Diels) Setten & Maas	F	S	N
<i>Mkilua fragrans</i> Verdc.	F	S	N
<i>Saba comorensis</i> (Bojer ex A. DC.) Pichon ^b	f	?	W
<i>Uvaria dependens</i> Engl. & Diels	F	S	N
<i>Uvariadendron</i> sp.	?	?	?
APOCYNACEAE			
<i>Ancylobothrys petersiana</i> (Klotzsch) Pierre	f	L	W
<i>Voacanga thouarsii</i> Roem. & Schult.	f	L&S	W
ARACEAE			
<i>Culcasia orientalis</i> Mayo ^b	F	L	N
ARALIACEAE			
<i>Cussonia arborea</i> Hochst. ex A. Rich.	O	L&S	W
ASCLEPIADACEAE			
<i>Mondia whitei</i> (Hook. f.) Skeels ^a	F	?	E
<i>Calotropis procera</i> (Aiton) W.T. Aiton ^a	O	?	W
ASPLENIACEAE			
<i>Asplenium nidus</i> L.	F	?	W
BASELLACEAE			
<i>Basella aba</i> L. ^b	O	?	W
BEGONIACEAE			
<i>Begonia</i> sp. ^a	?	?	?
BIGNONIACEAE			
<i>Kigelia africana</i> (Lam.) Benth.	F	L	W
<i>Stereospermum kunthianum</i> Cham.	F	L&S	W
BOMBACACEAE			
<i>Bombax rhodognaphalon</i> K. Schum.	F	L	N

Table 5 continued.

Species	Ecological type	Habitat	Endemic status
BURSERACEAE			
<i>Commiphora africana</i> (A. Rich.) Engl.	O	?	W
CAPPARIDACEAE			
<i>Boscia salicifolia</i> Oliv.	O	?	W
CELASTRACEAE			
<i>Salacia leptoclada</i> Tul.	F	?	W
CHRYSOBALANACEAE			
<i>Magnistipula butayei</i> var. <i>greenwayii</i> (Brenan) R. Graham	F	?	EU
<i>Maranthes goetzeniana</i> (Engl.) Prance	f	S	W
<i>Parinari excelsa</i> Sabine	f	S	W
COMPOSITAE			
<i>Anisopappus oliverianus</i> Wild ¹	?	?	W
<i>Bidens pilosa</i> L. ^a	O	?	W
<i>Crassocephalum montuosum</i> (S. Moore) Milne-Redh. ^a	F	?	W
<i>Solanecio mannii</i> (Hook. f.) C. Jeffrey ^a	O	?	W
<i>Tithonia diversifolia</i> (Hemsl.) A. Gray	O	?	W
<i>Vernonia amygdalina</i> Delile ¹	?	?	?
<i>Vernonia myriantha</i> Hook. f.	f	?	W
CUCURBITACEAE			
<i>Luffa cylindrica</i> (L.) M. Roem. ^b	O	?	W
<i>Momordica foetida</i> Schumach. ^b	O	?	W
<i>Peponium vogelii</i> (Hook. f.) Engl. ^b	O	?	W
<i>Telfairia pedata</i> (Smith ex Sims) Hook. ^b	F	?	N
DENNSTAEDTIACEAE			
<i>Pteridium aquilinum</i> (L.) Kuhn ^a	O	?	W
DRACAENACEAE			
<i>Dracaena afromontana</i> Mildbr. ¹	F	?	W
<i>Dracaena deremensis</i> Engl. ¹	f	?	W
<i>Dracaena laxissima</i> Engl. ^{1b}	F	?	W
<i>Dracaena steudneri</i> Engl. ^{1a}	f	S (forest gaps)	W
<i>Sansevieria kirkii</i> Baker ^{1a}	O	?	W
EBENACEAE			
<i>Euclea</i> sp.	?	?	?
EUPHORBIACEAE			
<i>Margaritaria discoidea</i> (Baill.) G.L. Webster	F	S	W
<i>Pycnocomma macrantha</i> Pax	F	?	E (EU)
<i>Tragia brevipes</i> Pax ^{1b}	?	?	?
GESNERIACEAE			
<i>Saintpaulia grotei</i> Engl. ^a	F	?	E (EU)
<i>Streptocarpus</i> sp. ^a	?	?	?
GRAMINAE			
<i>Leptaspis cochleata</i> Thwaites ^a	F	?	W
<i>Olyra latifolia</i> L. ^{1a}	f	?	W
GUTTIFERAE			
<i>Vismia orientalis</i> Engl.	f	?	N
ICACINACEAE			
<i>Leptaulus holstii</i> (Engl.) Engl.	F	?	W
LABIATAE			
<i>Hoslundia opposita</i> Vahl	F	?	W
<i>Leucas</i> sp.	?	?	?

Table 5 continued.

Species	Ecological type	Habitat	Endemic status
LEGUMINOSAE: CAESALPINIACEAE			
<i>Afzelia quanzensis</i> Welw.	f	?	W
<i>Cynometra brachyrrhachis</i> Harms	F	L&S	E (EU)
LEGUMINOSAE: MIMOSACEAE			
<i>Albizia adianthifolia</i> (Schumach.) W. Wight	f	L&S	W
<i>Albizia anthelmintica</i> Brongn.	O	S&L	W
<i>Parkia filicoidea</i> Welw. ex Oliv.	F	L&S	W
LEGUMINOSAE: PAPILIONACEAE			
<i>Dalbergia lactea</i> Vatke	f	?	W
<i>Ormocarpum trachycarpum</i> (Taub.) Harms	?	?	?
<i>Xeroderris stuhlmannii</i> (Taub.) Mendonça & E.C. Sousa	O	?	W
LOGANIACEAE			
<i>Strychnos spinosa</i> Lam.	f	?	W
<i>Tapinanthus zizyphifolius</i> (Engl.) Danser	?	?	?
MALVACEAE			
<i>Sida acuta</i> Burm. f. ^a	O	?	W
<i>Sida</i> sp. ^a	?	?	?
MELASTOMATAACEAE			
<i>Calvoa orientalis</i> Taub.	F	?	W
<i>Memecylon microphyllum</i> Gilg.	F	?	E(EU)

KEY TO ABBREVIATIONS FOR TABLE 5

Ecological type: (based on Iversen, 1991b)

- F - Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest;
- f - Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species; and
- O - Non-forest species: These are species that do not occur in primary or secondary forest or forest edge.

Habitat: (based on Hamilton, 1989)

- L - Lowland: Species occurring at altitudes of <850 m;
- S - Submontane: Species occurring at altitudes of >850 m.

In the case where species occur in both lowland and submontane habitats, the most common habitat will be listed first and only this habitat will be counted in the summary statistics. If a species is common in forest gaps, rather than in the forest proper, this will also be noted.

Endemic status: (based on Iversen, 1991b):

- E - Endemic: Occurring only in the Usambara mountains;
- N - Near endemic: Species with limited ranges in the Eastern Arc mountains and/or the East African lowland forests;
- W - Widespread distribution.

EU - Range limited to the East Usambaras; WU - Range limited to the West Usambaras

? Insufficient data

Life Form

^a Herbaceous species

^b Climber species

Species accumulation rate:

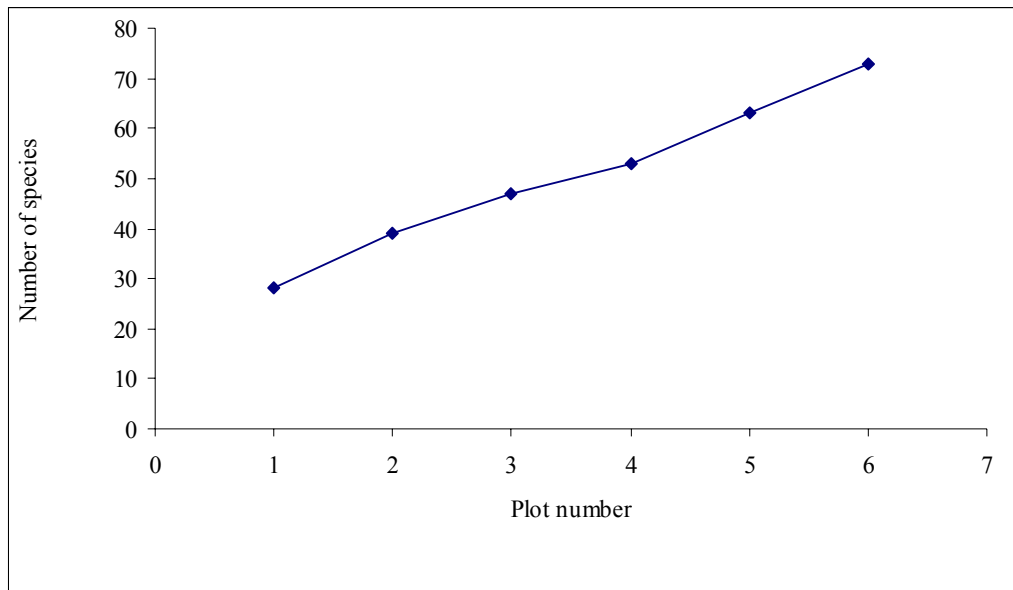


Figure 3 Species accumulation rates of recorded species by vegetation plot.

Table 6 summarises information for species that were recorded in Mpanga outside the range described by Ruffo *et al.* (1989)¹. Mpanga VFR has been categorised within location 6, Mtai of Ruffo *et al.* (1989), thus the table below highlights those species recorded in Mpanga that were not recorded within location 6, Mtai.

Table 6. Tree and shrub species (recorded from vegetation plots) found outside their previously recorded range¹ in the East Usambara mountains.

Species	Location as previously recorded ¹
ANISOPHYLLEACEAE	
<i>Anisophyllea obtusifolia</i> Engl. & Brehm	Not recorded during survey
APOCYNACEAE	
<i>Funtumia africana</i> (Benth.) Stapf	Southern parts of the range, Longuza, Marimba, Mlinga
COMPOSITAE	
<i>Vernonia colorata</i> (Willd.) Drake	Not recorded during survey
EUPHORBIACEAE	
<i>Alchornea hirtella</i> Benth. *	Southern part of the range, Lutindi (Nilo), Longuza, Mlinga
<i>Bridelia micrantha</i> (Hochst.) Baill.	Southern part of the range, Lutindi (Nilo), Longuza, Mlinga
<i>Suregada zanzibariense</i> Baill.	Longuza, Churwa
GUTTIFERAE	
<i>Harungana madagascariensis</i> Lam. Ex Poir. *	Southern aprt of the range, Lutindi & Kilanga (Nilo), Longuza, Mlinga
ICACINACEAE	
<i>Alsodeiopsis schumannii</i> (Engl.) Engl.	Southern part of the range, Kilanga (Nilo)
LEGUMINOSAE: CAESALPINIACEAE	
<i>Englerodendron usambarensense</i> Harms *	Southern part of the range
MELASTOMATACEAE	
<i>Memecylon microphyllum</i> Gilg	Lutindi
MELIACEAE	
<i>Trichilia emetica</i> Vahl	Not recorded during survey
MORACEAE	
<i>Ficus lutea</i> Vahl	Southern part of the range, Lutindi (Nilo), Longuza
<i>Ficus natalensis</i> Hochst.	Lutindi (Nilo), Longuza, Mlinga
RUBIACEAE	
<i>Aورانthe penduliflora</i> (K. Schum.) Robbr. *	Not recorded during survey
<i>Chazaliella abrupta</i> (Hiern) E.M.A. Petit & Verdc. (var. <i>abrupta</i>)	Lutindi (Nilo), Mlinga
<i>Coffea robusta</i> Linden *	Not recorded during survey
<i>Keetia venosa</i> (Oliv.) Bridson	Not recorded during survey
<i>Psychotria peteri</i> E.M.A. Petit	Southern part of the range
<i>Rytigynia flavida</i> Robyns	Southern part of the range, Lutindi (Nilo), Mlinga
<i>Tarenna nigrescens</i> (Hook. F.) Hiern *	Not recorded during survey
<i>Tricalysia anomala</i> E.A. Bruce	Kilanga
RUTACEAE	
<i>Vepris nobilis</i> (Delile) Mziray *	Southern part of the range, Kwamgumi
SAPINDACEAE	
<i>Deinbollia kilimandscharica</i> Taub.	Southern part of the range, Longuza,
<i>Pancovia holtzii</i> Gilg ex Radlk.	Not recorded during survey
SAPOTACEAE	
<i>Manilkara obovata</i> (Sabine & G. Don) J.H. Hemsl.	Southern part of the range

Table 6 continued

Species	Location as previously recorded ¹
STERCULIACEAE	
<i>Cola usambarensis</i> Engl. *	Southern part of the range
ULMACEAE	
<i>Trema orientalis</i> (L.) Blume	Southern part of the range, Lutindi (Nilo), Mlinga, Kwamgumi/Segoma
VERBENACEAE	
<i>Clerodendrum scheffleri</i> Gürke	Lutindi (Nilo)
<i>Lantana camara</i> L. (exotic)	Southern part of the range, Longuza, Marimba, Mlinga, Kwamgumi/Segoma
<i>Vitex amaniensis</i> W. Piep.	Southern part of the range, Kwamgumi/Segoma

¹ Information is based on Ruffo *et al.* (1989).

Ecological type (refer to Figures 4, 5, 6, 7.):

Table 7. Summary of ecological type for tree and shrub species. (Based on Table 3 only, excluding regeneration plot only species)

Ecological Type	Number of species	% of total number of species	Number of individuals	% of total number of individuals
(F) Forest dependent species	34	46	324	64
(f) Non-forest dependent species	27	37	146	29
(O) Non-forest species	5	7	18	4
(?) Unknown	7	10	13	3
Total:	73	100	501	100

Habitat (refer to Figures 8 & 9):

Table 8. Summary of habitat for tree and shrub species (based on Table 3).

Habitat	Number of species	% of total number of species	Number of individuals	% of total number of individuals
(L) Lowland Species	29	40	156	31
(S) Submontane Species	28	38	319	64
(?) Unknown	26	22	26	5
Total:	73	100	501	100

Table 9. Submontane species occurring in lowland areas and the lowest altitudes where they were recorded.

Species	Lowest Recorded Altitude (metres above sea level)
<i>Chrysophyllum perpulchrum</i>	680
<i>Vitex amaniensis</i>	680
<i>Oxyanthus pyriformis</i>	680
<i>Anthocleista grandiflora</i>	680
<i>Myrianthus holstii</i>	680
<i>Harungana madagascariensis</i>	680
<i>Newtonia buchananii</i>	680
<i>Allanblackia stuhlmannii</i>	680
<i>Mesogyne insignis</i>	680
<i>Alchornea hirtella</i>	680
<i>Tabernaemontana pachysiphon</i>	680
<i>Isobertia scheffleri</i>	780
<i>Antiaris toxicaria</i>	780
<i>Strombosia scheffleri</i>	780
<i>Teclea nobilis</i>	780
<i>Manilkara obovata</i>	780
<i>Odyendea zimmermannii</i>	780
<i>Sorindeia madagascariensis</i>	780
<i>Milicia excelsa</i>	787
<i>Rothmannia manganjae</i>	787
<i>Ficus exasperata</i>	787
<i>Cola usambarensis</i>	825
<i>Englerodendron usambariense</i>	825

Endemic status (refer to figures 10, 11, 12, 13):

Table 10. Summary of endemic status for tree and shrub species (based on Table 3).

Endemic status	Number of species	% of total number of species	Number of individuals	% of total number of species
E (EU) Endemic	3	4.1	5	1
E (EU&WU) Endemic	1	1.4	6	1.2
(N) Near Endemic	16	21.9	109	21.7
(W) Widespread	50	68.5	373	74.5
(?) Unknown	3	4.1	8	1.6
Total:	73	100	501	100

* EU - East Usambara mountains WU - West Usambara mountains

Timber value

Logging has previously been undertaken in Mpanga financed by businessmen from Tanga and Iringa. Table 11 lists the species stated by Sikh Saw Mills (Ruffo, 1989) utilised for plywood and timber. Pitsawyers selectively cut timbers almost exclusively of *Khaya*, *Milicia*, *Newtonia*, *Octotea*, of which only *Milicia* and *Newtonia* were recorded in Mpanga vegetation plots.

Table 11. The abundance of selected timber species.

Species	Number of plots in which recorded*	Total individuals recorded	% of stems sampled (n=501)
<i>Albizia gummifera</i> ³	4	6	1.2
<i>Allamnlackia stulmanni</i> ³	6	16	3.2
<i>Anthocleista grandiflora</i> ¹	3	4	0.8
<i>Antiaris toxicaria</i> ²	3	3	0.6
<i>Bersama abyssinnia</i> ³	2	4	0.8
<i>Macaranga capensis</i> ³	5	57	11.4
<i>Milicia excelsa</i> ³	1	1	0.2
<i>Newtonia buchananii</i> ²	5	8	1.6

* total number of plots = 6

1 Plywood species only: (Sikh Saw Mills)

2 Timber & plywood species: (Sikh Saw Mills)

3 Timber only: listed from the Forest Division but not necessarily used as timber species in the East Usambaras.

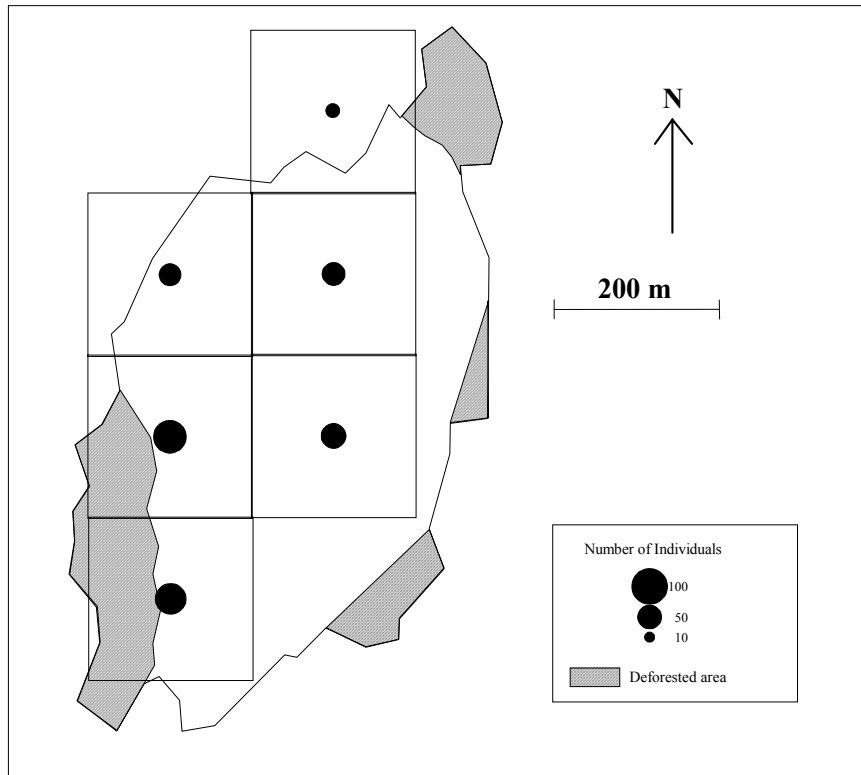


Figure 4 Distribution of forest dependent tree and shrub individuals.

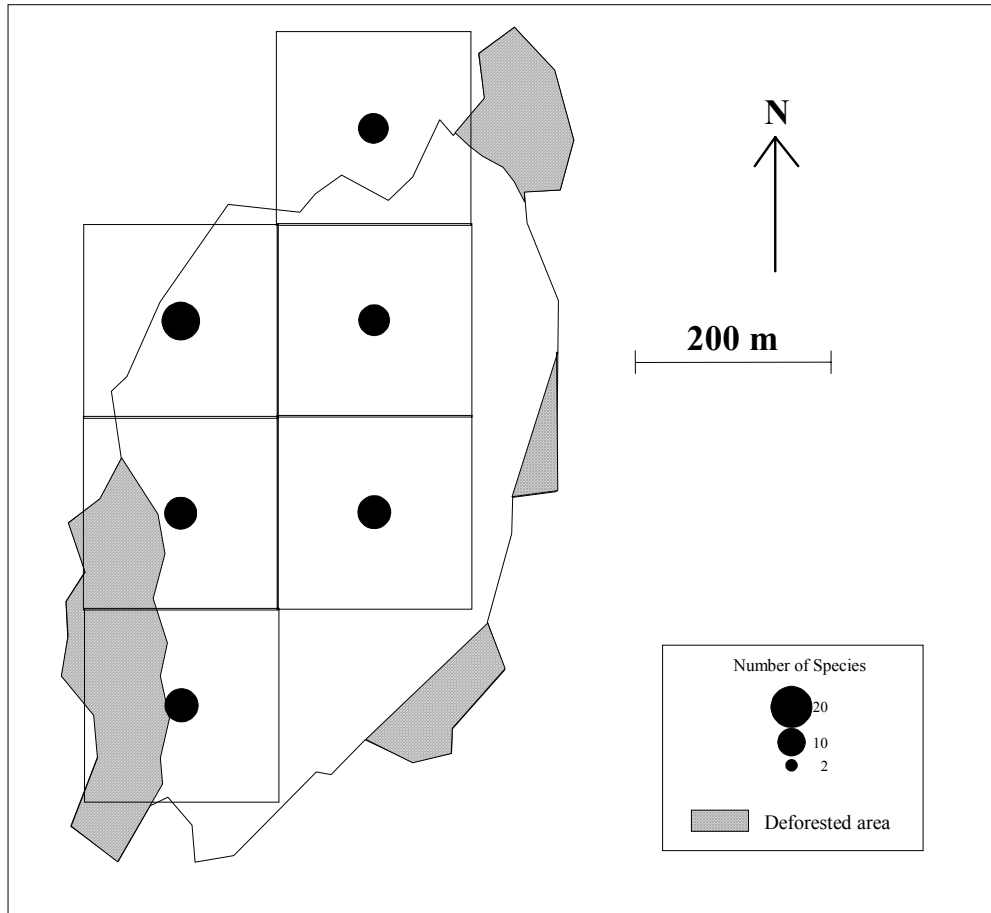


Figure 5 Distribution of forest dependent tree and shrub species.

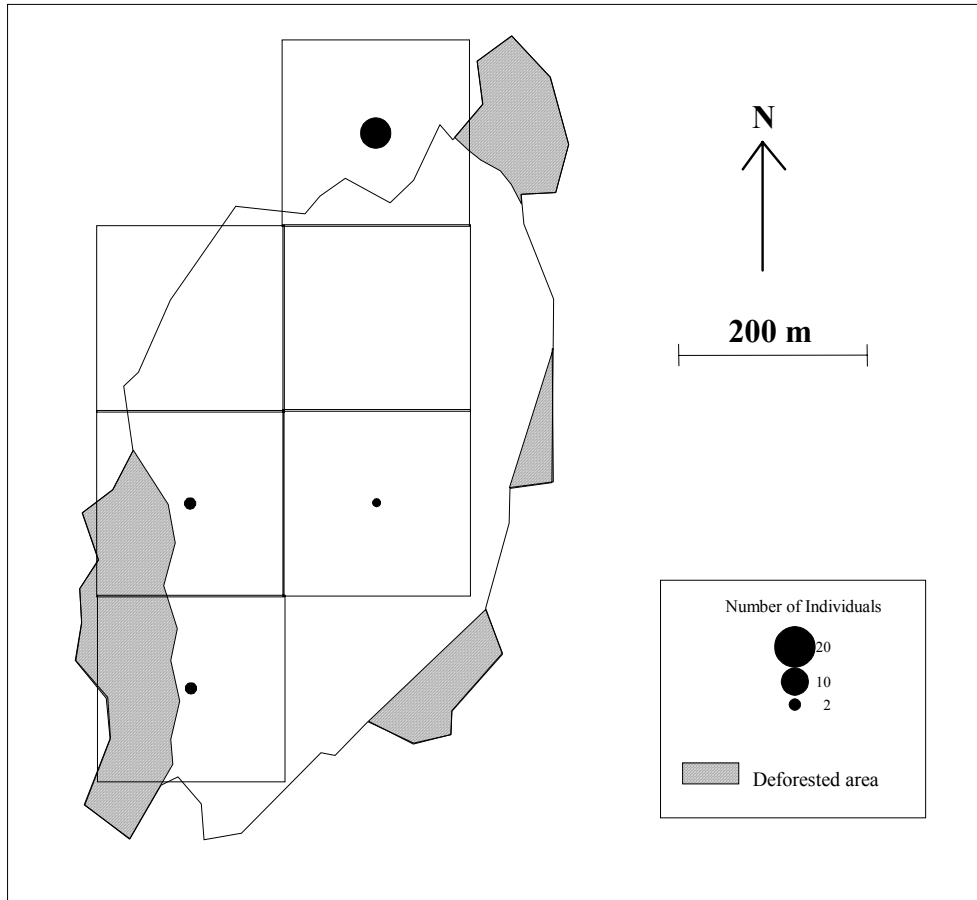


Figure 6 Distribution of non-forest tree and shrub individuals.

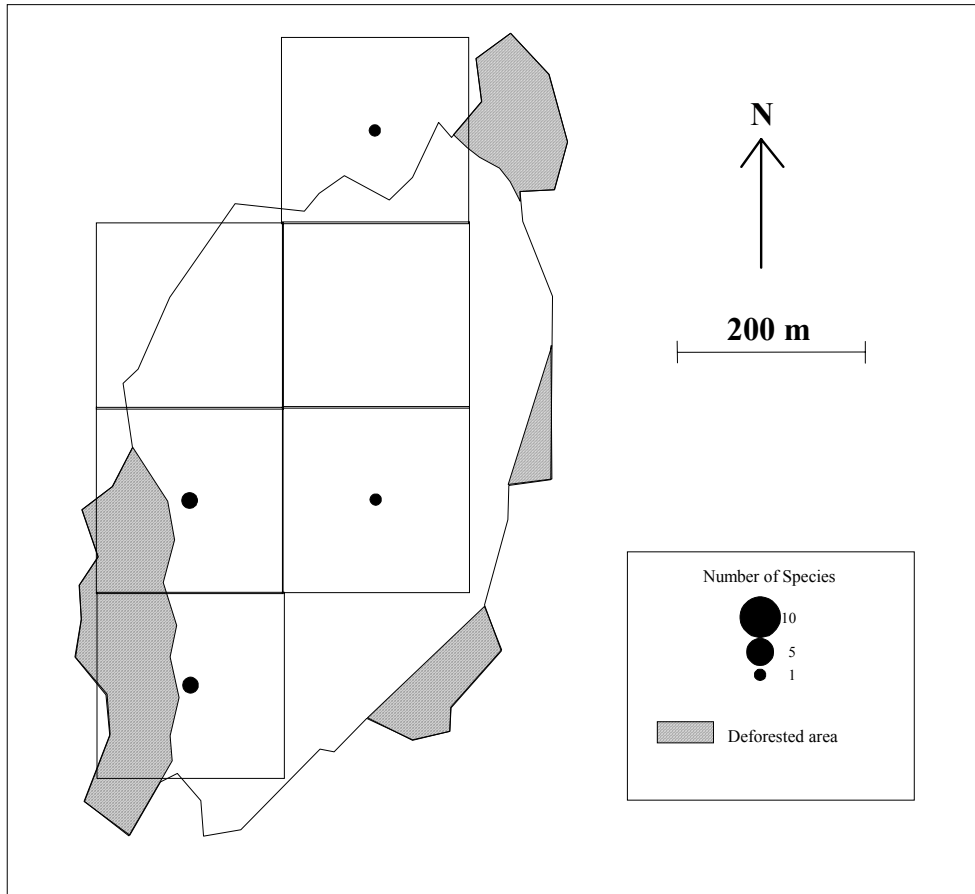


Figure 7 Distribution of non-forest tree and shrub species.

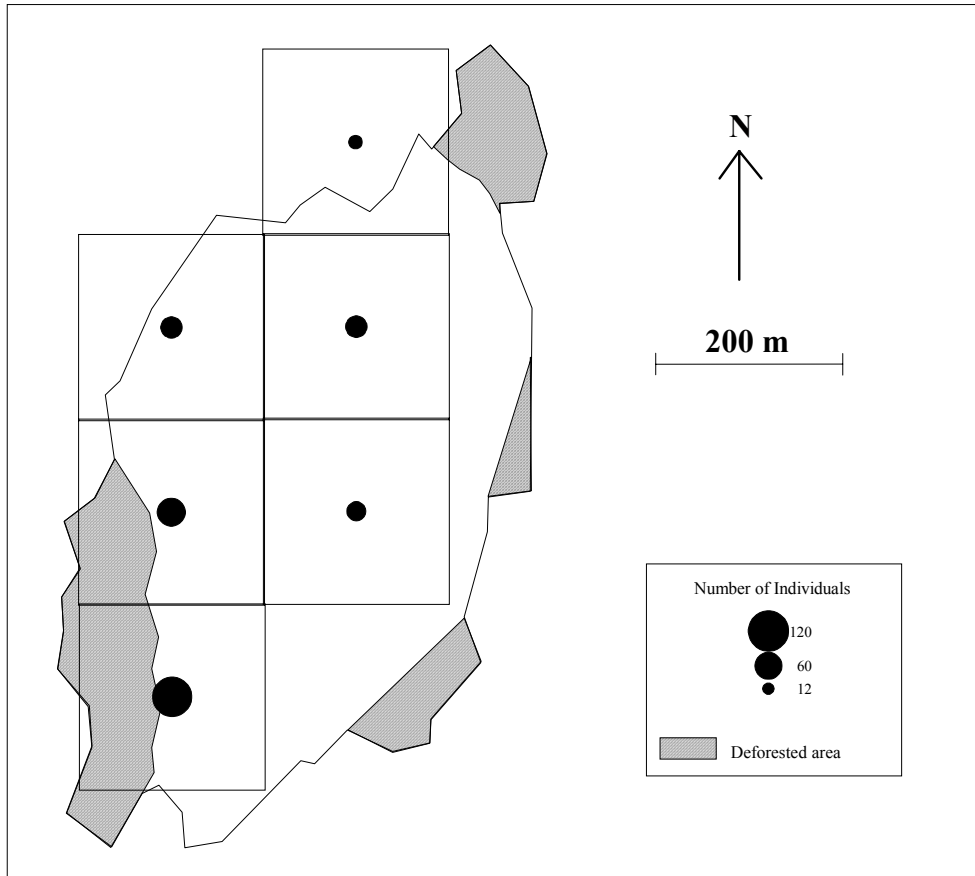


Figure 8 Distribution of submontane tree and shrub individuals.

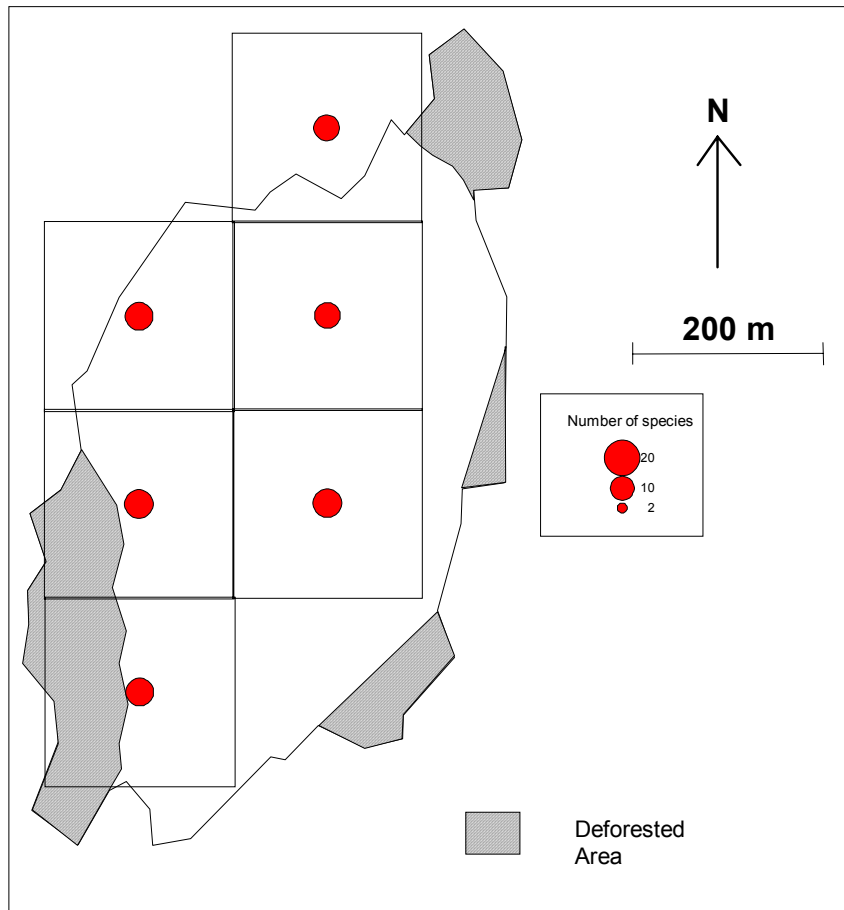


Figure 9 Distribution of submontane tree and shrub species.

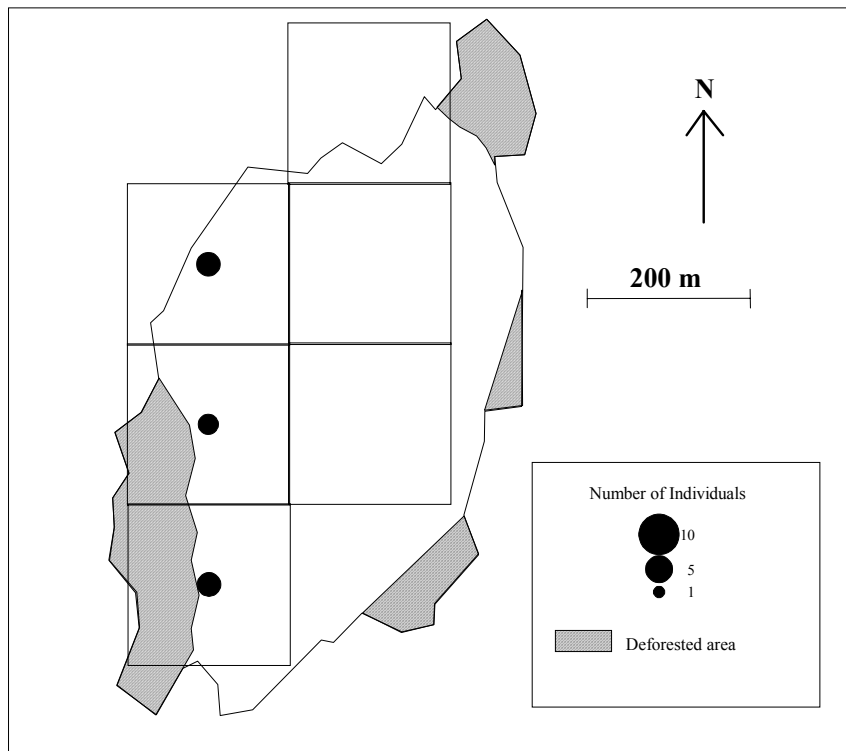


Figure 10 Distribution of endemic tree and shrub individuals.



Figure 11 Distribution of endemic tree and shrub species.

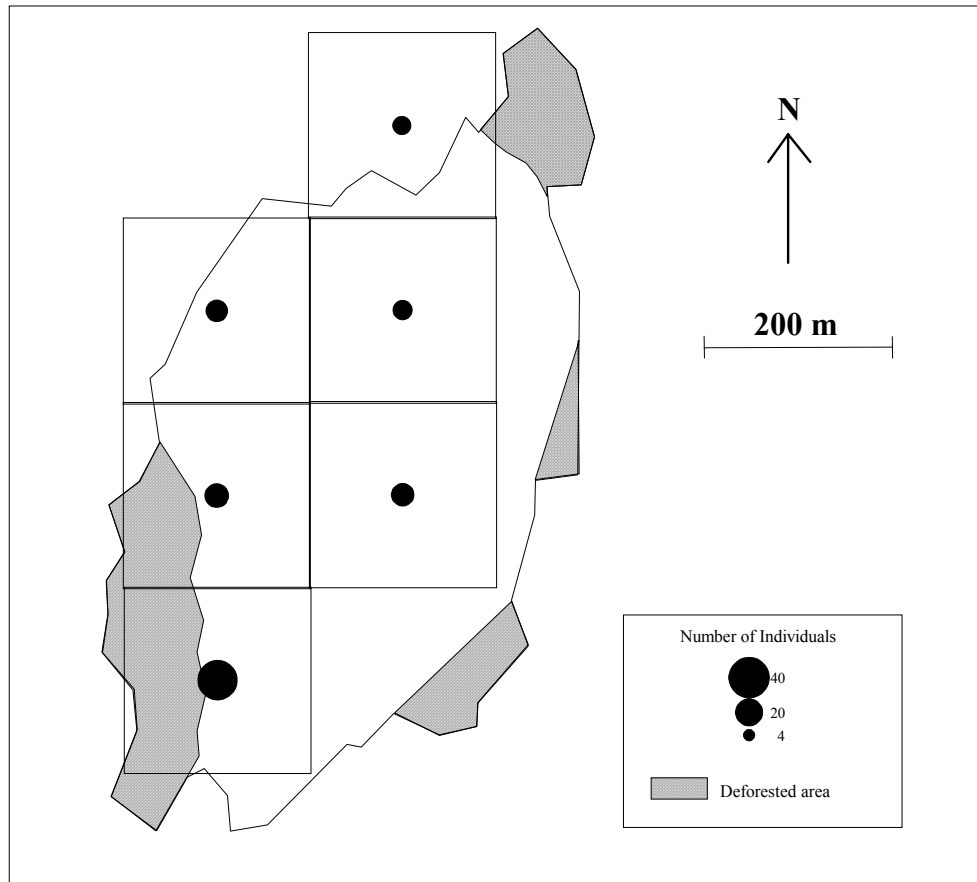


Figure 12 Distribution of near-endemic tree and shrub individuals.

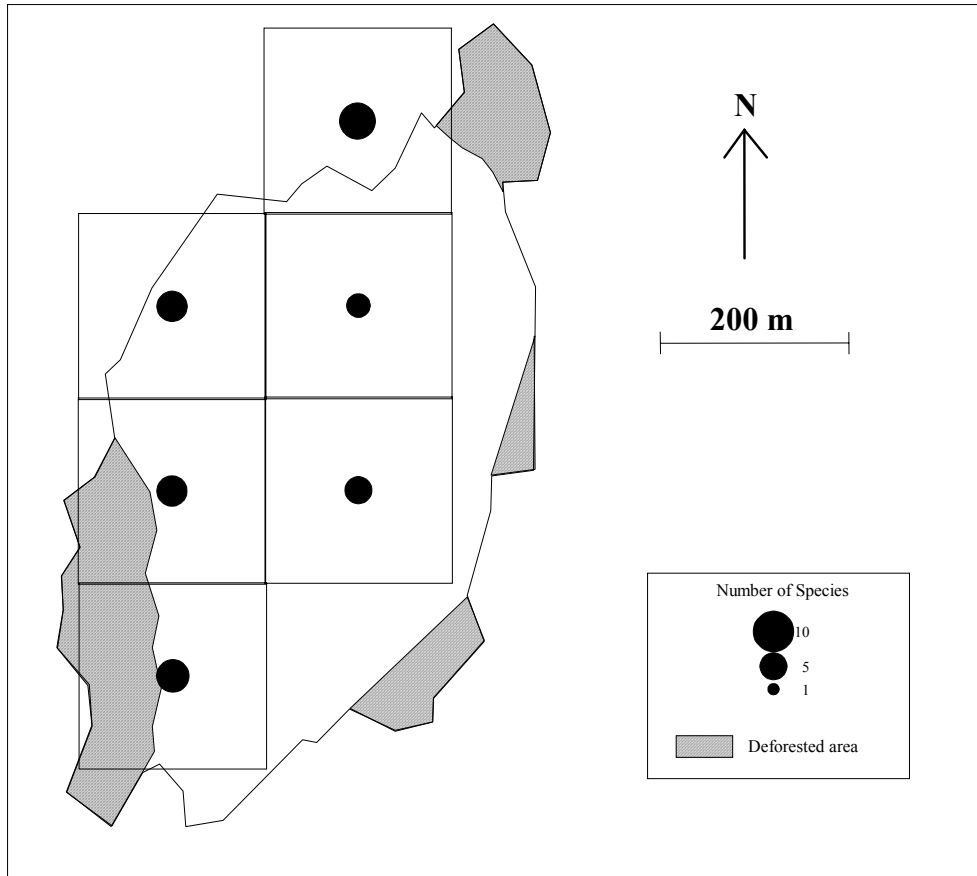


Figure 13 Distribution of near-endemic tree and shrub species.

4.3.2 Disturbance transects

Pole and timber extraction was recorded along all four transects. The results are summarised in Table 12 for poles and Table 13 for timber. The term pole refers to all stems 5 – 15 cm dbh, the term timber refers to stems > 15 cm dbh. New cut poles or timbers were categorised by stumps being freshly cut i.e. not blackened and thus approximately within the last six months. Other disturbances were recorded systematically and are listed in Table 13.

Table 12. Disturbance transect results for pole counts.

Transect number	Length of transect (m)	Total poles sampled	Live pole	Ave live per ha	Old cut pole	New cut pole	Average cut per ha	Naturally fallen pole	Average per ha
1	220	117	71	323	34	6	181	6	27
2	425	303	236	555	57	1	136	9	21
3	340	222	188	553	22	5	79	7	21
4	140	133	118	843	13	0	93	2	14

Note: A pole is defined as 5-15 cm dbh with 2 m straight trunk.

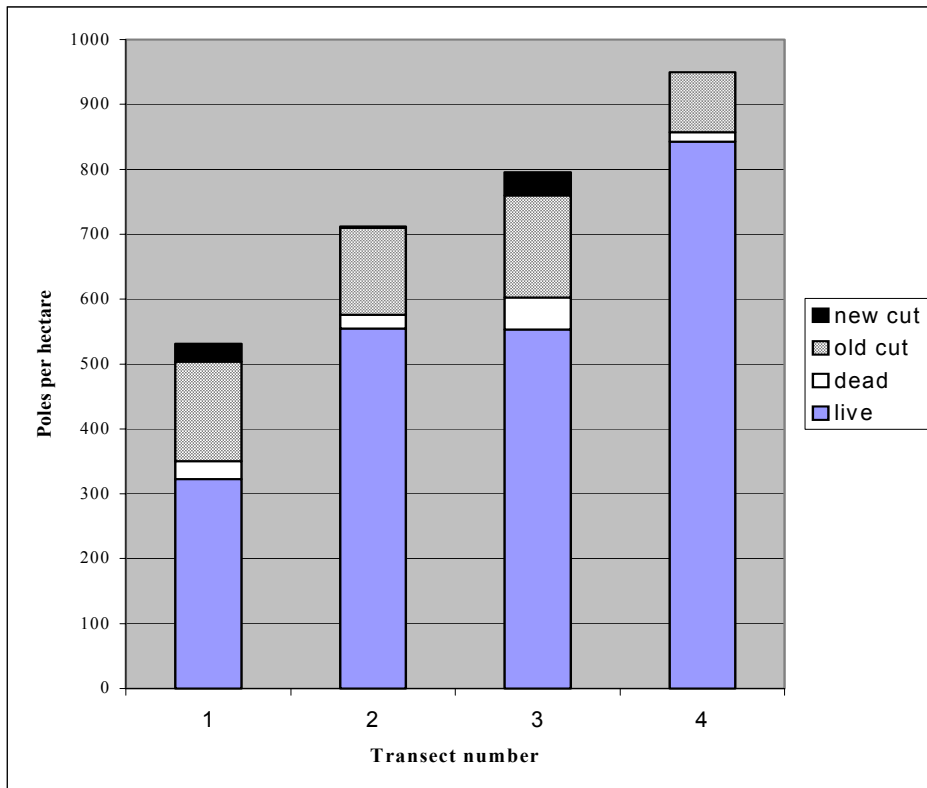


Figure 14 Live, cut and naturally fallen poles recorded by transect.

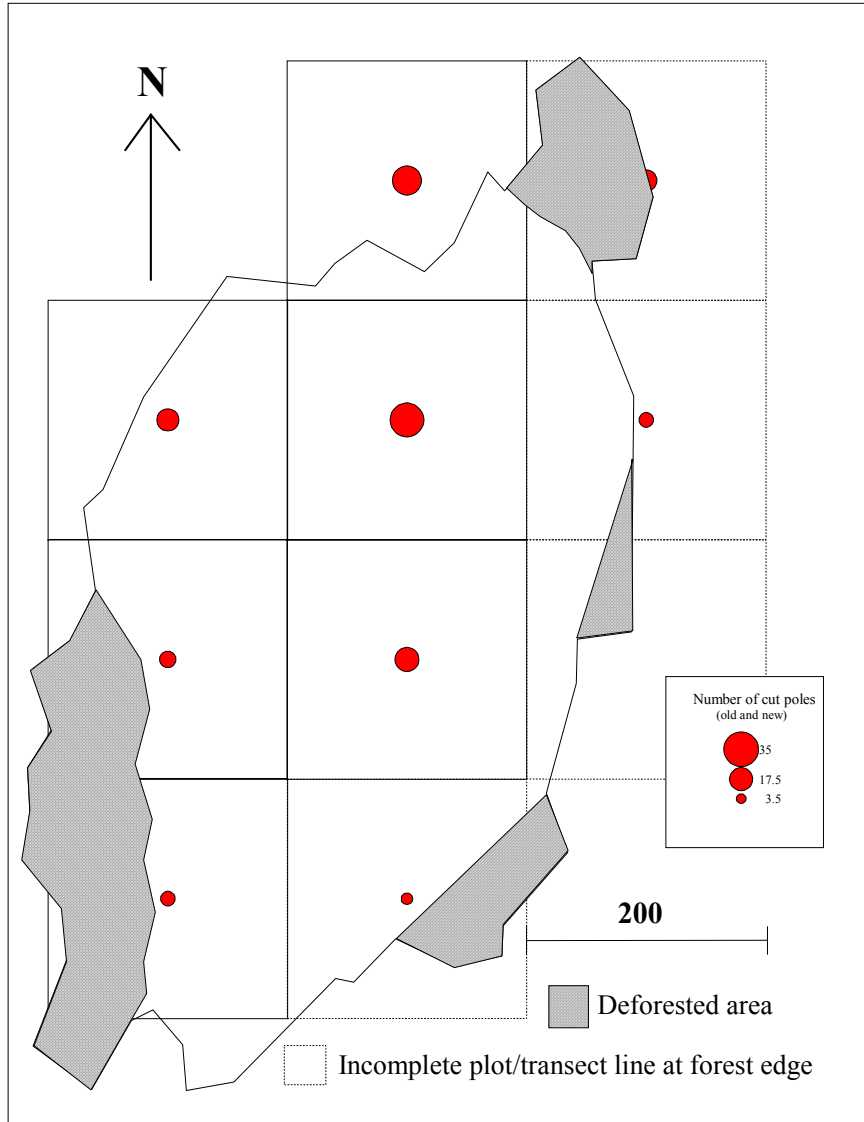


Figure 15 Pole extraction (old and new cut).

Table 13. Disturbance transect results for timber counts.

Transect number	Length of transect (m)	Total timber sampled	Live timber	Average live timbers per ha	Old cut timber	New cut timbers	Average per ha	Naturally fallen timber	Average dead per ha
1	220	58	52	236	4	0	18	2	9
2	425	81	58	136	14	0	33	9	2
3	340	54	41	121	9	0	26	4	12
4	140	37	35	250	1	0	7	1	7

Note: Timber is defined as >15 cm dbh and 3 m straight trunk.

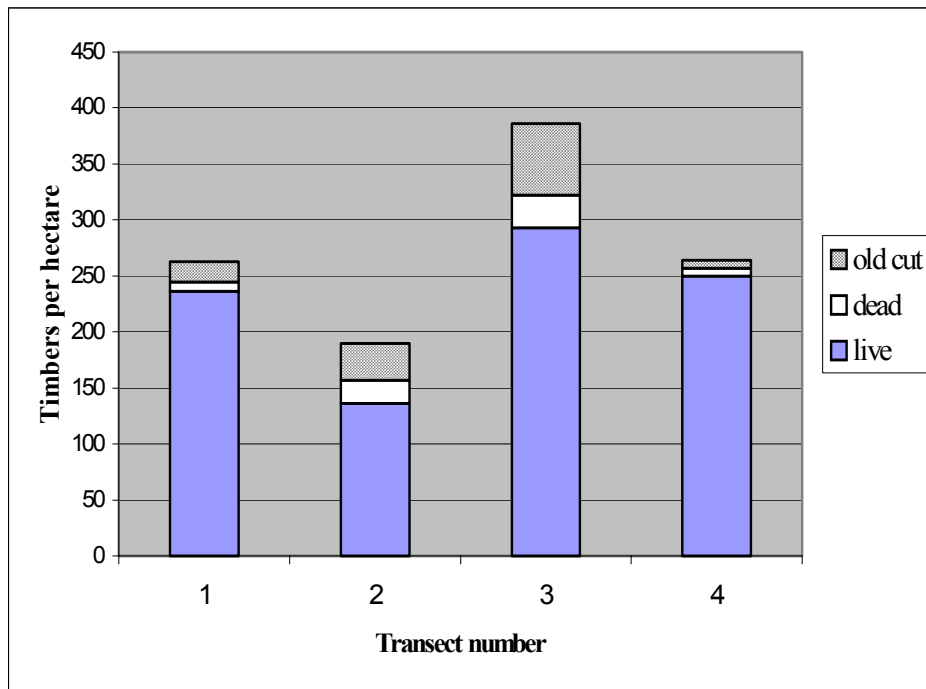


Figure 16 Live, cut and naturally fallen timber recorded per ha

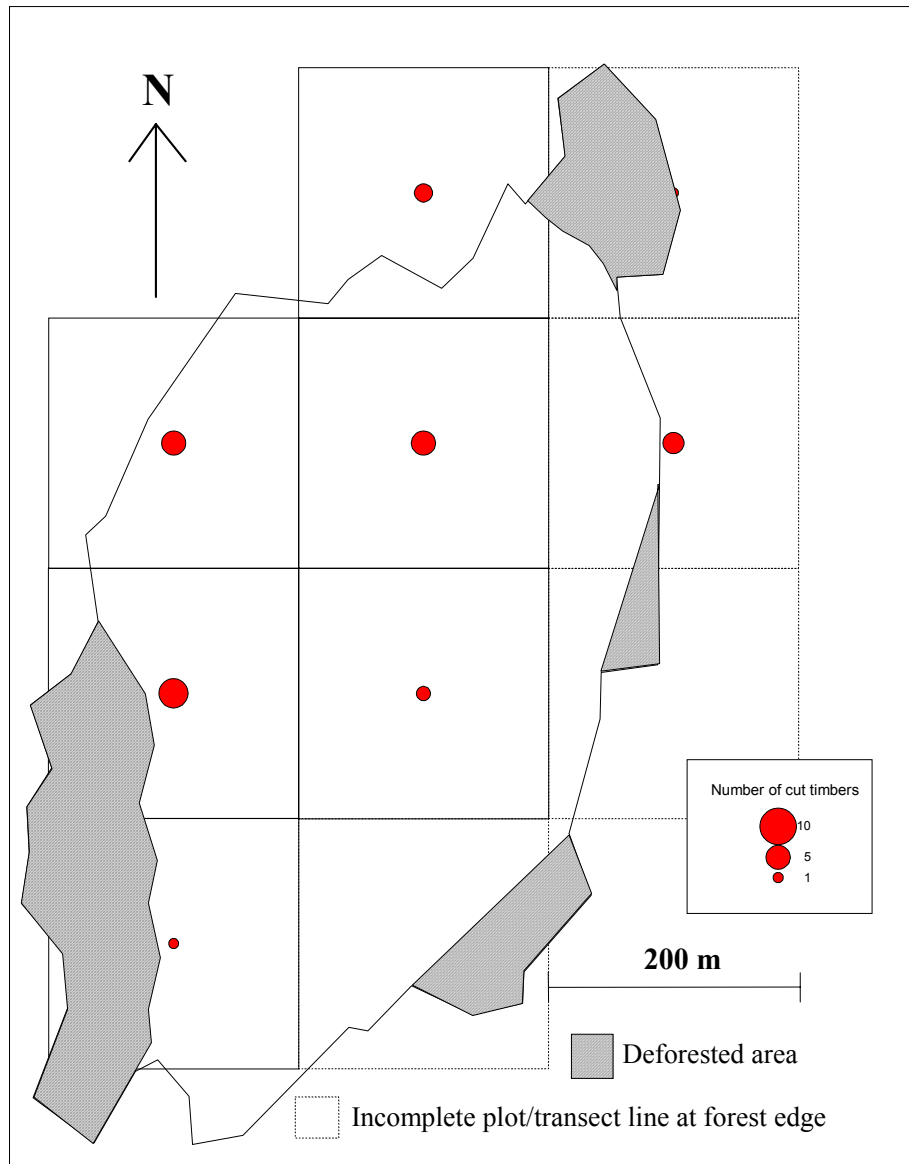


Figure 17 Timber extraction (old and new cut).

4.4 Summary

The gazetted area of Mpanga Village Forest Reserve is an area of 24 ha of which approximately 20 ha is still forested, with an altitudinal range of 650 to 920 m.

Species richness

In the systematic vegetation plots 501 tree and shrub individuals were surveyed, representing 73 species from 25 families. An additional four species were recorded in the regeneration plots. Casual observations from outside of the vegetation plots recorded an additional 67 vascular plant species from 33 families including 21 families not previously recorded (based on Table 5).

In total 144 species from 48 families were recorded.

Of the 6 plots systematically surveyed, 2 (33.3 %) of the plots analysed were recorded as mature mixed forest and 4 (66.6 %) were recorded as previously disturbed or poorly mixed forest.

Species Accumulation Rates

Despite the relatively high sampling intensity, the species accumulation graph (Figure 3) based on Table 3 (vegetation plot data only) has not reached an asymptote. The graph indicates that there are more species yet to be recorded for Mpanga VFR.

Opportunistic botanical collections and observations contribute almost as many species as recorded in the vegetation plots. The majority of opportunistic records were of trees and shrubs and this may bring the tree and shrub species list for the VFR closer to completion.

Ecological Type

Forest dependent species defined as limited to primary forest only, were recorded on 324 occasions. This represents 64 % of all specimens recorded. Forest dependent individuals were distributed throughout the reserve. The most common forest dependent tree (represented by 111 individuals) was *Tabernaemontana pachysiphon*. It appears that this species was very numerous as the next most frequently observed forest dependent tree species were *Macaranga capensis* represented by 57 individuals and *Isobertinia scheffleri* represented by 35 individuals. The remaining forest dependent species were all represented by far fewer individuals than the species listed above.

14 (41 %) of the forest dependent species were endemic or near-endemic to the Usambaras.

Four non-forest species were recorded in two thirds of the plots. *Coffea robusta* was the most common non-forest species, occurring in half the plots.

Habitat

Of the tree species surveyed with known altitude characteristics, 51 % were considered to be typical of lowland forest and 49 % were considered typical of submontane forest. 4 vegetation plots in Mpanga Forest Reserve were categorised within lowland forest and 2 within submontane forest.

These data are indicative of the fact that the majority of plots were at the cross over zone between lowland and submontane forest. Thus, there were a corresponding mix of lowland and submontane species. Many of the species categorised as “lowland” and “submontane” occur for the majority within the defined habitat but do also occur less frequently outside of the habitat stated (refer to Table 8).

The high percentage of submontane species occurring at relatively low elevations indicates the variability in the ecological requirements and niches and suggests such species are not exclusive to the defined habitat type. It should be noted that the habitat types are defined by altitudinal cut off points which rarely exist in the natural world due to many connecting factors, e.g. rainfall, parent rock, soil type, humidity, temperature etc.

The most common submontane species (represented by 111 individuals) was *Tabernaemontana pachysiphon*. As described in the ecological type section above this species was observed far more frequently than other submontane species.

Endemic Status (vegetation plot data)

Of the plant species recorded, 50 (68.5 %) were of widespread distributions.

Near-endemics contributed 16 species (21.9 %), from 11 families, to the floristic composition of the reserve. These near-endemics were found in all plots surveyed (6) (100 %) and account for 21.7 % of recorded trees and shrub individuals in the reserve. Plot 6 was found to have the most (38) near endemic individuals than any of the other plots (which range from 10 – 16 near endemic individuals). The most common near-endemic species recorded in the reserve was *Isoberlinia scheffleri* represented by 35 individuals. Of the 16 near-endemic species, 11 species were also considered to be forest dependent.

There were 4 endemic species to the Usambaras recorded from 3 families, comprising 5.5 % of the floristic composition from the systematic plot data. These endemics were found in 3 of the 6 plots surveyed (50 %) mostly on the western edge of the reserve, and accounted for 2.2 % of recorded trees and shrub individuals in the reserve. The most common endemic species recorded in the reserve was *Englerodendron usambariense* represented by 6 individuals. The remaining endemic species were all at very low densities within the reserve. *Cola usambarensis* was represented by 3 individuals and *Memecylon microphyllum* and *Cola scheffleri*. Were represented only by one individual each. All of the 4 endemic species were also considered to be forest dependent.

Range Extensions

Five species, *Diospyros squarrosa* (Ebenaceae), *Clerodendrum scheffleri* (Verbanaceae), *Anisophyllea obtusifolia* (Anisophylleaceae), *Allophylus callophylus* (Sapindaceae) and *Coffea robusta* (Rubiaceae) [an exotic] recorded in this survey, were not recorded by Iversen (1991b).

Regeneration

Within the survey plots 28 species were recorded as regenerating. Four of these species were not recorded as adult trees and shrubs in the survey. 32 % of the recorded adult trees and shrubs were noted as regenerating.

Of particular interest, two of the four endemic tree and shrub species recorded were recorded regenerating: *Englerodendron usambarensis* and *Cola usambarensis*. However, *Memecylon*

microphyllum and *Cola scheffleri* the endemic species with the lowest densities were not recorded regenerating.

Only three principal timber species were found to be regenerating within the reserve, *Milicia excelsa*, *Albizia gummifera* and *Newtonia buchananii* and only one individual of *Milicia excelsa* was recorded in the regeneration layer.

Disturbance

In comparison with other reserves in the East Usambara Mountains high rates of pole and timber cutting were recorded in Mpanga VFR. Mpanga VFR had an average cutting rate across the reserve of 123 cut poles per hectare and 22 cut timbers per hectare.

By comparison:

Mtai FR had an average of 69 cut poles per ha and 15 cut timbers per ha.

Nilo FR had an average of 29 cut poles per ha and 10 cut timbers per ha.

Amani NR had an average of 29 cut poles per ha and 9 cut timbers per ha.

Semdoe FR had an average of 19 cut poles per ha and 4 cut timbers per ha.

Approximately, one fifth on the gazetted forest area was no longer forest. In the areas concerned, (see figure 3) the area had been deforested and cultivation was taking place on some of the land. The forest borders were indistinct at best and non-existent in places despite border demarcation activities in 1995.

Evidence of old pitsawing was observed on five occasions located on transect lines two, three and four. Evidence of old pole cutting was observed throughout the reserve. Evidence of fresh pole cutting was observed on three of the four transect lines (transect line one, two, and three: refer to table 12).

Evidence of old timber cutting was observed throughout the reserve, but no signs of recent timber cutting were recorded.

The invasive species *Maesopsis eminii* [Rhamnaceae], was not recorded in any of the plots.

5.0 FAUNA

Authors: Doody, K. Z., Scholtz, O., Siurua, H., Barrio-Frøjan, C., & Loader, S. pp. 40-57

5.1 Introduction

The faunal biodiversity of Mpanga Village Forest Reserve were studied using systematic and replicable survey methods. An inventory was compiled of mammal, reptile, amphibian and select invertebrate species. The results of the inventory were analysed to assess the biodiversity value of the reserve.

5.2 Methods

Methods used during the survey are described in detail in the FT FRP methodology report (SEE, 1996). A brief description is presented below. The location of the trap site is presented in Figure 18.

5.2.1 Mammals

The aim of this survey was to compile a species list of mammals that inhabit Mpanga VFR. Five different methods were used to sample mammals within Mpanga VFR: (1) Sherman live traps, (2) bucket pitfalls, (3) bat netting (4) dung surveys and (5) opportunistic observations.

5.2.1.1 *Sherman live traps*

Rodents were sampled using standard sherman traps (live-traps). Typically the traps were set out in three lines of approximately 33, with traps positioned at least 2 m apart in association with the bucket pitfall lines. The traps were set each evening and checked early the following morning. The traps were baited with fried coconut and peanut butter. Each mammal caught was weighed and measured and detailed habitat notes were recorded. Trapping and biometric data were recorded on standardised data sheets. Unless otherwise indicated, specimens were identified by Prof. Kim Howell or by Dr. Dieter Kock (see Appendix 2).

5.2.1.2 *Bucket pitfall trapping*

The bucket pitfall traps consisted of three lines of eleven 20 litre plastic buckets sunk flush to ground level in a linear transect. These were positioned approximately 5 m apart. A continuous piece of plastic sheeting ran perpendicular to the ground across the centre of each bucket forming a “runner”. A lip of plastic sheeting was kept on the ground onto which soil and leaf litter was placed. Animals were channelled along the plastic to one of the buckets. The bucket pitfalls, acting as live traps, were designed to sample shrews within the forest. Each mammal captured was weighed and measured. Trapping and biometric information were recorded on standardised data sheets. Unless otherwise indicated, taxonomic identification was made by Prof. K. Howell, Dr D. Kock or Dr. W. Stanley (see Appendix 2).

5.2.1.3 *Dung survey*

The aim of this study is to provide baseline information with regard to more cryptic mammals particularly duiker.

The tagged transects were surveyed for dung from border to border of the reserve. The transects were walked by a team of three people. One person surveyed 2 m on one side of the transect, the other person, 2 m on the other side. The third person recorded the findings.

5.2.1.4 *Mammal observations*

Observations of other mammals, particularly primates, were recorded throughout the survey.

5.2.2 Reptiles

The aim of this study was to compile a species list of reptiles found within Mpanga VFR. Ground-dwelling reptiles were sampled using bucket pitfall traps (see 6.2.1.2 above). Opportunistic captures were also made by hand, or with a snake stick where necessary. Unless otherwise indicated, taxonomic identifications were made by Prof. Kim Howell or Dr. Don Broadley (see Appendix 2).

5.2.3 Amphibians

The aim of this study was to compile a species list of amphibians found within Mpanga VFR. Ground-dwelling amphibians were sampled using the bucket pitfall method (see 5.2.1.2 above). Opportunistic captures were also made, particularly of tree frogs. After rain, typical amphibian habitats were targeted for sampling. Unless otherwise indicated, taxonomic identifications were made by Prof. Kim Howell or by Prof. John Poynton (see Appendix 2).

5.2.4 Invertebrates

Three groups of invertebrates were sampled: (1) butterflies; (2) molluscs and (3) millipedes.

5.2.4.1 *Butterflies*

The aim of this study was to compile a species list of butterflies. Butterflies were sampled using Blendon-style traps set in the tree canopy. Rotting banana was used as bait. Traps were checked at midday. Five traps were set for 10 nights in each of the five trapping sites. Unless otherwise indicated, taxonomic identifications were made by Steve Collins (see Appendix 2).

5.2.4.2 *Mollusc*

The aim of this study was to compile a species list of molluscs. At each trapping site three sites with representative microhabitats were selected. At each of these sites a 1m x 1m quadrat was established. In this square, the leaf litter and the first 3 cm of soil was searched carefully for molluscs. All specimens were collected. Unless otherwise indicated, taxonomic identifications were made by Dr. B. Vercourt (see Appendix 2).

5.2.4.3 *Millipedes*

The aim of this study was to compile a species list millipedes. At each trapping site three sites with representative microhabitats were selected. At each of these sites a 3m x 3m quadrat was established. In this square, the leaf litter and the first 3 cm of soil was searched carefully for millipedes. All specimens were collected. Unless otherwise indicated, taxonomic identifications were made by Dr. Richard Hoffman (see Appendix 2).

5.3 Trapping sites and sampling intensity

Five trapping sites were conducted in representative habitats. Table 13 describes the sites and Tables 14 and 15 summarise the sampling intensity for each site and for each trapping method.

Table 14. Summary descriptions of trap site.

Plot number	Vegetation type	Altitude (m)	Topography	Slope (degrees)
3	Lowland / Submontane forest	820 - 900	Ridge / Hill Top, Gully, Steep Mid Slope, Gentle Mid Slope, Gentle Upper Slope.	Various

Table 15. Sampling intensity by trap night (number of nights x number of traps).

Trapping method	Plot 3
Date	November 11 th – 20 th 1999
Snap traps	993
Bucket pitfall*	330
Butterfly traps	50
Molluscs**	3
Millipedes**	3

* Each bucket represents one trap night.

**This represents plots sampled not trap nights.



Figure 18 Location of trap site.

5.4 Results

5.4.1 Mammals

5.4.1.1 Small mammals

A total of 16 specimens were retained for taxonomic purposes, an additional 3 animals were identified and released. These represent at least 4 species from 2 families. Unfortunately taxonomic determinations were not available for most species at time of publication. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (UDSM, 1997) Kingdon (1997), IUCN (1996) and Kingdon (1974, 1989). Nomenclature names follow Kingdon (1997).

Table 16 Summary of small mammals (non-bats).

Species	Ecological Type	Endemic Status	IUCN status	Capture location by plot number	Total
				3	
MURIDAE					
Soft-furred rats					
<i>Praomys</i> spp.	?	?		9	9
Common mice					
<i>Mus minutoides</i>	F	W		1	1
Narrow-footed woodland mice					
<i>Grammomys</i> spp.	O	W		1	1
SORICIDAE					
White-toothed shrews					
<i>Crocidura</i> spp.	?	?		5	5
Total					16

5.4.1.2 Dung survey

No animal dung was observed during the survey period. Suggesting duiker species and bush pig commonly found in other EU reserves were absent from or at a very low density in the reserve.

5.4.1.3 Mammal observations

A total of 4 species from 3 families were observed but not retained for taxonomic purposes. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (UDSM, 1997), Kingdon (1974), Kingdon (1989), Kingdon (1997) and IUCN (1996).

Table 17 Summary of Mammal Observations

Species	Certainty	Ecological Type	Endemic status	IUCN status
COLOBIDAE				
Angola pied colobus <i>Colobus angolensis</i>	Definite	F	W	
CERCOPITHECIDAE				
Vervet Monkey <i>Cercopithecus aethiops</i>	Definite	f	W	
Gentle monkey <i>Cercopithecus mitis</i>	Definite	f	W	
GALAGONIDAE				
Greater galago <i>Otolemur crassicaudatus</i>	Definite	f	W	

KEY TO ABBREVIATIONS FOR Table 17 (Definitions based on those described in the botanical section of this report).	
<u>Ecological type:</u>	
<ul style="list-style-type: none"> • F - Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest; • f - Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species; and • O - Non-forest species: These are species that do not occur in primary or secondary forest or forest edge. 	
<u>Endemic status:</u>	
<ul style="list-style-type: none"> • E - Endemic: Occurring only in the Usambara mountains; • N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests; • W - Widespread distribution. 	
<u>IUCN status:</u>	
<ul style="list-style-type: none"> • NT - Near-threatened 	
OR	Refers to observations outside but in proximity to the reserve to be considered associated to it.
?	No data available
Certainty:	Indicates the probability of the correctness of the identity of the species observed;
	Definite: Can be regarded as occurring in the reserve.
	Probable: Identification is likely but requires further information before being considered on the reserve's species list.
	Possible: Species identification is may not be accurate.

5.4.1.4 Bats

Bats were not surveyed during the study period.

5.4.2 Reptiles

A total of 21 individuals were retained for taxonomic purposes. These specimens represent 8 species from 4 families. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (1996), IUCN (Hilton-Taylor 2000), Broadley & Howell (unpublished), Howell (1993), and Branch (1994).

Table 18 Summary of reptiles.

Species	Ecol. Type	End. Status	IUCN status	Capture location by plot and number collected			
				2	3	OR	Total
GEKKONIDAE							
Common name							
<i>Cnemaspis africana</i>	F	W	NT		3		3
SCINIDAE							
Kilimanjaro five-toed skink							
<i>Leptosiaphos kilimensis</i>	F	N	VU		9		9
Speckle-lipped skink							
<i>Mabuya maculilabris</i>	f	W			2		2
ELAPIDAE							
<i>Elapsoidea</i> spp.	?	?	?			2	2
COLUBRIDAE							
Tornier's cat snake							
<i>Crotaphopeltis tornieri</i>	F	W	VU	1	1		2
Olive marsh-snake							
<i>Natriciteres olivacea</i>	f	W		1			1
Common name							
<i>Philothamnus hoplogaster</i>	f	W			1		1
Usambara green-snake							
<i>Philothamnus macrops</i>	F	N	VU			1	1
Total							21

An additional three species from two families were observed but not collected (Table 20).

Table 19 Ranges for near-endemic reptile species recorded (Howell, 1993).

Near Endemic Species	Range
<i>Bradypodion fischeri</i>	Usambaras; Nguru; Ulugurus;
<i>Philothamnus macrops</i>	Usambaras; Coastal forest
<i>Rhampholeon brevicaudatus</i>	East Usambaras; Ulugurus; Udzungwas; Coastal forest

Table 20 Summary of reptile observations

Species	Certainty	Ecological type	Endemic status	Observation location	IUCN / CITES status
CHAMAELEONIDAE					
Bearded pigmy-chameleon					
<i>Rhampholeon brevicaudatus</i>	Certain	F	N	UK Observed 4 times	VU
Common name					
<i>Bradypodion fischeri (fischeri)</i>	Certain	F	N	UK Observed 1	VU CITES Appendix II
COLUBRIDAE					
Mozambique vine-snake					
<i>Thelotornis capensis</i>	Certain	F	W	UK	

KEY TO ABBREVIATIONS FOR Table 18 and Table 20 (Definitions based on those described in Section 1.2).

Ecological type:

F - Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest;
 f - Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species; and
 O - Non-forest species: These are species that do not occur in primary or secondary forest or forest edge.

Endemic status:

N - Near endemic: Species with limited ranges usually only including coastal forest and/or the Eastern Arc mountains;
 W - Widespread distribution

IUCN status:

V - Vulnerable
 R - Rare

OR: Refers to observations outside but in proximity to the reserve to be considered associated to it.

Certainty: Indicates the probability of the correctness of the identity of the species observed;

Definite: Can be regarded as occurring in the reserve.

Probable: Identification is likely but requires confirmation before placing on the reserve's species list.

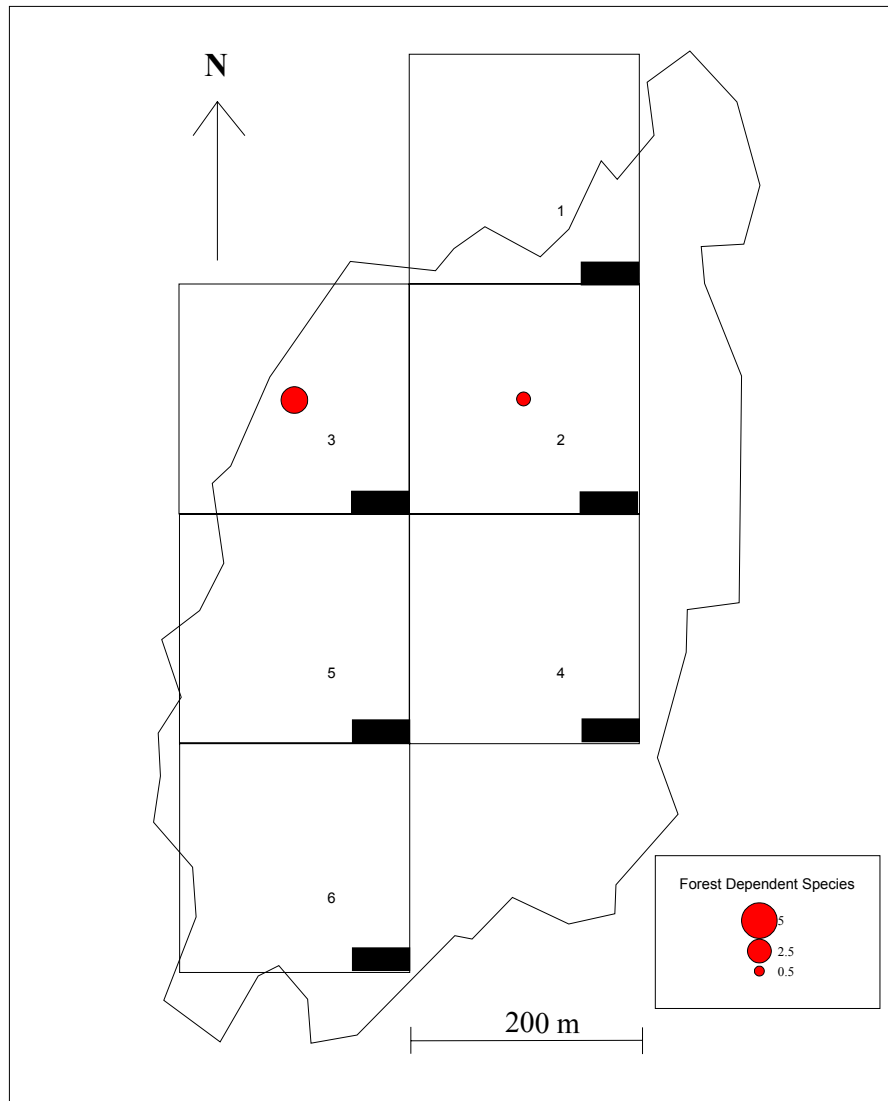


Figure 19 Distribution of forest dependent reptile species.

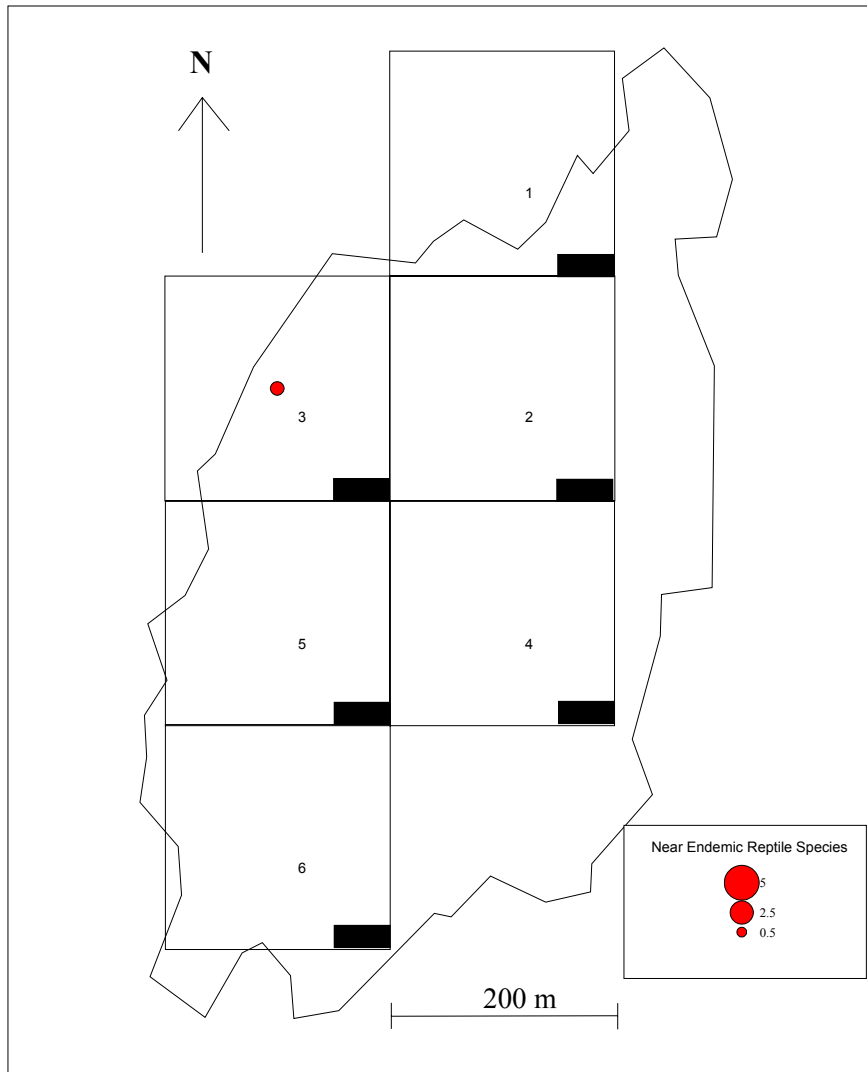


Figure 20 Distribution of near-endemic reptile species.

5.4.3 Amphibians

A total of 29 individuals were retained for taxonomic purposes. These specimens represent 13 species from 5 families. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (UDSM, 1997), IUCN (1996) and Poynton and Broadley (1991). Identifications were provided by K. M. Howell or are awaiting confirmation from J. C. Poynton. Common names are from Passmore and Carruthers (1995).

Table 21 Summary of amphibians.

Species	Ecol. Type	End. Status	IUCN status	Capture site by plot and number collected			Total
				3	6	OR	
ARTHROLEPTIDAE							
Dune squeaker							
<i>Arthroleptis stenodactylus</i>	f	W		5		1	6
Dwarf squeaker							
<i>Arthroleptis xenodactylus</i>	F	N	VU	2			2
BUFONIDAE							
Dead-leaf toad							
<i>Bufo brauni</i>	F	N	VU	1			1
Flat backed toad.							
<i>Nectophrynoides tornieri</i>	F	N	VU	4		1	5
HYPEROLIIDAE							
Reed frogs							
<i>Hyperolius mitchelli</i>	F	W			2		2
<i>Hyperolius punctulatus</i>	F	W				1	1
Tree frogs				2			2
<i>Leptopelis uluguruensis</i>	F	N	VU	3			3
<i>Leptopelis vermiculatus</i>	F	N	NT			1	1
MICROHYLIDAE							
<i>Callulina krefftii</i>	F	N	VU	1			1
Rain frog							
<i>Probreviceps macrodactylus</i>	F	N	NT	2			2
Plain grass frogs							
<i>Ptychadena anchietae</i>	f	W				1	1
Puddle frogs							
<i>Phrynobatrachus acridoides</i>	f	W				1	1
Common river frog							
<i>Rana angolensis</i>	f	W				1	1
Total							29

Table 22 Ranges for endemic and near-endemic amphibian species recorded (Howell, 1993).

Near Endemic Species	Range
<i>Arthroleptis xenodactylus</i>	West and East Usambara; and Uluguru.
<i>Bufo brauni</i>	West and East Usambara; Uluguru; and Udzungwa.
<i>Callulina krefftii</i>	West and East Usambara; Nguru; Uluguru; Udzungwa and Taita Hills (Kenya).
<i>Leptopelis uluguruensis</i>	West and East Usambara; Uluguru; and Udzungwa.
<i>Leptopelis vermiculatus</i>	West and East Usambara; and Southern Highlands.
<i>Nectophrynoides tornieri</i>	West and East Usambara; Uluguru; and Udzungwa.
<i>Probreviceps macrodactylus</i>	West and East Usambara; Uluguru; and Rungwe

An additional two individuals from one species were observed but not collected.

Table 23 Summary of amphibian observations.

Species	Certainty	Ecological type	Endemic status	Observation location
HYPEROLIDAE				
Reed Frog				
<i>Hyperolius mitchelli</i>	Probable	F	W	UK Observed 2 times

KEY TO ABBREVIATIONS FOR Table and Table (Definitions based on those described in Section 1.2).

Ecological type:

F – Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest;
 f – Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species; and
 O – Non-forest species: These are species that do not occur in primary or secondary forest or forest edge.

Endemic status:

N – Near endemic: Species with limited ranges usually only including coastal forest and/or the Eastern Arc mountains;
 W – Widespread distribution

IUCN status:

V – Vulnerable
 R – Rare

OR: Refers to observations outside but in proximity to the reserve to be considered associated to it.

Certainty: Indicates the probability of the correctness of the identity of the species observed;

Definite: Can be regarded as occurring in the reserve.

Probable: Identification is likely but requires confirmation before placing on the reserve's species list.

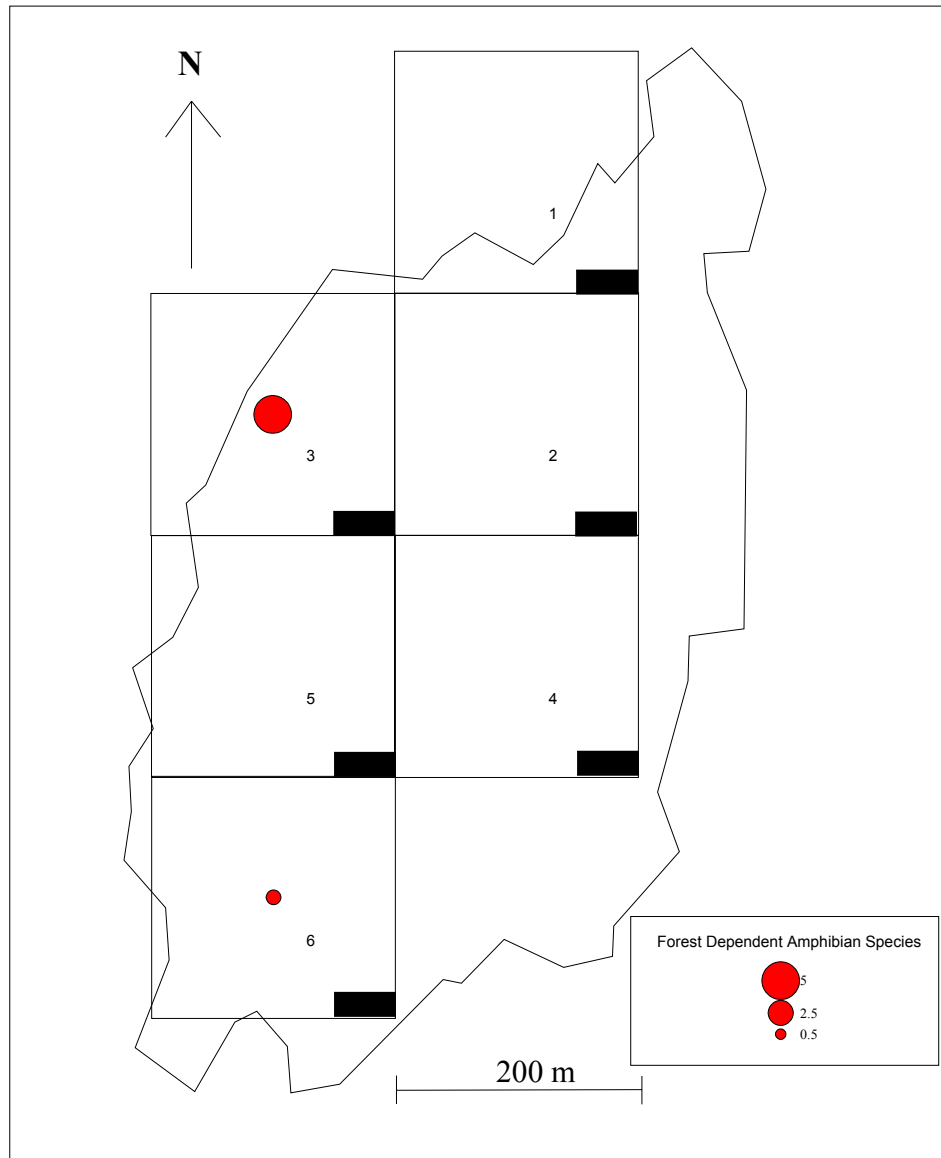


Figure 21 Distribution of forest dependent amphibian species.

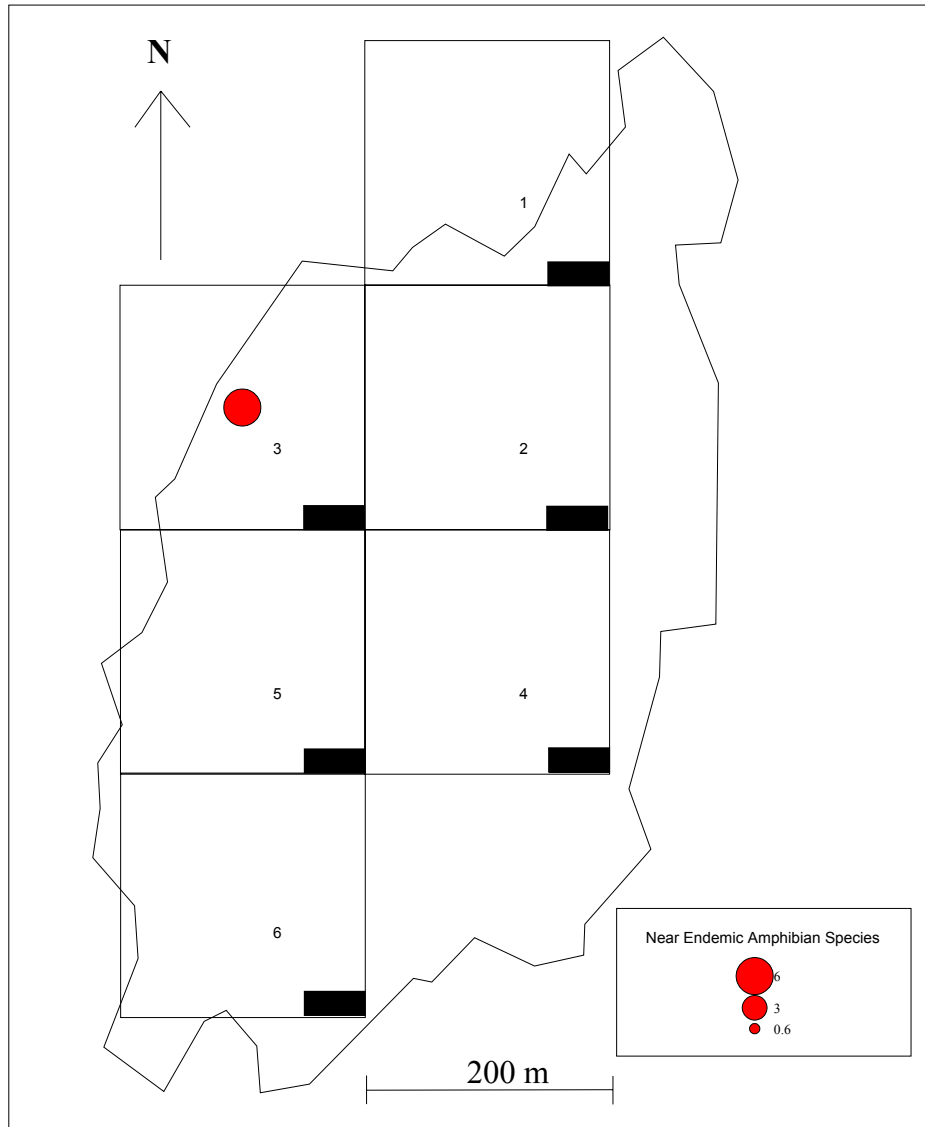


Figure 22 Distribution of near-endemic amphibian species.

5.4.4 Invertebrates

5.4.4.1 Butterflies

Butterflies were collected at the trapsite and around the reserve for a period of 10 days. A total of 37 specimens were retained for taxonomic purposes, of these 35 have been tentatively identified by Frontier Tanzania personnel. They represent 17 species from six families. Ecological type and endemic status were compiled from Kielland (1990).

Table 24 Summary of butterflies

Species	Ecol. Type	End. Status	Number of individuals collected
PAPILIONIDAE			
<i>Papilio dardanus tibullus</i>	F	W	2
DANAIDAE			
<i>Amauris niavius dominicus</i>	F	W	2
SATYRIDAE			
<i>Melantis leda africana</i>	f	W	2
<i>Bicyclus campinus ocelligerus</i>	F	W	1
<i>Bicyclus safitza</i>	f	W	4
NYMPHALIDAE			
<i>Euxanthe tiberius tiberius</i>	F	N	1
<i>Charaxes brutus alcyone</i>	f	W	1
<i>Charaxes cithaeron kennethi</i>	F	W	1
<i>Charaxes pollux mirabilis</i>	F	W	2
<i>Euphaedra neophron littoralis</i>	F	W	3
<i>Aterica galene theophanes</i>	f	W	4
<i>Catuna sikorana</i>	F	W	1
<i>Pseudacraea dolomena usagara</i>	F	W	1
<i>Eurytela dryope angulata</i>	f	W	3
<i>Eurytela hiarbas lita</i>	F	W	1
ACRAEIDAE			
<i>Bematistes aganice montana</i>	f	W	4
LYCAENIDAE			
<i>Oboronia bueronica</i>	F	W	2

KEY TO ABBREVIATIONS FOR Table

Ecological type:

- F - Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest;
- f - Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species; and
- O - Non-forest species: These are species that do not occur in primary or secondary forest or forest edge.

Endemic status:

- E - Endemic: Occurring only in the Usambara mountains;
- N - Near endemic: Species with limited ranges usually only including coastal forest and/or the Eastern Arc mountains;
- W - Widespread distribution.

5.4.4.2 Molluscs

5 Mollusc specimens were retained for taxonomic purposes. Unfortunately, taxonomic determinations were not available at the time of publication.

5.4.4.3 Millipedes

16 Millipede specimens were retained for taxonomic purposes. Unfortunately, taxonomic determinations were not available at the time of publication.

5.5 Summary

Species Richness

In this section, species are examined in terms of how frequently they were recorded. Those species that were recorded three or more times during the survey were considered locally common. Although unproven this figure is based on the assumption that the frequency of records reflects the abundance of the species within the local area. Table 24 provides the number of families and approximate numbers of species recorded.

Table 25. Summary of faunal families and species (identified to date).

Taxon	Number of families	Number of species
Mammals (not bats)	5	8
Birds*	3	3
Reptiles	6	11
Amphibians	13	4
Butterflies	17	6
Molluscs	Unknown	Unknown
Millipedes	Unknown	Unknown

* Does not represent all species in reserve, information was not recorded through systematic observations.

Mammals:

The most common small mammal species was *Praomys* sp. (Soft furred rat). It is possible that there was more than one species of *Praomys*.

The genus *Crocidura* sp. (White toothed shrews) appeared to be locally common. It is probable that the sample represents more than one species of *Crocidura*.

Reptiles:

The most common reptile species was *Leptosiaphos kilimensis* (Kilimanjaro five-toed skink). The only other reptile species that appeared to be locally common was *Cnemaspis africana* (Usambara Forest gecko).

Amphibians:

The most common amphibian species was *Arthroleptis stenodactylus* (Dune squeaker).

Other species which appeared to be locally common were: *Nectophrynoides tornieri* (Flat backed toad) and *Leptopelis ulugurensis* (Tree frog).

Butterflies

Three species were equally most common. These were: *Bicyclus safitza*, *Aterica galene theophanes* and *Bematistes aganice montana*.

Other locally common species were: *Euphaedra neophron littoralis* and *Eurytela dryope angulata*.

Molluscs

Taxonomic determinations were not available at time of publication.

Millipedes

Taxonomic determinations were not available at time of publication.

Endemics and near-endemics:

11 species of vertebrates (mammal, reptile and amphibian) were recorded as endemic or near-endemic to the Usambaras during the survey. Four of which appeared to be locally common, as they were recorded at least three times during the survey. These species were: [Reptiles] -

Cnemaspis africana, *Rhampholeon brevicaudatus* and [Amphibians] - *Nectophrynoides tornieri* and *Leptopelis uluguruensis*.

Forest dependent species:

27 species of vertebrates (mammal, reptile and amphibian) were recorded as dependent on primary forest during the survey. Five of which appeared to be locally common. These were: [Reptiles] *Cnemaspis africana*, *Leptosiaphos kilimensis*, *Rhampholeon brevicaudatus*, [Amphibians] *Nectophrynoides tornieri*, *Leptopelis uluguruensis*.

High risk species:

Assuming that the number individuals of a species recorded during the survey reflects relative population size, the locally uncommon species that are both forest dependent and near-endemic or endemic may well be of high conservation concern due to their low population density.

Species that were recorded as forest dependent, endemic or near endemic and were observed at low density during the survey were: [Reptiles] *Philothamnus macrops*, *Bradypodion fischeri (fischeri)*, [Amphibians] *Arthroleptis xenodactylus*, *Bufo brauni*, *Leptopelis vermiculatus*, *Callulina kreffti*, *Probreviceps macrodactylus* and [Butterfly] *Euxanthe tiberius tiberius*.

Table 26. Summary of capture locations of faunal species by plot number.

Taxon	Trap site			Casual observations	
	3	2	6	Out-side reserve	Unknown capture location
Small mammal*	4				
Reptile	5	2		2	3
Amphibian	8		1	7	1
Butterflies	17				
Molluscs	Unknown				
Millipede	Unknown				

*Primates excluded due to their large ranges.

Note that as there was only one trapsite in the forest reserve the majority of species were recorded from a single location.

Ecological type

Of the 27 forest dependent species, 1 was a mammal (primate), none were birds, 6 were reptiles, 9 were amphibians, and 11 were butterflies.

Of the two non-forest species, one was a bird and the other a small mammal species.

Table 27. Summary of ecological type of mammal, bird, reptile amphibian and butterfly species.

Ecological type	No. of species	% of total species recorded
(F) Forest dependent	27	50.9 %
(f) Forest dwelling but not forest dependent	20	37.7 %
(O) Non-forest species	2	3.8 %
Unknown	4	7.6 %
Total:	53	100

Endemic Status

No Usambara endemic species were recorded.

12 species were near-endemic to the Usambara Mountains, of these 4 reptiles, 7 were mammals and one was a butterfly.

Table 28. Summary of endemic status of mammal, bird, reptile, amphibian and butterfly species.

Endemic status	No. of species	% of total species recorded
(E) Endemic to the Usambara Mountains	0	0
(N) Near-Endemic: ranges in restricted locations	12	22.6%
(W) Widespread	38	71.7 %
Unknown	3	5.7 %
Total:	53	100

IUCN Status (National Biodiversity Database, 1997)

Using IUCN criteria to assess the conservation status of each species, the following 7 species are considered **vulnerable** to extinction: =[Amphibians] *Leptopelis ulugurensis*, *Arthroleptis xenodactylus*, *Bufo brauni*, *Callulina krefftii*, [Reptiles] *Leptosiphos kilimensis*, *Philothamnus macrops*, *Rhampholeon brevicaudatus* and *Bradypodion fischeri* (*fischeri*).

Using IUCN criteria to assess the conservation status of each species, the following 3 species are considered **near threatened**: [Reptile] *Cnemaspis africana*, [Amphibians] *Leptopelis vermiculatus* and *Probreviceps macrodactylus*.

6.0 CONCLUSIONS

Authors: Doody, K. Z., Ntemi, A., Killenga, R & Beharrell, N. K. pp 58-60

This report presents the raw data of the survey with preliminary descriptions in terms of ecological type and endemic status. These two factors provide an indication of three aspects of biodiversity and conservation:

1. the relationship between forest dependency and endemism;
2. the extent to which non-forest species are established in the reserve; and
3. the relationship between disturbance and areas of biological value.

Mpanga forest, gazetted as a village forest reserve in 1998, covers an area of 24 hectares in the north eastern area of the East Usambara range. It has an altitudinal range of 650 m to 920 m.

Disturbance

The measures put in place in 1995 by the village committees have not fully succeeded in protecting Mpanga Village Forest Reserve.

Despite the bye law which prohibits extraction from the reserve, disturbance is a problem in Mpanga Village Forest Reserve. Approximately one fifth of the gazetted area of forest has been deforested. In these areas there was no forest canopy cover and in some places land had been cleared for cultivation. It is unclear as to when these areas were deforested, villagers state it was before gazettelement.

Poles continue to be cut from within the reserve illegally. No new timber harvesting was observed during the survey period but evidence of old pitsawing was observed throughout the reserve on three of the four transects. No active pitsaw pits were observed during this survey.

The invasive species *Maesopsis eminii* was not observed in the reserve.

Species Richness

The forest reserve was found to contain a minimum of 142 species of trees and shrubs; 8 mammal species, 11 reptile species, 14 amphibian species and 17 species of butterfly.

Flora

Eight endemic (to the Usambara mountains) tree species were recorded during the survey, 4 species were recorded within the systematic vegetation plots and 4 were recorded opportunistically.

A further 25 species were recorded as near endemic with ranges restricted to the Eastern Arc and/or East African lowland forests, (16 species recorded in the systematic vegetation plots and 9 recorded opportunistically).

48 species were recorded as dependent on primary forest (34 recorded in the systematic vegetation plots and 14 recorded opportunistically), and of these species, 22 were also regarded as endemic or near endemic to the Usambara mountains.

10 non-forest tree and shrub species were established within the reserve boundaries.

Fauna

No animal species recorded were endemic to the Usambara Mountains.

12 animal species were recorded as near-endemics i.e. as having restricted ranges limited to the Eastern Arc and/or East African lowland forests.

27 animal species were dependent on primary forest, and of these species, 8 were also near endemic to the Usambara Mountains.

Only 2 non-forest animal species were recorded in the reserve.

The reserve appeared to have low mammal diversity in comparison to other East Usambara forests surveyed by Frontier Tanzania. This can be attributed to the short survey period and the small size of the reserve. Independent of this no medium to large mammals such as duiker and bushpig or signs of these species were observed during the survey. Amphibian and reptile diversity also appeared low. However, one has to consider the extremely small size of Mpanga Village Forest Reserve in comparison with other forests in the East Usambaras.

Table 29. Summary of biodiversity of taxa surveyed.

Taxon	Total no. of species	% forest dependent	No. of non-forest species	No. of endemics	No. of near-endemics	No. of forest dependent endemics and near-endemics
Trees and shrubs ^a	142	34 %	10	8	25	22
Mammals	8	12.5 %	1	0	0	0
Birds	3*	0	1	0	0	0
Reptiles	11	63.6 %	0	0	4	4
Amphibians	14	64.3 %	0	0	7	7
Butterflies	17	64.7 %	0	0	1	1

^a Includes Vegetation Plot data (table 3) and Opportunistic collections data (table 5). Please note: tables in botany section relate to Vegetation plot data only.

* Does not represent all species in reserve

Conservation

Village forest reserves are one option within a management system that is community based. They have an important role to play in the future of forest management as village groups / committees provide the initiatives to define the management objectives of a particular reserve. In comparison, catchment forest reserves are solely government managed and surrounding villagers have little input with regard to the management strategies.

The forests of the Eastern Arc Mountains are recognised as being a biodiversity hotspot of global significance. The East Usambara forests are a hotspot within a hotspot. They are a conservation priority due to the diversity of the flora and fauna and high degree of endemism. The forests have a direct value to surrounding communities as a principal water catchment area and as a source of fuel-wood and medicinal plants. The forests of the East Usambara mountains have been reduced to fragments within a matrix of agricultural land. Little forest remains outside of the gazetted forest reserves. For those species which are regarded as forest dependent, the forest reserves now provide almost the only available habitat.

Mpanga VFR was a pilot programme from which positive strategies can be gleaned and lessons learned kept in mind for future gazettelement of other village forest reserves. It must be stated that despite the strict byelaw prohibiting extraction, poles were extracted illegally. Degradation and further fragmentation of Mpanga forest may lead to local extinctions of populations of those species identified as being at high risk. The loss of the forest will also reduce the reliability of the water supply to the nearby villages.

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8.0 APPENDICES

APPENDIX 1: GENERAL PLOT INFORMATION

Plot Number	Topography	Altitude (metres)	Slope (degrees)	Vegetation Condition	Canopy Height (metres)
1	GLS	787	28	LF	10-20 m
2	GLS	680	-	LF	10-20 m
3	SMS	825	34	LF	10-20 m
4	GMS	780	30	LF	10-20 m
5	GMS	900	30	SMF	10-20 m
6	RT	865	25	SMF	10-20 m

KEY TO ABBREVIATIONS

Topography

GL - gentle lower slope
 SL - steep lower slope
 M - mid-slope
 GU - gentle upper slope
 SU - steep upper slope
 FV - flat valley floor
 RT - ridge top

Vegetation Condition

LF - Lowland forest
 SF - Submontane forest
 CF - Colonizing forest
 RF - Riverine forest
 PF - Plantation forest
 S - Scrub / thicket / Bush
 W - Woodland

APPENDIX 2: TAXONOMIC VERIFICATION

BOTANY

Ahmed Mdolwa	TAFORI	Silvicultural Research Centre, P.O. Box 95, Lushoto, Tanzania
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ZOOLOGY - VERTEBRATES

Bats and small mammals:

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Rodents and Shrews:

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Dr. Dieter Kock	Frankfurt Zoological Museum	Saugetiere III, Senckenberg, Senckenberganlage 25, 60325 Frankfurt am Main, Germany dkock@sng.uni-frankfurt.de
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Prof. J. Poynton	British Natural History Museum	Cromwell Road, South Kensington, London, UK.
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Dr. Don Broadley	The Natural History Museum of Zimbabwe	P.O. Box 240, Bulawayo, Zimbabwe bfa@coldfire.dnet.co.zw
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Mollusca:

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Millipedes

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Butterflies

Steve Collins	African Butterfly Research Institute	P.O. Box 14308, Nairobi, Kenya collinsabri@iconnect.co.ke
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East Usambara Conservation Area Management Programme Technical Paper Series

(ISSN 1236-620X)

The East Usambara Conservation Area Management Programme Technical Papers Series consists of reports on forestry issues in the East Usambara Mountains. This series started in 1991. These reports aim to make information more widely available to staff members of the East Usambara Conservation Area Management Programme, to the Forestry and Beekeeping Division, and to other institutions and individuals concerned and interested in the conservation of the East Usambara forests.

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