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Conservation and Management of the Eastern Arc Mountain Forests,
Tanzania
GEF-UNDP: URT/01/G32

**Uluguru Component Biodiversity Survey 2005
(Volume II)**

Uluguru South Forest Reserve



Frontier-Tanzania

Frontier-Tanzania Environmental Research

CMEAMF: Uluguru Component Biodiversity Survey 2005 (Volume II)

Uluguru South Forest Reserve

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Uluguru Mountains Environmental Management and Conservation Project (UMEMCP)

This project is a component of the Conservation and Management of the Eastern Arc Mountain Forests (CMEAMF), a project of the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism - funded by the Global Environment Facility through the United Nations Development Programme. UMEMCP is managed by CARE International in Tanzania under a Memorandum of Understanding with the Forestry and Beekeeping Division of the Ministry of Natural Resources and Tourism. It aims to improve forest management and conservation of catchment forests in the Uluguru Mountains, as well as improve land husbandry practices in adjacent villages with local communities, government authorities and other stakeholders. Implementation of UMEMCP is over a six-year period from 2003-2008.

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

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The Society is a non-profit making company limited by guarantee and was formed in 1989. The Society's objectives are to advance field research into environmental issues and implement practical projects contributing to the conservation of natural resources. Projects organised by The Society are joint initiatives developed in collaboration with national research agencies in co-operating countries.

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 Frontier-Tanzania, of which one component is the Frontier-Tanzania Forest Research Programme (FT FRP). Biological field surveys were conducted in the coastal forests from 1989 to 1994, in the East Usambara mountains in collaboration with EUCAMP, Tanga from 1995 to 2002, the Udzungwa mountains in collaboration with MEMA, Iringa 1999 to 2001, in the Mahenge Mountains in 2003 and in Mpanga / Kipengere Game Reserve, in collaboration with WWF-TPO, Dar es Salaam, in 2003.

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LIST OF ABBREVIATIONS AND ACRONYMS

CITES	Convention on the International Trade of Endangered Species
CMEAMF	Conservation and Management of the Eastern Arc Mountain Forests
FBD	Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism
FR	Forest Reserve
FT FRP	Frontier-Tanzania Forest Research Programme
FTEA	Flora of Tropical East African
ICBP	International Council for Bird Preservation (now called BirdLife International)
IUCN	The World Conservation Union
LEAP	List of East African Plants
S & H	Svendsen and Hansen
SEE	Society for Environmental Exploration
SUA	Sokoine University of Agriculture
UCBS	Uluguru Component Biodiversity Survey
UDSM	University of Dar es Salaam
UMADEP	Uluguru Mountains Agricultural Development Project
UMBCP	Uluguru Mountains Biodiversity Conservation Project
UMEMCP	Uluguru Mountains Environmental Management and Conservation Project
WCST	Wildlife Conservation Society of Tanzania

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EXECUTIVE SUMMARY

1. The Conservation and Management of the Eastern Arc Mountain Forests (CMEAMF): Uluguru Component (GEF/UNDP: URT/01/G32) is a project of the Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism and funded by the Global Environment Facility through the United Nations Development Programme. CARE International in Tanzania implements the Uluguru Component under the terms of an agreed Memorandum of Understanding with the Forest and Beekeeping Division that was signed on the 12th August 2003.
2. Frontier-Tanzania (a collaboration between the Society for Environmental Exploration (UK) and the University of Dar es Salaam (Tanzania)) were contracted from September 2004 – April 2005 to undertake systematic biodiversity and human disturbance assessments of the Uluguru North and Uluguru South Forest Reserves - aiming to establish a baseline for measuring the Uluguru Component Project's impact on maintaining biodiversity values and reducing threats over the long-term. This study was known as the Uluguru Component Biodiversity Survey (UCBS).

Overview

3. Uluguru South Forest Reserve (FR) is located within the Uluguru Mountains, part of the Eastern Arc Mountains, on a latitude 7° 01' - 7° 12' and longitude 36° 43' - 37° 45'. It is situated in Morogoro District, 26 km south of Morogoro, and was established in 1906 for its water catchment value supplying surrounding villages, Morogoro town and Dar es Salaam. It covers 17,292.7 ha and consists of montane and upper montane forest with some grassland at Lukwangule Plateau. It has an elevational range of 1200 – 2638m above sea level (asl) and an average rainfall of 2500-4000 mm per year on eastern slopes and 2000 mm on the western slopes (Lovett and Pócs 1993).
4. Frontier-Tanzania accompanied by staff of CMEAMF, Catchment Forestry Project and District Natural Resources office, Morogoro conducted a baseline biodiversity survey of Uluguru South Forest Reserve lasting 13 weeks from 20th September – 21st December 2004. Work included systematic trapping, casual observations and collection of small mammals, reptiles, amphibians and birds. Transects confirmed the presence/absence of large mammals; disturbance transects quantified the level of human disturbance; and vegetation plots and regeneration plots confirmed botanical species present and their abundances (Table 1).

Table 1 Summary of survey effort for UCBS work in Uluguru South FR

Survey technique (and sampling unit)	Target taxa	Total sampling effort
Flora		
Vegetation plot	Trees, shrubs, herbs	53 Vegetation plots
Regeneration plot	Trees, shrubs, herbs	53 Regeneration plots
Opportunistic observation/collection	Trees, shrubs, herbs	-
Fauna		
Sherman traps (trap-nights)	Small mammals	3787 trap-nights
Bucket pitfall traps (trap-nights)	Reptiles, amphibians, rodents	1320 trap-nights
Animal signs transects	Larger mammals	32 transects, 28.8km
Bat netting (mist-net hours)	Bats	188 mist-net metre hours
Bird surveys (mist-net hours)	Birds	28,400 mist-net metre hours
Timed searches (man-hours)	Reptiles, Amphibians	51.5 man-hours
Opportunistic observation/collection	All animal taxa	-
Human disturbance		
Transects	Human disturbance	32 transects, 27.9km
Opportunistic observation	Human disturbance	-

5. Animal specimens have been deposited at the Department of Zoology and Marine Biology, University of Dar es Salaam and sent on loan to: The British Museum of Natural History, London (amphibians); Natural History Museum, Zimbabwe (reptiles); California Academy of Sciences, California (reptiles); Chicago Field Museum, Chicago (small mammals); Zoological Museum, Copenhagen (birds). Botanical specimens are held in the Herbarium at Dar es Salaam University, with specimens being sent to Missouri Botanical Gardens, USA.
6. Uluguru South Forest Reserve has exceptional conservation value at an international, national and local level. Our surveys recorded 36 endemic species and subspecies of vertebrates and plants (out of more than 150 endemic vertebrate and plant taxa confined to this mountain). Our surveys also recorded 64 flora and vertebrate fauna species and subspecies limited to the Eastern Arc Mountains ecoregion, which is part of the Eastern Afrotropical Hotspot and is therefore of high priority for conservation efforts (Table 2).

Table 2 Summary of biodiversity taxa surveyed by UCBS in Uluguru South FR

Taxa	No. of total species	No. of Uluguru endemic species (subspecies)	No. of Eastern Arc endemic and near endemic species (subspecies)	No. of IUCN listed threatened species	No. of CITES listed
Trees / shrubs	192	9	24	19	2
Herbs / grasses	77	15	10	0	1
Climbers	7	0	0	0	0
Ferns	1	0	0	0	0
Mammals	30	1 (1)	6	9	8
Birds	94	2 (4)	11 (1)	4	8
Reptiles	6	0 (1)	5	0	3
Amphibians	22	3	7	7	2
Total	429	36	64	39	24

* Note that additional species are known from the Uluguru Mountains but were not recorded during this survey

Species richness and diversity

7. In terms of plants, UCBS recorded 277 flora species from Uluguru South FR, with 206 species recorded from 53 vegetation and regeneration plots and 71 species from opportunistic surveys. Of these, 9% are strict Uluguru endemics and 12% are Eastern Arc endemic and near endemic species. 7% of species are threatened as listed by IUCN.
8. Of the 53 50m x 20m vegetation plots established, 77.2% of plots were in montane forest (1500 – 2100m asl) and 22.7% in upper montane forest (>2100m asl). A total of 2643 individual stems were measured.
9. Of the more than 135 strict Uluguru Mountains endemic plants, UCBS recorded 24 species only. Of these, 21 species were recorded at Lukwangule plateau, nine species from Kasanga-Ukwama and six species from Bunduki-Vinile. The main genera with endemic species are: *Impatiens* (herb), *Saintpaulia* (herb), *Lobelia* (herb), *Steptocarpus* (herb), *Panicum* (grass), *Lasianthus* (shrub), and *Schefflera* (tree).
10. Of the 34 Eastern Arc endemic and near endemic plant species, most were trees and shrubs in the genera: *Allanblackia*, *Cola*, *Dorstenia*, *Psychotria* and *Coffea*.
11. Of the key floristic species *Allanblackia uluguruensis* and *Ocotea usambarensis* (Camphor), 3.6% of individual stems of *O. usambarensis* were recorded in 32 of 53 vegetation plots. Camphor was

the targeted species for timber extraction. *A. uluguruensis* was recorded in one plot only (43) at 1980m asl and was the dominant species with 26% of stems measured within this plot.

12. The five most abundant flora species within the vegetation plots for species coverage (presence in vegetation plots) are: *Garcinia volkensii* (62.3% plots), *Ocotea usambarensis* (60.4% plots), *Rapanea melanophloeus* (58.5% plots), *Drypetes gerrardii* (49.1%) and *Maytenus undata* (43.4% plots).
13. The five most abundant flora species within the vegetation plots for species abundance (stems per vegetation plot) are: *Garcinia volkensii* (7.3% stems), *Allanblackia stuhlmanni* (5.4% stems), *Drypetes gerrardii* (4.7% stems), *Aphloia theiformis* (3.9% stems) and *Ocotea usambarensis* (3.7% stems).
14. Out of the known Uluguru vertebrate fauna of 201 species, UCBS recorded 152 species in Uluguru South FR, including an additional 35 species not previously known from the reserve. Of the 152 recorded species, 8% are strictly Uluguru endemic and 19% Eastern Arc endemic and near endemic. 11% of species are threatened as listed by IUCN.
15. This survey discovered five new species of *Nectophrynoides* toad (spp A, C, D, E and G) and one species of reptile, *Chameleo wernerii* which has anatomical differences to the Udzungwa counterpart and may represent a new subspecies.
16. This survey added the following Eastern Arc strict and near endemic species / subspecies to the known list of species in Uluguru South: Lesser pouched rat (*Beomya hindiei*), White-winged apalis (*Apalis chariessa macpharsoni*), Tanzanian mountain weaver (*Ploceus nicolli*), Bi-coloured blind snake (*Rhinotyphlops nigrocandidus*), Uluguru forest-snake (*Bufo procterae*), *Arthroleptides yakusini*, *Hoplophryne uluguruensis* and *Probreviceps macrodactylus loveridgei*.
17. This study also verified the presence of Stuhlmann's golden mole (*Chrysochloris stuhlmanni tropicalis*), an Uluguru endemic subspecies, which was last recorded in 1950.
18. Of the 31 strict Uluguru or Eastern Arc endemic fauna species / subspecies known from Uluguru South, this survey failed to locate five species: White-toothed shrew (*Crocidura telfordii*), Uluguru bush-shrike (*Malaconotus alias*), Usambara eagle owl (*Bubo vosseleri*), Uluguru one-horned chameleon (*Bradypodion oxyrinum*) and *Nectophrynoides* toads (*Nectophrynoides cryptus* and *Nectophrynoides laevis*). *Crocidura telfordii* is critically endangered, whilst *Nectophrynoides cryptus* and *Malaconotus alias* are endangered and *B. vosseleri* is vulnerable.
19. This survey also failed to locate two species of Eastern Arc near endemics vertebrates: Woolly bat (*Kerivoula Africana*) and Abbot's duiker (*Cephalophus spadix*). Abbot's duiker has not been directly sighted and recorded in published papers in Uluguru South FR since 1950. UMBCP (Doggart et al 2005) recorded its presence from discussions with locals as did this study; however direct evidence is needed. It is under severe hunting pressure.
20. The most abundant species in each taxon group in the FR were: *Praomys* and *Hylomyscus* for rodents (3.2 and 2.0 individuals per 100 sherman trap nights, excluding recaptures); *Crocidura nana/elongius* and *Sylvisorex howelli* for shrews (2.4 and 2.2 individuals per 100 bucket pitfall trap nights); *Probreviceps macrodactylus loveridgei* and *Nectophrynoides viviparus* for amphibians (3.6 and 1.4 individuals per 100 bucket pitfall trap nights) and; *Nectarinia loveridgei* and *Batis mixta* for birds (3.7 and 3.3 individuals per 1000 net metre hour).
21. Several important bird species were recorded by this study: Tanzania mountain weaver (*Ploceus nicolli*), last seen in 1981 and endangered; the verification of its presence in Uluguru South is extremely important; Loveridge's sunbird (*Nectarinia loveridgei*), an Uluguru endemic, which was abundant at 2040m and 1660m asl in this study; Mrs Moreau's warbler (*Bathmocercus*

winifredae), an Eastern Arc endemic whose largest population is in the Uluguru Mountains and was collected at this FR, and; Usambara nightjar (*Caprimulgus guttifer*), known from the Usambaras and highlands of north Lake Malawi, and possibly an undescribed subspecies for Lukwangule plateau. DNA testing will confirm this.

Human disturbance

22. This study conducted 32 transects of a total length of 27.9 km in Uluguru South FR. A total of 5,652 poles (defined as woody stems 5-15 cm dbh) and 7,591 timber trees (defined as woody stems 15cm dbh and above) were recorded. An average of 184.2 live, 12.3 dead and 6.2 cut poles were recorded per hectare, with an average of 232.1 live, 34.4 dead and 5.5 cut timbers recorded per hectare.
23. The transects were split into 18 'edge' (starting 0 -500m from the forest edge) and 14 'interior' transects (starting 500m and beyond from the forest edge). Comparison of these data using Mann Whitney U test revealed that pole and timber cutting is greater at the forest edge (cut poles, $Z = -3.766$, $P < 0.001$; cut timbers, $Z = -2.693$, $P < 0.001$).
24. Of the total poles and timbers recorded, 3.0% of poles and 2.0% of timbers were cut. However, when comparing old (three months and over) and new (less than three months) cutting, 77% and 59% were old cut poles and timbers, respectively. Most of these cutting data were recorded from the west of the mountain near Tchenzema and Bunduki, where pressure on the forest reserve is intense. However casual observations did record pitsawing sites, targeting *Ocotea usambarensis* in the east near Lanzi.
25. Comparison of two datasets, the first from 2000 (O. Hymas) and the second from 2005 (this study) allowed analysis of changes in human disturbance within the forest over time. Analysis of the data from nine edge transects on the east near Lanzi and Nyingwa studied by Hymas and the east transects of this study shows a significant increase in pole and timber cutting since 2000 (cut poles $Z = -3.972$, $P < 0.001$; cut timbers $Z = -3.595$, $P < 0.001$). Analysis of nine transects on the west near Bunduki and Tchenzema studied by Hymas and the west transects of this study shows no significant difference in the levels of cutting since 2000 (cut poles $Z = 0.0068$, $P < 0.946$; cut timbers $Z = -0.763$, $P < 0.446$), suggesting that the demand on forest resources is still high.
26. Assessment of the canopy cover along the transect lines revealed that few areas had large open gaps indicative of disturbance and timber extraction. Six of the 32 transects had 75% of the line with $>51\%$ canopy cover, five of which were located on the east side of the reserve, where most of the pristine forest was observed. One transect had a 75% dominance of 0-10% canopy cover, whilst only two transects had 75% of the line with 11-50% canopy cover; these were located above Tchenzema.
27. Invasive species, such as *Rubus* brambles and *Maesopsis eminii* were recorded. The presence of *Rubus* was recorded in two transects (20 and 22), located on Lukwangule plateau and by casual observations on the western slopes above Tchenzema and Bunduki. The presence of *Rubus* was not recalled by Hymas (pers comm.) from 2000, which makes this a worrying problem. *M. eminii* was recorded twice near Nyingwa and Bunduki and is not yet of concern.
28. Burning was recorded at Lukwangule plateau on the grassland. It is a yearly event (pers comm., Sangeda, CMEAMF) and is potentially changing the grassland ecology as well as pushing back the pockets of forest. This is of concern in light of the abundance of Uluguru endemic plants in this area.
29. Hunting prevalence is high in Uluguru South FR. Four large mammal and 18 small mammal traps (for rodents, shrews and birds) were recorded along transects and casually, all located along pathways or near to the forest edge in the east (except for one rodent trap at Bunduki). It was ascertained from locals that the trapping and eating / selling of rodents and shrews is common in

the east of the mountain around Ukwama, Kasanga, Nyingwa, Lanzi and Lumba, to the extent that there may be a market selling rodents/shrews at Lumba Juu and Chamwino, Morogoro. This has serious implications for the survival of endemic shrew species and for the socio-economic status of these communities.

30. Firewood collection was seen on the west of the mountain above Tchenzema with ring-barking observed, which kills the tree and increases the availability of firewood. This large demand for firewood may also allow *Rubus* brambles to spread into the forest in the gaps created by tree removal.
31. Illegal trade of chameleons at Bunduki (pers comm., local villagers) is known to occur and is of concern as all chameleons recorded in this study are Uluguru or Eastern Arc endemic species.
32. There is a lack of clear forest boundaries on the east; at Ng'weme, approximately 30ha (pers comm., Sangeda, CMEAMF) of forest has been cleared in the reserve for cultivation.

Management and Monitoring Recommendations

33. Active patrols in the reserve by Forest Officers, involving local communities, such as environmental committees, to monitor activities such as hunting, pole cutting, pitsawing, burning, tree clearance for farmland and presence of *Rubus*.
34. Clear border demarcation by planting boundary trees and / or beacons; this is particularly important in the east of the reserve.
35. Consideration should be given to trying to reforest Bunduki gap to rejoin Uluguru North and South FRs, in light of the forest loss over time at this altitudinal band, and the known negative effects on biodiversity value of reducing forest area and increasing fragmentation.
36. Monitoring the impact of human disturbance within the FR by repeating the disturbance transects from this study in five years and comparing to the datasets from 2000 and 2005.
37. Research and monitoring of the *Rubus* invasion and design of a management strategy to control the spread.
38. Monitoring the extent of *Maesopsis eminii* to ensure no spread of this invasive species.
39. Research, monitoring and management of the effects of the fires on Lukwangule plateau and changes to grassland/forest ecology.
40. Socio-economic survey at the villages of Ukwama, Kasanga, Nyingwa, Lanzi and Lumba Juu to determine the intensity and reasons for rodent and shrew hunting noted by this study and to establish the validity of the markets at Lumba Juu and Chamwino.
41. Monitoring floral species change and forest structure by remeasuring the vegetation plots established in this study after five years to allow comparison of dbh values and species composition and abundance in vegetation and regeneration plots.
42. Monitoring the illegal trade of Uluguru and Eastern arc endemic chameleons with the aim of banning this activity.
43. Biological monitoring of the most abundant flora species in the vegetation plots by remeasuring the vegetation plots established for this study. Those species are: *Garcinia volkensii*, *Ocotea usambarensis*, *Rapanea melanophloeus*, *Drypetes gerrardii*, *Maytenus undata*, *Allanblackia stuhlmanni* and *Aphloia theiformis*.

44. Biological monitoring of the most abundant fauna species in each taxa from systematic trapping methods of Sherman traps, bucket pitfall traps and mist netting by repeating the study in five years. Those species are *Praomys* and *Hylomyscus* for rodents; *Crocidura nana/elongius* and *Sylvisorex howelli* for shrews; *Probeviceps macrodactylus loveridgei* and *Nectophrynoides viviparous* for and; *Nectarinia loveridgei* and *Batis mixta* for birds.
45. Species level monitoring of key faunal and floral indicators, including those endemic, rare, threatened and/or have not been recorded in this study. The following key species are suggested:
 - Abundance and coverage in vegetation plots of *Ocotea usambarensis*, *Allanblackia stuhlmanni* and *Allanblackia uluguruensis*
 - Presence and population abundance of Abbot's duiker (*Cephalophus spadix*)
 - Population abundance of Black and white colobus (*Colobus angolensis*) and Mountain galago (*Galagoides orinus*)
 - Population abundance and distribution of *Sylvisorex howelli*, *Crocidura monax* and *Crocidura telfordi*
 - Population abundance and distribution of Loveridge's sunbird (*Nectarinia loveridgei*) and Mrs Moreau's warbler (*Bathmocercus winifredae*)
 - Presence of Uluguru bush-shrike (*Malaconotus alias*) and Usambara eagle owl (*Bubo vosseleri*)
 - Population abundance of all chameleons, in particular *Bradypodion oxyrinum*
 - Population abundance of *Nectophrynoides* species
46. Intensify research on amphibians to discover additional probable new species, in particular within the genus *Nectophrynoides*.

1. INTRODUCTION

1.1 Report Structure

This report provides a floral and faunal inventory recorded during 13 weeks of biodiversity survey of Uluguru South Forest Reserve. Each species is described in terms of its ecological requirements and endemic status.

The report is comprised of six main sections: Executive Summary; Introduction; Methods; Results Discussion; Appendices.

- The Executive Summary provides an overview of the UCBS project inclusive of key findings.
- The Introduction provides background information to the project aims and objectives as well as a brief history of previous research in the Uluguru Mountains.
- The Methods present a summary of the research methodologies implemented throughout this project. For a complete explanation of methodologies, please refer to Uluguru Component Biodiversity Survey Methods Manual (Volume I).
- The Results report the findings of this UCBS project within three main subsections: Flora; Fauna; Human disturbance. Each subsection quantifies relevant data and these provide the basis with which to monitor changes over time and to what extent, intensity and direction.
- The Discussion summarises the results and compares them to previous research within Uluguru North and South FRs, and concludes this report.
- The Appendices provide details of the CARE-Tanzania Consultant Agreement, Taxonomic verifications, GPS co-ordinates and full species lists for flora and fauna. The lists of faunal species found in the appendices update those of Doggart et al (2005), thus now providing a full inventory of those species recorded in the forest reserve over time. Species that were not recorded in the past but have been recorded by UCBS project have been shaded in grey and are found in the appropriate appendices.

1.2 Background to the Biodiversity Survey

The Conservation and Management of the Eastern Arc Mountain Forests (CMEAMF): Uluguru Component (GEF/UNDP: URT/01/G32) is a project of the Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism and it is funded by the Global Environment Facility through the United Nations Development Programme. CARE International in Tanzania implements the Uluguru Component under terms of an agreed Memorandum of Understanding with the Forest and Beekeeping Division that was signed on the 12th August 2003.

The purpose of the Uluguru Component is:

Improved forest management and conservation and improved land husbandry practices in the Uluguru Mountain forests and adjacent villages implemented by local communities, government authorities and other stakeholders.

Frontier-Tanzania* was contracted by CARE International in Tanzania to undertake a biodiversity survey to provide a baseline to assess the impact of the project on the flora and fauna of the Uluguru Mountains and generate information relevant to the development of management plans for the Uluguru Mountain forests (Appendix 1). This report serves to detail the findings of the survey of the

* Frontier-Tanzania a collaboration between the University of Dar es Salaam and the Society for Environmental Exploration

Uluguru South Forest Reserve. It provides an inventory of flora and fauna compiled throughout the fieldwork, highlighting records of particular interest. An assessment of the level of human disturbance within the area is also made, giving the extent and potential threat of each form of 'disturbance' recorded.

Specific aims and objectives of the survey were defined in the ToRs as:

Aim: To undertake systematic biodiversity and resource-use assessment of the Uluguru North and Uluguru South Forest Reserves to establish a baseline for measuring the Uluguru Mountains Environmental Management and Conservation Project (UMEMCP) impact on maintaining biodiversity values and reducing threats in the longer term.

Objectives of the biodiversity assessment:

1. Major types of forest disturbance and proportion of habitat affected by forms of disturbance;
2. Population density of key floral indicator species e.g. *Allanblackia uluguruensis*; *Ocotea usambarensis*;
3. Species richness of flora and vertebrates; and
4. Crude abundance of endemic; globally threatened and Eastern Arc characteristic species.

1.3 Linkages to Frontier-Tanzania Forest Research Programme

Frontier-Tanzania has been conducting baseline biodiversity surveys within the biologically rich Eastern Arc and Coastal forests since 1989. Technical reports have been published from work in the Coastal forests and the following Eastern Arc Mountains: East Usambaras, Udzungwa, Mahenge; and Mpanza / Kipengere Game Reserve. *

During the East Usambara forest biodiversity surveys, Frontier-Tanzania Forest Research Programme (FT FRP) developed a methodology that allowed systematic baseline biodiversity surveys to be conducted in a cost-effective way. This methodology has been applied to the present study and is comprehensively documented in Volume I of this series of project reports.† Frontier-Tanzania provides feedback to the Catchment Forest Project of the Forestry and Beekeeping Division of the Ministry of Natural Resource and Tourism (FBD) on the strength of their research findings, as well as training in survey techniques used to facilitate future monitoring initiatives. The long-term aim of FT FRP is to provide baseline information about targeted areas, those understudied and unknown, within the Eastern Arc Mountains, thus helping to further scientific knowledge, identify conservation values and allow effective development of forest management plans.

1.4 The Uluguru Mountains

The Uluguru Mountains are one of thirteen mountain ranges that comprise the Eastern Arc Mountains, sweeping from Southern Kenya through Tanzania (Figure 1). The Eastern Arc Mountains have been recognised as a Biodiversity Hotspot, a Globally Important Ecoregion and an Endemic Bird Area by conservation organisations such as Conservation International (Mittermeier et al 2004; Myers et al 2000), BirdLife International (ICBP 1992; Stattersfield et al 1998) and the Worldlife Fund for Nature (Olson and Dinerstein 1998, Burgess et al 2004).

* Refer to Frontier Publications List www.frontier.ac.uk. Selected reports will be available for download on the website shortly and can also be accessed at www.easternarc.or.tz

† Report series: Uluguru Component Biodiversity Survey Methods Manual 2005 (Volume I); Uluguru Component Biodiversity Survey Uluguru South Forest Reserve 2005 (Volume II); Uluguru Component Biodiversity Survey Uluguru North Forest Reserve 2005 (Volume III)

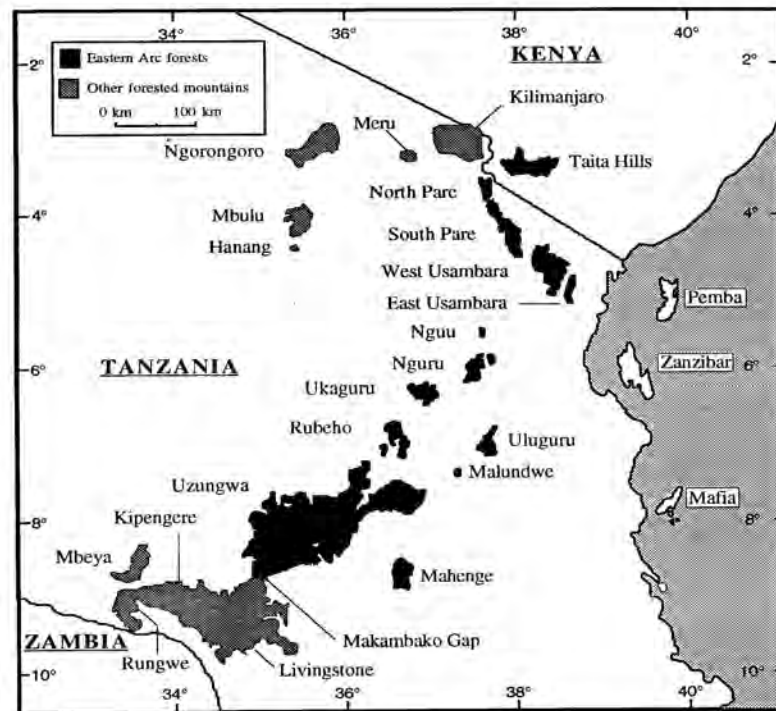


Figure 1 Map of the Eastern Arc Mountains that support moist forest. Eastern Arc Forest shown in black (Lovett, 1993)

The Eastern Arc Mountains are ancient crystalline block-faulted mountains upon which forests grow under the climatic influence of the Indian Ocean. Due to millions of years of isolation the Eastern Arc Mountains have diversified into a biologically rich area for both flora and fauna species. Many of these species are endemic, contained predominantly within around 5,000 sq. km of highly fragmented and isolated forests. Approximately 30% of vascular plants (c.650 species) and 74 vertebrate species (Burgess et al, 2002) in the Eastern Arc Mountains are endemic.

The Uluguru Mountain range is located in Morogoro District, Morogoro Region within 180 km of the Indian Ocean. It stretches 45 km on a north-south axis and is divided into two main ridges by the Bunduki Gap, a saddle which until 1955 joined the two ridges. Deforestation for clearance of new farmland is the major cause of this habitat loss and subsequent losses occurring throughout the mountains. An estimation of the potential natural closed forest cover is 500 km² (Burgess et al 2002) but due to deforestation this had been reduced to 300km² in 1955 and to c.230km² by 2001; forest loss has been greatest at 600m-1600m asl outside the reserves (Burgess et al 2002). The 1.7% forest loss per annum from 1955-1977 has declined to 0.6% per annum, however with the Uluguru human population growth being approximately 2.5 - 3% per annum (a double in the population over 20 years), the threats are huge to the forest. Almost all of this remaining forest is found within forest reserves at 1700m asl and above. The two largest Forest Reserves (FRs) containing almost all of the high altitude forest fall within Uluguru North Forest Reserve and Uluguru South Forest Reserve. These FRs encompass a total area of 256.50 km² with 83.57 km² in Uluguru North FR and 172.93 km² in Uluguru South FR. Uluguru North rises to 2640m asl and Uluguru South to 2638m asl. These mountains rise steeply out of the foothills and plains below and are separated from Selous Game Reserve in the south east and east and Mikumi National Park in the south west by a mosaic of agriculture and woodland.

1.5 Previous research and studies

The Uluguru South FR has been the subject of biodiversity research since the early part of the last century (for example, Barbour and Loveridge 1928). The vegetation and water catchment has been studied (Pócs 1974, Pócs 1976). More recently studies occurring in Uluguru North and South FRs

have documented both biodiversity values and human disturbance, with most time spent in Uluguru North FR: a vegetation survey conducted during the 1980s and up to 1992 (Lovett 1985, Lovett 1986, Lovett 1988, Lovett 1990, Lovett and Pócs 1993, Lovett 1996), a fauna survey conducted in 1993 (Svendsen and Hansen 1995), a human disturbance survey conducted in 2000 (Hymas 2001) and a biodiversity survey conducted in 2000 (Doggart et al 2005, Perkin 2000).

Fourteen vertebrate species and two sub-species are found only in the Uluguru Mountains. More than 135 plant taxa are endemic to the Ulugurus (Burgess et al 2002). The Uluguru Mountains were recently assessed as the third most important of the Eastern Arc Mountains in terms of conservation of endemic fauna (Burgess et al 1998). Within a National Survey of Catchment FRs in 1993 it was ranked most important (Lovett and Pócs 1993) given its extensive water catchment value, supplying both Morogoro and Dar es Salaam via the Ruvu, Morogoro and Ngerengere rivers. The economic significance of these forests, as well as their biological significance, makes the Uluguru Mountains a main target of conservation efforts.

Recent surveys of birds (e.g. Stuart and Jensen 1985, Jensen and Brøgger-Jensen 1992, Svendsen and Hansen 1995, Tøttrup et al 2004 and Doggart et al 2005) have failed to locate the endangered Tanzanian mountain weaver (*Ploceus nicolli*) and the vulnerable Banded green sunbird (*Anthreptes rubritorques*) which were previously found in the mountains. Five endemic species of vertebrate have not been recorded in the last 10 years (prior to this study): three endemic snakes (*Typhlops uluguruensis**, *Typhlops* sp. nov and *Prosymna ornatissima*); the sub-species of the Golden mole (*Chrysochloris stuhlmanni tropicalis*); and one amphibian (*Hyperolius tornieri*). Of particular concern are those species typically confined to lower altitudes where destruction of forest is at its greatest, such as the snakes and Banded green sunbird.

The most recent biodiversity survey of the Uluguru Mountains conducted in 2000 (prior to this study) (Doggart et al 2005) located all near-endemic species of mammal, reptile and amphibians shared with other Eastern Arc Mountain forests. Rare species previously known from other Eastern Arc Mountain forest blocks and *not* the Uluguru Mountains were also discovered e.g. Horned bush-viper (*Atheris ceratophorus*). Other research has described five new *Nectophrynoides* species (toads) last year alone (Menegon et al 2004), two of which are Uluguru endemics (*Nectophrynoides pseudotornieri* from Uluguru North FR and *Nectophrynoides laevis* from Uluguru South FR). This suggests that there may be other undiscovered species that exist and that may have existed in deforested areas.

* One specimen of *T. uluguruensis* has been collected *near* Uluguru North FR (pers comm, Simon Loader, British Natural History Museum)

2. STUDY SITE

2.1 Location

Uluguru South Forest Reserve (FR) is located on the main Uluguru range, Eastern Tanzania. It covers an area of 172.93 km² (17 292.7 ha) and lies in the divisions of Mgeta and Matombo in Morogoro and Mvomero Districts, Morogoro Region, covering land approximately 26 km south of Morogoro town located on latitude 7° 01' – 7° 12' S and longitude 37° 36' – 37° 45' E. Selous Game Reserve is located to the south with Mikumi National Park to the south west. Agricultural land and woodland plains separate these protected areas from Uluguru South FR.

2.2 Site Description

Name: Uluguru South Forest Reserve

Area: 17 292.7 ha

Status: Catchment Forest Reserve (protective)

Maps: Ordnance Survey topographic maps 1:50,000, Series Y 742 201/1: Forestry and Beekeeping Division Map No. Jb. 579, Jb. 585

Delineated and described on Forest and Bee Keeping Division Map No. Jb. 579, Jb. 585, 1963.

Gazettement notice GN 219 of 23/06/1961. There is no variation order.

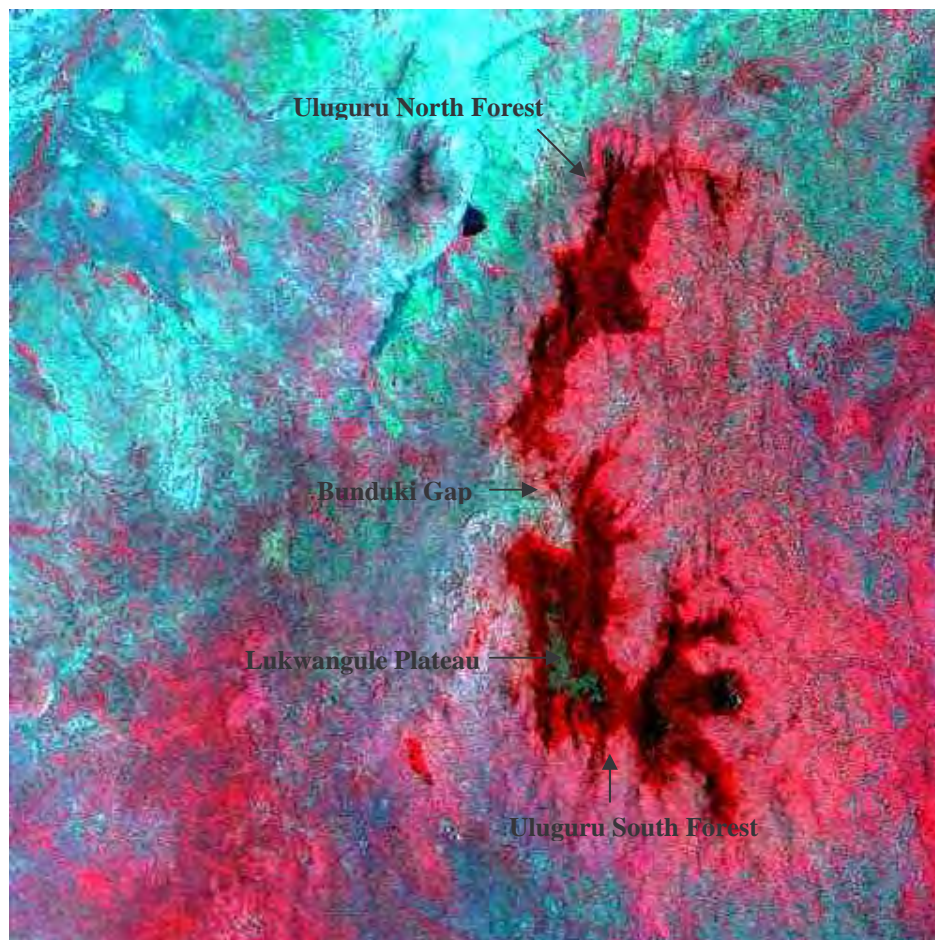


Figure 2 Spot satellite image of the Uluguru Mountains (2003) (sourced from Dr. N. Burgess)

Red indicates closed forest graduating to pink indicating woodland, tree-crop agricultural systems, agroforestry and bracken. Green indicates no cover at all, which can represent natural grassland such as the Lukwangule plateau, or areas cleared of trees such as the east side of Uluguru South FR.

2.3 Topography

Uluguru South FR consists of a main ridge running on a north – south axis with several steep high peaks dominating the landscape (Figure 3): Makumbaku (2420m asl), Kimhandu (2634m asl) and Lukwangule (2368m asl). Lukwangule plateau is a 20 km² upland grassland and swamp area with pockets of elfin forest starting at an altitude of 2300m asl and lying between two parallel ridges. The eastern slopes rise from 1200m asl and from 1800m asl on the west. Both are covered by moist forest with montane forest from 1500 -2400m asl and upper montane forest above 2000m asl. Bamboo thicket covers large areas in the upper Mgeta valley, on Kimhandu summit and the saddle which connects Lanzi and Lumba Juu villages, usually above 2000m asl but as low as 1600 m asl. Steeply carved out valleys descend to form two important water sources, the Mgeta river, supplying locals, and the Ruvu river, supplying Dar es Salaam.

Soil types are acidic lithosols and ferralitic red, yellow and browns latosols, which have developed on Precambian granulite, gneiss and migmatite rocks. Some of the upper areas, such as Lukwangule Plateau are covered by peat deposits (Lovett and Pócs, 1993).

2.4 Climate

The Uluguru Mountains are one of the wettest areas in Tanzania, particularly the eastern slopes with 2500 – 4000 mm per annum and 2000 mm per annum on the western slopes. There is no marked dry season on the eastern slopes, but on the west June to October is dry. Daytime temperatures range from 20-22°C on the lower slopes (max) and 15-17°C (min). Frost is common on the higher ground and on the Lukwangule Plateau (above 2300m asl) temperatures can drop to -7°C during May and June (Lovett and Pócs, 1993).

2.5 Land Use

Most of the reserve is covered in moist forest with the grassland plateau covering 11% of the total area. Cultivation occurs up to the borders and occasionally within the FR itself. Many well used paths cut across the FR connecting the surrounding villages, these facilitate entry into the interior of the FR which can be exploited to hunt, extract timber and non-timber resources. Clearance of land on the edge and inside of the FR removes the regenerating vegetation. Activities within the FRs are illegal. Catchment FRs have protective status meaning resources should not be extracted, however it is clear that such illegal activities still occur.

2.6 History and Status

Uluguru South FR was gazetted for its extremely important water catchment value in 1906 and to protect the remaining high altitude forests. Some of the western boundary is well demarcated by *Eucalyptus* and *Cupressus* trees. Although the lowland forests, for example Mvuha and Chamanyani Catchment FR, are being severely degraded by charcoal burning, pitsawing, pole extraction, mining and fire, the higher altitude forests on the western slopes of the Uluguru Mountains have also been exploited and timber extracted. Hunting for large mammals has occurred for many years, leaving an area depleted of most large fauna, except for primates and browsers such as duiker and bushpig. The west side of the mountains below the FR is intensively cultivated using terracing and fertiliser, whereas the east is less intensively farmed, planting directly on to the slopes. Sokoine University of Agriculture (SUA) have a centre at Nyandira for teaching good agricultural practices, which includes encouraging tree planting to compensate for denuded slopes below the forest. The close proximity of the western side of Uluguru South FR to Morogoro reflects the exposure to more sophisticated agricultural techniques leading to greater economic wealth. However better roads and accessibility has also allowed more timber extraction to occur. At Bunduki, the northern end of Uluguru South FR, the Forest and Beekeeping Division has established tree nurseries outside of the reserve mainly for border marking with a small proportion of trees for villages.

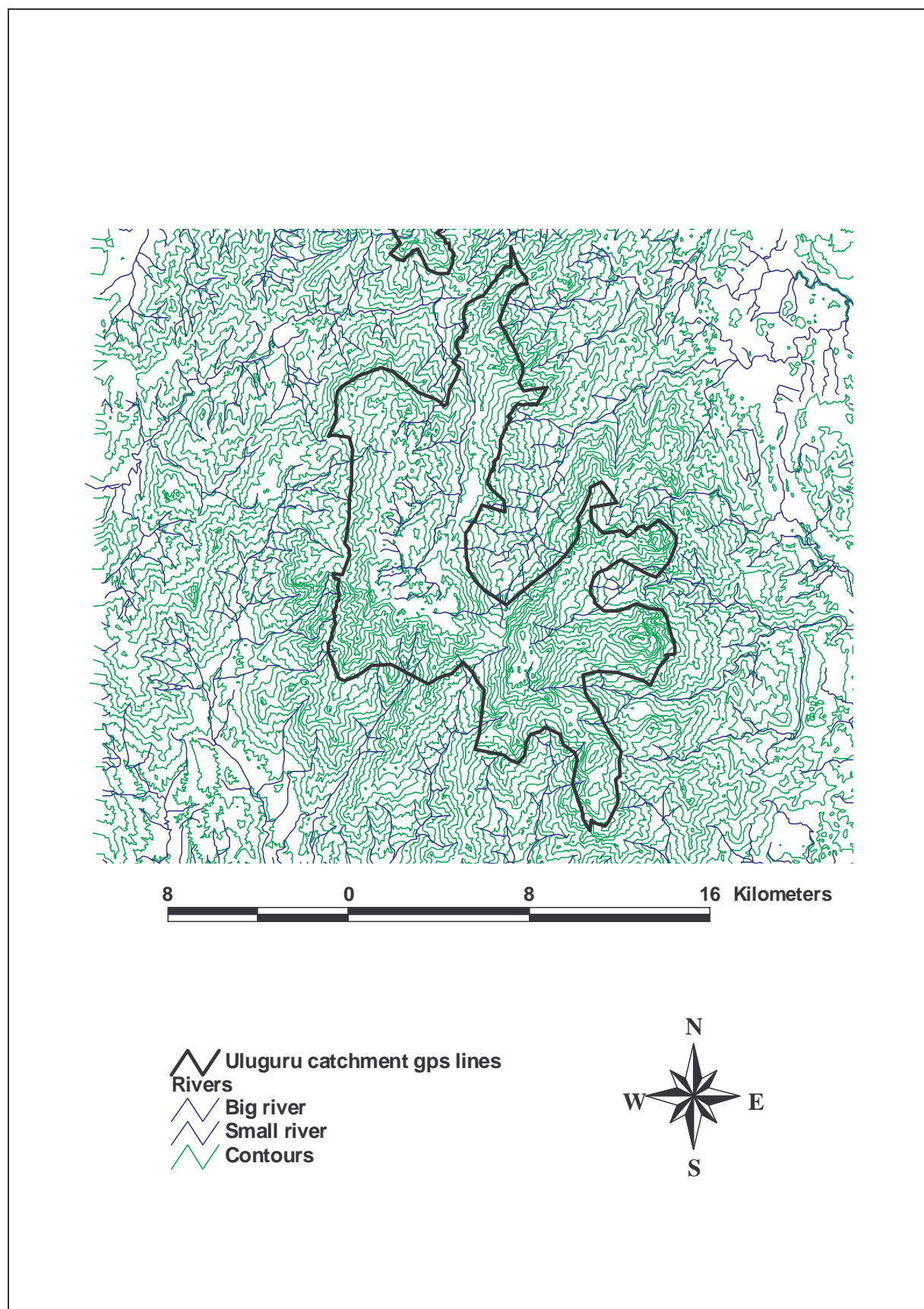


Figure 3 Topographical map of Uluguru South FR

3. METHODOLOGY

Please refer to the *Uluguru Component Biodiversity Survey Methods Manual 2005 (Volume I)* for full details of the systematic survey techniques. The original dataset is lodged at the University of Dar es Salaam, soft copies of this dataset are provided with this report series.

Fieldwork was conducted during the short rains between 20th September and 21st December 2004 for 13 weeks. Survey work concentrated on investigations of the reserve's flora, fauna and human disturbance, with methods based on those employed by FT FRP in the East Usambara Biodiversity Survey and Udzungwa Mountains Biodiversity Survey. Five zoological sites (Figure 4), 53 vegetation plots (Figure 5) and 32 transect lines (Figure 6) were carried out within the FR. The survey effort for each technique is shown in Table 3. For work site descriptions see Table 4. Please see Appendix 4 for GPS co-ordinates of all working locations.

Three criteria of ecological type, habitat preference and endemic status were used to analyse the uniqueness of the biodiversity of the reserve and its vulnerability to disturbance. Key definitions and information sources are outlined below.

3.1 Key definitions and information sources

Ecological Type: (Iversen, 1991b)

- FF – Forest dependent species: Species previously recorded as restricted to primary or closed canopy forest only e.g. wet evergreen forest, dry evergreen forest and/ or riverine forest; does not include forest edge or secondary forest species;
- F - Forest dwelling but not forest dependent: Species previously recorded in primary or closed canopy forest as defined above and / or in forest edge, clearings, secondary forest, deciduous forest and woodland, thus they may also be adversely affected by forest destruction;
- O - Non-forest species: These are species that do not occur in primary or secondary forest or forest edge e.g. species that have been recorded in bushland, heathland, thicket, secondary scrub, grassland, rocky outcrops, swamps, wastelands and cultivation.

Habitat: (Pócs, 1976)

Contrary to the usual categorisation of vegetation types by Lovett and Pócs (1993), Pócs' (1976) study mapping the Uluguru Mountains vegetation has been used, as it is a more accurate representation of vegetation change according to altitude and rainfall within this Eastern Arc block.

- L – Lowland: Species occurring at altitudes of <800m above sea level;
- S - Submontane: Species occurring at altitudes of 800m – 1500m above sea level;
- M - Montane: Species occurring at altitudes of 1500m – 2100m above sea level.
- U – Upper montane: Species occurring at altitudes of >2100m above sea level.

Endemic Status: (based on Iverson, 1991b):

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

The categories are based on information from various sources. For plants the ecological type and endemic status are primarily based on Iversen (1991b). 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). Species defined as forest dwelling also occur in other habitats.

Information provided in the appendices with regards to flora is taken from the Flora of Tropical East Africa (FTEA) or List of East African Plants (LEAP), (Knox 2000).

Endemic and near endemic status for plants was taken from Iversen (1991b) and FTEA categories Tanzania T3, T6, T8 and Kenya K7. Rare plant species are defined by the LEAP database as being present in less than two out of eight vegetation regions in Tanzania.

For animals, endemic and near endemic status was gleaned from a table from Burgess et al (in press) which has up to date information for forest, endemic, near endemic and red list status.

The following references were also used for identification purposes (in order of priority):

Mammals:	Kingdon (1997), Kingdon (1989), Kingdon (1974)
Birds:	Stevenson & Fanshawe (2002)
Reptiles:	Spawls et al (2002), Howell (1993).
Amphibians:	Channing (2001), Passmore and Carruthers (1995), Schiotz (1999)
Plants:	FTEA, LEAP, Palgrave (1983), Polhill (1988), Heywood (1993), Mabberley (1997)

Flora and fauna lists were compiled with regard to status and threat within Tanzania and East Africa, using Burgess et al (in press) for IUCN (2004) and also CITES (2002). Explanations of each are given below:

Threat status IUCN

CR = Critically endangered; *extremely* high risk of extinction in the wild

EN = Endangered; *very* high risk of extinction in the wild

VU = Vulnerable; high risk of extinction in the wild

NT = Near threatened; Taxa that do not qualify as Critically endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

DD = Data deficient

Threat status CITES

CITES I = Threatened with extinction and excluded from commercial international trade

CITES II = Not yet threatened with extinction, but may be so if trade is not regulated, thus export permits are required

It must be noted that with many newly described species these will not be found within any listing of threat status, but are more than likely to come under a Vulnerable or greater category once recognised.

Within the tables in the Appendices acronyms are used for three projects to cite the most recent records within the FR for each species. The faunal species lists update those of Doggart et al (2005) who compiled a lists for each FR based on all known research conducted prior to this work. Other recordings directly cite the authors:

S&H 1995	Uluguru Biodiversity Survey	Svendsen and Hansen 1995
UMBCP 2000	Uluguru Mountains Biodiversity Conservation Project	Doggart et al 2005

UCBS 2005

Uluguru Component Biodiversity Survey

Frontier-Tanzania 2005

Table 3 Summary of survey effort

Survey technique (and sampling unit)	Target taxa	Total sampling effort
Flora		
Vegetation plot (VPs)	Trees, shrubs, herbs	53 VPs
Regeneration plot (RPs)	Trees, shrubs, herbs	53 RPs
Opportunistic observation/collection	Trees, shrubs, herbs	-
Fauna		
Sherman traps (trap-nights)	Small mammals	3787 trap-nights
Bucket pitfall traps (trap-nights)	Reptiles, amphibians, rodents	1320 trap-nights
Animal signs transects	Larger mammals	32 transects, 28.8km
Bat netting (mist-net hours)	Bats	188 mist-net metre hours
Bird surveys (mist-net hours)	Birds	28,400 mist-net metre hours
Timed searches (man-hours)	Reptiles, Amphibians	51.5 man-hours
Opportunistic observation/collection	All animal taxa	-
Human disturbance		
Transects	Human disturbance	32 transects, 27.9 km
Opportunistic observation	Human disturbance	-

Table 4 Works site descriptions

Work site	Waypoint	Description of location	Zoological work	Grid ref (E) UPS	Grid ref (N) UTM	Altitude (m)
1	US-BC1	Basecamp 1 , montane forest close to Ukwama village	Zoological site 1	355604	9206427	1515
2	US-BC2	Basecamp 2 , upper montane forest close to Lanzi village	Zoological site 2	351337	9216372	1830
2	US-SC1	Sat camp 1 from Lanzi		351427	9210510	1695
2	US-SC2	Sat camp 2 from Kasanga		355741	9206398	1450
3	US-BC3	Basecamp 3, bamboo zone, upper montane forest near top of pass to Lumba Juu from Lanzi	Zoological site 3 and bird mist netting	351850	9208900	2040
3	US-SC3	Sat camp 3 from Nyingwa	Bird mist netting	354624	9212425	1620
4	US-BC4	Base camp 4, from Tchenzema	Zoological site 4 and bird mist netting	347750	9212868	2450
5	US-BC5	Base camp 5, from Bunduki	Zoological site 5 and bird mist netting	350329	9220658	1660
5	US-SC4	At forestry campsite near Bunduki village		348832	9223207	1284

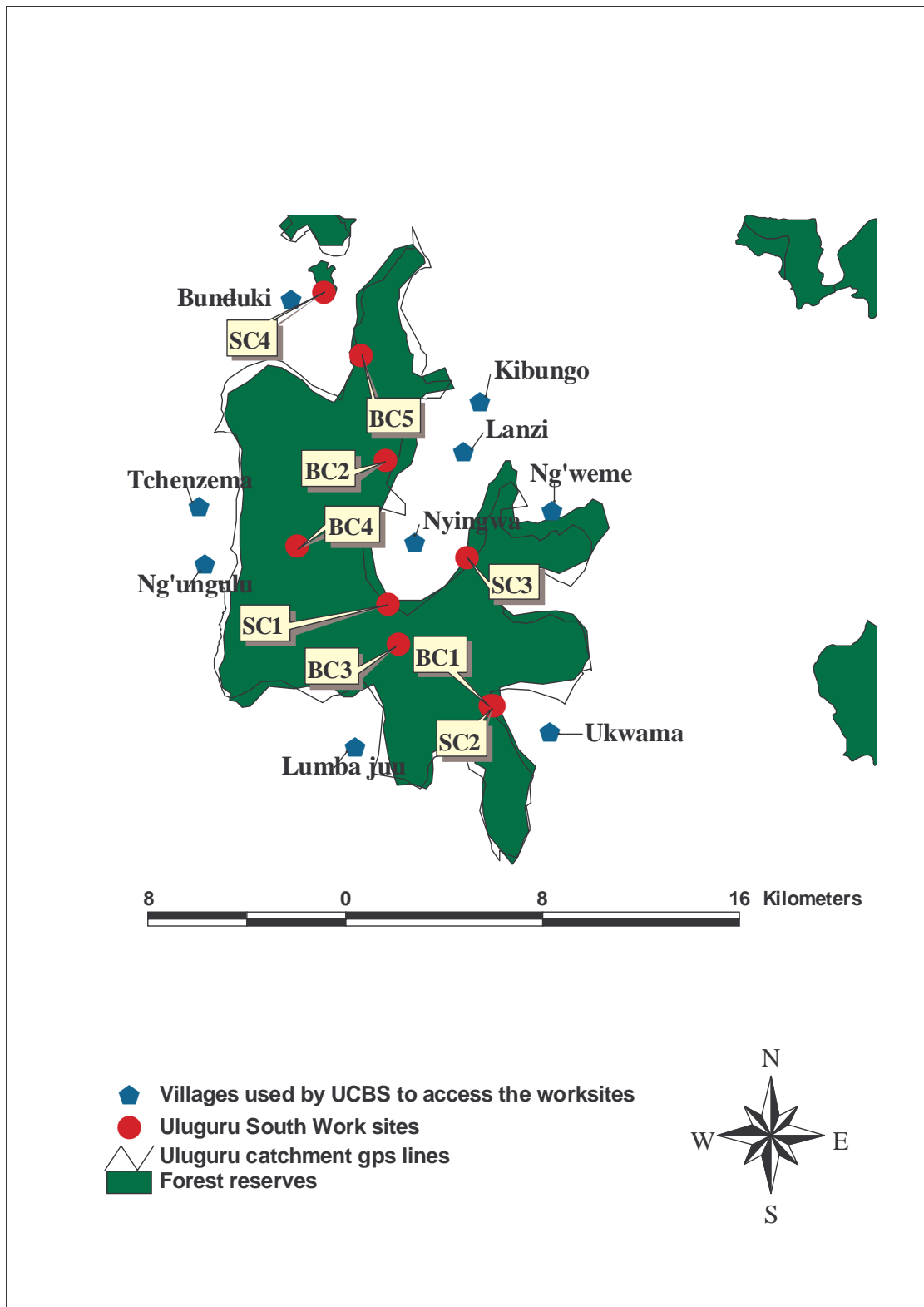


Figure 4 Map of work sites at Uluguru South FR

Zoological sites and bird mist netting sites were based at basecamps (BC) and satellite camps (SC)

3.2 Flora

A species inventory was compiled of trees and shrubs found within the Uluguru South Forest Reserve (FR). Simple, quantitative and repeatable methods were employed; these results are comparable with other forest surveys undertaken by FT FRP, and can be used for future monitoring purposes.

The forest reserve was stratified into 'edge' (classified as starting from forest edge and up to 500m inside the forest) and 'interior' (starting 500m and beyond from the forest edge), with 900m transects placed randomly within these two strata. Vegetation and regeneration plots were placed along the disturbance transect where vegetation was considered representative. The location of vegetation plots and disturbance transects were recorded using Global Positioning System (GPS) (Appendix 4).

Three methods were used to analyse forest composition:

- (1) Vegetation plots
- (2) Regeneration plots
- (3) Opportunistic observations

- *Vegetation plots (VPs)*

Usually two plots 50m x 20m were sampled along each transect line, which produced a sampling intensity of 0.03% of the overall FR area. Within each sample (vegetation) plot, every tree with a diameter at breast height (dbh, 1.3m) of 10cm and over was recorded, marked with red paint, and identified. A botanist provided the field identification of plant species. Specimen collection was made of fertile individuals and difficult to identify species. These were given preliminary identification at the University of Dar es Salaam Herbarium before being sent to Missouri Botanical Gardens, USA.

- *Regeneration plots*

The regeneration layer was sampled within 6m x 6m nested subplots at the centre of each vegetation plot. All trees and shrubs with a dbh below 10cm were counted and identified within these plots. The ground cover (of herbaceous vegetation, bare soil, leaf litter and rocks), and the dominance of other vegetation (such as grasses, forbs, mosses, lichens and ferns) were documented as percentages.

Systematically sampled vegetation data are presented in the form of checklists and analytical calculations are summarised in tables, graphs and maps. These data will provide the baseline information with which to monitor vegetation plot dbh and species composition changes over time.

- *Opportunistic collections and observations*

Opportunistic collections and observations of ground, shrub and tree floras were made throughout the survey. Fertile individuals were collected as specimens and dried in the field using a kerosene stove. Detailed field notes were made of each specimen and are stored with the specimens. All botanical specimens are held at the Herbarium, University of Dar es Salaam and sent to Missouri Botanical Gardens, USA. Opportunistic data are presented as a checklist, with location information for specimens that were collected.

A botanist was employed to identify all individuals recorded in the VPs, RPs and on the opportunistic basis. When necessary and if possible, up to five specimens of leaves and preferably flowers and fruits were taken to aid identification of an individual. All specimens were pressed and dried in the field and later identified in the University of Dar es Salaam Herbarium, with specimens also being sent to National Herbarium, Arusha, Tanzania; Missouri Botanical Gardens, USA; and Kew Botanical Gardens, UK (see Appendix 2 for named experts used for taxonomic verifications).

Vegetation data were analysed using various statistical techniques. The diversity of species was determined using a Shannon Wiener Diversity Index. This diversity index is preferred as it looks at the species richness and their proportional abundance. Parametric t – test and one-way analysis of variance (ANOVA) test were used to compare various parameters with aspect and altitude. Both techniques compare the arithmetic mean and require a normal distribution with equal variance.

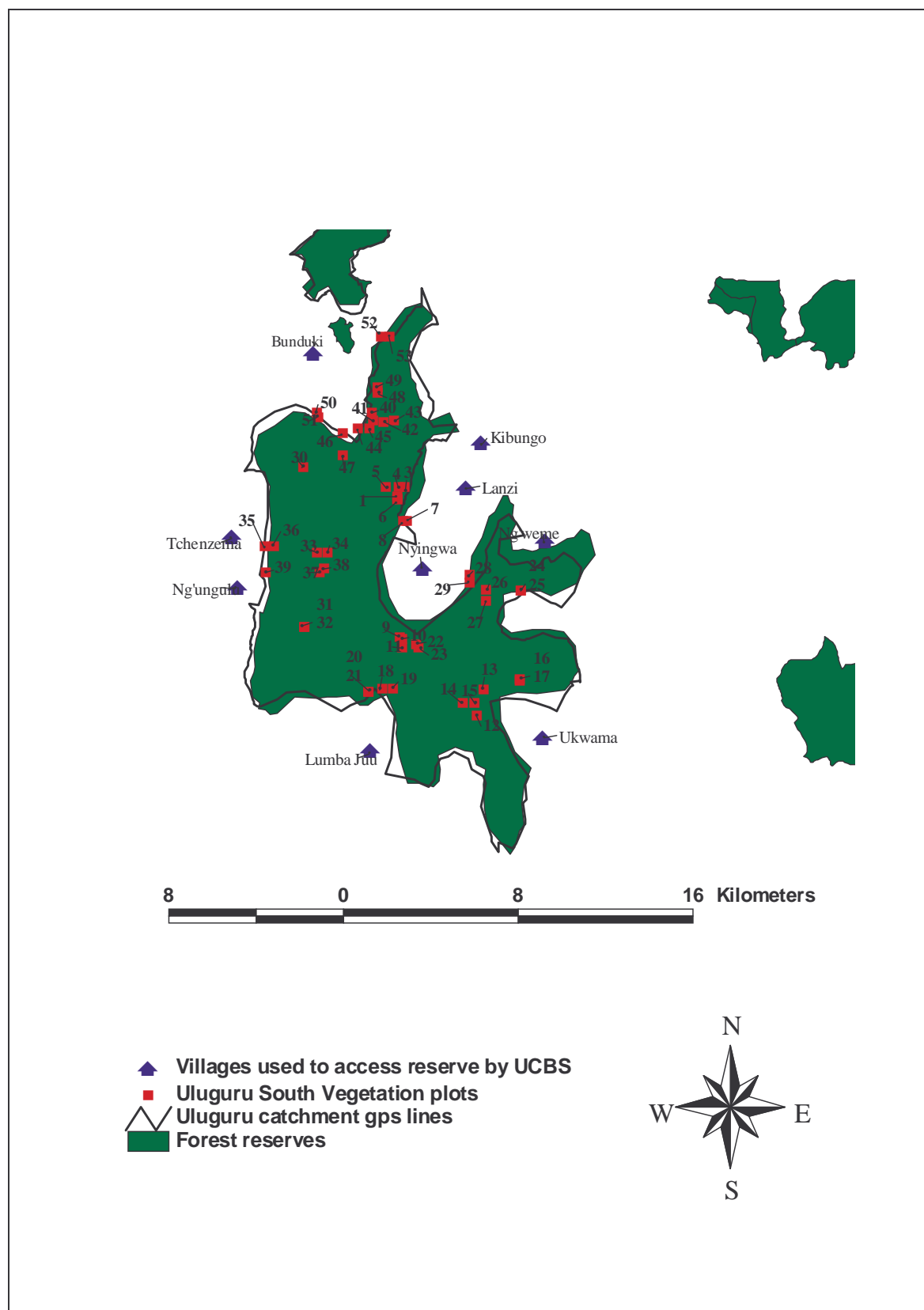


Figure 5 Map of vegetation plots in Uluguru South FR

3.3 Fauna

The fauna of Uluguru South FR was studied to assess diversity within specific taxonomic groups. Inventories were compiled of mammal, reptile, amphibian and bird species. Practicalities of capture methods, identification techniques and potential information that could be extracted from these data influenced the taxonomic groups chosen for the study. The results of the inventories were analysed to assess the relative biodiversity value of the reserve's fauna. Relative abundance of each taxa was calculated by correcting for the differences of survey effort between sites thereby quantifying capture rates per chosen unit (Sherman trap night and bucket pitfall trap night units are: X animal per 100 trap nights and mist net units are: X birds per 1000 mist net metre hours). Such data can be used for future monitoring.

Within Uluguru South FR, target groups of fauna were surveyed using a combination of standardised, repeatable methods at 'zoological trapsites', which lasted for eight nights each. Each zoological trap site and bird netting site was located within 500m of a basecamp. Basecamp location was selected in order to sample representative habitat types within the FR. Transect surveys of dung and other animal signs, and the opportunistic collection and observation of all animals were also implemented. Brief descriptions of the methods employed and zoological sites locations follow.

- *Sherman traps*

Small rodents and insectivores were sampled using 100 Sherman traps (standard size) baited with toasted coconut and peanut butter. Traps were placed around three bucket pitfall lines, approximately 5m apart. Where appropriate Sherman traps were placed in branches to increase the chances of capturing arboreal species.

Traps were baited each evening (1600hr or later) for the duration of the zoological sites and checked early the following morning (0800hr or earlier). Traps were closed during each day of the trapsite. Data regarding the identification, sex, breeding status and biometrics of each animal captured, as well as habitat notes, were recorded on standardised sheets. Specimens were retained when species level could not be ascertained and in cases where sexed specimens were required; these specimens were subsequently sent to international taxonomic experts (Appendix 2). In the case of small rodents, individuals to be released were each given a distinct mark-code made by trimming small patches of fur in a given pattern. 'Recaptured' individuals were then able to be identified.

- *Bucket Pitfall Traps*

Small mammals, amphibians and reptiles were sampled using bucket pitfall traps. Three 50m linear transects were created at each zoological site location whereby eleven 10 litre plastic buckets were positioned 5m apart from each other. Buckets were sunk into the ground with their rims flush to ground level. Buckets had small holes in their base to allow rainwater to drain from them. A sheet of vertical plastic (approximately 0.5m high, and no less than 0.2m) was run along the bucket line crossing the centre of each bucket to form a 'drift fence'. A 10-15cm lip of plastic sheeting was left flat on the ground onto which soil and leaf litter was placed to prevent any gap in the drift fence at ground level. Animals moving into the area from either side would be channelled along the plastic sheet towards the bucket traps. Each bucket pitfall line was placed no more than 50m apart, but was located to encompass a range of micro-habitats. Brief habitat notes were taken for each bucket position. Traps were checked early each morning for the duration of the zoological site period and data recorded on standardised data sheets regarding the identification of each animal captured.

- *Bat mist netting*

Bats were sampled using varying combinations and configurations of mist-nets within the trapping sites. Up to three mist-nets of varying sizes (2.6 m x 2.6 m, 6m x 2.6m, 9m x 2.6m) were utilised at any one time. Nets were placed across assumed 'flight corridors' such as rivers and paths. Nets were opened at dusk (approximately 1830hr) and checked every 10 to 15 minutes for the duration of the netting session. Data were recorded on standardised data sheets regarding the identification, sex,

breeding status, weight and biometrics of each bat captured. Detailed habitat notes were taken for each mist-netting location and the number of net-metre hours calculated for each session.

- *Bird mist netting*

Birds were sampled using varying combinations and configurations of mist-nets within the trapping sites. Approximately 80m lines were cut through the vegetation to permit the erection of the mist nets. This type of methodology targets birds of the lower storey (other birds from mid to upper storey are recorded through visual and vocal observations). Two trapping days were conducted at each mist net site. Nets were opened from approximately 0530 hour until 1815 hour and checked every hour. Nets were closed if rain ensued. Data were recorded on standardised data sheets regarding the identification and whether blood and/or tissue samples were taken. Birds were marked by cutting a small amount off the tail feather to enable identification of recaptures. Net-metre hours were calculated for each session. An ornithologist conducted this work.

- *Timed man-hour searches*

The reptile and amphibian fauna of the reserve was additionally surveyed through timed searches. Searches were conducted during both the day and night and were of various lengths (1-4 man hours), with various numbers of the survey team (1-6 people). Data were recorded on standard recording forms and included the survey effort, habitat and altitude of each search, as well as the identification of any captures. If not taken as specimens, captures were released, unmarked.

- *Animal sign transects*

Spoor and other signs of animal presence were assessed along every established transect line (that also sampled human disturbance) through the Forest Reserve (Figure 3). A 5m strip either side of each transect line was assessed for animal dung, tracks and paths, as well as other signs such as burrows, diggings, feathers etc. All animal signs were recorded along with brief geographical and habitat details. To determine identification of indirect evidences, the knowledge of experienced field assistants was utilised in conjunction with the fieldguide Walker (1996).

- *Opportunistic collection and observations*

All taxa were collected and observed on an opportunistic, casual basis throughout the survey period to determine the presence of species otherwise omitted by the standardised techniques. Opportunistic collections of amphibians and reptiles were made with direct and indirect observations of birds and larger mammals recorded. Vocalisations of amphibians were also recorded and identified by Michele Menegon. Within the species lists in the Appendices, the distinction between casual collections and those collected by systematic methods are specified.

3.4 Human disturbance

- *'Disturbance transects'*

Disturbance transects were used to record the intensity of pole and timber cutting and incidence of other disturbance types in the forest reserve. The GPS positions of the starting point (0m) of each transect were recorded to enable repetitions of data collection to take place in the future to assess changes of disturbance over time. The disturbance transects were randomly placed within the FR (Figure 6). Each 900m transect sampled either the edge (classified as starting from the forest edge and up to 500m inside the forest) or interior (starting 500m and beyond from the forest edge) of the FR. Disturbance was recorded per 50m section along each transect. Every self-standing tree and sapling (not lianas or creepers) 5cm or above dbh was measured within 5m either side of the transect line. Each plant was recorded under one of four categories: live, old cut, new cut or naturally dead. Within these categories a distinction was made between poles and timbers. Poles were classified as having a dbh between 5 and 15cm with a minimum of 2m of relatively straight trunk. Timbers were classified as having a dbh of 15cm or above with a minimum of 3m of relatively straight trunk. These divisions are based on their differences in use. New cut stems were recognised by a cream coloured slash and classified as freshly cut within recent months (approximately within the past 3 months). Old cut stems were recognised by black coloured slash and classified as old cut (approximately more than 3 months old). Timber and pole cutting data are presented as an average

per hectare and summarised in graphs and maps. The level of human disturbance in the forest can be quantified by comparing the categories of live, naturally dead, new cut and old cut within each 50m section of the transect. Other types of human disturbance were noted within each 50m section, such as the presence of fire damage, pitsawing, charcoal production, animal traps, cultivation, settlement and mining. The presence or absence of these disturbance data per 50m section could be used to assess disturbance in the FR by calculating the percentages of total transect 50m sections where disturbance was observed.

Previous work by Olivier Hymas for WCST in 2000 (Hymas 2001) also assessed forest disturbance within Uluguru South and Uluguru North FRs, as well as forest (public land) to the east of Uluguru North FR; nine transects were carried out around Lanzi on the east and nine around Tchenzema and Bunduki on the west of Uluguru South FR; nine transects were carried out from Tegetero north to Kinole in Uluguru North FR; and nine transects were carried out in forest (public land) just north of Kinole, approximately 5km east of the FR. One kilometre transects were placed at the forest edge and disturbance was assessed using the same methodology as UCBS. Comparison of the two pole and timber datasets from 2000 and 2005, using the Mann Whitney U two-tailed test, enabled assessment of changes over time in human disturbance and provides key information for future monitoring.

- *Opportunistic observations*

Observations of human disturbance were made in each vegetation plot and throughout the reserve. Again, it was hoped that this would complement the standard quantifiable methods employed and give a fuller picture of the state of the reserve with regards to human impact.

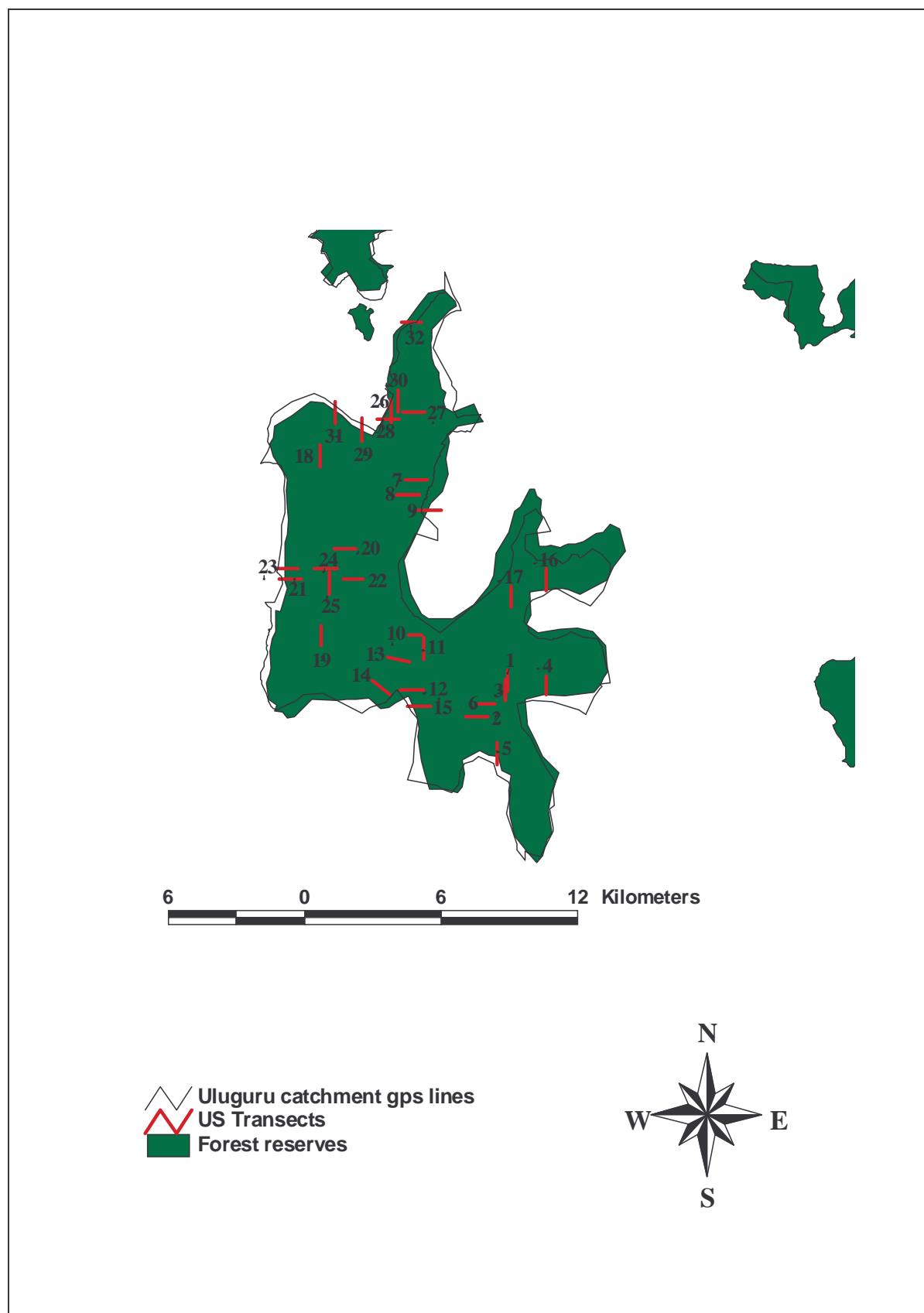


Figure 6 Map of transect lines in Uluguru South FR

4. RESULTS

All data presented in this results section are from the UCBS study only. Appendices 6 to 8 present the vegetative data. Appendices 9 to 12 list the faunal data, incorporating UCBS' results with previous research, thus updating Doggart et al (2005).

4.1 Flora

Preliminary plant identifications have been carried out by Mr. George Sangu and Mr. Frank Mbago at the Herbarium of UDSM. These await verification from Missouri Botanical Gardens, Kew Gardens and National Herbarium, Arusha.

A total of 277 species were recorded from 72 families in Uluguru South FR by UCBS (Table 5), with 206 species recorded from 53 vegetation and regeneration plots (74% of species) and 71 species from opportunistic surveys (26%). This includes five exotic species and three specimens known to family only, which were found in both survey localities, Uluguru North and Uluguru South FRs. 24 species in Uluguru South FR were Uluguru endemics (8.7% of species) and 34 species were Eastern Arc endemic and near endemic species (12.3%) (Figure 7). 19 species were listed as IUCN threatened with three as CITES listed and six as rare, categorised by LEAP (Table 6). 217 species were found to overlap between both Uluguru North and Uluguru South FRs, of which 17 were Uluguru endemics and 27 Eastern Arc endemic and near endemic species.

Table 5 Summary of floral data for Uluguru South and Uluguru North FRs recorded by UCBS

Species	No. of sp recorded in Uluguru North	No. of sp recorded in Uluguru South	No. of sp recorded in both FRs
Uluguru endemic	18	24	17
Eastern Arc endemic and near endemic	29	34	27
Widespread	190	219	173
Total	237	277	217

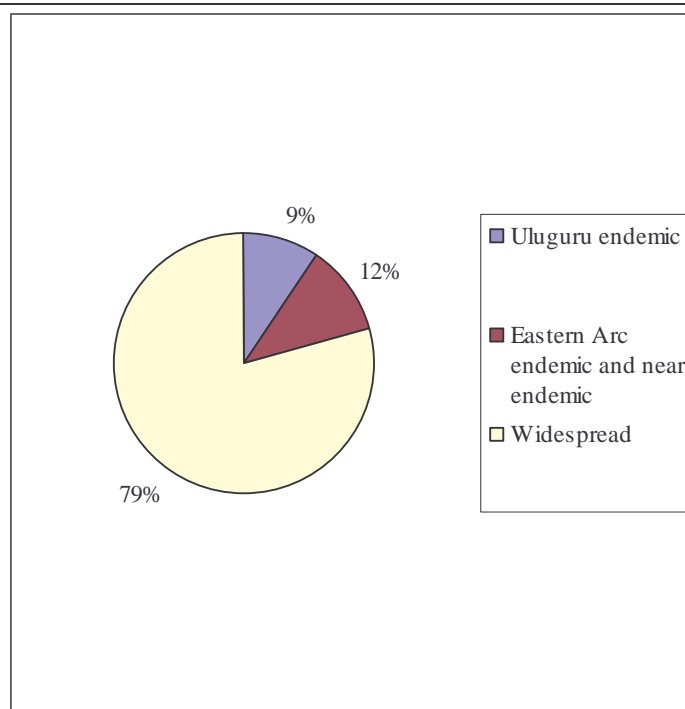


Figure 7 Percentage of species within Uluguru South FR

Table 6 provides a break-down of the 277 total species UCBS recorded in Uluguru South FR. Species have been split into widespread species, Uluguru endemics and Eastern Arc endemic and near endemic species; these categories are mutually exclusive and represent accumulatively the full species list. Data representing the IUCN and CITES listed species and rare species are with regards to the total 277 species, these data are not mutually exclusive.

Table 6 Summary of floral data for Uluguru South FR recorded by UCBS

	Widespread	Uluguru endemic ^a	Eastern Arc Endemic and near endemic ^b	Threat status listed by IUCN ^c	Threat status listed by CITES ^d	Rarity as defined by LEAP ^e
Trees / shrub	159	9	24	19	2	5
Herb	48	14	10	0	1	1
Climber	7	0	0	0	0	0
Grass	4	1	0	0	0	0
Fern	1	0	0	0	0	0
Total	219	24	34	19	3	6
% of Total	79.1	8.7	12.3			
Grand total of all species		277				

a Those species restricted to the Uluguru Mountains only

b Those species restricted to the Eastern Arc Mountains and/or East African lowland forests and other adjacent locations

c Those species listed by IUCN as threatened by extinction to varying degrees, such as Endangered or Vulnerable

d Those species listed by CITES which have restrictions on trade, such as Cites I and II

e Those species listed by LEAP as rare, rare defined by LEAP as occurring in two of eight vegetation regions

69.3% of species recorded were trees and shrubs, with 26% herbs, 2.5% climbers, 1.8% grass and 0.4% ferns.

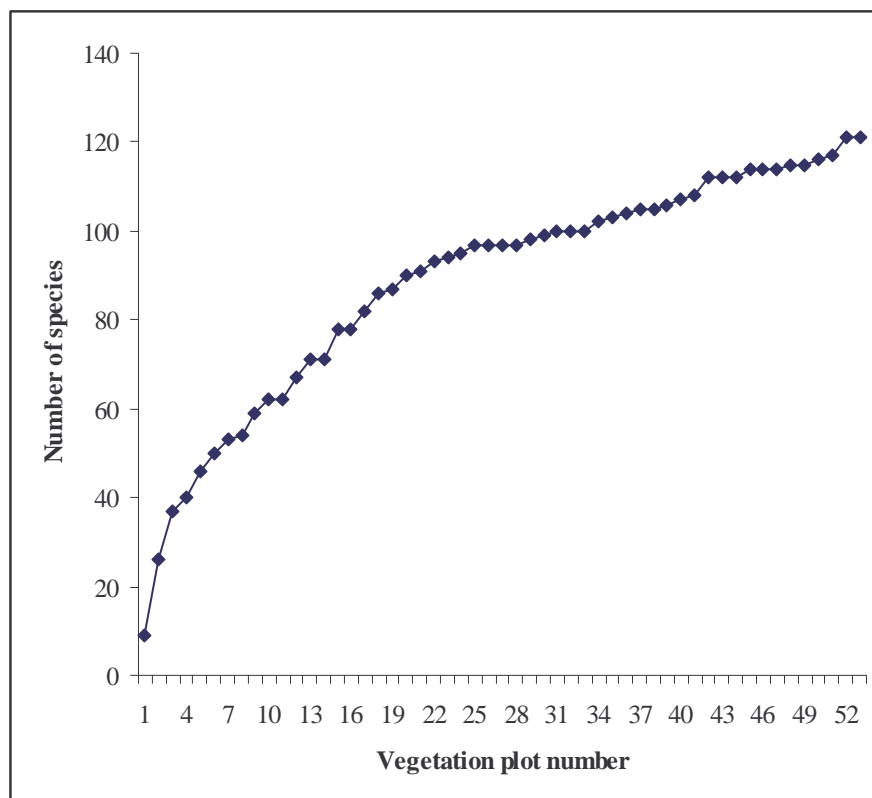


Figure 8 Species accumulation rates of recorded species by vegetation plot (trees >10 cm dbh)

Figure 8 shows the accumulation of tree and shrub species recorded in the vegetation plots. The curve has not leveled out thus there are yet more species to record within the FR, particularly herbs, epiphytes and other non woody plants which are not recorded within the vegetation plots.

4.1.1 Vegetation plots

A total of 206 species were recorded from the systematic vegetation survey within 53 vegetation plots from a total of 2643 individual trees. An average of 46.5 (standard deviation (SD) = 21) individual trees and an average of 15.5 species (SD = 5.4) were recorded within each plot. 77.2% of plots were within montane forest (1500m – 2100m asl) with 22.7% in upper montane forest (>2100m asl). 25% of vegetation plots were placed on an east aspect, 17% on a west aspect, 30% on a north aspect and 18% on a south aspect with 10% on flat areas with no aspect.

Species were ranked according to coverage and abundance and the top twelve are presented in Table 7 and Figure 9. Species coverage presents the frequency of plots the species were recorded in and species abundance relates to the number of individuals recorded as a percentage of all individuals recorded within the plots.

Table 7 Species coverage and abundance for the top twelve species within 53 vegetation plots

Family	Species	Rank species coverage ¹	No. plots present	% plots	Rank: species abundance ²	No. indivs	% indivs.
Guttiferae	<i>Garcinia volkensii</i>	1	33	62.26	1	179	7.27
Lauraceae	<i>Ocotea usambarensis</i>	2	32	60.38	5	90	3.65
Myrsinaceae	<i>Rapanea melanophloeus</i>	3	31	58.49	9	73	2.96
Euphorbiaceae	<i>Drypetes gerrardii</i>	4	26	49.06	3	116	4.71
Celastraceae	<i>Maytenus undata</i>	5	23	43.40	6	78	3.17
Flacourtiaceae	<i>Aphloia theiformis</i>	6	21	39.62	4	96	3.90
Araliaceae	<i>Schefflera umbellifera</i>	6	21	39.62	12	60	2.44
Guttiferae	<i>Allanblackia stuhlmannii</i>	8	20	37.74	2	134	5.44
Araliaceae	<i>Cussonia spicata</i>	9	17	32.08	7	76	3.09
Myrtaceae	<i>Syzygium cordatum</i>	9	17	32.08	8	74	3.00
Myrtaceae	<i>Syzygium guineense</i>	11	14	26.42	9	73	2.96
Rubiaceae	<i>Oxyanthus speciosus</i>	12	12	22.64	11	64	2.60

Top 12 ranking

Species Coverage¹: most common species recorded during systematic survey (recorded by vegetation plot 53 in total)

Species Abundance²: individuals of a species recorded during the systematic survey compared with the total number of individuals recorded (number of individual trees recorded 2,643 in total)

Garcinia volkensii was ranked first for species coverage as it was recorded in 62% of all plots and was the most commonly recorded species. It was also ranked first for species abundance representing 7% of all individual trees. Ranked second for species coverage was *Ocotea usambarensis*, a well known timber species of the Eastern Arc, recorded in 60% of all plots. Its ranking for species abundance was fifth with 4% of all individuals. It is targeted in Uluguru South for timber extraction. *Allanblackia stuhlmannii*, an important Eastern Arc endemic, was the second most abundant species with 5.5% of individuals recorded. It was not however recorded in the west of the reserve. Both *Syzygium* species (*S. cordatum* and *S. guineense*) were ranked 9th and 11th for species coverage and 8th and 9th for species abundance. These species dominated the upper montane forests of Lukwangule plateau.

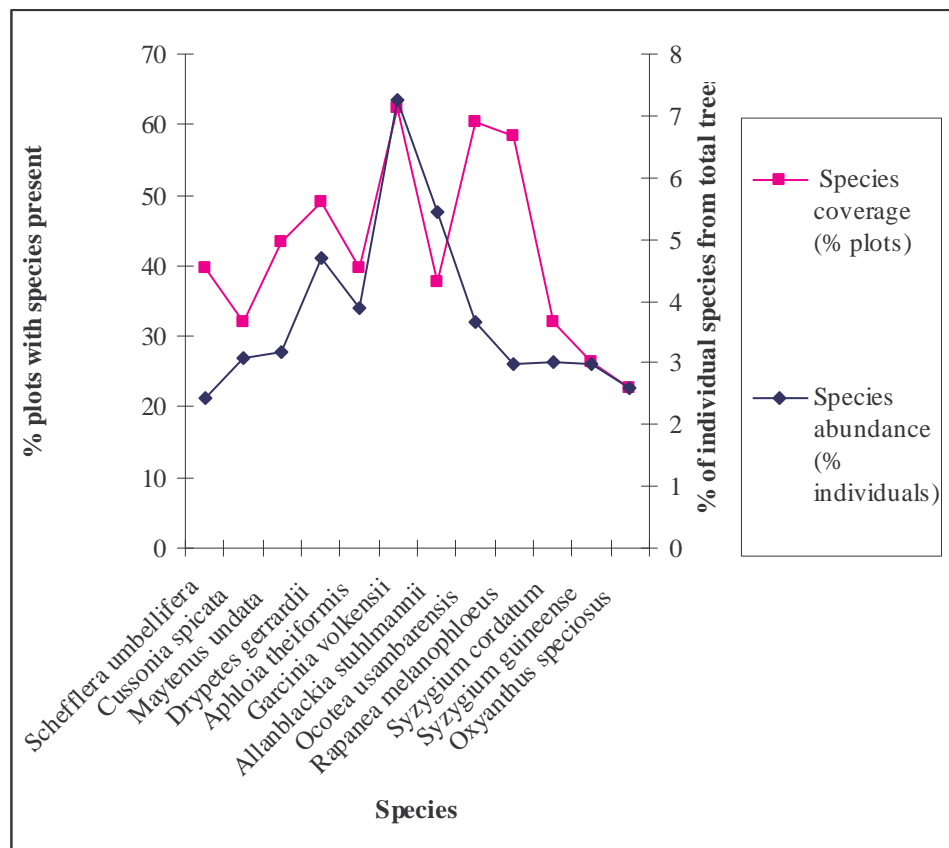


Figure 9 Species coverage and abundance for the top twelve species within vegetation plots

Species abundance differed according to aspect. The highest density was found to be in the flatter areas, either valley bottoms or ridge tops with 523 stems per hectare (ha) followed by the east slopes with 453 stems per ha and north with 364 stems per ha. Lovett et al (in press) measured east and west aspects at Lupanga in Uluguru North FR and found that the east aspect vegetation plots had higher stem densities.

4.1.2 Species composition/dominance

The characteristic species throughout the reserve varied in dominance by aspect and altitude summarised in Table 8.

Table 8 Dominant tree species by aspect and altitude

Aspect	<2000 m asl		>2000m asl	
	Tree layer	Shrub layer	Tree layer	Shrub layer
East	<i>Ocotea usambarensis</i> , <i>Allanblackia uluguruensis</i> , <i>Allanblackia stuhlmannii</i> , <i>Drypetes gerradii</i> , <i>Garcinia volkensii</i> , <i>Uvariadendron usambarense</i> , <i>Balthasaria schliebenii</i> , <i>Oxyanthus speciosus</i>	<i>Lasianthus spp</i>	<i>Schefflera spicata</i> , <i>Schefflera lukwangulensis</i> , <i>Schefflera umbellifera</i> , <i>Aphloia theiformis</i> , <i>Myrica salicifolia</i> , <i>Rapanea melanophloeos</i> , <i>Cussonia spicata</i> , <i>Maesa lanceolata</i> , <i>Syzygium</i> species	Species from families: Rubiaceae, Euphorbiaceae, Apocynaceae, Flacouritaceae but sharing dominance with Bamboo.
West	<i>Schefflera spp</i> , <i>Garcinia volkensii</i> , <i>Dovyalis abyssinica</i> , <i>Maytenus accuminata</i> , <i>Aphloia theiformis</i>	<i>Lasianthus spp</i> ; in disturbed areas <i>Rubus pinnatus</i> , <i>Rubus ablata</i> , <i>Rubus sp</i>		Species from families: Rubiaceae, Euphorbiaceae, Apocynaceae, Flacouritaceae
North	<i>Dovyalis abyssinica</i> , <i>Aphloia theiformis</i> , <i>Cussonia spicata</i> , <i>Kiggelaria africana</i> , <i>Harungana sp</i> , <i>Macaranga capensis</i> , <i>Maytenus accuminata</i>	Species from families: Rubiaceae, Euphorbiaceae, Flacourtiaceae, Apocynaceae		
South	<i>Ocotea usambarensis</i> , <i>Maytenus holstii</i> , <i>Cola usambarensis</i> , <i>Uvariadendron usambarense</i> , <i>Mimusops schliebenii</i> , <i>Myrianthus holstii</i>	Species from families: Rubiaceae, Euphorbiaceae, Sterculiaceae, Apocynaceae, Graminae		

4.1.3 Overall species richness

The highest number of species was recorded within an altitudinal range of 1600-1900m asl. This corresponds to the results of Lovett's 1981 study where he found species richness greatest at 1600m asl (Lovett et al in press). More common species were dominant, whilst higher altitude (>2000m asl) had a high species richness of endemic plants, particularly Lukwangule plateau but a lower overall species richness. Tree ferns (*Cyathea manniana*) became a more dominant species from 1700m asl, also recorded in Lovett et al (in press). With regard to aspect, the east had a higher species richness with 66 species, followed by the west with 62, flat areas (valley bottoms or ridgetops) with 54 and north and south with 52 and 44 species respectively (Appendix 8).

4.1.4 Overall species diversity

When assessing species diversity, which considers both species richness and abundance, a similar trend was found. At lower altitude (forest boundary – 2000m asl), there was a higher diversity of species with an average diversity index of 3.456. Species diversity is greatest in the western slopes of the mountains with an index score of 3.719 followed by the east and north with index scores of 3.654 and 3.601 respectively (Table 9). When considering common species and endemic species, the

diversity of endemics is greatest at high altitude (>2000m asl), in particular above Tchenzema and on Lukwangule plateau.

Table 9 Diversity indices and species richness for main species

Aspect	Diversity	Richness
East	3.654	66
West	3.719	62
South	3.293	44
North	3.601	54

Uluguru endemic species

24 plants were found to be Uluguru endemic species (Table 10). These were recorded within tree/shrubs, herbs and grasses, at 37.5%, 58.3% and 4.2% respectively. This constitutes only 17.8% of the known 135 species known within the Uluguru Mountains.

Table 10 Endemic species found within Uluguru South FR by UCBS

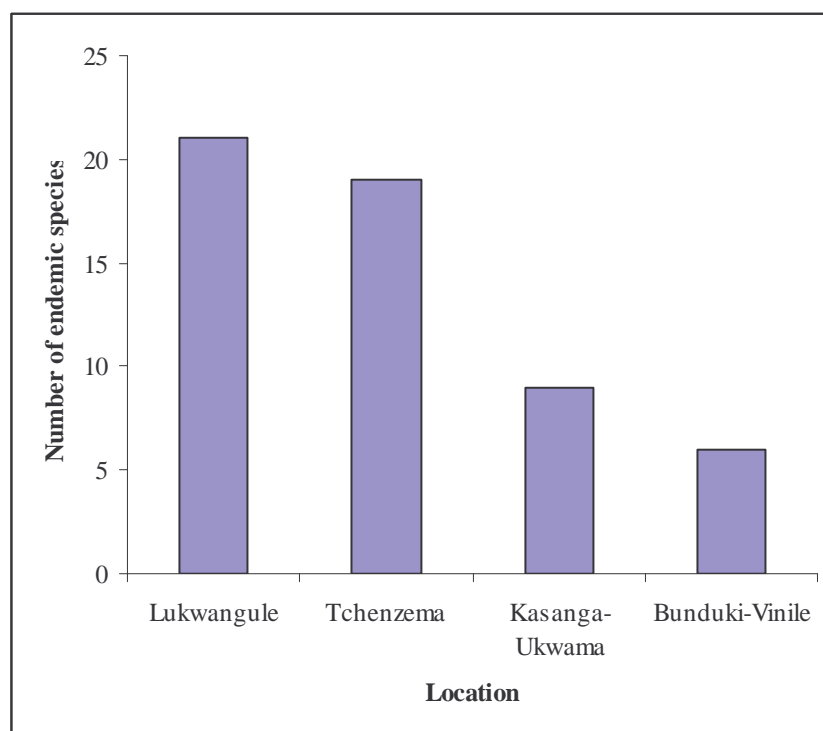
Family	Species	Altitudinal range	Distribution ^a	Life form
Acanthaceae	<i>Justicia beloperonoides</i>			Herb
Araliaceae	<i>Schefflera lukwangulensis</i>	1400 - 2600		Tree
Balsaminaceae	<i>Impatiens lukwangulensis</i>	1650-2250	Bondwa; Lukwangule plateau	Herb
Balsaminaceae	<i>Impatiens pallide-rosea</i> var. <i>pallide-rosea</i>	1600 -2500	Bunduki; Lukwangule plateau	Herb
Balsaminaceae	<i>Impatiens pseudohamata</i>	2250	Lukwangule plateau above Tchenzema	Herb
Balsaminaceae	<i>Impatiens serpens</i>	1680 - 2430	Bondwa; Lukwangule plateau; Kibungo-Mkambaku	Herb
Balsaminaceae	<i>Impatiens simbiniensis</i>	1400-1500	Bunduki; Simbini; Kihunza/Mkambaku Mt	Herb
Balsaminaceae	<i>Impatiens uluguruensis</i>	1600-2550	Bondwa; Lukwangule; Kibungo mission	Herb
Gesnariaceae	<i>Saintpaulia goetzeana</i>			Herb
Gesnariaceae	<i>Saintpaulia incospicua</i>			Herb
Gesnariaceae	<i>Streptocarpus glandulosissimus</i>	2700	U2; K1,4,7; T2,3,6,7; Rwanda, Burundi	Herb
Gesnariaceae	<i>Streptocarpus sp2</i>			Herb
Guttiferae	<i>Garcinia lukwangulensis</i>			Tree
Lobeliaceae	<i>Lobelia gilgii</i>		Lukwangule plateau	Herb
Lobeliaceae	<i>Lobelia graniticola</i>		Mkambaku Mt	Herb
Lobeliaceae	<i>Lobelia lukwangulensis</i>	0 - 1780	K1, 4, 7; T1,3,4,6-8; Z; P; Ethiopia, zimbabwe, Mozambique, Comoro Isl, Madagascar, Reunion, Brazil.	Herb
Moraceae	<i>Syzygium parvulum</i>	1100 - 2600		Shrub
Poaceae	<i>Panicum lukwangulense</i>			Grass
Rubiaceae	<i>Lasianthus grandiflorius</i>	1200 - 2040	Bondwa	Tree
Rubiaceae	<i>Lasianthus macrocalyx</i>	1200 - 2400	Bondwa; Lukwangule plateau	Tree
Rubiaceae	<i>Lasianthus microcalyx</i>	2100 - 2600	Bondwa; Lukwangule plateau	Tree
Rubiaceae	<i>Lasianthus wallacei</i>	1100 - 1900	Bondwa; Lukwangule plateau; Kinolo road	Tree
Rubiaceae	<i>Pavetta aff. sparsipila</i>		NW Uluguru; Bondwa; Bunduki	Shrub
Rubiaceae	<i>Psychotria sp 1</i>			Tree

^a Uluguru endemics distributions taken from Temu and Nsolomu (2000) and Burgess et al (2002)

Table 11 Distribution of endemic species recorded by UCBS

Site	No of family	No of genera	No of species
Lukwangule	6	9	21
Above Tchenzema	6	7	19
Kasanga – Ukwama	3	5	9
Bunduki – Vinile	2	2	6

Abundance of endemic species was greatest at higher altitude on Lukwangule plateau with 21 species. This constitutes 63.6% of the endemics, with 57.5% recorded above Tchenzema (>1800m asl) and only 27% recorded from below 1800m asl (Table 11 and Figure 10). The family Rubiaceae had the greatest abundance of endemic species, followed by Balsaminaceae, Fabaceae, Melastomataceae, Lobeliaceae and Euphorbiaceae. At genus level, the most abundant species are found in *Impatiens*, followed by *Psychotria*, *Saintpaulia* and *Streptocarpus*.

**Figure 10** Distribution of endemic species by location

4.1.6 Eastern Arc endemic and near endemic species

34 species were recorded as Eastern Arc endemic and near endemic (Table 12). For Eastern Arc endemics and near endemics 70.6% were recorded for tree/shrubs and 29.4% recorded for herbs.

The distribution patterns for Eastern Arc endemics and near endemics were similar to the endemic species in that Lukwangule plateau has higher species richness. Most of these species were recorded by casual observation/collections.

Table 12 Eastern Arc endemic and near endemic species recorded within Uluguru South FR by UCBS

Family	Species	Altitudinal range	Distribution	Life form
Acanthaceae	<i>Isoglossa lactea</i>	250 - 800	T6;	Herb
Acanthaceae	<i>Justicia interrupta</i>	810-1530	T2,6;	Herb
Anacardiaceae	<i>Sorindeia madagascariensis</i>	1 - 1830	K4,7; T2,3,5-8; P;Z; Malawi, Mozambique and Mascarene Islands	Tree
Annonaceae	<i>Uvariadendron usambarense</i>	1230 - 2100		Tree
Araceae	<i>Amorphophallus stuhlmannii</i>	0 - 1400 m	T3, 6; not known elsewhere.	Herb
Balsaminaceae	<i>Impatiens hamata</i>	1350-2220		Herb
Ebenaceae	<i>Diospyros sp</i>	1500- 1900		Tree
Euphorbiaceae	<i>Euphorbia quadrialata</i>	400 - 1300	T3, 6; not known elsewhere.	Tree
Guttiferae	<i>Allanblackia stuhlmannii</i>	540 - 2100	T3,T7	Tree
Guttiferae	<i>Allanblackia uluguruensis</i>	750 - 2300		Tree
Liliaceae	<i>Aloe bussei</i>	580 - 1500	T5-7;	Herb
Melastomataceae	<i>Dissotis polyacantha</i>			Herb
Moraceae	<i>Dorstenia dionga</i>	0 - 1300	U2,4; K7; T3,6,7; extending to Angola and Cameroun , also in W. Africa.	Herb
Moraceae	<i>Dorstenia goetzi</i>			Herb
Moraceae	<i>Dorstenia hildebrandtii</i>	0 - 2100	U2-4; K1-7; T1-7; Zaire, Rwanda, Burundi, Mozambique	Herb
Moraceae	<i>Dorstenia schliebenii</i>	300 - 2000	T 6-8; Malawi	Herb
Moraceae	<i>Mesogyne insignis</i>	500 - 1300	T3,6; S. Tome	Shrub
Rubiaceae	<i>Chassalia discolor</i>	1200 - 1900		Shrub
Rubiaceae	<i>Coffea pseudozanguebaricae</i>			Tree
Rubiaceae	<i>Lasianthus kilimandcharicus</i>	1000-2300	T6; not known elsewhere	Shrub
Rubiaceae	<i>Pavetta crebilibolia var crebilibolia</i>	950 -1900		Shrub
Rubiaceae	<i>Psychotria brucei</i>	300-1000	T3, T6; not known elsewhere	Herb
Rubiaceae	<i>Psychotria goetzei</i>	1100 - 1800		Shrub
Rubiaceae	<i>Psychotria megalopus</i>	1140 - 1850	T6; T7	Tree
Rubiaceae	<i>Psychotria schliebenii</i>	0 - 2000		Shrub
Rubiaceae	<i>Rytigynia lichenoxenos</i>	950 - 1830	K7; T3,6; not known elsewhere	Shrub
Rubiaceae	<i>Tricalysia pedicellata</i>	300 - 700	T6; not known elsewhere.	Shrub
Sterculiaceae	<i>Cola clavata</i>		T2,3,5;	Tree
Sterculiaceae	<i>Cola greenwayi</i>	1050 - 2300	U2,4; T3,4,8; Rwanda, Burundi	Tree
Sterculiaceae	<i>Cola scheffleri</i>	100 - 750	K7; T6,8; Z;	Tree
Sterculiaceae	<i>Cola usambarensis</i>			Tree
Sterculiaceae	<i>Dombeya shupangae</i>	600	T2,3,4; Madagascar	Tree
Sterculiaceae	<i>Leptonychia usambarensis</i>			Tree
Zamiaceae	<i>Encephalartos hildebrandtii</i>	0 - 600	U2; K7; T3,6; Z;	Tree

Eastern Arc endemics from Iversen 1991b and FTEA

4.1.5 Species listed by IUCN/CITES as threatened and species listed as rare by LEAP

Six species making 2.2% of total species were found to be rare, which is defined by the LEAP database as found in less than two of eight vegetation regions of Tanzania (Table 13). *Allophyllus abssinica* was actually recorded as a common species in Uluguru South, particularly in the north-west despite overall categorisation as rare.

19 species (6.8%) were recorded as being vulnerable to extinction with two species CITES II regulated and one species CITES I regulated. The distribution of the species was localised as most species were recorded through opportunistic collections.

Table 13 Species listed as threatened or rare found within Uluguru South FR by UCBS

Family	Species	Altitudinal range	Life form	Species listed as IUCN threatened	Species listed as CITES threatened	Rare species as defined by LEAP
Annonaceae	<i>Uvariadendron usambarense</i>	1230 - 2100	Tree	Vulnerable		
Araliaceae	<i>Schefflera lukwangulensis</i>	1400 – 2600	Tree	Vulnerable		
Euphorbiaceae	<i>Drypetes gerrardinoides</i>	1500 - 2100	Tree	Vulnerable		
Euphorbiaceae	<i>Drypetes natalensis</i>	15 - 1500	Tree	Vulnerable		
Guttiferae	<i>Allanblackia stuhlmannii</i>	540 - 2100	Tree	Vulnerable		
Guttiferae	<i>Allanblackia uluguruensis</i>	750 - 2300	Tree	Vulnerable		
Leguminosae	<i>Millettia usaramensis</i>	10 - 700 (1200)	Tree	Vulnerable		
Liliaceae	<i>Aloe bussei</i>	580 - 1500	Herb		CITES II	
Moraceae	<i>Mesogyne insignis</i>	500 - 1300	Shrub	Vulnerable		
Rosaceae	<i>Prunus africana</i>	1500 - 2600	Tree		CITES II	
Rubiaceae	<i>Coffea pseudozanguebaricae</i>		Tree	Vulnerable		
Rubiaceae	<i>Lasianthus grandiflorius</i>	1200 - 2040	Tree	Vulnerable		
Rubiaceae	<i>Lasianthus wallacei</i>	1100 - 1900	Tree	Vulnerable		
Rubiaceae	<i>Pavetta aff. sparsipila</i>		Shrub	Vulnerable		
Rubiaceae	<i>Psychotria brucei</i>	300 - 1000	Herb			R
Rubiaceae	<i>Psychotria goetzei</i>	1100 - 1800	Shrub	Vulnerable		
Rubiaceae	<i>Psychotria megalopus</i>	1140 - 1850	Tree	Vulnerable		
Rubiaceae	<i>Psychotria schliebenii</i>	0 - 2000	Shrub			R
Rubiaceae	<i>Rytigynia bogoyensis</i>		Tree	Vulnerable		
Rubiaceae	<i>Rytigynia lichenoxenos</i>	950 - 1830	Shrub	Vulnerable		R
Rubiaceae	<i>Tricalysia ovalifolia</i>	0 - 1000	Shrub	Vulnerable		
Rubiaceae	<i>Tricalysia pedicellata</i>	300 - 700	Shrub	Vulnerable		
Rutaceae	<i>Zanthoxylum gillettii</i>	1700	Shrub			R
Sapindaceae	<i>Allophyllus abyssinica</i>	1400-2100	Tree			R
Sterculiaceae	<i>Cola scheffleri</i>	100 - 750	Tree	Vulnerable		
Theaceae	<i>Balthasaria schliebenii</i>	1300 - 1900	Shrub			R
Zamiaceae	<i>Encephalartos hildebrandtii</i>	0 - 600	Tree		CITES I	

b Vu = Vulnerable to extinction as listed by IUCN, CITES I represent s a ban on trade of species, whilst CITES II regulates any trade. R = Rare species as defined by LEAP

4.1.8 Invasive species

Two genera were noted to be invasive in terms of their ability to outcompete the indigenous species; *Rubus*, the bramble, and *Maesopsis eminii*. The brambles were identified as *Rubus pinnatus*, *R. albata* and *Rubus* sp. These are not known to be native to Tanzania; they could be from South Africa (Pers comm Frank Mbago, UDSM). These species prefer less moist areas particularly around Tchenzema, Lukwangule plateau and Bunduki. The spread of *Rubus* was found to hinder forest generation as the seedlings of canopy and sub-canopy trees were missing in the areas in which *Rubus* was observed. Two individual trees of *M. eminii* were seen on the east side above Nyingwa village to Kihunza foot path and around the Bunduki area. *M. eminii* was also located in Uluguru North FR at forest edge at Tegetero and within the forest at Kinole.

4.1.9 Uses of trees

Various tree species were noted by the botanist through casual observations and informal discussions with the local populous to have been used by local villagers for a variety of purposes (Table 14):

Table 14 List of tree species observed to be used by people, recorded by UCBS botanist

Family	Species	Uses			
		Building material	Firewood	Medicine	Tools
Lauraceae	<i>Ocotea usambarensis</i>	x		x	
Berberidaceae	<i>Berberis holstii</i>			x	
Flacourtiaceae	<i>Aphloia theiformis</i>	x			x
Myricaceae	<i>Myrica salicifolia</i>		x	x	
Celastraceae	<i>Maytenus undata</i>		x		
Euphorbiaceae	<i>Drypetes gerrardii</i>	x	x		
Euphorbiaceae	<i>Macaranga capensis</i>		x		
Piperaceae	<i>Piper capense</i>			x	
Ebenaceae	<i>Diospyros sp</i>			x	
Graminae	<i>Sinarundinalia alpina</i>	x			x
Cyatheaceae	<i>Cyathea maniana</i>	x			
Begoniaceae	<i>Begonia oxylooba</i>			x	
Flacourtiaceae	<i>Dovylis abyssinica</i>		x		
Sapindaceae	<i>Allophylus abyssinica</i>		x		x
Myrsinaceae	<i>Maesa lanceolata</i>		x		
Podocarpaceae	<i>Podocarpus latifolius</i>	x			
Guttiferae	<i>Allanblackia uluguruensis</i>			x	
Leguminosae	<i>Newtonia buchananii</i>	x			
Moraceae	<i>Myrianthus holstii</i>		x		
Guttiferae	<i>Garcinia volkensii</i>	x			
Dracaenaceae	<i>Dracaena afromontana</i>				x
Myrsinaceae	<i>Rapanea melanophloeos</i>	x	x		x

4.2 Fauna

UCBS recorded 152 faunal species within 62 families in Uluguru South forest reserve (Table 15), an addition of 35 species (18%) to the total known fauna for this FR (those species highlighted in Appendix 9, Appendix 10, Appendix 11 and Appendix 12). 16% of the total species are endemic to the Uluguru Mountains and Eastern Arc Mountains, whilst another 11% are near endemic. 10% of species are threatened and/or trade restricted, recognised either by IUCN and/or CITES. 37.5 % of species are strictly forest dependent / associated (see definitions under Table 15). Of the total species number, 62% are birds and 20% mammal species. Amphibians and reptiles have lower species richness at 14% and 4% respectively. This may reflect previous research focusing on specific taxa, such as avifauna. It is clear that this FR has extremely high biodiversity value, particularly with regard to small fauna.

Table 15 provides a break-down of the 152 total species recorded in the Uluguru South FR. Species have been split into widespread species, Uluguru endemics, Eastern Arc endemics and Eastern Arc near endemics; these categories are mutually exclusive and represent accumulatively the full species list from this study. Data representing the IUCN and CITES listed species and forest dependant species are with regards to the total 152 species, these data are not mutually exclusive.

Table 15 A summary of fauna recorded in Uluguru South Forest Reserve by UCBS (Appendices 9-12 give full species lists of all known fauna in Uluguru South FR)

Taxa	Number of families	Number of species ^b	No. of wide-spread species	No. of Uluguru endemic species (sub-species)	No. of Eastern Arc endemic species ^c (sub-species)	No. of Eastern Arc near endemics ^d	No. Species listed as IUCN threatened ^e	No. Species listed as CITES threatened ^f	No. forest dependent species ^g
Mammals	17	30	23	1 (1)	2	4	6	4	6
Birds ^a	36	94	82	2 (4)	2 (1)	9	4	8	37
Reptiles	3	6	0	0 (1)	4	1	0	2	4
Amphibians	6	22	12	3	4	3	6	1	10
Total	62	152	111	12	12	17	16	15	57
% total of species			73	8	8	11	10.5	10	37.5

a Includes those birds seen on the forest edge

b Includes all opportunistic observations together with those from systematic survey work

c Those are species that are found in the Eastern Arc mountains only

d Those are species that are found in the Eastern Arc mountains, Coastal forest and other adjacent locations e.g. Southern Highlands, N. Malawi/Mozambique, S. Kenya

e Those species are threatened with extinction by varying degrees, such as Endangered, Vulnerable, Near threatened

f Those species that have restrictions on trade, such as Cites I and II

g Those species dependent and associated with primary forest, not forest edge or secondary forest

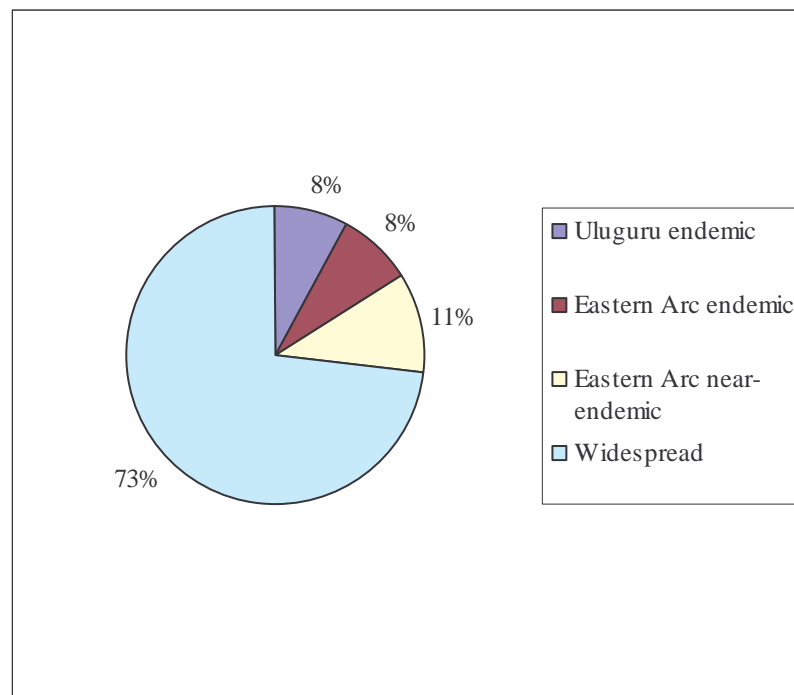


Figure 11 Percentage of faunal species that are widespread or endemic

4.2.1 Mammals

Although the identification of most species is certain, those species that were captured remain tentative whilst awaiting taxonomic verifications (i.e. all small mammals, including bats) and some of the dung found could only be identified to genus. All taxonomy and nomenclature follows that of Kingdon (1997). Preliminary identifications based on biometric data were made by Dr Bill Stanley for shrews; these await confirmation by skull and dentition analysis.

4.2.1.1 Species richness

During this survey 30 mammal species representing 17 families were recorded in the reserve (Appendix 9). Of these 7% are Uluguru endemics, 7% are Eastern Arc endemics, 13% are near endemic to the Eastern Arc and approximately 33% of species are threatened to varying degrees by extinction (IUCN and CITES listed). Uluguru South FR has more small fauna species than large fauna (87% of total mammal species recorded by UCBS) (40cm head-body and smaller), with large fauna low in species number and abundance.

4.2.1.2 General/species abundance

Overall abundance of large fauna is low within Uluguru South FR. Of the larger mammals recorded by UCBS most were by indirect observation, such as vocalisations and spoor. The most common directly observed large mammals were the Black and white colobus (*Colobus angolensis*) and the Blue monkey (*Cercopithecus mitis*) (nine times in 13 weeks and four times in 13 weeks, respectively) (Figure 12). Blue monkey were recorded more frequently at the forest edge, where they are known as crop raiding pests. Black and white colobus were more commonly seen in the interior of the forest. Abundance of each in terms of observations was less than Uluguru North FR. Vocalisations of the Tree hyrax (*Dendrohyrax validus*) and the Mountain galago (*Galagoides orinus*) were heard at all camp sites. Uluguru South and North FRs have been shown to have significant *Galagoides orinus* populations, estimated 23,000 (Perkin 2000). Dung and stomach contents of the Tree hyrax were found on a rock by the river near basecamp one. Urine and dung of hyrax can also be used to make gunpowder (pers comm Dr Hartley), although it is not known if this occurs within Uluguru South FR. Hunting pressure is severe in Uluguru South.

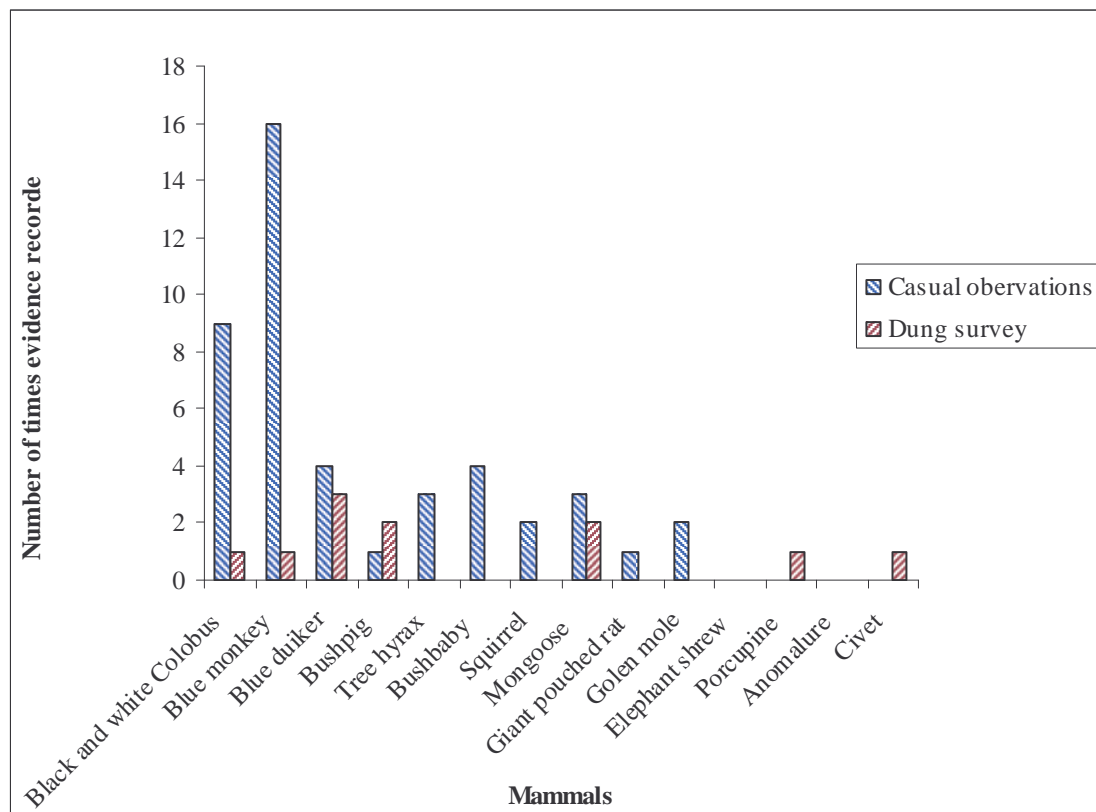


Figure 12 Number of times evidence recorded for both casual observations and dung surveys of large mammals along 27.9km of transect

Spoor of Bushpig (*Potamochoerus larvatus*), Blue duiker (*Cephalophus monticola*), Water Mongoose (*Atilax paludinosus*) and Slender mongoose (*Herpestes sangiunea*) were found throughout the reserve, with one observation of a Slender mongoose caught in a trap at basecamp one near Ukwama and a Blue duiker killed by a snare trap near Tchenzema. No signs were observed of large carnivores. Abbot's duiker (*Cephalophus spadix*) was not directly recorded by UCBS; evidence of its presence was ascertained by talking with villagers. Stuhlmann's golden mole (*Chrysochloris stuhlmanni tropicalis*) was recorded indirectly using evidence of mole hills on Lukwangule plateau. This has not been recorded since Swynnerton and Hayman (1950).

Some signs of domestic animals were recorded within the reserve. One pig was tied up next to a stream a few hundred metres into the reserve near Nyingwa. The owner was encountered and a discussion took place in which UCBS told him he should remove the animal as it was illegal to keep it within the reserve and it was starving to death. It was later known that the pig died. Two pigs and owners were seen walking from Lumba juu to Nyingwa using the path through the forest reserve. Dogs accompanying people were seen and heard on the west of the reserve.

Of the small mammals, zoological trapping resulted in captures of 16 species within seven families, including bats. 32 rodent specimens were taken from 213 captures (excluding recaptures) from 3,787 Sherman trapping nights. Common species found were; Soft-furred rat (*Praomys sp*), African wood mouse (*Hylomyscus denniae*) and Brush-furred mouse (*Lophuromys flavopunctatus*). UCBS also recorded the Lesser pouched rat (*Beamys hindei*) and the Climbing mouse (*Dendromus mesomelas*).

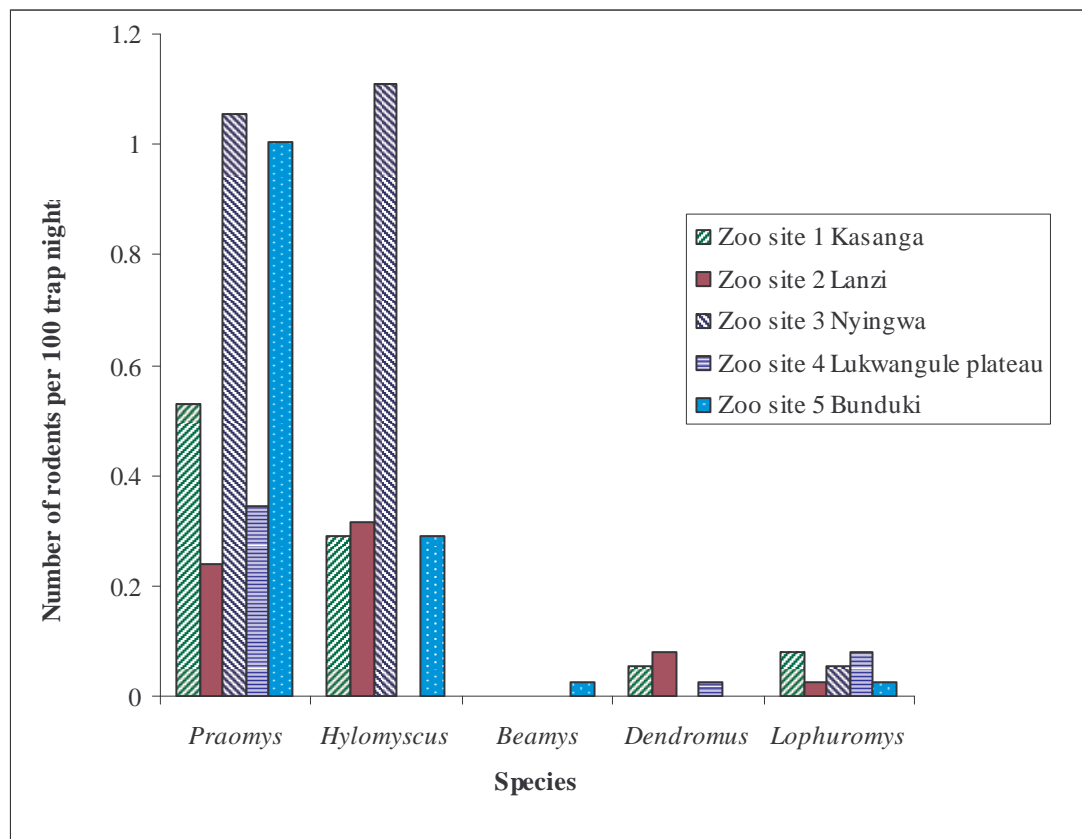


Figure 13 shows relative abundance of rodent captures at each site (rodent numbers per 100 trap night)

Relative abundance of *Praomys* and *Hylomyscus* was high, such that they dominated all trapsites (Figure 13). Abundance of *Praomys* was particularly high at trapsites three and five (with 1.05 and 1.0 animals per 100 trap night respectively), although *Hylomyscus* had a marginally higher abundance at zoological site three (1.1 animal per 100 trap night). Zoological site three was montane forest with bamboo at 2000m asl and zoological site five was submontane forest at 1660m asl; both undisturbed forest. *Hylomyscus* was not recorded at zoological site four, which was 2400m asl on Lukwangule plateau. Abundance was generally low in rodents at this site, with only *Praomy*, *Dendromus* and *Lophuromys* recorded. *Lophuromys* was recorded in low abundance at every trapsite (0.02-0.08 animals per 100 trap night), whilst *Dendromus* was present at sites one, two and four; again in low abundance (0.03-0.08 animals per 100 trap night). *Lophuromys* relies on moisture and grass making it hard to survive under closed canopy forest. It is more active during the daytime than other rodents and this may also account for low capture numbers. *Dendromus* is very well adapted for climbing making it hard to capture within terrestrial Sherman traps, although some traps were placed within trees.

Only one *Beamys* was recorded by UCBS at zoological site five, which was surprising as this genus is a relic species of the Eastern Arc Mountains and it was expected to capture greater numbers. However it is known to be very trap-shy and this may explain the absence at trapsites.

Of the shrews, zoological trapping resulted in captures of seven species within one family. 36 specimens were taken from 104 captures in 1320 bucket pitfall trapping nights. *Sylvisorex howelli* was generally abundant at all sites, except site two, with overall dominance in zoological site three (0.98 shrews per 100 bucket pitfall trap night) (Figure 14). This species is an Eastern Arc endemic, thus such high abundance of this species highlights the Uluguru Mountains as an important conservation area for it. *Crocidura nana/elongius* was also abundant at zoological sites three, four and five (0.8, 0.6 and 0.9 shrews per 100 bucket pitfall trap night, respectively). *Myosorex* sp. was

also abundant at zoological site three. Interestingly the presence of *M. geata* was at different sites to *Myosorex* sp. *Myosorex geata* was recorded in the north east and north of the reserve whilst *Myosorex* sp. was recorded in the three other zoological sites south east and west in the reserve. *S. megalura* was most commonly captured at zoological site four (0.5 shrew per 100 bucket pitfall trap night), with low capture numbers at both trapsites two and three. *Crocidura hirta* was present at all sites except zoological site one, with highest abundance at zoological site five (0.6 shrew per 100 bucket pitfall trap night). Within the trapsites, zoological site three had highest abundance of shrews overall and the greatest number of species captured at six.

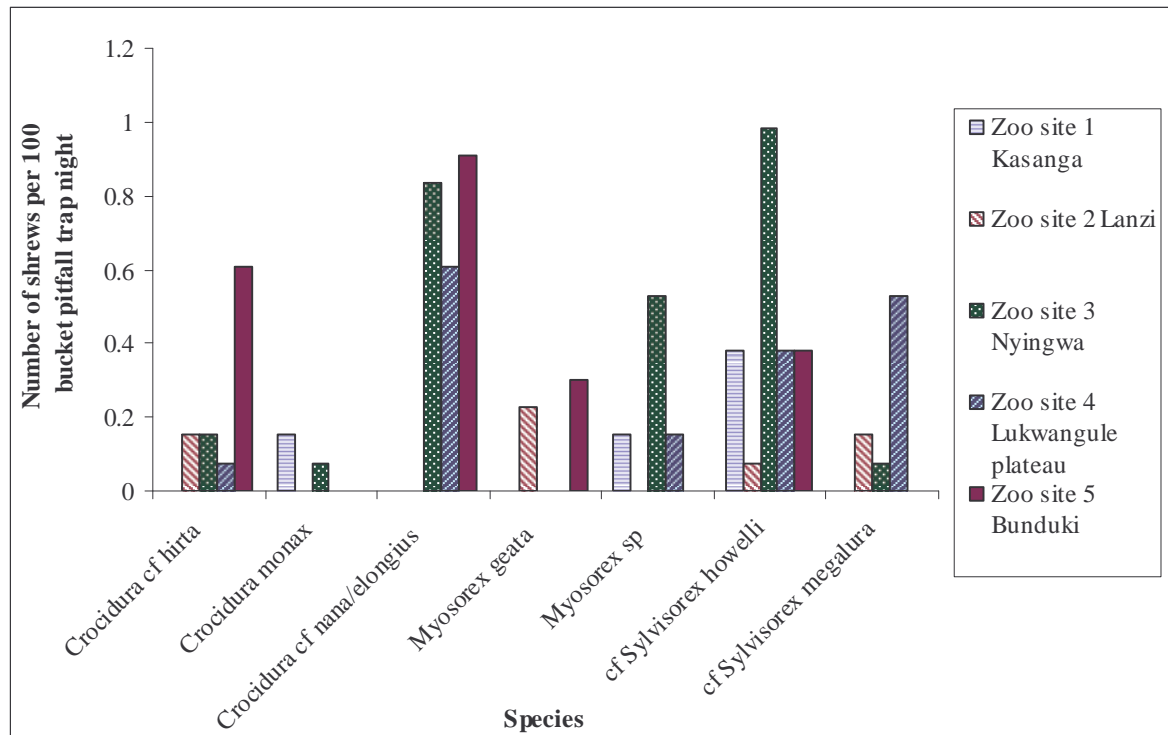


Figure 14 Relative abundance of shrews at each zoological trapping site (number of shrews per 100 bucket pitfall trap night)

Four bats species were captured from ten individuals within three families during 188 mist-net hours; Mountain fruitbat (*Stenonycteris lanosus*), Horseshoe bats (*Rhinolophus clivosus/fumigatus* and *R. darlingi*) and Pipistrelle bat (*Pipistrellus nanus*). Abundance was low for all species and this may be attributed in part to low sampling intensity.

4.1.1.3 Endemics

One species and one subspecies strictly endemic to the Uluguru Mountains were recorded: Mouse shrew (*Myosorex geata*) and Stuhlmann's golden mole (*Chrysochloris stuhlmanni tropicalis*), respectively. The Golden mole was last recorded by Swynnerton and Hayman in 1950.

There are two other species that are strictly endemic to the Eastern Arc Mountains: Climbing shrew (*Sylvisorex howelli*) and the Mountain galago (*Galagoides orinus*). *S. howelli* is found in Northern and Central Eastern Arc ranges; West and East Usambaras, Nguru, Nguu, Uluguru and Ukaguru.

4.1.1.4 Near endemics

UCBS recorded four Eastern Arc near endemic species in Uluguru South FR (Table 16).

Table 16 Near endemic mammal species of the Eastern Arc Mountains found by UCBS

Species	Common name	Range
<i>Beamys hindei</i>	Lesser pouched rat	Usambara, Uluguru, Udzungwa, Nguru, Pare, Coastal forest and Southern rift
<i>Crocidura monax</i>	White-toothed shrew	Eastern Arc, Kilimanjaro and one other site.
<i>Dendrohyrax validus</i>	Tree hyrax	Eastern Arc, Coastal forests, Kilimanjaro
<i>Rhynchocyon petersi</i>	Zanj elephant shrew	S. Pare, Usambara, Uluguru, Nguru?, Coastal Forests

4.1.1.5 Threatened species

UCBS recorded six species categorised as threatened by IUCN and four CITES listed species (Table 17).

Table 17 IUCN and CITES listed mammals of the Uluguru South FR found by UCBS

Species	Common name	IUCN	CITES
<i>Beamys hindei</i>	Lesser pouched rat	Vulnerable	
<i>Cephalophus monticola</i>	Blue duiker		II
<i>Cercopithecus mitis</i>	Gentle monkey		II
<i>Colobus angolensis</i>	Angola pied colobus		II
<i>Crocidura monax</i>	White-toothed shrew	Vulnerable	
<i>Dendrohyrax validus</i>	Tree hyrax	Vulnerable	
<i>Galagoides orinus</i>	Usambara galago		II
<i>Myosorex geata</i>	Mouse shrew	Endangered	
<i>Rhynchocyon petersi</i>	Zanj elephant shrew	Endangered	
cf. <i>Sylvisorex howelli</i>	Climbing shrew	Vulnerable	

Important to note are seven threatened species that are known from Uluguru North FR by from previous research but were not recorded by UCBS: Abbot's duiker (*Cephalophus spadix*), Leopard (*Panthera pardus*), Serval cat (*Leptailurus serval*), African clawless otter (*Aonyx capensis*), Red bellied coastal squirrel (*Paraxerus palliatus*), Small-eared galago (*Otolemur garnettii*) and White-toothed shrew (*Crocidura telfordi*).

4.1.1.6 Forest dependent species

UCBS recorded eight forest dependent species (Table 18).

Table 18 Forest dependent mammal species of the Uluguru South FR found by UCBS

Species	Common name
<i>Cephalophus monticola</i>	Blue duiker
<i>Colobus angolensis</i>	Black and white colobus
<i>Crocidura monax</i>	White-toothed shrew
<i>Dendrohyrax validus</i>	Tree hyrax
<i>Galagoides orinus</i>	Usambara galago
<i>Myosorex geata</i>	Mouse shrew
<i>Paraxerus lucifer</i>	Tanganyika mountain squirrel
cf. <i>Sylvisorex howelli</i>	Climbing shrew

4.1.1.7 UCBS new records for Uluguru South

UCBS listed an additional six species to the list compiled by Doggart et al (2005) of mammal recorded in Uluguru South FR (Table 19). This may reflect in some cases the lack of intensive species specific research conducted within Uluguru South, thus most species are common and their presence would be expected in the area.

Table 19 New records of mammal species recorded in the Uluguru South FR by UCBS

Species	Common name	Range
<i>Beamys hindei</i>	Lesse pouched rat	Usambara, Uluguru, Udzungwa, Nguru, Pare, Coastal forest and Southern rift
<i>Crocidura cf. nana/elongius</i>	White-toothed shrew	
<i>Herpestes sanguinea</i>	Slender mongoose	Widespread
<i>Hylomyscus denniae</i>	African wood mouse	Widespread
<i>Myosorex sp</i>	Mouse shrew	
<i>Paraxerus flavovittis</i>	Striped bush squirrel	Widespread

4.2.2 Birds

All taxonomy and nomenclature follows that of Stevenson and Fanshawe (2002). Identifications await confirmation by Professor J. Fjeldså in Copenhagen.

4.2.2.1 Species richness

This survey recorded 94 species of birds representing 36 families in Uluguru South FR (Appendix 10) during mist netting by the ornithologist and casual observations by the ornithologist and field team. 519 birds were captured during mist netting with: 119 birds caught at basecamp three, 47 at satellite camp three, 129 at basecamp four and 224 at basecamp five. Basecamp four had the highest species richness with 23 species, followed by basecamp five with 19 species. Basecamp three and satellite camp three had 15 and 12 species netted respectively. Both sites four and five also had the highest species richness when assessing endemic (Uluguru and Eastern Arc) species, seven and six species respectively. 6% of species were endemic to the Uluguru Mountains, 3% endemic and 3% near endemic to the Eastern Arc mountains. 9% of species were threatened to extinction and 40% were forest dependent.

4.2.2.2 General/species abundance

Within 28,400 mist net metre hours, 70 skins, 218 DNA samples and two skeletons were taken (Appendix 10d). A total of 519 birds were captured in mist nets: 119 at basecamp three, 47 at satellite camp three, 129 at basecamp four and 224 at basecamp five (Appendix 10e). Relative abundance was calculated correcting for different survey effort at each site (Figure 15).

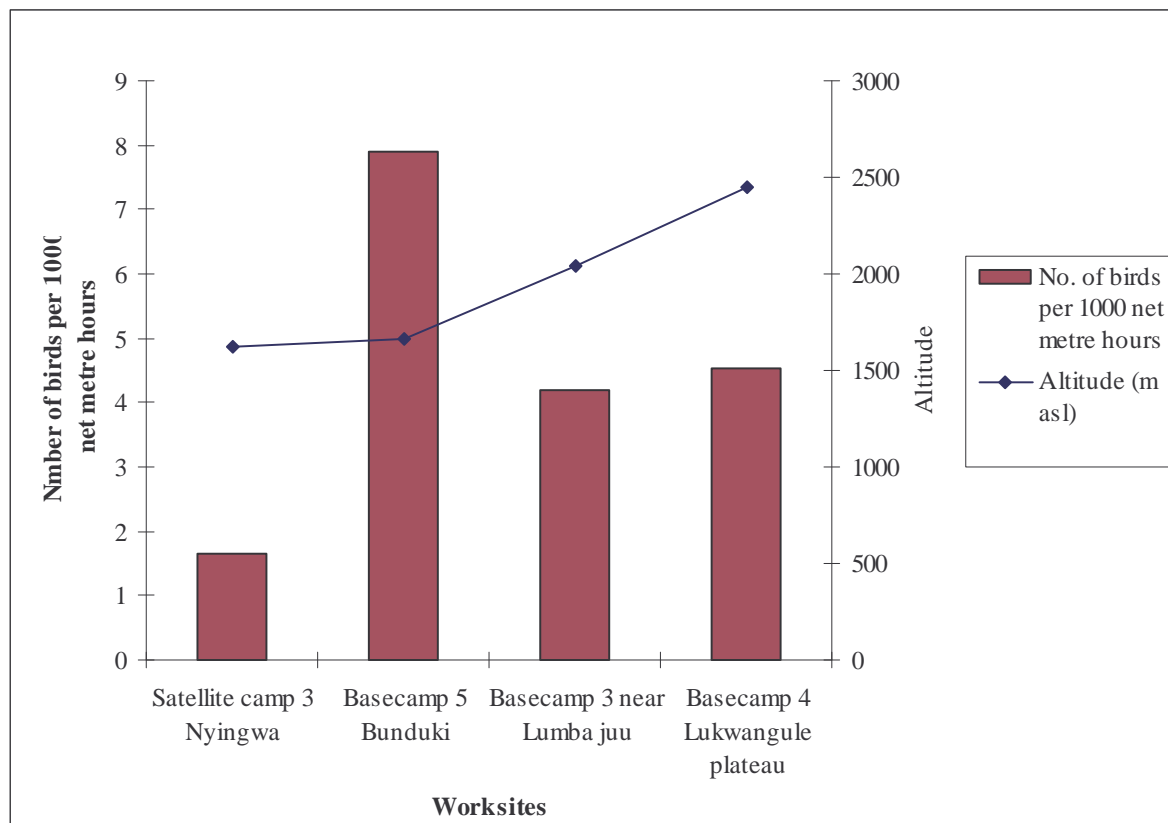


Figure 15 Relative abundance at sites compared with altitude (number of birds per 1000 net metre hours)

The greatest overall abundance of birds for systematic mist netting work (i.e. those bird species inhabiting lower and mid canopy forest) was found at basecamp five (8 bird per 1000 net metre hours), a camp in the northern end of the forest. Abundance of birds was similar at basecamp three and basecamp four (4.0 and 4.5 birds per 1000 net metre hours) with abundance of birds lowest at satellite camp three (1.6 birds per 1000 net metre hours).

The most common birds in absolute number and those of conservation interest such as endemic/near endemic and threatened species were selected to calculate relative abundance per site (Figure 16). The most abundant bird captured was the Forest batis (*Batis mixta*) at basecamp five (3.1 birds per 1000 net metre hours). It was also recorded in lower abundance from all other sites. For general abundance throughout the reserve, Loveridge's sunbird (*Nectarini loveridgei*), an Uluguru endemic, was common at all sites, particularly from basecamp three (1.5 birds per 1000 net metre hours). Loveridge's sunbird is known from altitudes between 800-2000m asl, mainly above 1500m asl (Stevenson and Fanshawe, 2002).

Three birds were found in low abundance at all sites, Bar-throated apalis (*Apalis thoracia uluguru*), an Uluguru endemic subspecies, the White-starred robin (*Pogonocichla stellata*) and the Spot-throat (*Modulatrix strctigula*), a near endemic to the Eastern Arc. The Little greenbul (*Andropadus virens*) and the Uluguru endemic subspecies Sharpe's akalat (*Sheppardia sharpei bangsi*) were both present in low abundance at basecamp five only. The Brown woodland warbler (*Phylloscopus umbrovirens fugglescouchmani*), an Uluguru endemic subspecies, and the Usambara nightjar (*Caprimulgus guttifer*), near endemic to the Eastern Arc mountains were present in low abundance at basecamp four only. The Usambara nightjar (*Caprimulgus guttifer*) was recorded at Lukwangule plateau. This may prove to be a subspecies of the population in the Usambaras. DNA samples will help to verify this.

Both the endemic Uluguru mountain greenbul (*Andropadus neumanni*) and the Eastern Arc endemic Mrs Moreau's warbler (*Bathmocercus winifredae*) were present in low abundance at basecamps four and five. The Uluguru population of Mrs Moreau's warbler is the largest of its limited range.

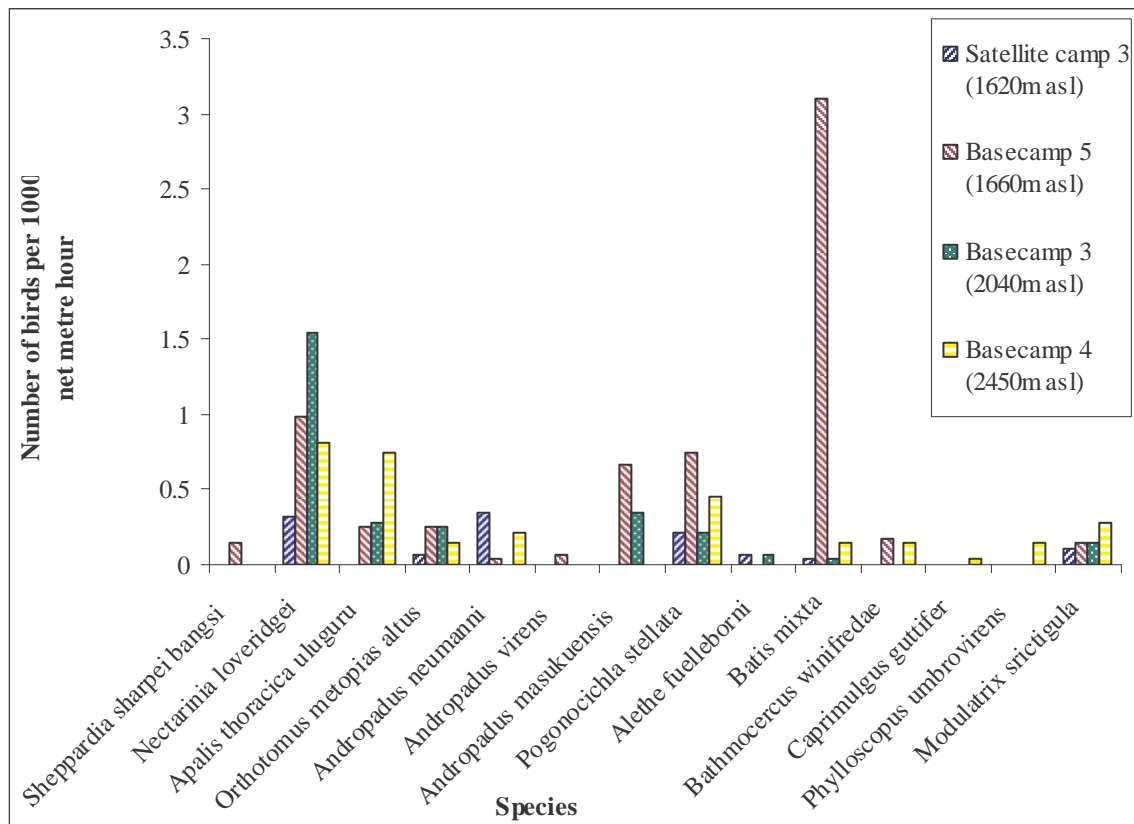


Figure 16 Relative abundance of selected birds at each netting site (number of birds per 1000 net metre hours)

Additionally, of particular note was the record of the Tanzanian mountain weaver (*Ploceus nicolli*) by the ornithologist at the forest edge at Lanzi, approximately 1800m asl; this is a rare and endangered species.

4.2.2.3 Endemics

Two species and four subspecies strictly endemic to the Uluguru Mountains were recorded in Uluguru South: Loveridge's sunbird (*Nectarinia loveridgei*), Uluguru mountain greenbul (*Andropadus neumanni*), Brown woodland warbler (*Phylloscopus umbrovirens fugglescouchmani*), Bar-throated apalis (*Apalis thoracica uluguru*), African tailorbird (*Orthotomus metopias altus*) and Sharpe's akalat (*Sheppardia sharpei bangsi*).

Two other species are strictly endemic to the Eastern Arc mountains: Usambara weaver (*Ploceus nicolli*) and Mrs Moreau's warbler (*Bathmocercus winifredae*), located in Ukagurus, Ulugurus, Rubehos and Udzungwas. One subspecies is strictly Eastern Arc endemic, limited to the Ulugurus and Udzungwas: White-winged apalis (*Apalis chariessa macpharsoni*).

4.2.2.4 Near endemics

UCBS recorded nine Eastern Arc near endemic species in Uluguru South FR (Table 20).

Table 20 Near endemic bird species of the Eastern Arc Mountains found by UCBS

Species	Common name	Range
<i>Andropadus masukuensis</i>	Shelley's greenbul	Eastern Arc / southern rift
<i>Apalis chapini</i>	Chestnut-headed apalis	Highlands in Tanz. & Malawi
<i>Batis mixta</i>	Forest batis	Eastern Arc & Coastal forests
<i>Caprimulgus guttifer</i>	Usambara Nightjar	Usambara Mtns and highlands north of Lake Malawi
<i>Cossypha anomala</i>	Olive-flanked robin-chat	N Tanz. & C&S Eastern Arc, Southern highlands and S Malawi and N Moz.
<i>Laniarius fuelleborni</i>	Fulleborn's black boubou	Eastern Arc and highlands of N Malawi
<i>Modulatrix stictigula</i>	Spot-throat	Eastern Arc & Mt Rungwe
<i>Oriolus chlorocephalus</i>	Green-headed oriole	Very localised and disjunct pop from S Kenya via Tanz. to S Malawi & C Moz.
<i>Poeoptera kenricki</i>	Kenrick's starling	Kenya C highlands through E Arc to S Tanz.

4.2.2.5 Threatened species

UCBS recorded four IUCN threatened and eight CITES listed birds (Table 21):

Table 21 IUCN and CITES listed bird species found by UCBS

Species	Common name	IUCN	CITES
<i>Accipiter tachiro</i>	African goshawk		II
<i>Polyboroides typus</i>	African harrier hawk		II
<i>Buteo oreophilus</i>	Mountain buzzard		II
<i>Buteo augur</i>	Augur Buzzard		II
<i>Falco cuvieri</i>	African Hobby		II
<i>Stephanoaetus coronatus</i>	African crowned eagle		II
<i>Tauraco livingstonii</i>	Livingstone's turaco		II
<i>Strix woodfordii</i>	African wood owl		II
<i>Bathmocercus winifredae</i>	Mrs Moreau's warbler	Vulnerable	
<i>Apalis chariessa</i>	White-winged apalis	Vulnerable	
<i>Ploceus nicolli</i>	Usambara weaver	Endangered	
<i>Nectarinia loveridgei</i>	Loveridge's sunbird	Near threatened	

Important to note are two threatened bird species that were not recorded by UCBS but have been recorded in the past in Uluguru North FR and may be present in Uluguru South FR: Usambara eagle owl (*Bubo vosseleri*) and Banded green sunbird (*Anthreptes rubritorques*).

Forest dependent species

UCBS recorded 37 forest dependent species (Table 22).

Table 22 Forest dependent bird species of the Uluguru South FR found by UCBS

Species	Common name
<i>Alethe fuelleborni</i>	White-chested alethe
<i>Andropadus masukuensis</i>	Shelley's greenbul
<i>Andropadus neumanni</i>	Uluguru mountain greenbul
<i>Apalis chariessa</i>	White-winged apalis
<i>Apalis thoracica uluguru</i>	(Uluguru) Bar-throated apalis
<i>Apaloderma vittatum</i>	Bar-tailed trogon
<i>Bathmocercus winifredae</i>	Mrs Moreau's warbler
<i>Batis mixta</i>	Forest batis
<i>Bradypterus mariae</i>	Evergreen forest warbler
<i>Coracina caesia</i>	Grey cuckoo-shrike
<i>Cossypha anomala</i>	Olive-flanked robin-chat
<i>Cryptospiza reichenovii</i>	Red-faced crimsonwing
<i>Dendropicos griseocephalus</i>	Olive woodpecker
<i>Laniarius fuelleborni</i>	Fulleborn's black boubou
<i>Linurgus olivaceus</i>	Oriole finch
<i>Modulatrix stictigula</i>	Spot-throat
<i>Nectarinia loveridgei</i>	Loveridge's sunbird
<i>Onychognathus walleri</i>	Waller's starling
<i>Orthotomus metopias altus</i>	Red-capped forest warbler / African tailorbird
<i>Phyllastrephus flavostriatus</i>	Yellow-streaked greenbul
<i>Phylloscopus ruficapillus</i>	Yellow-throated woodland warbler
<i>Phylloscopus umbrovirens fugglescouchmani</i>	Brown woodland warbler
<i>Phyllostrephus cabanisi</i>	Cabanis' Greenbul
<i>Ploceus nicolli</i>	Usambara weaver
<i>Poeoptera kenricki</i>	Kenrick's starling
<i>Pogoniulus leucomystax</i>	Moustached green tinkerbird
<i>Pseudoalcippe abyssinica</i>	African hill babbler
<i>Sheppardia sharpei bangsi</i>	Sharpe's akalat
<i>Smithornis capensis</i>	African broadbill
<i>Stactolaema olivacea</i>	Green barbet
<i>Stephanoaetus coronatus</i>	African crowned eagle
<i>Tauraco livingstonii</i>	Livingstone's turaco
<i>Telophorus nigrifrons</i>	Black-fronted bush-shrike
<i>Trochocercus albonotatus</i>	White-tailed crested flycatcher
<i>Turdus olivaceus</i>	Olive thrush
<i>Zoothera gurneyi</i>	Orange ground thrush

4.2.1.7 UCBS new records for Uluguru South

UCBS listed an additional 13 species to the list compiled by Doggart et al (2005). Most of these species are widespread (Table 23).

Table 23 New records of bird species recorded in the Uluguru South FR by UCBS

Species	Common name	Range
<i>Anas sparsa</i>	Africa black duck	Widespread
<i>Apalis chariessa macpharsoni</i>	White-winged apalis	Uluguru and Udzungwa mountains
<i>Bycanistes bucinator</i>	Trumpeter hornbill	Widespread
<i>Guttera pucherani</i>	Crested guineafowl	Widespread
<i>Indicator variegatus</i>	Scaly-throated honeyguide	Widespread
<i>Malaconotus nigrifrons</i>	Black-fronted bush-shrike	Widespread
<i>Motacilla agiump</i>	African pied wagtail	Widespread
<i>Motacilla clara</i>	Mountain wagtail	Widespread
<i>Oriolus auratus</i>	African golden oriole	Widespread
<i>Phyllastrephus flavostriatus</i>	Yellow-streaked greenbul	Patchy distribution in eastern half of the continent incl. Albertine Rift
<i>Phyllostrephus cabanisi</i>	Cabanis' Greenbul	Widespread
<i>Ploceus nicolli</i>	Tanzanian mountain weaver	Eastern Arc (but not Taita hills in Kenya) Tz endemic
<i>Tockus alboterminatus</i>	Crowned hornbill	Widespread

4.2.3 Reptiles

All specimens were identified by Mr. Michele Menegon in country, whilst taxonomic verification of snake specimens was confirmed from Dr. Don Broadley at the Natural History Museum in Zimbabwe. Other reptile specimens (chameleons and skinks) await taxonomic verification.

Taxonomy and nomenclature follows that of Spawls et al (2002).

4.2.3.1 Species richness

This survey recorded six species of reptiles representing three families in Uluguru South FR during 1320 bucket pitfall trapping nights, 51.5 man-hour timed searches and casual collections (Appendix 11). All 12 captures were taken as specimens. 16.5% of the species were strictly Uluguru endemics, 67% strictly Eastern Arc endemic and 16.5% near endemic to the Eastern Arc. 33% of species are listed as threatened by IUCN and/or CITES and 67% forest dependent. Species richness was low and this may reflect the high altitude of most of the reserve, which is a harsh environment for cold blooded animals, and low research intensity within this FR.

4.2.3.2 General/species abundance

Abundance of reptiles is hard to quantify as the number of individuals caught was 15 for seven species only. Ten of these were casual captures. Abundance is low as is species richness, reflecting the high altitude of the reserve.

An interesting record was the capture of Werner's chameleon (*Chamaeleo cf werneri*) at sites three, four and five, which may later be recognised as a separate subspecies.

4.2.3.3 Endemics

UCBS recorded one subspecies strictly endemic to the Uluguru Mountains: Uluguru two-horned chameleon (*Bradypodion fischeri uluguruensis*) and four species strictly endemic to the Eastern Arc Mountains (Table 24):

Table 24 Eastern Arc endemic reptiles found by UCBS

Species	Common name	Range
<i>Buroma procterae</i>	Uluguru forest-snake	Uluguru & Udzungwa
<i>Chamaeleo cf. wernerii</i>	Werner's three-horned chameleon	Uluguru, Udzungwa, Nguru and Ukaguru
<i>Rhampholeon uluguruensis</i>	Uluguru pigmy chameleon	Uluguru, Ukaguru & Rubeho
<i>Rhinotyphlops nigrocandidus</i>	Bi-colored blind snake	Uluguru & Udzungwa

All of these species are restricted to the southern Eastern Arc.

4.2.3.4 Near endemics

One near endemic species was recorded: Bearded pigmy chameleon (*Rhampholeon brevicaudatus*).

4.2.3.5 Threatened species

Two CITES II listed species were recorded: Uluguru two-horned chameleon (*Bradypodion fischeri uluguruensis*) and Werner's three-horned chameleon (*Chamaeleo cf. wernerii*).

4.2.3.6 Forest dependent species

UCBS recorded four forest dependent species (Table 25).

Table 25 Forest dependent reptile species of the Uluguru South FR by UCBS

Species	Common name
<i>Bradypodion fischeri uluguruensis</i>	Uluguru two-horned chameleon
<i>Buroma procterae</i>	Uluguru forest-snake
<i>Rhampholeon brevicaudatus</i>	Bearded pigmy chameleon
<i>Rhampholeon uluguruensis</i>	Uluguru pigmy chameleon

4.2.3.7 UCBS new records for Uluguru South FR

UCBS listed an additional two species to the list compiled by Doggart et al (2005) that have not been recorded from Uluguru South FR previously, both are Eastern Arc endemics: Bi-coloured blind snake (*Rhinotyphlops nigrocandidus*) and Uluguru forest-snake (*Buroma procterae*). The Uluguru forest snake is known to eat the amphibian *Hoplophryne uluguruensis*, an Eastern Arc endemic which is vulnerable to extinction; UCBS recorded it in Uluguru South FR.

4.2.4 Amphibians

All specimens were identified by Michele Menegon in country. They will be sent to the British Natural History Museum (BNHM) for taxonomic verifications, particularly of those unidentified.

4.2.4.1 Species richness

UCBS recorded 22 species of amphibians representing six families in the reserve (Appendix 12). 68 specimens were taken from 141 individuals captured during 1320 bucket pitfall trapping nights, 51.5 man-hour timed searches and casual collections. Of these, 20% of species were strictly Uluguru endemics, 16% Eastern Arc endemics and 16% near endemic to the Eastern Arc. 28% of species were threatened by extinction (as categorised by IUCN and CITES) and 48% were forest dependent. Species richness across five zoological worksites varied, with 13 species recorded at site three above Nyingwa, eight species at site one above Ukwama, six species at site four at Lukwangule Plateau, five species at site two above Lanzi and four species at site five above Bunduki.

4.2.4.2 General/species abundance

Relative abundance of amphibians during bucket pitfall trapping (Figure 17) was greatest for *Probreviceps macrodactylus loveridgei* at zoological site three (3 animals per 100 bucket pitfall traps); it was also present in lower abundance at zoological sites one and two. Low abundance of *Probreviceps uluguruensis*/ *P. cf uluguruensis* was also recorded at site three (0.5 animal per 100 bucket pitfall traps), which was montane forest with areas of bamboo. High rainfall was recorded for this site and this may explain the high capture numbers and the overall high species diversity. *Arthroleptis* species were recorded in low abundance at zoological site three only (<0.5 animal per 100 bucket pitfall traps). *Nectophrynoides viviparus*, a toad most commonly found in the Eastern Arc Mountains, was most abundant at zoological site two (0.8 animal per 100 bucket pitfall traps). Two more *Nectophrynoides* species A and E were in low relative abundance predominantly at site one (0.3 animal per 100 bucket pitfall traps). Caecilians, *Scolecormorphus uluguruensis* and *S. vittatus* or *kirkii* were both captured in low relative abundance with the Uluguru endemic *S. uluguruensis* found at three sites.

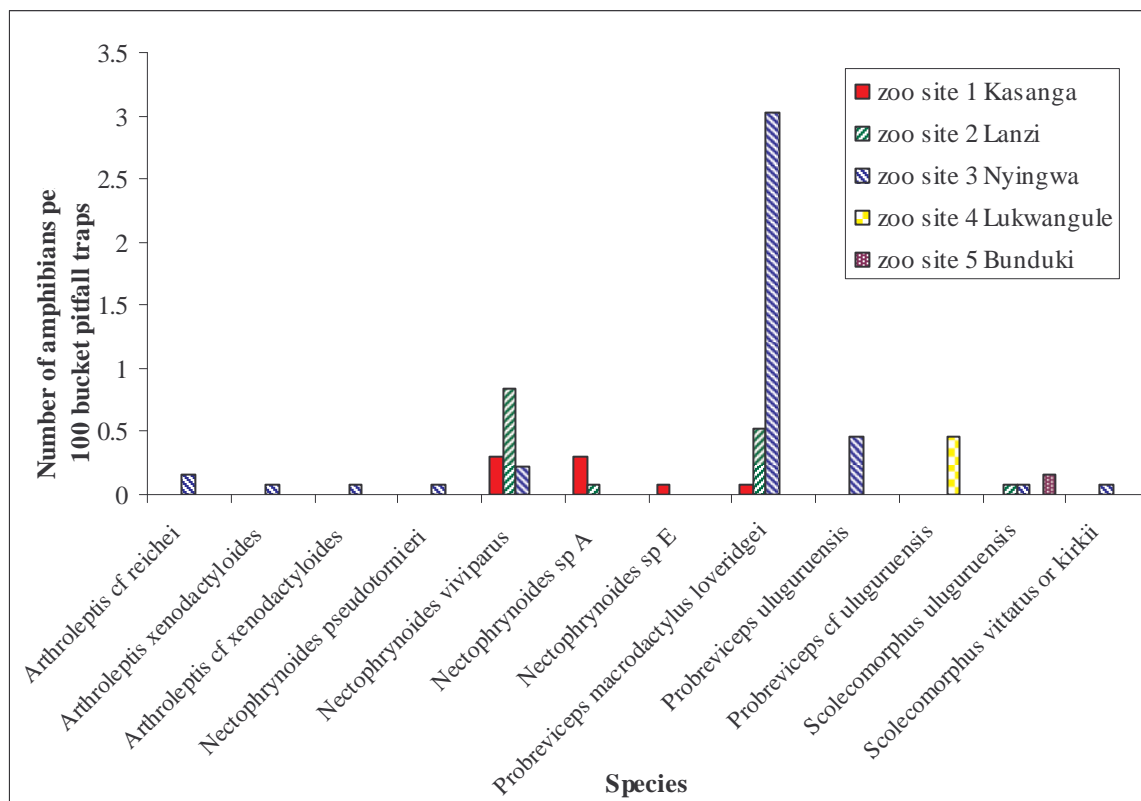


Figure 17 Relative abundance of amphibians captured in bucket pitfall traps (number of amphibians per 100 bucket pitfall traps)

When conducting herpetological searches, different species were captured to those within the bucket pitfall traps thus the two methods of bucket pitfall trapping and systematic searches should be combined to target different species and increase the species list. Biasing occurs with searches depending on the conspicuousness of each species and thus the ease of capture. This makes quantifying the data difficult as it cannot reflect a true measure of abundance. Total capture numbers for herpetological searches only are shown in Figure 18.

Nectophrynoides viviparus and *Leptopelis parkeri* were the most commonly captured species by hand. The tree frogs are easy to locate once vocalising as they stay approximately 1 to 1.5 metres above the ground and will continue to call despite the researcher's presence. *N. viviparus* seems to be

very abundant within Uluguru South especially on the east side of the mountain. Site three captures were the highest for both actual numbers and species richness, as was found for zoological trapping. The high rainfall during this period may account for this as frogs are more active during rains with an increase in vocalisations making it both easier to trap and hand captures individuals.

Five species captured during herpetological searches but not at the zoological site were: *Nectophrynoides* sp D, *Leptopelis parkeri*, *Hyperolius puncticulatus*, *Afrana angolensis* and *Strongylopus fuelleborni*. A further five species were added to the list by casual collections: *Arthroleptis* cf *affinis/reichei*, *Nectophrynoides* species C and G, *Hoplophryne uluguruensis* and *Arthroleptides yakusini*.

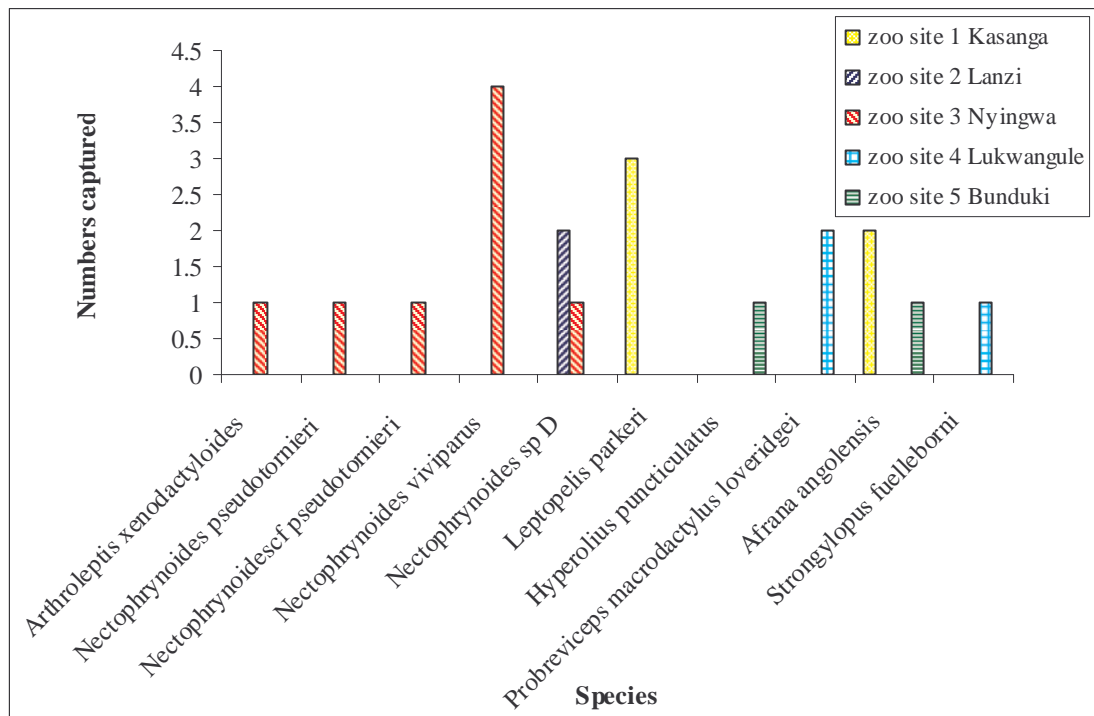


Figure 18 Total number of captures of amphibians during systematic searches only

UCBS recorded *Nectophrynoides pseudotornieri*, an Uluguru endemic described by Menegon et al (2004). The type locality for this species is Uluguru North FR in submontane forest. Our specimen was collected at 2040m asl at site three in a banana tree. Nothing is known of the breeding biology of this species.

In addition to the known *Nectophrynoides* species, UCBS also collected 17 specimens that M. Menegon split into five potential species, A, C, D, E and G, as shown below in Figure 19. All of these species were found on the eastern side of the mountain or on Lukwangule plateau, areas that are less well known than the more accessible western side. Species A was located at sites one, two and four, thus may be well distributed throughout the FR. Species D was located at sites two and three, both in the forests surrounding the valley of Lanzi. Species C, E and G were collected at one site only with one specimen each. Clearly more intensive studies need to be carried out. The species C specimen was very different in appearance compared to all other collected specimens seen previously (Menegon, pers comm) and it is possible that it could be a Lukwangule plateau endemic, as this habitat is unique amongst the moist forest of Uluguru South. M. Menegon has recognised with certainty that species D is new. The other specimens need to be compared to others already at the BNHM, as some of the new Uluguru endemics have one or two specimens only and the UCBS collection will assist in further clarification.

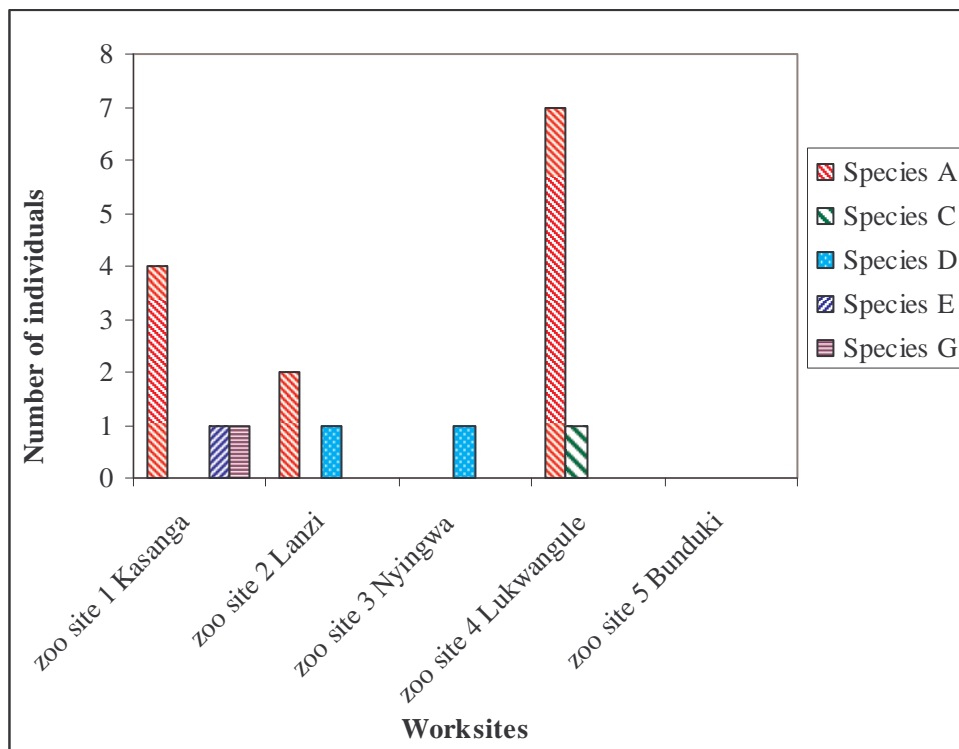


Figure 19 Capture location of five unknown *Nectophrynoides* species

Several species of *Arthroleptis* were likened to known species, but need to be verified by a taxonomist. This genus is currently undergoing revision and little is known about those species listed in Appendix 12a: *Arthroleptis affinis*, *A. cf reichi*, *A. cf affinis/reichei*, *A. xenodactyloides*, *A. cf xenodactyloides* and *A. cf xenochirus*. None of them are endemics to the Ulugurus and one species only is endemic to the Eastern Arc, *A. affinis*.

4.2.4.3 Endemics

UCBS recorded three Uluguru endemic species and four Eastern arc endemic species (Table 26).

Table 26 Endemic amphibian species of the Eastern Arc Mountains found by UCBS

Species	Range
<i>Arthroleptides yakusini</i>	Uluguru, Mahenge and Udzungwa
<i>Probreviceps macrodactylus loveridgei</i>	Eastern Arc endemic
<i>Probreviceps uluguruensis</i>	Uluguru endemic
<i>Hoplophryne uluguruensis</i>	Uluguru & Udzungwas
<i>Leptopelis parkeri</i>	Usambara, Ulugurus and Udzungwas
<i>Nectophrynoides cf. pseudotornieri</i>	Uluguru endemic
<i>Scolecophorus uluguruensis</i>	Uluguru endemic

Three of the four Eastern Arc species are restricted to the southern end of the mountain chain.

4.2.4.4 Near endemics

UCBS recorded three Eastern Arc near endemic amphibians (Table 27).

Table 27 Near endemic amphibians of the Eastern Arc Mountains found by UCBS

Species	Range
<i>Arthroleptis affinis</i>	Eastern Arc and Coastal forests
<i>Hyperolius puncticulatus</i>	Localised from N. Tanz. through the Eastern Arc to S Malawi
<i>Leptopelis parkeri</i>	Tanzania endemic, Eastern Arc Usam., Ulug., & Udz.

4.2.4.5 Threatened species

UCBS recorded six IUCN threatened and one CITES listed amphibians (Table 28).

Table 28 IUCN and CITES listed amphibian species of the Uluguru South FR found by UCBS

Species	IUCN	CITES
<i>Arthroleptides yakusini</i>	Endangered	
<i>Hoplophryne uluguruensis</i>	Vulnerable	
<i>Leptopelis parkeri</i>	Vulnerable	
<i>Nectophrynoides viviparus</i>	Vulnerable	I
<i>Probreviceps macrodactylus loveridgei</i>	Vulnerable	
<i>Probreviceps uluguruensis</i>	Vulnerable	

4.2.4.6 Forest dependent species

UCBS recorded ten forest dependent species:

Arthroleptides yakusini, *Arthroleptis* cf *reichei*, *Arthroleptis* cf *affinis/reichei*, *Probreviceps macrodactylus loveridgei*, *Probreviceps uluguruensis*, *Leptopelis parkeri*, *Nectophrynoides* cf. *pseudotornieri*, *Scolecormorphus uluguruensis* and *Scolecormorphus vittatus* or *kirkii*.

4.2.4.7 UCBS new records for Uluguru South

UCBS listed an additional nine species to Doggart et al's (2005) species list (Table 29).

Table 29 New records of amphibian species of the Uluguru South FR by UCBS

Species	Range
<i>Afrana angolensis</i>	Widespread
<i>Arthroleptides yakusini</i>	Tanzania endemic, Uluguru, Mahenge and Udzungwa
<i>Arthroleptis</i> cf <i>affinis/reichei</i>	
<i>Arthroleptis</i> cf <i>reichei</i>	Mountains in Northern Malawi & Southern Tanzania
<i>Arthroleptis xenodactyloides</i>	N Tanz., through Malawi, N&C Moz to E Zimbabwe
<i>Arthroleptis</i> cf <i>xenodactyloides</i>	
<i>Hoplophryne uluguruensis</i>	Tanzania Endemic, Uluguru & Udzungwas
<i>Nectophrynoides</i> cf. <i>pseudotornieri</i>	Uluguru endemic
<i>Nectophrynoides</i> sp A	
<i>Nectophrynoides</i> sp C	
<i>Nectophrynoides</i> sp D	
<i>Nectophrynoides</i> sp E	
<i>Nectophrynoides</i> sp G	
<i>Probreviceps macrodactylus loveridgei</i>	Eastern Arc endemic
<i>Scolecormorphus vittatus</i> or <i>kirkii</i>	

Low survey intensity previously in Uluguru South will account for some of these species not being recorded, although their presence would be expected.

4.3 Human disturbance

Survey work aimed at investigating the level of human disturbance within the reserve.

Table 30 Summary of disturbance transect in Uluguru South FR

	Total transect length (m)	Total area of transect (m ²)	Total no. sampled	Live (% of total)	Average live per area hectare (ha)	Dead (% of total)	Average dead per area hectare (ha)	Cut (% of total)	Average cut per area hectare (ha)
Poles	27,900	279,000	5652	5138 (90.9)	184.2	342 (6.0)	12.3	172 (3.0)	6.2
Timbers	27,900	279,000	7591	6476 (85.3)	232.1	960 (12.6)	34.4	155 (2.0)	5.5

A total of 5652 poles and 7591 timbers were surveyed along transect lines (Table 30). An average of 6.2 poles was cut per hectare with timber cutting observed with an average of 5.5 per hectare. However with 3% and 2% cut poles and timbers, extraction is very low. Averages of dead poles and timbers are higher than cut poles and timbers at 12.3 and 34.4 per hectare, respectively; depending on steepness of the slope, large trees fall naturally or from lightening strikes, this may explain the higher average of dead timbers.

When comparing 18 edge transects (numbers 4,5,6,7,8,9,10,11,12,14,15,16,21,23,26,28,29,31,32) with 14 interior transects (numbers 1,2,3,6,13,17,18,19,20,22,24,25,27,30) for cut poles and cut timbers using a Mann Whitney U two tailed test, significant differences were found which indicate that higher numbers of cut poles and timbers occur at the forest edge (Cut poles, $Z = -3.766$, $P < 0.001$; Cut timbers, $Z = -2.693$, $P < 0.001$) (Figure 20) This would be expected as access is easier as is proximity to villages. There is a lot of pressure exerted on Uluguru South as there are few trees outside of the forest reserve in *shamba* (farmland). However, if one compares the percentage of new vs old cut poles and timbers, it is mainly old cutting that has been recorded (that of three months and more); with 77% of cut poles being old and 59% old cut timbers. When compared with Uluguru North percentages of old cut poles and timbers (91% and 86% respectively), it can be seen that there is more recent cutting in Uluguru South, particularly timbers. Therefore, the main problem area for timber resource extraction is in Uluguru South, where two pitsawing sites were also seen as casual observations, on the east side. These were above Lanzi village and currently in use, cutting *Ocotea usambarensis*. The Forest officer Mr Shirima was accompanying the UCBS team at that time and established that it was actually the *mwenyekiti* (village chairman) who was organising the illegal activity and had been doing so for several years. He organised a meeting with the *mwenyekiti* and village elders to discuss the problem. This is still being followed up by the Catchment Forestry office.

The majority of the cutting data along transect lines was recorded from the west side of the mountains with 63.6% for old cut poles, 100% for new cut poles, 49% for old cut timbers and 98.4% for new cut timbers; however casual observations recorded pitsawing sites on the east near Lanzi. This was particularly seen in the forests above Tchenzema, which is very degraded. Old extraction of timber resources is similar on either side of the forest. Apart from 1.6%, all new cutting is occurring on the west of the FR. All of the new cut poles were found within seven transects (21, 23, 26, 28, 29, 30, 31) that were located above Tchenzema and Bunduki (refer to Figure 6). 46% were recorded in transect 21 with a further 18% and 19% found within transects 26 and 31 respectively. Similarly the new cut timbers were located within six transects (21, 23, 26, 28, 29, 30, 31), with 42% and 31% from transects 23 and 28 respectively. Clearly the areas for concern, sampled within the UCBS survey are the forests above Tchenzema village and at the northern end of Uluguru South above Bunduki.

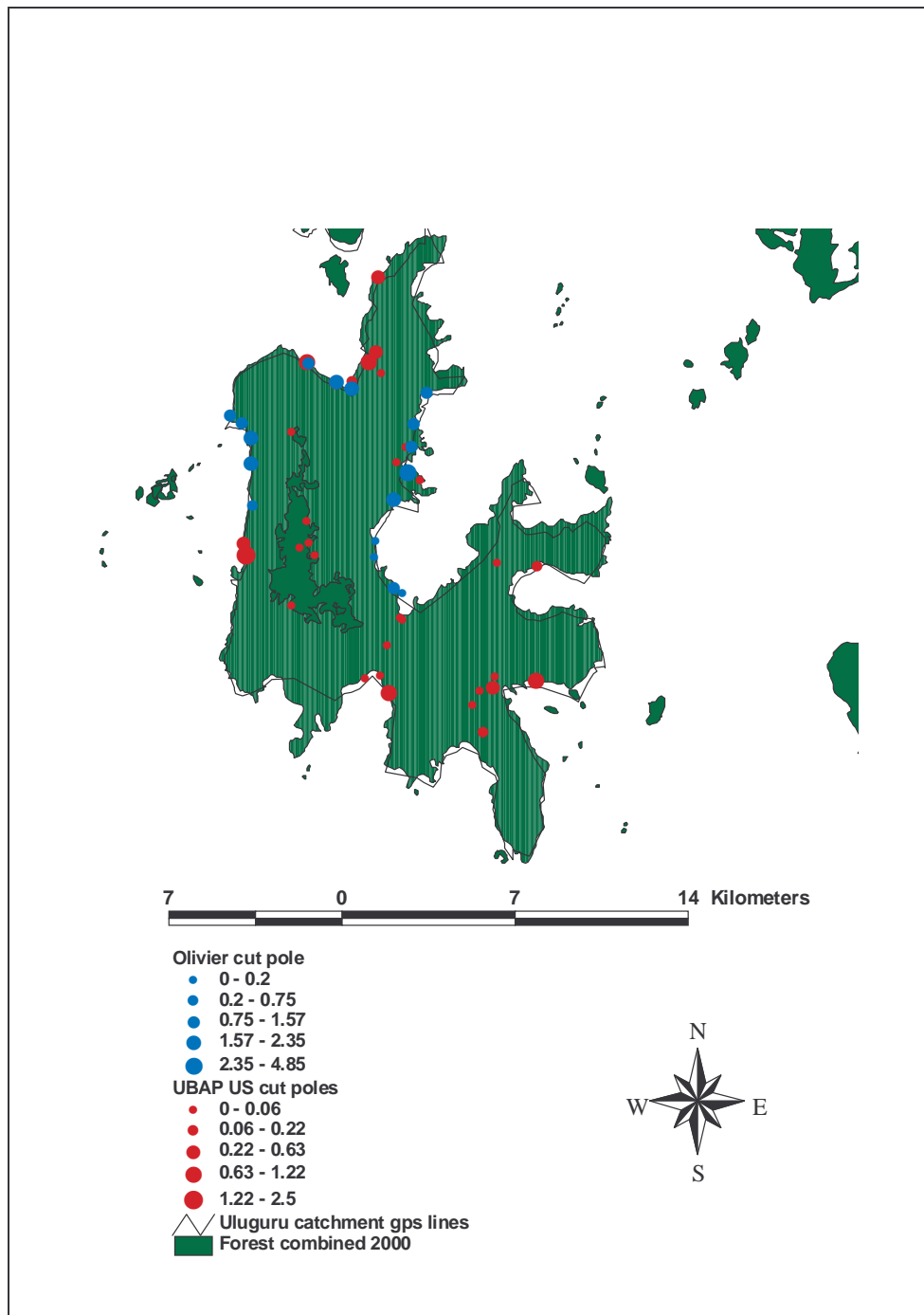


Figure 20 Comparison of Hymas 2000 cut pole data and all UCBS cut pole data

The circles represent the average number of cut poles for each transect, with size of circle directly correlating to the number of cut poles. Each circle marks the beginning of the transect line. The average number is taken as Hymas used 1000m transects and UCBS 900m transects.

When comparing UCBS's forest edge transects with Hymas' transects for cut poles and timbers (Mann Whitney U two tailed test), it was found that there is no significant difference between the two data sets for cut poles meaning there is no change over time in pole extraction ($Z = -2.360$, $P < 0.018$) (Figure 20). A significant difference was found between the cut timbers with more timber extraction occurring today ($Z = -2.634$, $P < 0.008$) (Figure 21).

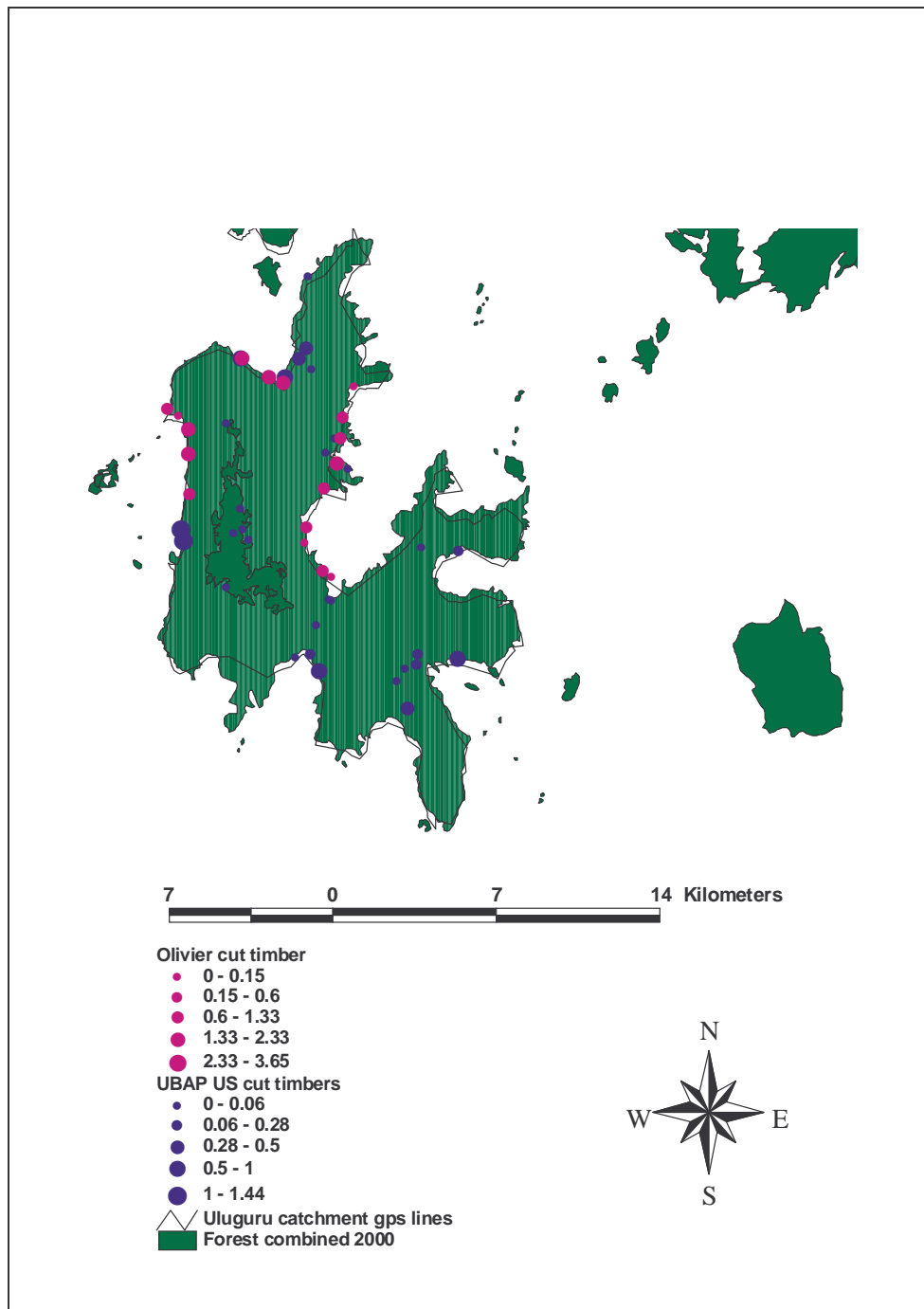


Figure 21 Comparison of Hymas 2000 cut timber data and all UCBS cut timber data

The circles represent the average number of cut timber for each transect, with size of circle directly correlating to the number of cut timber. Each circle marks the beginning of the transect line. The average number is taken as Hymas used 1000m transects and UCBS 900m transects.

If the data is analysed further and Hymas' east and west transects are compared separately against UCBS forest transects, one finds that the level of cutting has not changed on the western side of the FR since 2000, indicating that there is an intense pressure on the forest resources (Cut poles $Z = 0.068$, $P < 0.946$; Cut timbers $Z = -0.763$, $P < 0.446$) which continues. However on the eastern side of the mountain, there have been significant changes over time with more pole and timber cutting occurring in 2005 (Cut poles $Z = -3.972$, $P < 0.001$; Cut timbers $Z = -3.595$, $P < 0.001$). This suggests

the pressure on the forest has increased due to continued land clearance and agricultural expansion of surrounding areas forcing exploitation of the FR.

As well as pole and timber data collection, other disturbance was noted along the transect lines. If the general assumption is made that open gaps in the forest are most likely associated with human disturbance, although natural tree falls also create this effect, then assessing the canopy cover along transect lines can indicate areas of disturbance. Transects are highlighted here if 75% (and over) of the 50m sections fell in to one of three categories used: canopy cover 0-10%, 11-50% and >51%. Two transects (24 and 25) were 100% open canopy, these were conducted on Lukwangule plateau grassland and are not relevant to this analysis. Only transect 22 had $\geq 75\%$ of open canopy. This was located in forest bordering the west of the grassland which is also where *Rubus* was observed along the same transect line. If you look at 50% of the transect having $\geq 75\%$ canopy cover per 50m section only two more transects are relevant, 19 and 21. Both of these were located on the west, transect 19 at the southern edge of the grassland and transect 21 at the edge of the forest above Tchenzema. Two transects (13 and 17) had 11-50% canopy cover in $\geq 75\%$ of the 50m sections, these were located on the east, transect 13 near the main path connecting Nyingwa and Lumba Juu with transect 17 near the path and shamba encroachment at Ng'weme. All these areas have also been noted through casual observations, particularly the west, as being disturbed by human activities. Six transect lines (3,5,6,9,14,30) had >51% canopy cover in $\geq 75\%$ of the 50m sections. All of these were located on the east of the mountains except for transect 30 which was located above Bunduki. Therefore in terms of timber extraction and the removal of large trees creating open gaps, the west is more disturbed, which corresponds to casual observations made by the UCBS team.

15% of the 50m sections (79 out of 522 50m sections) have paths crossing them. These were predominantly on the western side of the FR, although large traditional paths that link villages on either side of the mountains are common on both sides. Paths varied in size with a network of well-used paths in the forest above Tchenzema, where hunting, cutting and firewood collection is high.

Burning was recorded in 23 out of 522 50m sections. These were all found within transects 22 and 24, which were conducted on Lukwangule plateau grassland. Burning occurs throughout the grassland area yearly, which is of great concern as it will change the ecology of the unique montane grassland whilst also pushing back the pockets of elfin forest.

The invasive bramble, *Rubus pinnatus*, *Rubus albata* and *Rubus* sp. were seen casually on the western slopes above Tchenzema and Bunduki, and particularly in the forest transects on the plateau. 14 of 522 50m sections all within transects 20 and 22, both located on Lukwangule plateau confirm that this is a problem that needs to be addressed within long-term management plans. The large demand for fuelwood may allow *Rubus* brambles to spread into the forest, which is feared to be invasive and of concern. Furthermore, Hyman does not recall the presence of brambles in 2000 (pers comm) suggesting this is a recent, therefore, more worrying problem.

Two pitsawing sites were seen along the transect lines, one old at transect 23 and one fresh at transect 12. A further two were found on the forest edge near Basecamp two above Lanzi (already sites referred to earlier in the section). These were in use and all pitsawing sites targeted *Ocotea usambarensis*. Therefore, pitsawing is occurring more on the east side, although the frequency is low. *Ocotea* was also seen cut to remove honey (on path leading to Lumba Juu from Nyingwa) and to take out the female hornbill and chicks who are closed in by the male (along transect 15). Ring-barking was seen at transect 26, where timber and pole cutting was also recorded. Ring-barking is used to kill the tree as easier collection of firewood. The demand around Tchenzema is high and most of it is taken from the FR. At transect 11, near Nyingwa, men were cutting bamboo and calling to each other. It was actually suspected that they were hunting but having heard the transect team approaching changed their activity. Some cutting observed around Ukwama was to take timber to produce *jembe* (hoe) handles.

Traps were also found along the transect lines, with four large mammal traps; one at each of these transects 3, 15, 23 and 32. Small mammal traps were found; a rodent trap at transect 23 and two shrew snares along transect three. Casual observations recorded an additional number of small fauna traps, all in the east except one rodent snare near transect 28. On the path from transect seven, 12 traps for birds and rodents were found with feathers by the bird trap. Two shrew/rodent snares were found north of transect nine. All these traps were along pathways or near to the edge of the forests. It is reported that rodents are eaten by villagers in Lanzi, Nyingwa, Lumba Juu and Ukwama (Johnny and Isaya pers comm, camp assistants, basecamp three) and that there is a market at Lumba juu where rodents are sold for 50 TSh and also Chamwino market in Morogoro (Johnny, pers comm). The people of the east are more protein deficient and seeking alternative sources of protein in an area where large mammals are found in low densities. This needs investigating further to establish intensity of trapping and validity of markets.

Chameleon collection for the pet trade at Bunduki is occurring and needs to be investigated further to identify species taken and the sustainability of this activity as there are several threatened and endemic species occurring in the FRs.

Camps were seen at transect six and one between basecamp one and transect five. Three stone fire places were observed along the path from basecamp three to Lumba juu, with some cutting also. Hunters with dogs were seen and heard at the end of transect 20 and 23, the latter being young boys, with pangas and two dogs. Dr. Neil Burgess also heard and saw dogs in the forest above Nyandira village (pers comm) and the UCBS team heard dogs from transect 19. All these incidences were in the forests surrounding the Tchenzema area.

Encroachment of farmland into the FR at Ng'weme was observed. This is a significant problem and it is reported that this area is 30ha (pers comm, Sangeda). Forestry Catchment is aware of this problem.

Old digging for mica was seen on Lukwangule plateau, this may have been to make glass. Also seen was some old quarrying, it is not certain for what purpose.

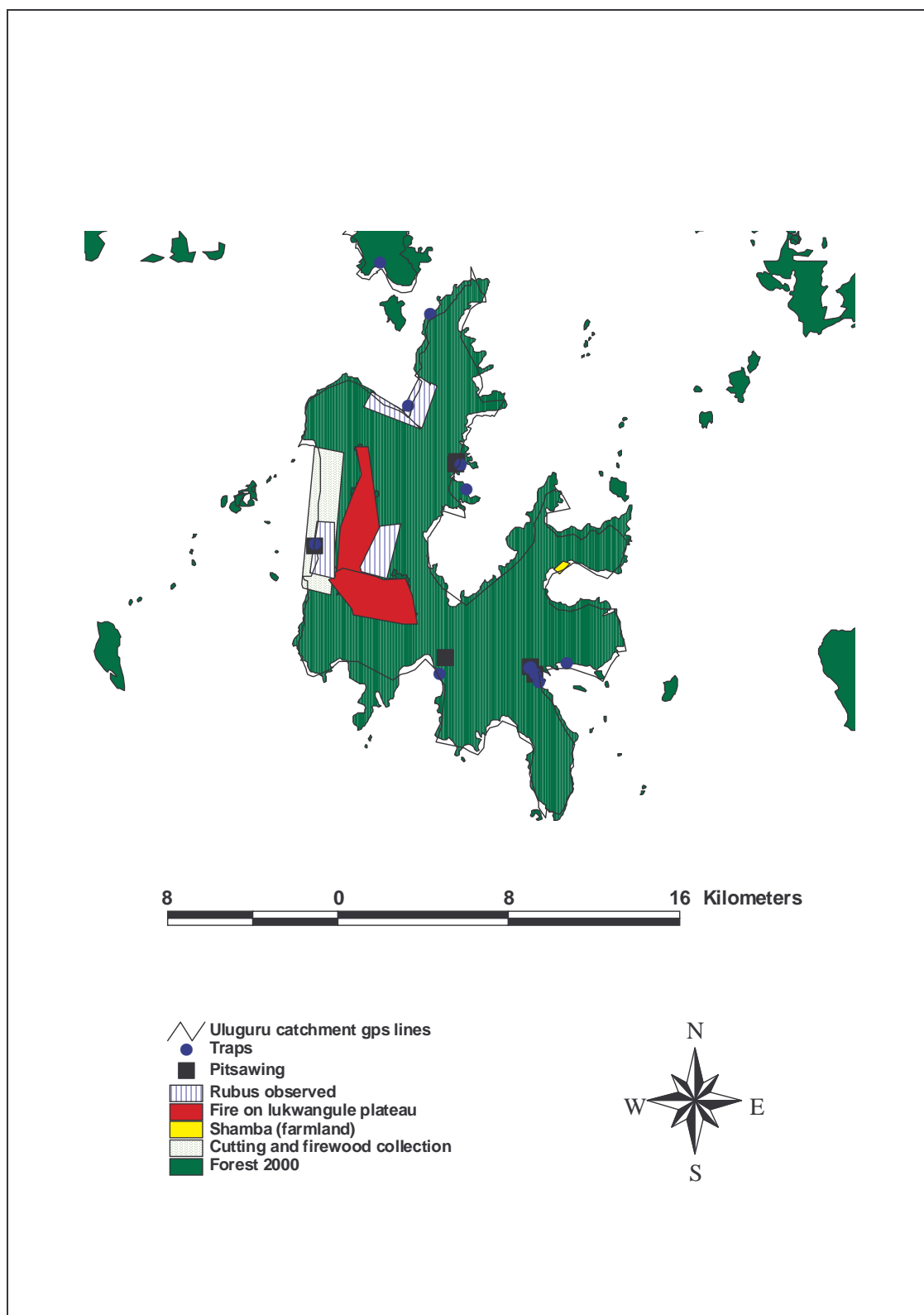


Figure 22 Map showing main areas of disturbance

Below are some photographic examples of traps and pitsawing sites observed by UCBS in Uluguru South FR



Figure 23 Pitsaw site, *Ocotea usambarensis* above Lanzi



Figure 24 Large rodent trap, targeting the Giant pouched rat, *Cricetomys*



Figure 25 Monkey trap



Figure 26 Slender mongoose, *Herpestes sanguinea*, caught in a steel trap at basecamp one



Figure 27 Snared Blue duiker, *Cephalophus monticolor* killed in forest on Lukwangule plateau

5. DISCUSSION AND RECOMMENDATIONS

5.1 Flora

Uluguru South FR is a typical Eastern Arc moist forest. It is composed of predominantly montane (1500m – 2100m asl) and upper montane (>2100m asl) forest with some submontane forest (1200 – 1500m asl) on the east. On Lukwangule plateau, upper montane forest is found in ‘islands’ within unique grassland. Forest structure varies with both altitude and aspect. At lower altitude (≤ 2000 m asl), the closed canopy forest is more pronounced on the eastern side near Lanzi, Kasanga and Ukwama villages.

UCBS recorded 277 species in Uluguru South FR, of which 206 were recorded from 53 vegetation and regeneration plots and 71 species from opportunistic surveys (Appendix 7). 9% of species recorded were Uluguru endemics; however this is only 18.5% of the known strict Uluguru endemics. The species accumulation rates of recorded species within the vegetation plots did not level out suggesting that this survey did not sample the full floral requisite of the FR. 12% of recorded species were Eastern Arc endemics and 19 species were listed by IUCN. 217 species were found in both Uluguru North and South FRs.

The high altitude areas of the FR are abundant in endemic species (>2000m asl) with 63.6% of the total number of endemic species recorded in the reserve collected from the unique grassland ecology of Lukwangule plateau, for example *Panicum lukwangulense*, *Impatiens lukwangulensis*, *Impatiens pseudohamata*, *Impatiens serpens*, *Impatiens uluguruensis*, *Schefflera lukwangulensis*, *Streptocarpus glandulosissimus*, *Lobelia lukwangulensis*, *Syzygium parvalum* and *Lasianthus* species. 57.5% of endemic species are recorded in the forests above Tchenzema (>1800m asl), thus do not include those species specifically found on Lukwangule plateau. The high level of endemism is found within the families of Rubiaceae and Balsaminaceae, whose species are capable of adapting and surviving the extreme terrains found in Uluguru South. Within Balsaminaceae, high rates of hybridisation for *Impatiens* produce many variants which are capable of inhabiting a wide range of ecological environments.

Only 27% of endemic species are found below 1800m asl, such as *Saintpaulia* species and *Psychotria brucei*. This highlights the importance of Lukwangule plateau for endemism of flora, especially herbs that are localised to a few high altitude areas, for example Lukwangule plateau and Bondwa and Lupanga peaks in Uluguru North FR. One grass species, *Panicum lukwangulense*, an endemic located on Lukwangule plateau, should be considered when investigating the yearly fires on the plateau and the effect on the overall grassland ecology. *Saintpaulia* sp, the African violet, was seen frequently through casual observations on the eastern side of the mountains above Kasanga, Lanzi and Nyingwa between approximately 1500m – 1900m asl. Not only was it found on moist rocks under closed canopy, but also around tree bases. Orchids (*Bulbophyllum* spp) are also present in the east, but the species are unknown. Most likely they are Eastern Arc, if not Uluguru, endemics.

Allanblackia stuhlmannii, *Allanblackia uluguruensis* and *Ocotea usambarensis*, as specified key floristic species, are abundant in Uluguru South FR. All are useful timber species, with *Ocotea usambarensis* the only timber species seen at pitsawing sites, for example above Lanzi village. *Ocotea usambarensis* has the second highest ranking species coverage in vegetation plots with the fifth highest species abundance. Therefore not only are many individual stems recorded but these are distributed across 32 of 53 vegetation plots. These vegetation plots are located throughout the reserve in submontane and montane forest. *Allanblackia stuhlmannii* is ranked second in species abundance with 5.44% of individual stems recorded in the vegetation plots. However it has a low species coverage indicating that these individual stems are less widely distributed in the reserve and concentrated into fewer vegetation plots. Interestingly all of the vegetation plots that recorded the presence of *A.stuhlmannii* are on the east side of the mountain with two plots (43 and 49) north above Bunduki each with one individual stem. *Allanblackia uluguruensis* was recorded in one plot only (43) which is located in the north of the reserve at 1980m asl; it was the dominant species

within this plot. Thus the abundance of these species is concentrated in the east of the reserve and this should be recognised within management plans. Lovett et al (in press) noted that *Allanblackia uluguruensis* dominated the east aspect at 1800 and 2000m asl and the west aspect at 1900m asl within a survey in Uluguru North FR.

Khaya anthotheca, the African mahogany tree, is an extremely valuable timber species that is often targeted intensively for this reason; it is a very tall rainforest species with a massive bole. In Uluguru South FR, only three stems were recorded in vegetation plot 17 on the far eastern side of the reserve.

The presence of the African violet and the above key floristic species predominating in the east of Uluguru South FR highlights the pristine conditions of the closed canopy forest and the importance of conserving these areas that also incorporate some submontane forest. The average tree height generally ranges between 28 – 30 m with the emergent trees reaching 35 – 40 m on the eastern side (Lanzi, Ukwama, Kihunza, Nyingwa) and the southern side towards Lumba village. Some of the tallest trees recorded are *Rapanea melanophloeos* and *Newtonia buchananii*. *Newtonia buchananii* is a valuable timber species which is targeted more in Uluguru North than Uluguru South FR. North and west of the mountains show less forest stratification probably due to decreasing amount of rainfall on these two aspects and more human disturbance, which has changed the forest structure and community composition. Tree cutting for timber extraction is destroying the canopy trees, species such as *Ocotea usambarensis*, as well as shrub and herbs that are destroyed as the trees fall, with gaps resulting, encouraging invasive species (*Rubus* sp) to spread. Selective removal of trees for poles and utensil making (for example, *Aphloia theiformis*, *Allophylus abyssinica*) alters the balance of species (Mremi, 1998). Removal of deadwood (for example, *Myrica salicifolia*, *Maytenus undata*) through fire wood collection affects the ecology and the population of invertebrates utilising dead trees as their habitat. This has implications for organisms predating on them (Price, 1975) and consequently throughout the food chain.

Invasive species noted within the FR are *Rubus* species and *Maesopsis eminii*. Both favour disturbed areas with gaps and therefore of greatest concern are the west and north of the mountains, such as above Tchenzema and Bunduki where most forest disturbance is occurring. The *Rubus* bramble is thought to be from South Africa (pers comm., Frank Mbago, UDSM). Some management controls are highlighted in the *human disturbance section 5.3*. *Maesopsis eminii* was seen on two occasions on the east above Nyingwa village on the Kihunza footpath and around the Bunduki area. Originally from western parts of East Africa it is an aggressive invader of disturbed forest, as seen in Amani Nature Reserve. However once it is under closed canopy its invasive ability is minimised, thus its presence deeper in forest should not be of major concern provided that new openings in the canopy are not made. *Lantana camara*, another invasive species commonly seen in disturbed areas was not seen within the reserve but outside of it near Bunduki. This should be monitored.

Widespread species are recorded at lower altitudes (1600m – 1900m asl) in higher densities, such as those described within Table 7, where the most abundant species recorded are *Garcinia volkensi*, *Drypetes gerrardii* and *Aphloia theiformis*. In terms of greatest species coverage within the vegetation plots, *Garcinia volkensis*, *Ocotea usambarensis*, *Rapanea melanophloeus*, *Drypetes gerrardii* and *Maytenus undata* were recorded in more vegetation plots than any other species. The east side of the mountain generally has higher species richness. The higher diversity of common species found at lower altitude in Lanzi, Ukama and Lumba can be attributed to the better soil and high rainfall on these sides of the FR. Higher altitudes are associated with low temperatures which hinder microbial activities in releasing nutrients required for plant growth (Sangu 2005) and the soil type is acidic which also impairs nutrient availability. Species dominance values in most areas were low, which indicates that dominance is shared by several species; similar results have been reported by Sangu (2005) in Uluguru South FR, Mremi (1998), Moshi (2000) in the Udzungwa Scarp FR.

Lovett et al (in press) carried out research in 1981 in Uluguru North FR at Lupanga and investigated species composition between montane and upper montane forest, species diversity differences with elevational changes and the effect of aspect. Vegetation plots were established on west and east

aspects. It was found that the highest stem density is at 1600m asl corresponding with the highest species richness, which decreased with altitude as did overall species diversity. Species composition varied linearly and continuously with altitude. Higher altitude western plots, such as 2000m asl were similar to 1800m asl plots on the east aspect. This can be contributed to the differences in exposure moisture levels and wind for each aspect, as slopes receiving lower rainfall would be expected to have higher and more available nutrient levels enabling maintenance of higher diversity at higher altitude. This study found similar results for effects on overall species richness and diversity with changes in elevational ranges and the higher stem density found in the east aspect.

The flora of the Uluguru South FR has many typical Eastern Arc forest tree species with a rich abundance of important endemics situated at higher altitude in particular at Lukwangule plateau. Furthermore the eastern side of the mountain houses important primary forest, which has the predominance of key floristic species: *Allanblackia stuhlmannii*, *A. uluguruensis* and *Ocotea usambarensis*, as well as *Saintpaulia*. Some small tracts of submontane forest remain and should be included in any management plans for the conservation of this FR.

5.2 Fauna

152 species have been recorded by UCBS in Uluguru South FR, most of which are small fauna, such as birds, rodents, shrews, amphibians and reptiles. In total, when compiling the species list of UCBS's research and that of Doggart et al (2005), which combines all previous research in Uluguru South FR, there are 197 faunal species present in Uluguru South FR (full lists are given in Appendices 9, 10, 11 and 12). UCBS has added 35 records not previously listed by Doggart et al (2005) and it has confirmed the presence of 117 species, mainly avifauna.

5.2.1 Mammals

UCBS research recorded a low species richness and abundance of large fauna. Most commonly recorded were the Black and white colobus (*Colobus angolensis*), Blue monkey (*Cercopithecus mitis*), Bushpig (*Potamochoerus larvatus*), Blue duiker (*Cephalophus monticola*), Tree hyrax (*Dendrohyrax validus*) and Mountain galago (*Galagoides orinus*). Perkin (2000) estimated the Mountain galago population to be 23,000 in Uluguru North and South FRs. Important records from this study are the Stuhlmann's golden mole (*Chrysochloris stuhlmanni tropicalis*), an Uluguru endemic subspecies, last recorded in 1950 (Swynnerton and Hayman); and Zanj elephant shrew (*Rhynchocyon petersi*) (endangered), an Eastern Arc/coastal forest endemic.

Small mammals are abundant with typical Eastern Arc rodent species, such as *Praomys*, *Hylomyscus* and *Lophuromys*. This confirms findings from a survey in Uluguru North above Tegetero (Stanley et al 1998). *Beamys hindei* was not recorded during previous research in Uluguru South FR; UCBS recorded its presence with one specimen from Bunduki. This species is vulnerable as listed by IUCN and is thought to be an Eastern Arc relic species. It is believed to be trap-shy; however previous Frontier-Tanzania research has found it abundant in lowland forest, for example Nambiga FR, Kilombero Valley, and in coastal forests in Mtwara (pers comm, C. Bracebridge). It is possible that abundance within trap sites is low due to the submontane and montane habitats UCBS worked within. Doggart et al (2005) recorded the presence of *Beamys hindei* within Kasanga Local Authority Forest Reserve, which has an altitudinal range of 660m – 940m asl and is located to the east of Kimhandu peak in Uluguru South FR. It would be interesting to conduct further trapping within lowland forest, such as Kimboza FR, as Doggart et al (2005) during their 2000 survey did not record the presence of *Beamys* within Kimboza FR, but sampling intensity may have been too low.

Several endemic and near endemic shrews were found by UCBS (*Myosorex geata*, *Sylvisorex howelli* and *Crocidura monax*), however this study did not record *Crocidura telfordii*, a critically endangered species and last recorded in 1998 (Stanley et al) (Table 31). *Sylvisorex howelli*, an Eastern Arc endemic was found to have abundant population numbers throughout the reserve, indicating that the Uluguru Mountains are important for its conservation. In general shrews have a more disjunct species distribution than rodents and are more vulnerable to environmental changes,

therefore monitoring shrew populations and abundances should be undertaken in the future as important small fauna indicators of forest habitat changes.

This study did not record several species previously recorded during research in Uluguru South FR. Of greatest concern is Abbot's duiker (*Cephalophus spadix*), which has not been sighted since 1950 and is listed as vulnerable by IUCN. Its larger size compared to that of the Blue duiker means it is targeted by hunters. It is particularly hunted around Bunduki/Vinile, where they use the meat and the skins (pers comm, local villager). If Abbot's duiker is still present in Uluguru South, the numbers are likely to be very low. Other populations of Abbot's duiker are found in isolated massifs, such as Kilimanjaro National Park, other Eastern Arc mountains such as the Udzungwa Mountains and the Southern rift. Further surveys targeting this species should be undertaken.

UCBS did not confirm the presence of the Leopard (*Panthera pardus*), Serval cat (*Leptailurus serval*), African civet (*Civettictis civetta*) and Blotched genet (*Genetta tigrina*) (Table 31). The last recordings of Leopard, Genet, Civet and Serval were by Swynnerton and Hayman (1950). A local (pers comm, local villager) stated that a Leopard had been known to come out of the forest near Bunduki to take a goat. If this is true, then it may indicate that natural prey numbers within the forest are low, due to hunting and habitat destruction.

Elephant (*Loxodonta africana*), Buffalo (*Syncerus caffer*) and Aardvark (*Orycteropus afer*) are also noticeably absent in the Ulugurus but present in other Eastern Arc Mountains, both undisturbed (Udzungwa) and disturbed (Rubeho) areas. It is not known if they were ever present in the Uluguru Mountains, and if they were when they were removed.

Table 31 Important species that UCBS did not verify the presence of

Species	Common name	IUCN	CITES	Last recorded
<i>Crocidura telfordii</i>	White-toothed shrew	Critically endangered		Stanley et al 1998
<i>Paraxerus palliatus</i>	Red-bellied coast squirrel	Vulnerable		Swynnerton and Hayman 1950
<i>Aonyx capensis</i>	African clawless otter		II	Swynnerton and Hayman 1950
<i>Leptailurus serval</i>	Serval cat		II	Swynnerton and Hayman 1950
<i>Panthera pardus</i>	Leopard		I	Swynnerton and Hayman 1950
<i>Cephalophus spadix</i>	Abbot's duiker	Vulnerable		Swynnerton and Hayman 1950

Seven records from UCBS research are new for Uluguru South, of which four are widespread species. *Beamys hindei* is an Eastern Arc near endemic species, also located in coastal forests and the southern rift. Both the shrew recordings, *Myosorex* sp and *Crocidura* cf *nana/elongius* have unknown ranges, but are likely to be Eastern Arc endemic, if not more localised to a specific mountain range. These await taxonomic verification to confirm species identification.

5.2.2 Birds

Avifauna has been well surveyed during previous research, for example Jensen and Brøgger-Jensen 1992; Svendsen and Hansen 1995; Tøttrup et al 2004. Comparisons are made to a list compiled by Doggart et al (2005) which includes all previous research for avifauna in Uluguru South FR. Most of the species UCBS recorded confirmed the presence of many widespread and common species.

Of particular note is the confirmation of the presence of the Tanzanian mountain weaver (*Ploceus nicolli*) which was last reported in 1981 and with only three records altogether, it is an elusive species of the Eastern Arc Mountains. It is listed by IUCN as endangered and the verification of its presence in Uluguru South FR is extremely important.

The Usambara Nightjar (*Caprimulgus guttifer*) is an interesting capture from Uluguru South FR. The Usambara nightjar is known from the Usambara Mountains and highlands north of Lake Malawi. It was captured on Lukwangule plateau grasslands and is likely also to be an undescribed subspecies; DNA samples will verify this.

UCBS recorded Loveridges sunbird (*Nectarinia loveridgei*), an Uluguru endemic, in abundance throughout the reserve. Tøttrup et al (2004) have estimated the population to be 36,971 within the Uluguru Mountains with highest densities (number per km²) within the altitudinal bands 1500m – 1800m and lowest densities at the extremes of the forest altitudinal ranges 1300m – 1400m asl and >2300m asl. Tøttrup et al had their highest catch rates at 1800m and 2200m asl, whilst Svendsen and Hansen (1995) captured most birds at 1520m and 1920m asl. UCBS captured most birds at 2040 and 1660m asl within Uluguru South FR. Abundance was lower at the highest altitude of 2450m asl, which corresponds with Tøttrup et al's (2004) findings.

This study confirmed the presence of seven other endemic species and subspecies: Uluguru mountain greenbul (*Andropadus neumanni*), White-winged apalis (*Apalis chariessa macpharsoni*), Brown woodland warbler (*Phylloscopus umbrovirens fugglescouchmani*), Bar-throated apalis (*Apalis thoracia uluguru*), the African tailorbird (*Orthotomus metopias altus*), Sharpe's akalat (*Sheppardia sharpei bangsi*) and Mrs Moreau's warbler (*Bathmocercus winifredae*). The Uluguru population of Mrs Moreau's warbler is largest of its limited population. All species were netted with the exception of the White-winged apalis which was observed casually.

UCBS did not record the presence of the rare and endangered Uluguru bush-shrike (*Malaconotus alias*) within Uluguru South FR. This Uluguru endemic species is found in low densities and is primarily dependent on submontane forest. It is almost exclusively confined to high canopy and thus very hard to detect unless heard. It has been heard only once in Uluguru South FR above Tchenzema at 2100m asl in 1981 (Collar and Stuart 1985, Collar and Jensen 1985). The surveys in 2000 (Doggart et al 2005) failed to locate it, thus perhaps it is already extinct in Uluguru South FR, which has very few tracts of submontane forest left in existence. Although it is important to verify the presence or absence of the Uluguru bush-shrike in Uluguru South FR, efforts to conserve this species and its habitat should focus on Uluguru North FR where the submontane forest is this species' stronghold for survival.

Two bird species that have not been recorded by UCBS or by previous research in Uluguru South FR (Usambara eagle owl (*Bubo vosseleri*) and Banded green sunbird (*Anthreptes rubritorques*)) are worth highlighting due to their vulnerable status and previous records in Uluguru North FR; more research should be undertaken to confirm their presence or absence in Uluguru South. The Usambara eagle owl (*Bubo vosseleri*) was not known from the Uluguru Mountains until 1995 (Hunter et al 1998). Romdal and Rahner (in press) recorded its presence in Uluguru North FR and made a population estimation of 1000 pairs. This is a species of highland forest canopy therefore Uluguru South FR would provide suitable habitat for the ecological requirements of the Usambara eagle owl; it is plausible that this species is present in the reserve, further specific research should be conducted to determine this. The Banded green sunbird (*Anthreptes rubritorques*), an Eastern Arc endemic, prefers submontane forest of which there are small tracts on the eastern side of Uluguru South FR. However, it has not been recorded in any surveys since 1950s. It is suspected to be extinct in the Uluguru Mountains. Only five specimens have been collected from Uluguru North FR (Svendsen and Hansen 1995).

The Uluguru Mountains have long been recognised as important for forest birds. In a review of key forests for the protection of threatened bird species in Africa (Collar and Stuart 1988), the Uluguru Mountains (including foothills) were ranked fourth among all forests in East Africa (and 16th within the African continent) in terms of conservation value for the protection of threatened and near threatened bird species. They are also an important part of C24, one of the 221 priority areas for global conservation listed by Birdlife International (1992).

5.2.3 Reptiles

Small fauna, such as reptiles can be good indicators of forest health due to their sensitivity to changes in the forest, such as human disturbance; this is particularly true of endemic species (Spawls et al 2002). This can be very useful in determining the status of the forest condition and the management requirements based on such information, especially as there were found to be many Eastern Arc endemic reptiles within Uluguru South FR, that are dependent on healthy forest conditions, for example: Usambara two-horned chameleon (*Bradypodion fischeri uluguruensis*), Werner's chameleon (*Chamaeleo werneri*), Uluguru-one horned chameleon (*Bradypodion oxyrhinum*) and the Uluguru forest snake (*Bufo proterae*). Comparisons are made to a list compiled by Doggart et al (2005) which includes all previous research for reptiles in Uluguru South FR.

Werner's chameleon is an interesting record as this species may later be recognised as a subspecies. Specimens that M. Menegon has compared from South and North Udzungwa and the Uluguru Mountains show some anatomical differences, for example the spines on the dorsal ridge. Other specimens previously collected from the Ulugurus, housed at University of Dar es Salaam, also confirm that the Uluguru Werner's chameleon looks quite different from the Udzungwa specimen.

Although the species richness of reptiles was found to be low with only six species recorded from this study (with an additional species not recorded by UCBS; Uluguru one-horned chameleon (*Bradypodion oxyrhinum*) recorded by Doggart et al in 2000), all of these species are endemic to the Eastern Arc with the exception of the Bearded pigmy chameleon (*Rhampholeon brevicaudatus*) which is near endemic. Two species that UCBS recorded for the first time in Uluguru South FR are the Bi-coloured blind snake (*Rhinotyphlops nigrocandidus*) and the Uluguru forest snake (*Bufo proterae*). This emphasises the importance of Uluguru South FR for the reptiles recorded, particularly chameleons which are targeted for the pet trade.

UCBS did not locate two species of conservation concern: the Ornate shovel-snake (*Prosymna ornatisimia*) (critically endangered) and the Uluguru blind snake (*Typhlops uluguruensis*). These are both predominantly submontane species and are less likely to be found in Uluguru South FR than Uluguru North FR but are worth mentioning because of their conservation importance. One specimen of *T. uluguruensis* has been collected near Uluguru North (pers comm Simon Loader, British Natural History Museum). For each snake very little is known about their behaviour and ecology. Only a few isolated specimens have been collected. Habitat loss is greatest at low to mid altitude so severely threatens these species.

Reptiles have yet to be formally assessed against IUCN red listing criteria but many of those recorded within our study will qualify as being threatened with extinction, especially if one considers the chameleon pet trade occurring in Uluguru South FR.

5.2.4 Amphibians

Small fauna, such as amphibians can be good indicators of forest health due to their sensitivity to changes in the forest, such as human disturbance. This can be very useful in determining the status of the forest condition and the management requirements based on such information. In addition, it is clear from this study that further studies can reveal a lot more about the amphibian fauna of Uluguru South FR. Comparisons are made to a list compiled by Doggart et al (2005) which includes all previous research for amphibians in Uluguru South FR.

Of particular interest are five unknown species of *Nectophrynoides* toad collected by UCBS (*Nectophrynoides* species A, C, D, E, and F). *Nectophrynoides* species are forest associated in submontane and montane forest patches in the Eastern Arc. The genus is considered an ancient Afrotemperate relict (Poynton 2003) but is poorly defined. The distribution of this species is thought to reflect the long history of the Eastern Arc forests and periods of isolation within fragmented mountain blocks. *Nectophrynoides* may be a useful indicator for reconstruction of the biogeography

of the Eastern Arc (Menegon et al 2004). Six species of *Nectophrynoides* are known to be present in the Uluguru mountains, three are strictly endemic (Figure 29).

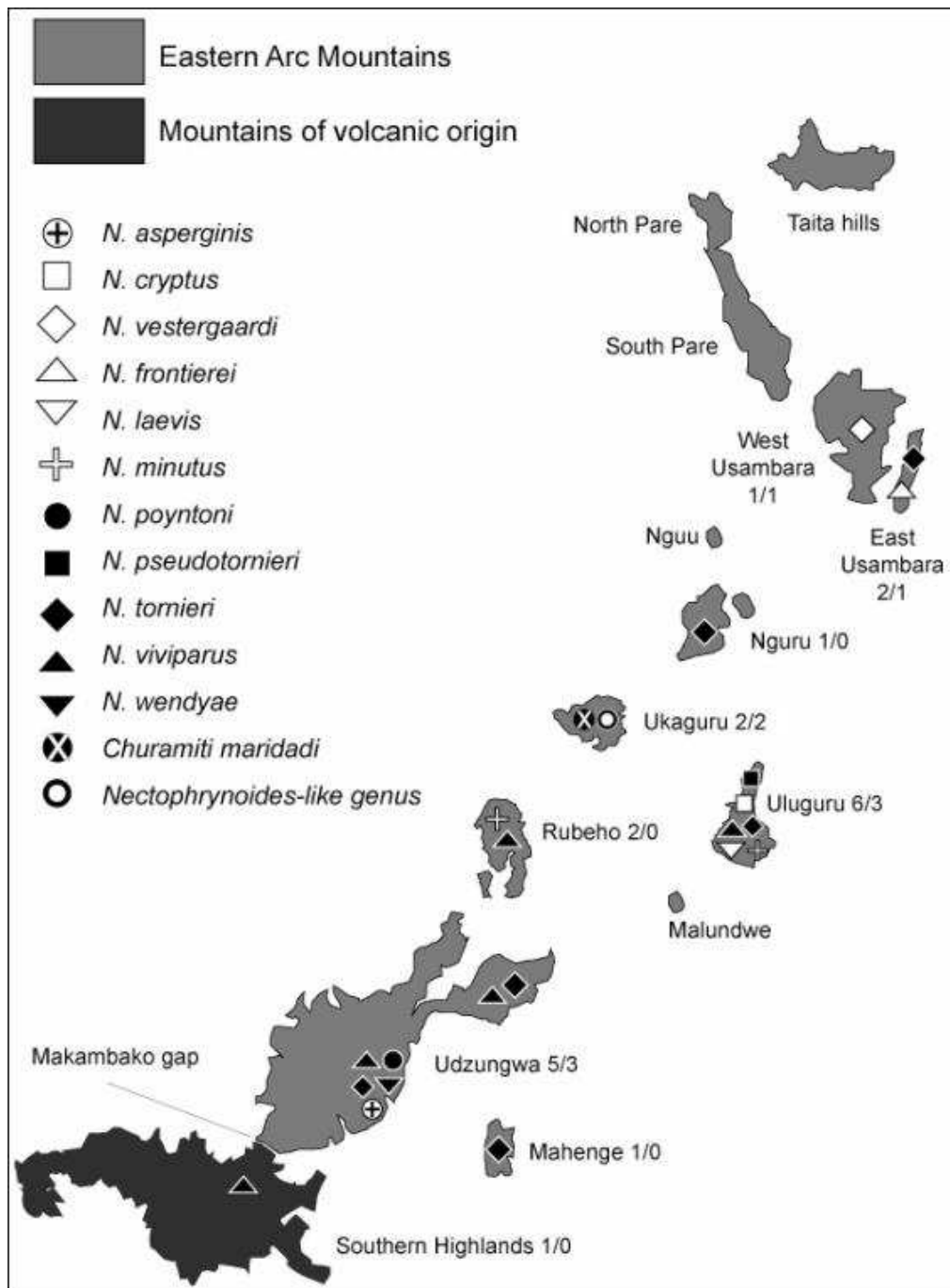


Figure 28 Distribution of *Nectophrynoides* species in the Eastern Arc Mountains and Southern Highlands (from Menegon et al, 2004)

All of the five unidentified species were located on either the east of the mountain or on Lukwangule plateau. Species C, collected from Lukwangule plateau is likely to be a Lukwangule plateau endemic. M. Menegon has also identified with certainty that species D is new. The other specimens await comparison to other collected individuals from the Ulugurus and other southern Eastern Arc mountain ranges. Clearly more intensive studies need to be undertaken.

UCBS also collected *Nectophrynoides pseudotornieri*, an Uluguru endemic described by Menegon et al (2004). The type locality for this species is Uluguru North FR. Of those *Nectophrynoides* species endemic to the Ulugurus UCBS did not record: *Nectophrynoides cryptus*, not recorded since 1993, *N. laevis*, recorded in 2002 and *N. tornieri*. *N. laevis* has a type locality in Uluguru South FR with one specimen collected. *N. cryptus*, previously collected at Nyingwa, is endangered. Uluguru South FR is one of the most important areas for *Nectophrynoides* in the Eastern Arc Mountains with the greatest species diversity. Six other important species were collected by UCBS which are listed by IUCN as vulnerable / endangered, with nine new species records for the reserve, five of which could be new species to science. Uluguru South FR is a biologically rich area for amphibians where there is great potential to discover new species, particularly in those areas still unexplored in depth.

It can be seen that Uluguru South FR has a high biodiversity value with many endemic and threatened species relying on its habitat. Degradation of forests is a continuing threat to the forest dependent and endemic species that have been recorded in this study. Furthermore there is great potential for discovering new species; more intensive studies concentrating on specific taxa, such as reptiles and amphibians, need to be conducted to try to provide a full faunal inventory of Uluguru South FR.

5.3 Human disturbance

Human disturbance is high within Uluguru South FR, with particular problems occurring on the west and north of the reserve. The main issues for management are:

- Invasive species, such as *Rubus*, spreading on the western slopes and Lukwangule plateau, preventing regeneration of trees and potentially pulling trees down
- Intensive firewood collection, including strategies such as ring-barking to increase availability, particularly on the west
- Fire on Lukwangule plateau, potentially changing the grassland ecology and pushing back pockets of forest; burning occurs yearly (pers comm, Sangeda)
- Pit-sawing, mainly for *Ocotea usambarensis*, on forest edge and along main paths bisecting the FR
- Encroachment of shamba into FR at Ng'weme
- Hunting with dogs on the western slopes and Lukwangule plateau
- Traps for small and large mammals, particularly on the eastern slopes, with major concern for the trapping of rodents
- Pet trade of chameleons around Bunduki
- Lack of clear forest boundaries, especially on the east side

The main cause for concern in terms of disturbance is the spread of the *Rubus* bramble; the threat to Uluguru South is very high and the spread has occurred rapidly within the last five years as Hymas did not record the presence of *Rubus* during his 2000 survey. UCBS recorded *Rubus* along transects 20 and 22 which are located on the east side of Lukwangule grassland in forest patches. The major areas in which *Rubus* has been encountered casually are above Tchenzema, Lukwangule plateau and Bunduki, where disturbance has caused gaps in the forest that allow the spread of this invasive species. Other countries also have problems with *Rubus* invasion; such as *Rubus fruticosus* in New Zealand; *Rubus alceifolius* in cleared areas in Queensland (but is a native to south east Asia) and; *Rubus discolor*, a pest in moist temperate regions of the world, native to western Europe. *Rubus* is usually spread by bird droppings and it is not easy to eliminate the actual spread, therefore management must consider germination, growth and proliferation. Methods suggested and used in other parts of the world fall into several categories, however these techniques are not necessarily used within a protected area. Viable methods would be biological controls and/or cultural controls (seedling regeneration is not as vigorous in well shaded areas, thus healthy forests and pastures may help prevent germination).

Analysis of cut poles and timbers within this study shows that cutting is more prevalent on the edge of the forest, where access is easier for those exploiting forest resources. However it is mainly old

cutting that has been recorded. The main disturbance area for extracting poles and timbers is the west side of the reserve. Pole extraction over time has not changed when compared to those data of Hymas, pole extraction was already at a significant level at the time of the Hymas study, thus this study by not recording a significant increase in pole extraction should not be mis-understood as being a positive result. However comparison of our data and that of Hymas (2001) for timbers indicates that timber cutting has increased on the east side since 2000 and this should be monitored.

It is clear that people use the forest to locomote between villages separated by this mountain range and 15% (79 of 522) of the 50m sections of the disturbance transects recorded paths, which varied from large paths to smaller, the latter more likely to be hunting trails leading to traps, and so on. Two large paths bisect Lukwangule plateau which are important access routes for trade of different food products between the villages of Tchenzema, Nyingwa and Lumba. This must be remembered and the impact of providing the Lukwangule plateau with any protection status that denies access to these paths. They are effectively a lifeline between villages geographically divided by this mountain range.

Hunting pressure is high in Uluguru South FR, especially in the east where this study recorded small snare traps for rodents. The prevalence and reasons for snaring rodents needs to be investigated. If the cause is protein deprivation then ways to supplement the local communities' diet and lifestyle must be investigated, as well as identifying which species are targeted and in what intensity. Overall hunting is much greater than in Uluguru North; this may in part be due to a difference in religious practices of the communities surrounding each forest reserve. Uluguru North communities are predominantly Muslim who are prohibited to hunt (although not all individuals may adhere to this), whilst Uluguru South FR is surrounded by Christian communities who do hunt. In contrast to the poverty in the east of the mountain, the communities of the west near Tchenzema seem to have increased in prosperity over time, such as new tin roofs on houses and improved road systems (Dr. N. Burgess, pers comm.).

The illegal trade of chameleons around Bunduki needs to be investigated further as there are several threatened and endemic species occurring in the FRs and if these are taken, it needs to be known if this practice is sustainable. Long-term management plans need to consider a total ban on this activity by enforcement and in the meantime monitor the trade.

Fire was recorded on the plateau with blackened soil seen between grassy hillocks. Both transect 22 and 24 conducted on the plateau recorded fire throughout the 900m. The effect of the yearly fires on Lukwangule plateau needs investigation through further research and should be considered of concern until detailed knowledge of the grassland ecology and its adaptation to fire is fully comprehended.

The Uluguru Mountains are one of the biologically most important areas of the Eastern Arc Mountains (Burgess et al 2002) with the third largest area of natural forest (Newmark 1998). Uluguru South FR has an extremely rich flora and fauna that have been highlighted in this baseline biodiversity study by assessing the richness and abundance of key taxa and species, confirming presence and absence of conservationally important species and finding potentially new species. This study provides a dataset that can be used as a monitoring baseline with which to assess changes over time to the biodiversity values and continuing human resource use in terms of disturbance to the forest. The conservation of the Uluguru forests is crucial to the survival of the endemic species. Uluguru South FR houses unique grassland at Lukwangule plateau, which is of extreme importance for plant endemism, and pristine montane and upper montane forest. The grassland plateau is threatened by yearly burning whilst the forests are severely threatened by the increasing pressure that human population growth is having on the demands for natural resources such as firewood and poles. With agriculture the dominant economy in the area, trees have been cleared over time and have forced people to look for their natural resources within the FR. These activities are strictly illegal and should be stopped but with clear alternatives to the local communities. Realistic management plans should involve the communities in how best to address the current problems facing Uluguru South

FR, such as patrolling borders and well used paths within the FR, encouraging tree planting on farm land (an activity already implemented in some areas of the mountains by WCST) and other joint management initiatives. As a globally recognised biodiversity hotspot both the larger and smaller perspectives and the short-term and long-term goals need careful planning and assimilation if this area is to be conserved for the future.

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Appendix 1: CARE-Tanzania Consultant Agreement

CARE-TANZANIA CONSULTANT AGREEMENT

Appendix K

Ms. THE SOCIETY FOR ENVIRONMENTAL EXPLORATION/FRONTIER (the "Consultant") of 50-52 Rivington Street, LONDON, U.K. EC2A 3QP and CARE, an international non-governmental development and relief organization, hereinafter referred to as CARE-Tanzania, P.O. Box 10242, Dar es Salaam, Tanzania, hereby agree to the following:

1. **Duties.** The Consultant shall complete the work described in the attached Schedule A, hereby incorporated into this Agreement, within the time frame specified therein. The Consultant shall not subcontract or sublicense any work hereunder without the written consent of CARE.
2. **Compensation.** The Consultant shall be compensated according to the terms specified in Schedule A, and shall not receive vacations, sick pay, insurance or other benefits usually afforded the employees of CARE.
3. **CARE Name.** The Consultant shall use the CARE name or marks only for activities authorized by CARE in writing. All other uses will be deemed infringements of the CARE trademark.
4. **Taxes.** The Consultant shall pay all personal taxes, social security, and other taxes per the national laws governing consultancy payments.
5. **Indemnity.** The Consultant shall indemnify and hold harmless CARE, and its officers, directors, employees, agents and its and their respective heirs, legal representatives, successors and assigns, from and against any and all claims, demands, liabilities, expenses (including reasonable attorney's fees and disbursements, court costs, judgments, settlements and fines), whether of omission or commission, that may be committed or suffered in connections with the performance of this Agreement by the Consultant or a partner or agent of the Consultant or the Consultant's general business operations. This paragraph shall survive termination or expiration of this Agreement.
6. **Ownership of Work.** The Consultant represents and warrants that all work created pursuant to this Agreement shall be original work and that no third party will hold any rights in or to such work. The Consultant agrees that CARE shall, solely and exclusively, own all rights in and to any work created by the Consultant in connection with this Agreement, including all data, documents, information, copyrights, patents, trademarks, trade secrets, or other proprietary rights in and to the work. By entering into this Agreement, the Consultant hereby expressly transfers all such rights to CARE.

7. **Disclosure.** The Consultant agrees not to disclose any matters of a confidential nature to which it may be or become privy as a result of the Agreement. Upon the expiration or termination of this Agreement, the Consultant shall surrender to CARE all confidential material relating to CARE in his or her possession, of whatever origin and including, without limitation, duplicates, facsimiles, models, prototypes and notes relating thereto. The Consultant shall promptly direct all inquiries relating to confidential and proprietary information from the public (whether from an individual, a government agency or official, the media or other sources) to your supervisor, except as CARE may otherwise provide by written instructions to the Consultant. This Article shall survive any termination or expiration of the Agreement.
8. **Business and Office Policies.** During the term of this Agreement, the Consultant shall comply with the business and office policies of CARE.
9. **Inability to Complete.** If the Consultant is unable to complete the described activities and duties described for any reason, then CARE Tanzania shall have the option to terminate this Agreement on five (5) business days written notice unless the Consultant furnishes another individual satisfactory to CARE. Otherwise, the Consultant's non-performance of the duties described in Schedule A will constitute a breach of this Agreement. CARE may withhold fees and compensation due to the Consultant until a settlement of any dispute between the parties has been reached.
10. **Termination.** This Agreement shall automatically terminate 30 days after the date set forth on Schedule A for the completion of the Consultant's duties. It may be terminated by CARE at any time for any reason, upon five (5) days written notice to the Consultant. Provisions which are intended to survive termination or expiration of this Agreement include, without limitation, to paragraphs 3, 4, 5, 6, and 7 hereof.
11. **Information.** CARE shall furnish the Consultant with such information as the Consultant deems necessary to perform agreed upon services, and CARE warrants that such information will be true and correct.
12. **No Joint Venture.** The Consultant is an independent contractor with respect to CARE. Nothing herein shall be deemed to create a joint venture, agency or partnership between the parties, and neither party shall have the power to obligate or bind the other in any manner whatsoever, except as specifically provided herein.
13. **Governing Law; Disputes.** This Agreement shall be construed and enforced in accordance with, and governed by the substantive laws of country in which the agreement is signed. CARE may withhold fees and compensation due to the Consultant until a settlement has been reached.

14. **Notices.** Any notice or other communication required or permitted hereunder shall be delivered in person or sent by first-class (certified mail return receipt requested) to the address set forth above. Such notice or communication shall be deemed to have been given as of the date so delivered, sent or mailed.
15. **Security Notice.** In connection with your consultation work for CARE, and travel relating to your work, you may encounter difficult conditions and hazards. The risks inherent in that travel and work include personal injury, illness, kidnapping, civil unrest and the loss of, or damage to, your property. In addition, emergency rescue, medical facilities or an adequate level of medical expertise may not be available to you. CARE cannot assure your safety or that of your property. It is your obligation to understand in advance all the risks inherent in your travel and work because, in accepting this consulting contract, you accept those risks. **CARE strongly recommends that you obtain appropriate insurance, including emergency medical evacuation coverage, to protect yourself against the risks inherent in your consulting work for CARE.**
16. **Entire Agreement.** This Agreement contains the entire understanding of the parties hereto with respect to the subject matter contained herein. This Agreement supersedes all prior agreements and understandings between the parties with respect to such subject matter and may only be modified or discharged by a written document executed by the parties hereto. No terms hereof may be waived or modified except by written amendment.
17. **Representations.** By his or her signature below, each signatory hereto represents and warrants that he or she is duly authorized to enter this Agreement on their behalf. Upon execution and delivery, this Agreement shall be a binding obligation of such party. The Consultant further represents and warrants that her or she has provided CARE with his or her correct social security number, and true and accurate information concerning citizenship and/or residency status. The Consultant agrees to notify CARE of any change in his or her citizenship and/or residency status during the term of this Agreement.

18. Headings. Article headings herein are included for convenience of reference only and shall not affect the construction or interpretation of this Agreement.

19. Time is of the essence of the Agreement.

20. The CARE contact person for this contract is: GABRIEL BATULAINÉ.

IN WITNESS WHEREOF, the parties have duly executed this Agreement as of the 23rd day of AUGUST, 2004.

CARE INTERNATIONAL IN TANZANIA


Name: NICK SOUTHERN
Title: COUNTRY DIRECTOR

24/8/04

CONSULTANT


Name: CIBLEIS FANNING

Circle Applicable Status: U.S. Citizen Resident of U.S. Non-U.S. Citizen

Social Security Number (for U.S. Citizens and Residents): _____

SCHEDULE A

Conservation & Management of the Eastern Arc Mountain Forests: Uluguru Mountains Environmental Management & Conservation Project (GEF/UNDP:URT/01/G32)

Introduction

The Uluguru Mountains Environmental Management and Conservation Project (UMEMCP) is a component of the Conservation and Management of the Eastern Arc Forests (GEF/UNDP: URT/01/G32). The project is implemented by the Forest and Beekeeping Division of the Ministry of Natural Resources and Tourism and it is funded by the Global Environment Facility through the United Nations Development Programme. CARE International in Tanzania (CARE) implements the UMEMCP component under the terms of an agreed Memorandum of Understanding with the Forest and Beekeeping Division that was signed on the 12th August 2003.

Objectives of the Consultancy

The purpose of the UMEMCP component is:

Improved forest management and conservation and improved land husbandry practices in the Uluguru Mountain forests and adjacent villages implemented by local communities, government authorities and other stakeholders.

Improving the management and protection systems of the Catchment Forest Reserves of the Ulugurus (North and South) is a key project output to achieving this objective. Central to improving the management of the forests is first understanding their biodiversity values and being able to measure any change in those biodiversity values. The project is now in its first year of implementation and the objective of the consultancy is to establish a baseline for measuring the Project's impact on maintaining biodiversity values and reducing threats in the longer term.

Therefore, CARE Tanzania is inviting proposals from service providers to undertake a biodiversity assessment of the Uluguru North and South Catchment Forest Reserves. The assessment will determine:

- i) Major types of forest disturbance and proportion of habitat affected by forms of disturbance;
- ii) Population density of key floral indicator species e.g. *Allanblackia uluguruensis*; *Ocotea usambarensis*;
- iii) Species richness of flora and vertebrates¹; and
- iv) Crude abundance of endemic; globally threatened and Eastern Arc characteristic species.

¹ Detailed population estimates of the Uluguru Bushshrike and Loveridge's Sunbird will be undertaken separately to indicate population trends in these key endemic species since 2000.

Potential service providers should note that CARE Tanzania works locally in partnership with: the District Councils of Morogoro and Mvomero Districts; the Morogoro Regional Catchment Forestry Office, Morogoro; The Tanzania Forest Conservation Group (TFCG); The Wildlife Conservation Society of Tanzania (WCST); and the Uluguru Mountains Agricultural Development Project (UMADEP).

Expected Products of the Consultancy

A detailed consultancy report presenting the assessment in both hard (3 copies) and soft copies together with the original data sets.

These will be lodged with:

- The proposed Eastern Arc Conservation Centre;
- Forest and Beekeeping Division; and
- The Tanzania National Biodiversity Database, UDSM.

Methods

The project requires service providers to outline their methodological approach and indicate how they propose to integrate relevant government partners into their methodology.

Special Issues

Service providers should:

- i) Specify how they intend to address the issue of specimen collection, storage, export permits and CITES clearance.
- ii) Indicate how their methods compare with those used for previous assessments within the Eastern Arc Mountains.

Implementation Arrangements

- 1) **Time-frame:** Field implementation to begin in October 2004 with a draft report completed by March 2005.
- 2) **Preparation & Briefings:** The project will provide a full briefing and copies of previous studies undertaken at the site and field orientation at the start of the field-work period.
- 3) **Debriefs:** The project will expect regular monthly debriefs throughout the implementation period to ensure timely execution of the contract. The Project Office should be used as the main operational base for the fieldwork.
- 4) **Reporting:** The Project expects to see a draft report of the first analysis by March 2005. A final report (after specimen identifications have been completed) will be produced not later than the end of 2005.
- 5) **Resources:** The project will provide a vehicle with a driver. The project will also provide access to office space and internet connection in Morogoro.

ULUGURU NORTH AND SOUTH FOREST RESERVES BIODIVERSITY AND RESOURCE-USE ASSESSMENT

Aim: To undertake systematic biodiversity and forest resource-use assessment of the Uluguru North and Uluguru South Catchment Forest Reserves to establish a baseline for measuring the Uluguru Environmental Management and Conservation Project's (UMEMCP) impact on maintaining biodiversity values and reducing threats in the longer term.

Objectives:

1. To conduct baseline biodiversity surveys (flora and fauna), assessing both species richness and diversity, using systematic surveys methodologies, field observations, and opportunistic collections.
2. To conduct baseline forest disturbance surveys, using systematic survey methodologies, field observations, and casual collections to quantify anthropogenic threats.
3. To collate and disseminate baseline biodiversity and forest resource-use information through the production of reports.
4. To provide information on the biological value and use of the forests based on systematic surveys.

Proposed work area and Justification: The proposed biodiversity and forest resource-use assessments will take place in both the Uluguru North and Uluguru South Catchment Forest Reserves. These reserves encompass a total area of 25,649.4 ha, with 8,356.7 ha in the Uluguru North and 17,292.7 ha in the Uluguru South. Uluguru North is characterised by large areas of sub-montane to upper montane forest while the Uluguru South is characterised by large areas of montane to upper montane forest with some grasslands. According to information collected by previous Uluguru Mountain Biodiversity Surveys (Doggart *et. al*, 2000), 15 endemic and 54 near-endemic vertebrates have been documented in the Ulugurus. These reports state that more than 300 vertebrate species inhabit the Uluguru Mountains and their foothills, with birds as the most diverse order with over 140 species.

Organisational Capacity and Previous Methodologies: Frontier-Tanzania (F-T) has been successfully conducting biodiversity surveys within the Eastern Arc and Coastal forests since 1989. The majority of biodiversity data in existence for this biodiversity hotspot was collected by Frontier-Tanzania via numerous partnerships, and in collaboration with the Forestry and Beekeeping Division at both national and local levels. During this time, Frontier-Tanzania has developed and utilised systematic methodologies for biodiversity surveys, allowing comparative analysis across the hotspot. These methodologies are briefly outline in the section below. Using these methodologies for data collection in the Uluguru Catchment Forest Reserves will allow comparative analysis with Frontier-Tanzania's previous assessments of the Eastern Arc Mountains, including the East Usambara mountains (1995-2002), Udzungwa mountains (1999-2001) and Mahenge mountains (2003). From these data, Frontier-Tanzania has produced 21 reports from the East Usambara Mountains, 7 reports from Udzungwa Mountains, 22 reports from coastal forests, Kipengere and Mahenge reports and over 50 peer-review manuscripts

and articles from the forest research programme alone. (Please refer to our Publications list for details.)

Methods: The proposed methods for this project will build upon the systematic methods traditionally used by Frontier-Tanzania, more specifically those utilised for the Udzungwa Mountains Biodiversity Surveys: West Kilombero Scarp Forest Reserve. Please note that degrees of flexibility exist within our traditional, systemised methodologies and that the proposed methodologies for the Uluguru project will first be approved and amended by members of the Frontier Tropical Resource Advisory Committee and relevant players within Tanzania prior to implementation in the field. This will be conducted during the initial preparation period within the project.

i). *Major types of forest disturbance and proportion of habitat affected by forms of disturbance:* This will be achieved through conducting forest disturbance and resource-use surveys. Disturbance is categorised via quantitative assessment of pole ($5 > 15\text{cm dbh}$) and timber ($\geq 15\text{cm dbh}$) cutting along systematic transect lines. Transect lines form a "grid system" for demarcating vegetation plots, allowing quantitative vegetation analysis. Each transect is demarcated at 3km intervals throughout each reserve. Evidence of grazing, burning, charcoal production, settlement, hunting/trapping, pit-sawing, honey-collection is recorded per 50m. For field purposes, habitat is initially categorised as either lowland ($X < 850\text{m A.S.L.}$), sub-montane ($1200\text{m} > X > 850\text{m}$) or montane ($X > 1200\text{m}$), and then further categorised during report production. For further detail please refer to Frontier-Tanzania Methods manual (2001).

ii). *Population density of key floral indicator species e.g. Allanblackia uluguruensis; Ocotea usambarensis.* Quantitative vegetation analysis will be achieved through the demarcation of 0.1 ha ($50 \times 20\text{m}$) vegetation plots at a sampling intensity of approximately 0.04%, within a grid system of 900m x 3000m, where vegetation plots are sited every 900m along transect lines. Tree species composition is evaluated using the vegetation plot data. Each tree $\geq 10\text{cm}$ diameter at breast height (dbh) is identified, marked and measured. Regeneration subplots ($3 \times 3\text{m}$) are established to identify those genera/species regenerating through ground and shrub layers ($0.5\text{cm} \geq 10\text{cm dbh}$). There is huge potential for utilising multivariate analyses (such as DECORANA) with these data from the Ulugurus, East Usambaras, Udzungwas and Mahenge mountains, where systematic data exists for comparative analysis within the hotspot. Specific indicator species data can be extracted from the major project data-set.

Opportunistic botanical sampling is conducted to supplement systematic data collection, to compile a more comprehensive botanical inventory. This will include herbaceous and woody plants.

Plant species will be identified in the field by botanists. Botanical samples will be collected where field identification is not possible, with duplicate specimens deposited for identification and curation at the University of Dar es Salaam Herbarium, Arusha Herbarium. Selected specimens will be sent to Missouri

and Kew botanical gardens for future verification description of potential new species.

iii) *Species richness of flora and vertebrates. Floral species richness will be determined from the vegetation plot and opportunistic botanical recording and collection. This can be presented as a species inventory checklist.*

Vertebrate species richness will be determined using a variety of methods and survey techniques. Zoological traps sites are conducted within representative forest habitats. Trap sites are sampled for an eight trap night duration, to record mammal, bird, amphibian and reptile species utilising: 100 sherman traps with a 10x10m grid system [small mammals]; 33 bucket pitfall traps within 3 trap lines (11 buckets/line) [small mammals, reptiles and amphibians]; standardised timed searches (15 man hours per trap site) for amphibians and reptiles; mist nets and potential use of harp traps to sample bats (mega and micro-chiroptera) within a standardised effort calculated by net metre hours; bird point counts, standardised time per trap site; bird transect counts (along standard transect lines); dung and track survey along transect lines. Opportunistic species records and specimen collection will occur throughout the field-work.

Each animal will be identified with appropriate data recorded (i.e. sex, weight, and location of capture), entered onto data sheets titled MAMMAL, BATS, REPTILE and AMPHIBIAN. Bird and bat data books will store effort, location and species data from each location (trap site, transect, opportunistic). In total, six systematic trap sites will be studied during the project period, spending 8 nights at each trap site.

iv) *Crude abundance of endemic; globally threatened and Eastern Arc characteristic species.*

Analysis of the project raw data will include species categorisation, using for example: IUCN Redlist, CITES, National Biodiversity Database, LEAP database (Knox 2000), Iversen (1991). Species can be categorised, for example, by: ecological requirements (forest dependent, forest non-dependent, non-forest species), endemism (endemic, near-endemic, wide-spread), habitat (lowland, sub-montane, montane), using a variety of references readily available to Frontier-Tanzania (2001). Crude abundance can be illustrated by using GIS applications. Categories will be defined during the preparation and report production period of the project.

Taxonomic verification: Selected specimens will be sent to a number of taxonomic authorities at established institutions via UDSM's collaborative links. Frontier-Tanzania has been successfully *collecting, storing, and exporting specimens* for 15 years. Voucher specimens are sorted and deposited at UDSM for reference and teaching purposes. Professor Kim Howell (Zoology Dept. UDSM) is able to *facilitate export permits and obtain CITES clearance* from the Wildlife Division, Ministry of Natural Resources and Tourism. All specimens are the property of UDSM. Species lists will be sent back to the UDSM and Frontier-Tanzania when specimens have been identified in order to

and Kew botanical gardens for future verification description of potential new species.

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verify and update field identifications. Please refer to Annex A for taxonomic verification.

Additional surveys: Upon request, the following specialised surveys could also be conducted: primate transect, galagos night-work, hyrax counts, chameleon transects, and bush-fire surveys.

Project Partners: Frontier-Tanzania is a collaborative venture between the Society for Environmental Exploration and UDSM. UDSM will play a large role in the formal identification of specimens during the project period, zoological and botanical. The Morogoro Regional Catchment Forestry Office of the Forest and Beekeeping Division can be integrated into the project through placement of forestry officers as research assistants on the project. However, associated costs such as per diems are not included in the budget. UMEMCP, as with our previous work, (EUCAMP, MEMA) would need to cover these costs. The District Councils of Morogoro and Mvomero will be consulted to seek local permissions, inform community representatives of the work aims and seek local knowledge and expertise to assist the project. Regular communication will be made after liaison with UMEMCP and FBD.

Timetable: The proposed work will take place over a period of 7 months, including 5 months of field work and 2 months of report production. Work is scheduled to begin in October 2004, with a draft report completed by May 2005. Monthly de-briefs will be conducted via update meetings at the UMEMCP office in Morogoro with the Frontier-Tanzania Project Co-ordinator.

Appendix 2: Taxonomic Verification

BOTANY

Mr. George Sangu	Frontier-Tanzania	P.O.Box 9473, Dar Es Salaam, Tanzania frontier@africaonline.co.tz
Mr. Frank Mbago	University of Dar es Salaam	UDSM Herbarium, P.O. Box 35060, Dar es Salaam, Tanzania mbago@uccmail.co.tz
Dr. Roy Gereau	Missouri Botanical Gardens	P.O. Box 299, St. Louis, Missouri 63166-0299 USA

ZOOLOGY

Mammals:

Prof. Kim Howell	University of Dar es Salaam	Department of Zoology P.O. Box 35064, Dar es Salaam, Tanzania khowell@udsm.ac.tz
Dr. Bill Stanley	Chicago Field Museum	Mammal Section, Field Museum, Chicago, IL 60605, USA stanley@fieldmuseum.org

Amphibians:

Prof. Kim Howell	University of Dar es Salaam	Department of Zoology P.O. Box 35064, Dar es Salaam, Tanzania khowell@udsm.ac.tz
Prof. J. Poynton	British Natural History Museum	Cromwell Road, South Kensington, London, UK
Mr. Michele Menegon	Museo Tridentino Di Scienze Naturali	Trento, Italy menegon@MTSN.TN.IT

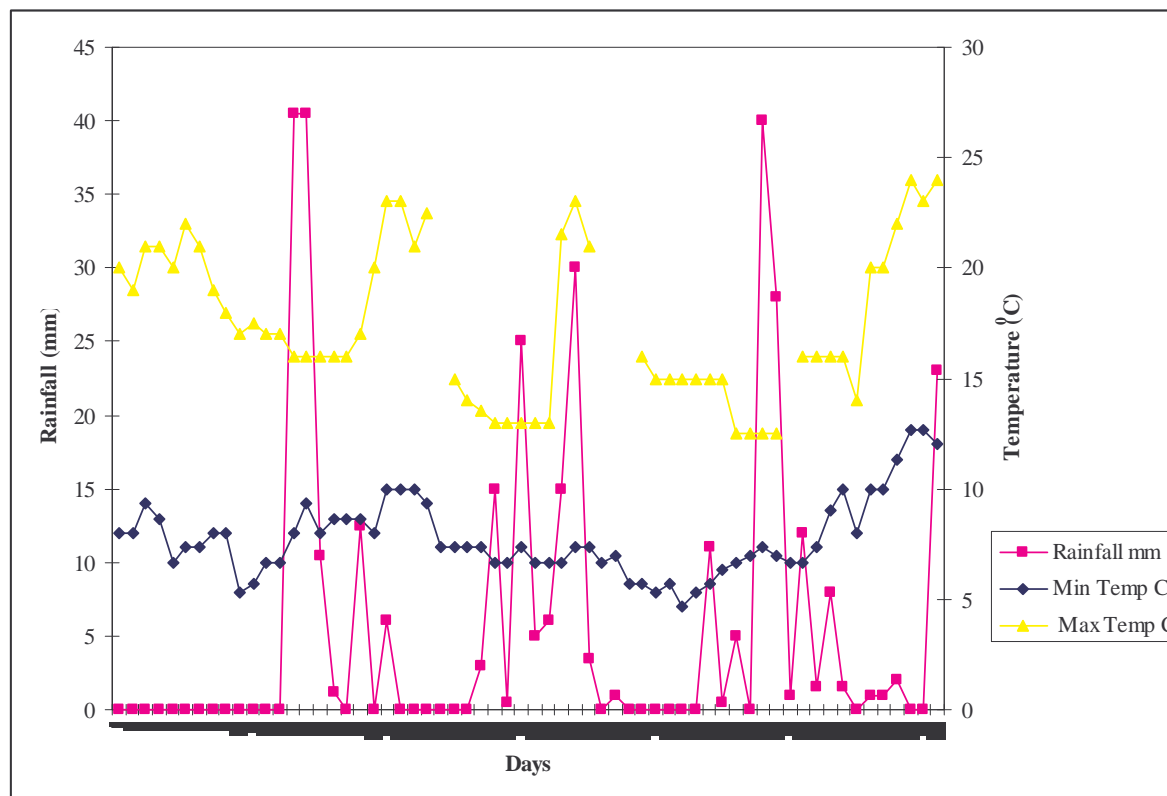
Reptiles:

Prof. Kim Howell	University of Dar es Salaam	Department of Zoology P.O. Box 35064, Dar es Salaam, Tanzania khowell@twiga.com
Mr. Michele Menegon	Museo Tridentino Di Scienze Naturali	Trento, Italy menegon@MTSN.TN.IT
Dr. Don Broadley	The Natural History Museum of Zimbabwe	P.O. Box 240, Bulawayo, Zimbabwe
Dr. R.C. Drewes	California Academy of Sciences	Department of Herpetology, Golden Gate Park San Francisco, California 94118, USA bdrewes@calacademy.org

Birds:

Mr. Jakob Kiure	Independent consultant	kiure@hotmail.com
Prof. Jon Fjeldså	Zoological Museum	Universitetsparken 15, DK-2100, Copenhagen, Denmark

Appendix 3: Summary of weather conditions



Day 1-8	Basecamp 1	1515 m asl	23/09/04 – 30/09/04
Day 9-17	Basecamp 2	1830 m asl	07/10/04 – 15/10/04
Day 18-20	Sat camp 1	1695 m asl	17/10/04 – 19/10/04
Day 21-24	Sat camp 2	1450 m asl	25/10/04 – 28/10/04
Day 25-33	Basecamp 3	2040 m asl	31/10/04 – 08/11/04
Day 34-38	Sat camp 3	1620 m asl	09/11/04 – 13/11/04
Day 39-50	Basecamp 4	2450 m asl	20/11/04 – 01/12/04
Day 51-62	Base camp 5	1660 m asl	07/12/04 – 18/12/04

Appendix 4: GPS Co-ordinates for Uluguru South FR

Longitude and Latitude in degrees, seconds, minutes and Grid references in UTM/UPS

4a Summary of basecamp and satellite campsites

Site no.	Waypoint	Description of location	Dates	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
1	US-BC1	Basecamp 1 , montane forest close to Ukwama village	23/09/04 - 30/09/04	07° 10' 40.8"	037° 41' 32.2"	0355604	9206427	1515
2	US-BC2	Basecamp 2 , Upper montane forest close to Lamzi village	07/10/04 - 15/10/04	07° 05' 17.0"	037° 39' 14.2"	0351337	9216372	1830
2	US-SC1	Sat camp from Lanzi	17/10/04 - 19/10/04	07° 08' 27.9"	037° 39' 16.5"	0351427	9210510	1695
2	US-SC2	Sat camp from Kasanga	25/10/04 - 28/10/04	07° 10' 42.2"	037° 41' 36.8"	0355741	9206398	1450
3	US-BC3	Basecamp 3, Bamboo zone, Upper Montane forest near top of pass to Lumba Juu from Lanzi	31/10/04 - 08/11/04	07° 09' 20.4"	037° 39' 30.1"	0351850	9208900	2040
3	US-SC3	Sat camp 3 from Ningwa	09/11/04 - 13/11/04	07° 07' 25.9"	037° 41' 00.9"	0354624	9212425	1620
4	US-BC4	Base camp 4, from Tchenzema	20/11/04 - 01/12/04	07° 07' 10.8"	037° 37' 16.9"	0347750	9212868	2450
5	US-BC5	Base camp 5, from Bunduki	07/12/04 - 18/12/04	07° 02' 57.4"	037° 38' 41.7"	0350329	9220658	1660
5	US-SC4	At forestry campsite near Bunduki village	30/01/05 - 03/02/05	07° 01' 34.3"	037° 37' 53.2"	0348832	9223207	1284

4b Summary of zoological sites

Site no.	Waypoint	Description of location	Date	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
1	Z1-L2	Zoo site 1, line 2 as in middle of site	23/09/04 - 30/09/04	07° 10' 41.3"	037° 41' 30.0"	355533	9206426	1570
2	US-L2	Zoo site 2, line 2 as in middle of site	08/10/04 - 15/10/04	07° 05' 17.2"	037° 39' 13.0"	351302	9216368	1858
3	US-Z3	Zoo site 3, by stream 2040m	01/11/04 - 08/11/04	07° 09' 20.4"	037° 39' 30.1"	351850	9208900	2040
4	US-Z4	Zoo site 4, on edge of upper montane forest patch on Plateau	21/11/04 - 28/11/04	07° 07' 10.8"	037° 37' 16.9"	347750	9212868	2450
5	US-Z5	Zoo site 5, near edge of the reserve	08/12/04 - 15/12/04	07° 02' 57.4"	037° 38' 31.0"	350000	9210658	1670

4c Summary of transects

Transect no.	Waypoint	Description of location	Direction of transect	Date	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
1	US-T1	Transect north from path above	N	24/09/2004	07° 10' 06.3"	037° 41' 20.8"	0355248	9207499	1600
2	SLIDE	Near the start of transect 2	W	25/09/2004	07° 10' 43.0"	037° 40' 51.4"	0354350	9206370	1960
2	US-T2E	Top of T2 on rocky outcrop			07° 10' 49.1"	037° 40' 51.4"	0353535	9206178	2280
3	US-T3	Extrapolated start of T3	N	26/09/2004	07° 10' 19.8"	037° 41' 18.9"	0355193	9207085	1700
3	UST3PA	Path into forest to get to T3			07° 10' 28.5"	037° 41' 32.4"	0355606	9206820	1639
4	US-B1	Beginning of T4, also border of FR	N	27/09/2004	07° 10' 42.1"	037° 41' 32.6"	0356928	9207343	1627
4	US-T4E	End of T4		28/09/2004	07° 09' 45.6"	037° 42' 14.9"	0356907	9208141	1853
5	no GPs cover, read off map	450m point of T5 where path crosses on the ridge	S		07° 11' 20.1"	037° 41' 06.0"	0354800	9205230	2050
6	US-T6	Start of T6 at cliff point 200m, extrapolated from US-T6E	W	29/09/2004	07° 10' 24.6"	037° 41' 02.0"	0354672	9206936	1860
6	US-T6E	End of T6 when transect hits a sheer cliff			07° 10' 25.9"	037° 40' 39.1"	0353972	9206893	2263
7	US-T7	Beginning of T7 (trying to find beginning of Olivier's transect)	W	09/10/2004	07° 05' 17.2"	037° 39' 13.0"	0351663	9216761	1780
7	US-T7E	End of T7 (extrapolated from 200m point)			07° 05' 04.3"	037° 38' 55.5"	0350763	9216761	2000
7	T7-200	200m point on T7			07° 05' 04.4"	037° 39' 18.3"	0351463	9216761	1825
8	US-T8	Start of T8 just south of zoo 2 in gully	W	11/10/2004	07° 05' 24.1"	037° 39' 13.2"	0351310	9216155	1840
8	T8-350	350m point of T8			07° 05' 24.1"	037° 39' 01.8"	0350960	9216155	1930
8	US-T8E	End of T8			07° 05' 24.4"	037° 38' 44.7"	0350435	9216143	2000
9	US-T9	Start of Transect T9	W	13/10/2004	07° 05' 47.1"	037° 39' 43.8"	0352250	9215450	1880
10	US-T10	Start of T10 approx	W	17/10/2004	07° 08' 48.6"	037° 39' 16.9"	0351440	9209875	1780
11	US-T11	100m west of start of T11	S	18/10/2004	07° 08' 50.4"	037° 39' 20.7"	0351556	9209818	1760
12	US-T12	Start at border of FR Lumba juu, east transect	E	01/11/2004	07 10' 04.7"	037 38' 50.1"	0350625	9207535	1780
13	US-T13	On ridge west of path (midway to Lumba juu)	NWW	02/11/2004	07 09' 24.8"	037 38' 59.5"	0350910	9208760	2160
14	US-T14	Start of T14 on the edge of the forest	NWW	04/11/2004	07 10' 08.6"	037 38' 30.0"	0350011	9207413	1840
15	US-T15	Start at forest edge, but at 300m, started at now 550m and hit rock so turned back and transected until the border	E	06/11/2004	07 10' 27.3"	037 39' 01.4"	0350974	9206840	1660
16	US-T16	Start of Border	N	09/11/2004	07 07' 41.2"	037 42' 17.7"	0356983	9211959	1760
17	US-T17	Start of T17 100m pass top of pass from Lanzi side	S	11/11/2004	07 07' 36.5"	037 39' 25.8"	0355380	9212100	1920
18	US-T18	North edge of the plateau glassland	N	21/11/2004	07 04' 43.6"	037 36' 55.9"	0347028	9217387	2516
19	US-LE	Follow path from end of Lukwangule Plateau (S) south for approx 300m until beginning of T19	S	22/11/2004	07 08' 31.1"	037 36' 53.5"	0347041	9210398	2460

Transect no.	Waypoint	Description of location	Direction of transect	Date	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
20	US-T20	East side of plateau	E	23/11/2004	07 06' 41.0"	037 37' 14.4"	0347670	9213771	2460
21	US-T21	Edge of forest-start of TL1	E	24/11/2004	07 06' 31.6"	037 35' 54.6"	0345221	9212400	2040
22	US-T22	Edge of path going to Ningwa	E	25/11/2004	07 07' 26.1"	037 37' 51.0"	0348003	9212400	2400
23	US-T23	Edge of forest by Ng'ungulu	E	27/11/2004	07 07' 10.3"	037 35' 51.0"	0345113	9212875	2140
24	US-T24	From base camp 4	W	29/11/2004	07° 07' 10.8"	037° 37' 16.9"	0347750	9212868	2450
25	US-T25	West across stream from base camp	S	30/11/2004	07° 07' 15.9"	037° 37' 04.5"	0347370	9212710	2450
26	US-T26	Start of T26 at junction of 2 paths on ridge.	S	08/12/2004	07° 03' 12.4"	037° 38' 35.6"	0350143	9220197	1800
27	US-T27	Start 150m other side of river on path to Lanzi	E	09/12/2004	07 03' 27.0"	037 38' 53.7"	0350700	9219750	1680
28	US-T28	Start at boarder of reserve	E	10/12/2004	07 03' 38.0"	037 38' 15.4"	0349525	9219409	1820
29	US-T29	Start at boarder of reserve	S	12/12/2004	07 03' 37.7"	037 37' 53.0"	0348839	9219415	1910
30	US-T30	Starts 100m east of camp, otherside of the river	S	14/12/2004	07 02' 57.4"	037 38' 45.0"	0350429	9220658	1660
31	US-T31	Near Kibigiri village, Bunduki	S	31/01/2005	07 03' 12.1"	037 37' 14.9"	0347665	9220200	1960
32	US-T32	Near Vinile village, Bunduki	E	01/02/2005	07 01' 19.6"	037 38' 49.5"	0350559	9223663	1530

4d Summary of vegetation plots

Plot no.	Waypoint	Description of location	Date	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
1	US-V1	Started near zoo site 2	08/10/2004	07° 05' 18.7"	037° 39' 14.1"	0351337	9216322	1860
2	US-V2	Started near zoo site 2	08/10/2004	07° 05' 21.4"	037° 39' 13.1"	0351304	9216239	1900
3	US-T7	Started at 0m T7	10/10/2004	07° 05' 17.2"	037° 39' 13.0"	0351663	9216761	1760
4	US-V4	Started at 300m T7	10/10/2004	07° 05' 04.4"	037° 39' 15.0"	0351363	9216761	1850
5	US-V5	Started at 550m T7	10/10/2004	07° 05' 04.3"	037° 39' 06.9"	0350813	9216761	1950
6	US-T8	Started at T8-0m	12/10/2004	07° 05' 24.1"	037° 39' 13.2"	0351310	9216155	1850
7	US-V7	Started at 0m T9	14/10/2004	07° 05' 54.1"	037° 39' 27.0"	0351734	9215236	1800
8	US-V8	Started at 150m T9	14/10/2004	07° 05' 55.3"	037° 39' 22.9"	0351609	9215198	1854
9	US-V9	Started of om T10	17/10/2004	07° 08' 48.6"	037° 39' 16.9"	0351440	9209875	1780
10	US-V10	Started 100m west of T11	18/10/2004	07° 08' 50.4"	037° 39' 20.7"	0351556	9209818	1760
11	US-V11	Started at 400m T11	18/10/2004	07° 09' 04.0"	037° 39' 20.6"	0351556	9209400	1880
12	US-V12	Start of V12	25/10/2004	07° 10' 45.3"	037° 41' 11.0"	0354950	9206300	1700
13	US-T1	100m point of T1 north, 20m west	25/10/2004	07° 10' 06.3"	037° 41' 20.8"	0355248	9207499	1928
14	US-V14	50m point west at T6 550m	26/10/2004	07° 10' 25.9"	037° 40' 50.5"	0354322	9206893	2170
15	US-V15	Start of V15	26/10/2004	07° 10' 25.8"	037° 41' 07.7"	0354850	9206900	1760
16	US-V16	Started 250m of T4	27/10/2004	07° 10' 03.4"	037° 42' 15.5"	0356928	9207953	1640
17	US-V17	Started 600m of T4	27/10/2004	07° 09' 52.0"	037° 42' 15.6"	0356928	9207943	1740

Plot no.	Waypoint	Description of location	Date	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
18	US-T12	Started om of T12	02/11/2004	07 10' 04.7"	037 38' 50.1"	0350625	9207535	1780
19	US-V19	Started 500-550m of T12	02/11/2004	07 10' 04.7"	037 39' 06.4"	0351125	9207535	1780
20	US-T14	Started 400m of T14	05/11/2004	07 10' 08.6"	037 38' 30.0"	0350011	9207413	1840
21	US-T14	Started 600m of T14	05/11/2004	07 10' 08.6"	037 38' 30.0"	0350011	9207413	2000
22	US-V22	Start of V22	07/11/2004	07 08' 57.6"	037 39' 41.6"	0352200	9209600	1820
23	US-V23	Start of V23	07/11/2004	07 09' 04.1"	037 39' 44.9"	0352300	9209400	2000
24	US-V24	Started 50m of T16	09/11/2004	07 07' 39.6"	037 42' 17.8"	0356983	9212009	1760
25	US-V25	Started 450m of T16	09/11/2004	07 07' 26.6"	037 42' 17.8"	0356983	9212009	1800
26	US-T17	Started 0m of T17	11/11/2004	07 07' 36.5"	037 41' 25.8"	0355390	9212100	1850
27	US-V27	Started 550m of T17	11/11/2004	07 07' 36.5"	037 41' 25.8"	0355390	9211550	1900
28	US-V28	Started near SC3	12/11/2004	07 07' 15.4"	037 41' 00.5"	0354612	9212745	1620
29	US-V29	Started near SC3	12/11/2004	07 07' 26.0"	037 41' 00.9"	0354623	9212420	1680
30	US-V30	Started 300m of T18	21/11/2004	07 04' 33.8"	037 36' 53.8"	0347028	9217687	2510
31	US-LE	Started om of T19	22/11/2004	07 08' 31.1"	037 36' 53.5"	0347041	9210398	2460
32	US-LE	Started 350m of T19	22/11/2004	07 08' 31.1"	037 36' 53.5"	0347041	9210398	2460
33	US-T20	Started 0m of T20	23/11/2004	07 06' 41.0"	037 37' 14.4"	0347670	9213771	2460
34	US-V34	Started 435-483m T20	23/11/2004	07 06' 41.4"	037 37' 28.6"	0348105	9213771	2480
35	US-V35	Started 50m T21	24/11/2004	07 06' 31.7"	037 35' 56.2"	0345271	9214062	2040
36	US-V36	Started 450m T21	24/11/2004	07 06' 32.7"	037 42' 09.3"	0345671	9214062	2310
37	US-BC4	Started at basecamp 4	26/11/2004	07° 07' 10.8"	037° 37' 16.9"	0347750	9212868	2450
38	US-V38	Started at basecamp 4	26/11/2004	07 07' 05.9"	037 37' 24.5"	0347982	9213018	2440
39	US-V39	Started 200m of T23	27/11/2004	07 07' 10.3"	037 35' 57.5"	0345313	9212875	2160
40	US-T26	Started om T26	08/12/2004	07 03' 12.4"	037 38' 35.6"	0350143	9220197	1800
41	US-V41	Started 450-500m of T26	08/12/2004	07 03' 25.3"	037 38' 37.4"	0350200	9219802	1862
42	US-V42	Started 0m of T27	09/12/2004	07 03' 27.0"	037 38' 53.7"	0350700	9219750	1680
43	US-V43	Started 450m T27	09/12/2004	07 03' 26.9"	037 38' 35.8"	0351150	9219780	1980
44	US-V44	Started 50m of T28	11/12/2004	07 03' 38.0"	037 38' 13.4"	0349525	9219409	1820
45	US-V45	Started 550m of T28	11/12/2004	07 02' 58.1"	037 38' 41.9"	0350025	9219409	2000
46	US-V46	Started 200m of T29	13/12/2004	07 03' 44.4"	037 37' 43.0"	0348839	9219215	1980
47	US-V47	Started 500m of T29	13/12/2004	07 03' 51.0"	037 37' 52.6"	0348830	9218190	2043
48	US-V48	Started 400m of T30	14/12/2004	07 02' 44.1"	037 38' 45.0"	0350429	9221068	1740
49	US-V49	Started 700m of T30	14/12/2004	07 02' 34.3"	037 38' 45.0"	0350429	9221368	1750
50	US-T31	Started 0m of T31	31/01/2005	07 03' 12.1"	037 37' 14.9"	0347665	9220200	1960
51	US-V51	Started 250m of T31	31/01/2005	07 03' 20.0"	037 37' 15.5"	0347686	9219954	2090

Plot no.	Waypoint	Description of location	Date	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
52	US-T32	Started 0m of T32	01/02/2005	07 01' 19.6"	037 38' 49.5"	0350559	9223663	1530
53	US-V53	Started 400 of T32	01/02/2005	07 01' 19.0"	037 39' 02.5"	0350959	9223663	1580

4e Summary of some disturbance

Site no.	Waypoint	Description of location	Latitude (S)	Longitude (E)	Grid ref (E)	Grid ref (N)	Altitude (m)
2	US-P1	Pitsawing site near Basecamp 2, Lanzi	07° 05' 06.6"	037° 39' 27.7"	0351751	9216693	1764
2	US-P2	Pitsawing site near Basecamp 2, Lanzi	07° 05' 04.2"	037° 39' 28.4"	0351778	9216769	1730
3	US-P5	Pitsawing site at 600m of Transect 12	07 10' 02.8"	037 39' 09.6"	0351224	9207596	1826
3	US-BLU	Path reaching border edge of FR by Lumba juu	07 10' 14.4"	037 38' 52.0"	350684	9207236	1716
3	PA-END	End of path near Kihunza village on other side of forest reserve to Ningwa.	07 07 45.5	037 41 50.3	356143	9211825	2460
3	Shamba	Shamba inside of forest reserve on way to Kihunza.	07 07 44,6	037 41 43.4	355928	9211853	2300

Appendix 5: Summary of Transecting data

Each transect is 900m length x 10m width = 9000m², apart from four transects which were shortened in length due to impassable terrain: transect 6 was 700m; transect 10 was 500m; transect 15 was 600m; transect 23 was 800m.

Tran- sect no.	Total Live pole (LP)	Average LP per 50m	Total Dead pole (DP)	Average DP per 50m	Total Old cut pole (OCP)	Average OCP per 50m	Total New cut pole (NCP)	Average NCP per 50m	Total Live timber (LT)	Average LT per 50m	Total Dead timber (DT)	Average DT per 50m	Total Old cut timber (OCT)	Average OCT per 50m	Total New cut timber (NCT)	Average NCT per 50m
1	353	19.61	10	0.56	0	0.00	0	0.00	439	24.39	87	4.83	5	0.28	0	0.00
2	227	12.61	3	0.17	0	0.00	0	0.00	412	22.89	24	1.33	0	0.00	0	0.00
3	383	21.28	33	1.83	9	0.50	0	0.00	344	19.11	42	2.33	4	0.22	0	0.00
4	235	13.06	19	1.06	22	1.22	0	0.00	235	13.06	36	2.00	16	0.89	0	0.00
5	234	13.00	23	1.28	3	0.17	0	0.00	245	13.61	26	1.44	7	0.39	0	0.00
6	180	12.86	8	0.57	0	0.00	0	0.00	287	20.50	48	3.43	0	0.00	0	0.00
7	169	9.39	9	0.50	1	0.06	0	0.00	169	9.39	20	1.11	0	0.00	0	0.00
8	117	6.50	3	0.17	0	0.00	0	0.00	229	12.72	33	1.83	0	0.00	0	0.00
9	153	8.50	16	0.89	0	0.00	0	0.00	126	7.00	24	1.33	0	0.00	0	0.00
10	55	5.50	2	0.20	0	0.00	0	0.00	84	8.40	27	2.70	0	0.00	0	0.00
11	114	6.33	6	0.33	0	0.00	0	0.00	167	9.28	9	0.50	0	0.00	0	0.00
12	144	8.00	15	0.83	0	0.00	0	0.00	241	13.39	39	2.17	2	0.11	1	0.06
13	98	5.44	31	1.72	0	0.00	0	0.00	207	11.50	37	2.06	0	0.00	0	0.00
14	159	8.83	6	0.33	0	0.00	0	0.00	192	10.67	40	2.22	1	0.06	0	0.00
15	185	15.42	12	1.00	10	0.83	0	0.00	126	10.50	17	1.42	10	0.83	0	0.00
16	218	12.11	14	0.78	3	0.17	0	0.00	257	14.28	28	1.56	3	0.17	0	0.00
17	108	6.00	4	0.22	0	0.00	0	0.00	133	7.39	20	1.11	0	0.00	0	0.00
18	272	15.11	19	1.06	0	0.00	0	0.00	408	22.67	55	3.06	0	0.00	0	0.00
19	88	4.89	15	0.83	0	0.00	0	0.00	133	7.39	16	0.89	0	0.00	0	0.00
20	198	11.00	13	0.72	0	0.00	0	0.00	343	19.06	41	2.28	0	0.00	0	0.00
21	190	10.56	2	0.11	39	2.17	6	0.33	141	7.83	19	1.06	23	1.28	2	0.11
22	83	4.61	13	0.72	0	0.00	0	0.00	121	6.72	49	2.72	1	0.06	0	0.00
23	80	5.00	1	0.06	2	0.13	8	0.50	82	5.13	10	0.63	0	0.00	23	1.44

Tran- sect no.	Total Live pole (LP)	Average LP per 50m	Total Dead pole (DP)	Average DP per 50m	Total Old cut pole (OCP)	Average OCP per 50m	Total New cut pole (NCP)	Average NCP per 50m	Total Live timber (LT)	Average LT per 50m	Total Dead timber (DT)	Average DT per 50m	Total Old cut timber (OCT)	Average OCT per 50m	Total New cut timber (NCT)	Average NCT per 50m
24	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
25	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
26	120	6.67	9	0.50	15	0.83	4	0.22	203	11.28	44	2.44	3	0.17	6	0.33
27	252	14.00	16	0.89	0	0.00	0	0.00	278	15.44	36	2.00	0	0.00	0	0.00
28	63	3.50	3	0.17	0	0.00	4	0.22	167	9.28	41	2.28	0	0.00	17	0.94
29	89	4.94	8	0.44	1	0.06	6	0.33	100	5.56	27	1.50	0	0.00	3	0.17
30	166	9.22	13	0.72	1	0.06	7	0.39	206	11.44	27	1.50	0	0.00	9	0.50
31	81	4.50	8	0.44	16	0.89	5	0.28	178	9.89	23	1.28	16	0.89	2	0.11
32	324	18.00	8	0.44	10	0.56	0	0.00	223	12.39	15	0.83	1	0.06	0	0.00
Total	5138	296.44	342	19.56	132	7.63	40	2.28	6476	372.14	960	55.84	92	5.39	63	3.66

Appendix 6: Vegetation plot descriptions

Plot ID	Topo-graphy	Altitude (m asl)	Slope (deg)	Aspect	Vegetation Type	Canopy height (m)	Canopy Cover (%)	Disturbance Category	Feature of Interest	No. Indivs	No. Species	Dominant species
1	GMS	1860	19	NNW	MF	>30	10-50			30	8	<i>Allanblackia stuhlmannii</i> , <i>Garcinia volkensii</i>
2	GMS	1900	21	NE	MF	>30	>50			42	18	<i>Garcinia volkensii</i>
3	GMS	1760	15	NE	MF	>30	>50			36	15	<i>Garcinia volkensii</i>
4	SMS	1850	25	E	MF	>30	>50			26	15	<i>Garcinia volkensii</i> , <i>Ponteria aldo-friedeneii</i>
5	GUS	1950	20	S	MF	20-30	>50			59	19	<i>Garcinia volkensii</i>
6	GUS	1850	10-45	SE	MF	20-30	>50			29	9	<i>Garcinia volkensii</i>
7	SLS	1800	30	E	MF	20-30	>50			61	17	<i>Rapanea melanophloeus</i> , <i>Drypetes gerrardii</i> , <i>Allanblackia stuhlmannii</i>
8	SUS	1854	30	E	MF	20-30	>50			71	16	<i>Allanblackia stuhlmannii</i>
9	SLS	1780	25	E	MF	20-30	>50			39	16	<i>Zanthoxylum</i> sp
10	SLS	1760	25	W	MF	20-30	>50			69	16	<i>Batholsaria</i> sp, <i>Drypetes gerrardii</i> , <i>Uvariadendron</i> sp
11	GMS	1880	<5	N	MF	20-30	>50			54	13	<i>Prunus africana</i> , <i>Dracaena afromontane</i> , <i>Allophylus</i> sp
12	GMS	1760	40	NW	MF	20-30	>50			78	20	<i>Batholsaria</i> sp, <i>Uvariadendron usambarense</i>
13	GMS	1928	20	N	MF	10-20	>50			63	20	<i>Apodytes dimidiata</i> , <i>Leptonychia usambarensis</i>
14	GUS	2170	5	E	UMF	20-30	>50	Old cutting, camp	monkey hair at camp	67	18	<i>Garcinia volkensii</i> , <i>Allanblackia stuhlmannii</i>
15	SUS	1760	15-20	N and E	MF	20-30	>50	old cutting	path	106	24	<i>Syzygium guineense</i>
16	GMS	1670	none	none	MF	20-30	>50	old cutting		54	22	<i>Allanblackia stuhlmannii</i>
17	GMS	1740	20	W	MF	20-30	>50		path	40	20	<i>Allanblackia stuhlmannii</i>
18	GMS	1780	-	-	MF	>30	>50	traps	path	66	24	<i>Oxyanthus speciosus</i>
19	GMS	1750	-	-	MF	20-30	10-50			60	21	<i>Oxyanthus speciosus</i>

Plot ID	Topo- graphy	Altitude (m asl)	Slope (deg)	Aspect	Vegetation Type	Canopy height (m)	Canopy Cover (%)	Disturbance Category	Feature of Interest	No. Indivs	No. Species	Dominant species
20	SMS	1840	35	E	MF	>30	10-50	cutting		42	16	<i>Kiggelaria africana</i> , <i>Psychotria</i> <i>sp</i>
21	SUS	2000	45	E	MF	>30	>50			44	21	<i>Drypetes gerrardii</i>
22	GUS	1820	15	N	MF	20-30	10-50			24	14	<i>Kiggelaria africana</i> , <i>Macaranga</i> <i>capensis</i>
23	GUS	2000	45	NW	MF	20-30	10-50			39	13	<i>Batholsaria sp</i>
24	GLS	1760	30	E	MF	>30	>50			32	20	
25	GLS	1800	25	E	MF	20-30	10-50			72	25	<i>Apodytes sp</i>
26	RIDGE	1850	2	S	MF	20-30	>50			42	16	<i>Allanblackia stuhlmannii</i>
27	GUS	1900	5	S	MF	20-30	>50		paths, rocky outcrops	49	18	<i>Drypetes gerrardii</i>
28	GMS	2500	2	0	UMF	20-30	>50			24	10	<i>Apodytes dimidiata</i> , <i>Rawsonia</i> <i>lucida</i>
29	GMS	1680	5-10	W	MF	>30	>50			60	23	<i>Oxyanthus speciosus</i>
30	GMS	2500	2	N	UMF	20-30	>50	Ring barking of 3 trees		71	15	<i>Syzygium cordatum</i> , <i>Syzygium</i> <i>sp</i> , <i>Maytenus undata</i>
31	GUS	2460	10-20	S	UMF	20-30	10-50			38	15	
32	GLS	2350	30	S	UMF	>30	10-50			10	5	<i>Kiggelaria africana</i>
33	GUS	2460	5	E	UMF	10-20				32	12	<i>Nuxia congesta</i> , <i>Ocotea</i> <i>usambarensis</i>
34	GMS	2480	5	E	UMF	20-30	10-50		path	26	9	<i>Syzygium cordatum</i>
35	SMS	2040	50	W	UMF	20-30	10-50			20	6	<i>Maesa lanceolata</i>
36	GMS	2200	15	S	UMF	10-20	10-50		path	60	13	<i>Maytenus undata</i> , <i>Aphloia</i> <i>theiformis</i> , <i>Cussonia spicata</i>
37	GUS/UP	2455	10	N	UMF	10-20	>50			70	16	<i>Syzygium cordatum</i> , <i>Syzygium</i> <i>guineense</i>
38	UP	2440	5	W	UMF	20-30	>50			41	13	<i>Syzygium guineense</i>
39	GLS	2160	20	SW	UMF	20-30	>50		paths	64	10	<i>Dracaena afromontane</i> , <i>Pterocarpus tinctorius</i>
40	RIDGE	1800	5	E	MF	20-30	>50	Logging	paths	45	13	<i>Aphloia theiformis</i>
41	SUS/RIDGE	1862	20	SE	MF	20-30	>50	Cutting, logging	paths	31	15	<i>Aphloia theiformis</i>
42	GLS	1830	20	N	MF	>30	>50		paths	61	21	<i>Dracaena afromontane</i>

Plot ID	Topo-graphy	Altitude (m asl)	Slope (deg)	Aspect	Vegetation Type	Canopy height (m)	Canopy Cover (%)	Disturbance Category	Feature of Interest	No. Indivs	No. Species	Dominant species
43	SUS	1980	45	EW	MF	>30	>50	Cutting		82	20	<i>Allanblackia uluguruensis</i>
44	SLS	1820	30	W	MF	20-30	10-50			31	8	<i>Cussonia spicata</i>
45	SUS / Ridge	1970	30	W & E	MF	20-30	>50			91	30	<i>Garcinia volkensii</i> , <i>Harungana</i> sp
46	GMS	1980	10	N	MF	20-30	10-50		path	17	6	<i>Maesa lanceolata</i> , <i>Cussonia spicata</i>
47	SUS	2043	40	N	MF	20-30	10-50		path	12	7	<i>Maesa lanceolata</i>
48	SMS	1740	45	W	MF	20-30	10-50		paths	38	16	<i>Aphloia theiformis</i>
49	SMS	1750	45	S	MF	20-30	10-50		paths	35	17	<i>Schefflerodendron usambarensis</i>
50	SMS	1960	25	N	MF	10-20	10-50	Cutting, logging	paths	18	10	<i>Myrica salicifolia</i> , <i>Aphloia theiformis</i> , <i>Maytenus undata</i>
51	SUS	2090	40	N	MF	20-30	10-50	Cutting	paths	27	10	
52	GLS	1530	20	W	MF	20-30	>50	Cutting poles, monkey & bird traps	paths	34	17	
53	GUS	1680	20	W	MF	20-30	10-50			31	13	<i>Garcinia kingaensis</i>

Key: Topography G = gentle, S = steep, LS = lower slope, MS = Mid slope, US = Upper slope, UP = upland plateau; Vegetation MF = Montane forest, UMF = Upper montane forest

Appendix 7: Regeneration plot descriptions

Regen Plot ID	Cover (%)				Dominance (%)				Soil texture	Soil colour	No. Inds	No. Species
	Herbs	Bare soil	Litter	Rocks	Grasses	Forbs	Mosses/ lichens	Ferns				
1	45	0	70	0	0	0	0	55	Sandy-clay	Light grey	38	8
2	30	0	80	0	0	0	10	40	Sandy-clay	Dark brown	69	13
3	30	0	80	0	0	0	0	70	Sandy-clay	Dark brown	63	9
4	70	0	70	0	0	0	10	20	Sandy-clay	Dark brown	80	9
5	60	10	60	0	0	0	10	30	Sandy-clay	Dark brown	95	12
6	60	10	50	0	0	0	10	50	Sandy-clay	Light grey	45	7
7	40	0	90	0	0	0	5	20	Sandy-loam	Dark brown	124	16
8	80	0	80	0	0	0	5	10	Sandy-loam	Dark brown	63	9
9	70	5	70	10	0	0	5	5	Sandy-loam	Dark brown	50	7
10	65	10	65	5	0	0	10	10	Sandy-clay	Light grey	96	12
11	80	0	80	0	0	0	20	40	sandy-clay	Light grey	86	8
12	70	5	60	0	0	0	10	60	sandy-clay	Light grey	76	10
13	40	20	30	<5	0	0	5	40	Sandy-loam	Dark grey	116	13
14	90	<5	60	0	0	0	5	10	Loamy-clay	Dark grey	104	11
15	50	10	50	0	0	0	10	5	Sandy-loam	Dark brown	75	9
16	80	0	80	0	0	0	10	50	Sandy-loam	Dark brown	72	15
17	30	10	60	20	0	0	10	40	Sandy-loam	Dark brown	41	8
18	80	0	60	0	0	0	10	20	Sandy-clay	Light grey	108	17
19	70	0	80	0	0	0	20	10	Sandy-clay	Light grey	77	10
20	70	10	50	50	0	0	10	30	Sandy-clay	Light grey	62	5
21	60	10	80	5	0	0	10	20	Loamy-clay	Dark brown	49	10
22	60	0	70	5	0	0	10	10	Sandy-clay	Dark grey	58	11
23	60	0	60	10	0	0	10	20	Sandy-clay	Dark grey	60	10
24	60	0	80	60	0	0	0	20	Loamy-clay	Dark brown	61	8
25	80	10	90	0	0	0	0	15	Loamy-clay	Dark brown	62	3
26	60	0	90	0	0	0	0	20	Loamy-clay	Dark grey	110	12
27	50	0	90	0	0	0	0	20	Clay	Yellowish	58	11
28	60	15	50	0	0	0	10	10	Clay	Light grey	59	10
29	60	5	80	0	0	0	10	20	Clay	Yellowish	39	10

Regen Plot ID	Cover (%)				Dominance (%)				Soil texture	Soil colour	No. Inds	No. Species
	Herbs	Bare soil	Litter	Rocks	Grasses	Forbs	Mosses/ lichens	Ferns				
30	20	0	80	1	0	0	0	30	Sandy clay	Brown	79	12
31	40	0	70	5	0	0	0	30	Sandy loam	Dark grey	>192	10
32	60	0	60	0	0	0	0	40	Loam	Dark grey	47	6
33	60	0	50	0	0	0	0	60	Loam	Dark grey	88	11
34	60	0	20	0	0	0	0	40	Loam	Dark brown	49	8
35	80	0	50	20	0	0	0	30	Sandy loam	Dark brown	89	11
36	20	10	50	5	0	0	0	20	Sandy clay	Light grey	51	8
37	70	0	60	0	0	0	0	20	Sandy-loam	Dark brown	87	14
38	50	0	70	0	0	0	0	30	Sandy-loam	Dark grey	83	10
39	80	0	40	<5	0	0	0	20	Sandy-clay	Dark grey	61	8
40	<10	0	80	0	0	0	0	15	Sandy-loam	Dark grey	>193	10
41	50	0	60	0	0	0	0	5	Sandy-loam	Brown	64	7
42	60	0	60	0	0	0	0	30	Sandy-clay	Brown	77	10
43	80	0	90	0	0	0	0	30	Clay	Dark grey	79	10
44	60	12	60	2	0	0	0	30	Sandy-clay	Light grey	36	7
45	60	0	80	0	0	0	0	30	Sandy-clay	Light grey	>89	6
46	80	0	80	5	0	0	0	15	Loamy-clay	Red brown	>104	9
47	90	0	70	0	0	0	0	40	Loamy-clay	Red brown	>54	9
48	70	5	70	0	0	0	0	30	Sandy-clay	Light grey	>93	9
49	70	0	40	0	0	0	0	40	Sandy-clay	Light grey	29	8
50	70	0	40	0	0	0	0	50	Loamy-clay	Light grey	27	8
51	80	0	60	<5	0	0	0	30	Loam	Brown	67	7
52	30	0	60	<5	0	0	0	10	Clay loam	Light grey	57	13
53	>60	0	40	5	0	0	0	5	Clay loam	Light grey	>77	7
MEAN	58.49	2.96	65.19	3.92	0.00	0.00	4.25	27.36			59.74	9.64

Appendix 8: Vegetative data

Plant species recorded by UCBS, including vegetation plots, regeneration plots and casual collections. Preliminary identifications have been conducted at Herbarium of University of Dar es Salaam by Mr. G. Sangu and Mr. F. Mbago.

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
ACANTHACEAE									
<i>Isoglossa lactea</i>	Lindau	250 - 800	T6;	Herb	N		Forest	LEAP (East African Herbarium)	
<i>Justicia beloperonoides</i>				Herb	E				
<i>Justicia interrupta</i>	(Lindau) C. B. Clarke	810-1530	T2,6;	Herb	N		Montane forest	LEAP (East African Herbarium)	
<i>Justicia tenella</i>	(Nees) T. Anderson		T6; P; Zaire; W. Africa	Herb				LEAP (East African Herbarium)	
ADIANTACEAE									
<i>Adiantum lunulatum</i>	Burm. F.			Herb					Not in LEAP
ANACARDIACEAE									
<i>Sorindeia madagascariensis</i>	Thouars ex DC.	1 - 1830	K4,7; T2,3,5-8; P;Z; Malawi, Mozambique and Mascarene Islands	Evergreen tree	N		Riverine, coastal and upland forest, often in wet or seasonally flooded places.	FTEA	
ANISOPHAELIACEAE									
<i>Anisophyllea abyssinica</i>		1700		Tree			Moist forest or forest margins	FTEA	
ANNONACEAE									
<i>Uvaria sp</i>		1300 - 1900		Shrub			Moist forest or forest margins	LEAP	
<i>Uvariadendron usambarense</i>	R.E.Fr.	1230 - 2100		Tree	N	Vu	Moist forest or forest margins	FTEA	

<i>Uvariadendron</i> <i>sp</i>				Shrub					
Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
APOCYNACEAE									
<i>Landolphia buchananii</i>		200 - 2300		Shrub to tree			Moist forest or forest margins	LEAP	
<i>Landolphia sp</i>		1600 - 2430		Shrub			Moist forest or forest margins	LEAP	
<i>Rauvolfia mombasiana</i>	Stapf	300 - 2440	U2; K4,7; T2,3,6-8; Burundi, Rwanda and Zaire	Tree				LEAP (East African Herbarium)	
<i>Rauvolfia volkensii</i>				Tree					
<i>Schizogygia coffeoides</i>	(Boj.) Baill.	0 - 500	K7;	Shrub				LEAP (East African Herbarium)	
ARACEAE									
<i>Amorphophallus sthlmannii</i>	(Engl.) Engl. & Gehrm.	0 - 1400 m	T3, 6; not known elsewhere.	Plant robust	N		Evergreen forest, often on limestone.	FTEA	
ARALIACEAE									
<i>Cussonia spicata</i>	Thunb.	530 - 2150		Shrub to tree			Montane forest	LEAP	
<i>Polyscias fulva</i>	(Hiern) Harms	1180 - 2160	U2-4; K5; T1-4,6,7; W. Africa, Malawi, Zambia, Zimbabwe, Angola	Tree			Upland and lowland rain-forest, riverine forest, also upland grassland.	FTEA	
<i>Schefflera lukwangulensis</i>		1400 - 2600		Tree	E	Vu	Moist forest or forest margins	LEAP	
<i>Schefflera spicata</i>		1400 - 2100		Tree			Moist forest or forest margins	LEAP	
<i>Schefflera umbellifera</i>		1400 - 2300		Woody climber			Moist forest or forest margins	FTEA	
ASTERACEAE									
<i>Conyza attenuata</i>	DC.			Herb				FTEA not ready yet	FTEA not ready. Listed in LEAP but no data

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Crassocephalum crepidioides</i>	(Benth.) S. Moore		U1-4; K1,3-7; T1-8;	Herb				LEAP	FTEA not ready
<i>Helichrysum odoratissimum</i>	(L.) Sweet	1700 - 3700	U1-3; K3,5; T2,4,7; Zimbabwe, Malawi, Mozambique, S. Africa	Herb				LEAP	
<i>Helichrysum traversii</i>	Chiov.	1850 - 3000	K2,3,5; T2,3,7; Ethiopia	Herb				LEAP	
<i>Vernonia bruceae</i>	C. Jeffrey	1000 - 1200	T6, 7 border; not known elsewhere.	Shrub, climber or small tree			Moist forest or forest margins	FTEA	NW Uluguru Mts and Mwanihana FR
<i>Vernonia glabra</i>	(Steetz) Vatke	0 - 2100	K1,4,5; T1-8; Z; Congo, Zambia, Malawi, Mozambique, Zimbabwe, Namibia, Botswana, South Africa	Perennial herb			Dry grassland, waste places like roadsides, woodland, grassland in the woodland zone	FTEA	
<i>Vernonia holstii</i>	O. Hoffm.	900 - 2100	K3,4,6,7; T2-7; Cameroon, Congo, Rwanda, Zambia, Malawi, Mozambique, Zimbabwe	Woody herb or Shrub			Margins of and clearings in dry evergreen forest, secondary bushland, maybe locally common	FTEA	
<i>Vernonia lasiopous</i>	O. Hoffm.	1050 - 2650	U2-4; K3,4,6,7; T1-3,5,6; Rwanda, Sudan and Ethiopia	Woody herb or Shrub			Forest clearings, forest margins, secondary bush derived from forest, riverine thicket, secondary grassland in forest or dry bush zone, roadsides maybe abundant in abandoned cultivation	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Vernonia stuhlmannii</i>	O. Hoffm.	350 - 1200	T3?,5,6,8; not known elsewhere	Woody herb or weak Shrub			Woodland, wooded grassland and thickets	FTEA	
BALSAMINACEAE									
<i>Impatiens hamata</i>		1350-2220		Herb	N		Montane rain forest		
<i>Impatiens lukwangulensis</i>		1650-2250		Herb	E		Montane rain forest in moist and shaded areas		
<i>Impatiens pallide-rosea</i> var. <i>pallide-rosea</i>		1600 -2500		Herb	E		Moist forest or forest margins		
<i>Impatiens pseudohamata</i>		2250		Herb	E		Montane rain forest in moist and open areas		
<i>Impatiens serpens</i>		1680 - 2430		Herb	E		Moist forest or forest margins		
<i>Impatiens simbiniensis</i>		1400-1500		Herb	E		Montane rain forest		
<i>Impatiens uluguruensis</i>		1600-2550		Herb	E		Montane rain forest among mosses and shaded areas		
<i>Impatiens walleriana</i>	Hook. f.	0-2000	K7; T2,3,6; Z, P; Mozambique, S. Malawi, E. Zimbabwe	Succulent perennial			In damp often shaded, places in upland and coastal rain-forest, particularly in riverine thickets, gullies and damp rocky places	FTEA	
<i>Impatiens whitii</i>				Herb					
BEGONIACEAE									
<i>Begonia oxyloba</i>	Welw.	1100	K5; T3,7; Burundi, Zaire, W. Africa	Herb				LEAP	
<i>Begonia oxylobata</i>		1550 - 2600		Herb			Moist forest or forest margins	FTEA	
BERBERIDACEAE									
<i>Berberis holstii</i>									

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
BIGNONIACEAE									
<i>Markhamia sp</i>		1210- 1900		Tree			Moist forest or forest margins	LEAP	
CAESALPINIACEAE									
<i>Zenkerella sp</i>	J. Leon	Unknown		Shrub to tree			Moist forest or forest margins		
CELASTRACEAE									
<i>Maytenus accuminata</i>	(L.F.)Los.	0 - 3150	U1-4; K1-7; T1-4,6,7; Z; W. Afr, Madagascar, Sudan, Somalia, Yemen	Tree			Forest, riverine forest, woodland, evergreen and coastal bushland	FTEA	
<i>Maytenus undata</i>	(Thunb.) Blakelock			Shrub					
<i>Maytenus spinosa</i>				Tree					
CHRYSOBALANACEAE									
<i>Parinari excelsa</i>	Sabine	1300 -1900		Shrub				Not in LEAP	
CONVOLVULACEAE									
<i>Ipomoea involucrata</i>	P. Beauv.	100 - 2700	U2,3; K6 ; T 1-8; Z; Throughout tropical Africa from West Africa to Angola and nothern Transvaal.	Herb			Grassland, forest, Brachystegia woodland and abandoned cultivated ground.	FTEA	
<i>Ipomoea urbaniana</i>	(Dammer) Hall. f.	0 - 1500	U2,4; K7; T3,6,8; eastern Congo Republic	Liane			Upland and lowland rain-forest, rarely in grassland.	FTEA	
<i>Ipomoea wightii</i>	(Wall.) Choisy	50 - 2400	U1-4; K1-6; T1-8; Z; Mozambique, Myassaland, Zimbabwe, South Africa also in Madagascar and tropical Asia.	Herb			Open forest, scrub.	FTEA	
CYATHACEAE									
<i>Cyathea manniana</i>	Hook			Herb					
CYPERACEAE									

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Cyperus cyperoides</i>	(L.) O. Ktze.	150 - 2150	U3,4; K1-4,6,7; T1-8; Ethiopia, Zaire, Burundi, S.Africa, Somalia	Herb				LEAP	
<i>Scleria lithosperma</i>	(L.) Sw.	80 - 500	K7; T3,6;	Shrub				LEAP	
<i>Scleria racemosa</i>	Poir.		U1; K5,7; T3,4; Z; Ethiopia, Zimbabwe	Shrub				LEAP	
DRACEANACEAE									
<i>Dracaena afromontana</i>	(L.) Ker-Gawl		U2-4; K5; T1,3,4,6; Zaire, S. Africa	Tree				LEAP	
EBENACEAE									
<i>Diospyras sp</i>		1500- 1900		Tree	N		Dry forest	FTEA not ready yet	
<i>Euclea natalensis</i>	Hiern	1100- 1800		Shrub to tree			Moist forest or forest margins	LEAP	
ERICACEAE									
<i>Blaeria johnstonii</i>		540-1351	T6, T8	Tree			Forest species	Not in LEAP	
EUPHORBIACEAE									
<i>Acalypha fruticosa</i>	Forssk	0 - 1890	U1-3; K1-7; T1-3, 6, 7, ?8; Z; Sudan to Somalia and south to Burundi with outlying stations in Namibia, S. Malawi and C. Mozambique, So. Arabia, S. india, Ceylon, Burma	Shrub or small tree			Coastal and deciduous bushland and thicket, wooded grassland, often riverine, on rocky shores or outcrops, and in other places with local water catchment and less grass competition, becoming common in over grazed places	FTEA	
<i>Brideria micrantha</i>		580-1800		Shrub layer			Moist forest or forest margins	FTEA	
<i>Drypetes gerrardii</i>	Pax	0 - 500 (1800)	K?1, 7; T3, 6-8; Z; Somalia, Mozambique, Zimbabwe, South Africa	Shrub or slender tree.			Evergreen forest and thicket, often riverine or in rocky places.	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Drypetes gerrardinoides</i>		1500 -2100		Shrub to tree		Vu	Moist forest or forest margins	Not in LEAP	
<i>Drypetes natalensis</i>	(Harv.) Hutch.	15 - 1500	K4,7; T2-6,8; Z; Sudan, Mozambique, Malawi, Zambia, S.Africa	Shrub		Vu		LEAP	
<i>Drypetes theiformis</i>				Tree					
<i>Euphorbia quadrialata</i>	Pax	400 - 1300	T3, 6; not known elsewhere.	Tree	N		Rocky slopes and gneiss outcrops with open deciduous bushland.	FTEA	Pare District: Kihunda, Lushoto District 13 km SQ of Soni on oMombo road; Handeni District;
<i>Euphorbia</i> sp				Shrub					
<i>Macaranga capensis</i>	(Baill.) Sim	1500 - 2100		Tree				LEAP	
<i>Macaranga kilimandscharicus</i>	Pax.	200 - 2100		Tree				LEAP	
<i>Phyllanthus nummulariifolius</i>	Por.	0 - 2450	U1 - 4; K1-5; T1-8; Z; P; from Sierra Leone to Sudan and south to South Africa; also in Madagascar, Mascarene Island and Seychelles	Woody herb or Shrub			Woodland, wooded grassland and forest edges, extending to upland grassland and bushland, often in seasonally wet and disturbed places.	FTEA	
<i>Suregada zanzibariensis</i>	Baill.	0 - 1600	K7; T3,6,8; Z; P. Somalia, Mozambique, Zimbabwe, Madagascar and South Africa	Shrub or small to large tree.			Coastal forest, woodland and bushland , common in places, occasionally found in similar places inland and at much higher altitudes.	FTEA	
FABACEAE									

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Crotalaria vasculosa</i>	Benth.	0 - 1650	U4; K5,7; T1-3, 5,6,8; Z; Mozambique, Malawi, Zimbabwe and South Africa.	Annual			Grassland and Brachystegia woodland, often on sandy soil, also persisting on roadsides and cultivated ground.	FTEA	
<i>Crotalaria goodiiiformis</i>	Vatke	75 - 2100	K1,4,6,7; T1-8; Mozambique, Eastern Congo.	Bushy Shrub			Margins and clearing of lowland and upland rain forest, dry evergreen forest, deciduous woodland and bushland, wooded grassland also persisting on abandoned cultivations.	FTEA	
<i>Desmodium gangeticum</i>	(L.) DC.	0 - 2000	U1-4; K3,4,7; T2-4, 6-8; Z; throughout the old world tropics; said to be introduced in America.	Perennial herb			Deciduous woodland, wooded and open grassland, riverine forest and swampy places.	FTEA	
<i>Desmodium repandum</i>	(Vahl) DC.	1000 - 3000	U1-4; K1-7; T1-8; tropical and subtropical Africa, Madagascar, Mascarene Is., India and Malaysia	Perennial herb			Occasional in shady grassland and marginal areas of cultivated land, but more often one of the dominant components of shaded places in dry evergreen forest or rain forest at the forest margin.	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Desmodium tortuosum</i>	(Sw.) DC.	0 - 1100	U4; T1-4, 6,8; throughout tropical and subtropical areas of America; introduced and naturalised throughout the tropics of the old world.	Herbaceous from a woody base.			Roadsides, grassy places, abandoned plantations.	FTEA	
<i>Dialium holtzii</i>	Harms	10 - 460	T3, 6-8; Mozambique	Tree			Lowland dry evergreen forest, riverine and swamp-forest, woodland; perhaps also in lowland forest.	FTEA	
<i>Indigofera mildbraediana</i>	Gillett	400	T6; Nigeria, Gabon, Congo, Central Africa Republic Sudan, Angola	Semi-woody branching herb.			Scattered tree grassland.	FTEA	
<i>Indigofera rhynchocarpa</i>	Bak.	500 - 2150	T1-8; Central African Republic, Congo, Rwanda, Burundi, Mozambique, Malawi, Zambia, Zimbabwe and Angola	Shrub			Brachystegia woodland	FTEA	
<i>Indigofera trita scabra</i>	L. f.	0 - 2200	U1,2; K1,2,4-7; T1-8; Z; P; Senegal to Ethiopia, Congo, Mozambique, Zimbabwe, Angola, South West Africa, South Africa	Erect woody herb			Chiefly in secondary growth.	FTEA	
<i>Indigofera vohemarensis</i>	Baill.	0 - 1800	U1-4; K1-7; T1-8; Z; P; Congo, Ethiopia, Mozambique and Madagascar.	Erect annual or perennial			Grassy and stony slopes.	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Senna alba</i>	(L) Irwin & Barneby	550 - 1220	U4; T3,6; originally from topical America, but now established in various parts of the Old World tropics.	Shrubby herb			A naturalised weed of plantations and cultivated ground in lowland rain forest areas; said to be v. common in the old cultivation in Kimboza Forest Reserve.	FTEA	
<i>Senna petersiana</i>	(Bolle) J. M. Lock	12 - 2130	U1-4; K3,5; T1,4,6-8; Z; eastern Africa from Ethiopia and the Sudan Republic southwards to Mozambique and the Transvaal, extending westwards to Central African Republic and Cameroon Republic; also in Madagascar.	Shrub or tree			In or on edge of rain-forest, riverine forest, deciduous woodland, coastal evergreen bushland and wooded grassland.	FTEA	
<i>Vigna fischeri</i>	Harms	1000 - 2250	K4,5; T2,3,6-8; Cameroon, Burundi, Ethiopia, Malawi and Zambia	Perennial herb			Swampy grassland with scattered shrubs, upland grassland with scattered trees, forest edges, old cultivations.	FTEA	
<i>Vigna reticulata</i>	Hook. f.	0 - 2460	U1-4; K3,7; T1,3,4,6-8; Z; widespread in tropical Africa from Sierra Leone to Angola, Ethiopia, Mozambique and Zimbabwe, also in Madagascar.	Climbing herb			Grassland, bushland or grassland with scattered trees, usually on damp or swampy ground.	FTEA	

FLACOURTIACEAE

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Aphloia theiformis</i>	(Vahl) Benn.	750 - 2300		Tree			Moist forest or forest margins	FTEA	
<i>Dovyalis abyssinica</i>				Tree					
<i>Flacourtia indica</i>	(Burm. f.) Merr.	0 - 2400	U1,3,4; K2-5, 7; T1-8; Z; widespread in tropical and subtropical Africa, Madagascar, Mascarenes and Seychelles, also in Asia and Malaysia, sometimes cultivated for its edible fruits.	Shrub or tree			Woodland, wooded grassland and bushland. Often riparian.	FTEA	
<i>Flacourtia sp</i>		Unknown		Shrub to tree			Montane forest	LEAP	
<i>Oncoba welwitschii</i>	Oliv.	800 - 1900	T3,6-8; Nigeria to Zaire and Angola also in Malawi and Mozambique	Shrub or tree			Lower storey of rain forest, dry evergreen forest and riverine forest, also in secondary growth.	FTEA	
<i>Rauvolfia sp</i>	L.	Unknown		Shrub			Moist forest or forest margins	FTEA	
<i>Rawsonia lucida</i>	Harv.& Sond.	50 - 1900	U2,3; K4-7; T1-3, 6-8; P; Somali Republic, Sudan, Angola, Zaire, Malawi, Zambia, Zimbabwe, Mozambique, Swaziland, South Africa	Shrub or tree			Understorey and shrub layer of lowland and upland rain forest, dry evergreen forest, semi-swamp and riverine forest.	FTEA	
GESNARIACEAE									
<i>Saintpaulia goetzeana</i>	H. Wendl			Herb	E				
<i>Saintpaulia inospicua</i>	H. Wendl			Herb	E				
<i>Streptocarpus glandulosissimus</i>	Engl.	2700	U2; K1,4,7; T2,3,6,7; Rwanda, Burundi	Herb	E			LEAP	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Streptocarpus sp1</i>		Unknown		Herb			dry forest	FTEA not ready yet	
<i>Streptocarpus sp2</i>	Lindl.			Herb	E				
GRAMINEAE									
<i>Sinarundinaria alpina</i>	Schumann		Tropical East African mountains	Shrub					
GUTTIFERAE									
<i>Allanblackia stuhlmannii</i>	(Engl.) Engl.	540 - 2100	T3,T7	Tree	N	Vu	Moist forest or forest margins	Not in LEAP	
<i>Allanblackia uluguruensis</i>	(Vahl) Bennett.	750 - 2300		Tree	N	Vu	Moist forest or forest margins	LEAP	
<i>Garcinia buchananii</i>	Bak.	1230- 1900		Shrub			Differentiated forest	FTEA	
<i>Garcinia kingaensis</i>		1600- 2350		Tree				FTEA	
<i>Garcinia lukwangulensis</i>				Tree	E				
<i>Garcinia volkensii</i>	Engl.	1200 - 2400		Tree				FTEA	
<i>Harungana madagascariensis</i>	Lam. ex Poir.	0 - 1800	U2-4; K4,5,7; T1,3,6,7; Z; P; widely spread throughout Tropical Africa.	Shrub			Lowland and upland rain forest	FTEA	
<i>Harungana sp</i>				Shrub					
<i>Symphonia globulifera</i>		750 - 2300		Tree			Moist forest or forest margins	LEAP	
HYDROCOLYTACEAE									
<i>Hydrocalytaceae sp</i>		Unknown		Shrub			Moist forest or forest margins		
HYPOXIACEAE									
<i>Hypoxis angustifolia</i>		2450		Tree			Moist forest or forest margins	Not in LEAP	
<i>Hypoxis multiflora</i>		2550		Shrub				Not in LEAP	
ICACENACEAE									

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Apodytes dimidiata</i>	Arn.	580 - 2100		Tree			forest, clearings and margins	FTEA	
IRIDACEAE									
<i>Gladiolus bussei</i>		1900 - 2600		Herb				Not in LEAP	
LABIATAE									
<i>Hoslundia opposita</i>	Vahl		U2,3; K1-6; T2-4, 6; Burundi, Somalia, Eritrea, Sudan.	Tree				LEAP	
<i>Plectranthus laxiflorus</i>	Benth.			Shrub					Not in LEAP
LAURACEAE									
<i>Cryptocarya libertiana</i>	R. Br.	1350 -1800		Tree			Moist forest or forest margins	FTEA	
<i>Ocotea usambarensis</i>	Engl.	1400 -2000		Tree			Moist forest or forest margins	FTEA	
LEGUMINOSAE									
<i>Isobelinia sp</i>	Craib & Stapf Ex. Holland	2040		Shrub			Moist forest or forest margins	LEAP	
<i>Millettia dura</i>		950- 1350		Shrub			Moist forest or forest margins	LEAP	
<i>Millettia usaramensis</i>	Taub.	10 - 700 (1200)	K7; T1,3,6,8; Z; Mozambique)	Shrub or small tree		Vu	Wooded grassland and margins of lowland forest.	FTEA	
<i>Newtonia buchananii</i>		1500 - 2600		Tree			Uppermontane forest	LEAP	
<i>Pterocarpus tinctorius</i>	Welw.	2100 - 2600		Tree			Uppermontane forest	Lovett Guide Not ready yet FTEA	
<i>Schefflerodendron usambarens</i>	Harms	1400 - 1900		Shrub					
LILIACEAE									
<i>Aloe bussei</i>	Berger	580 - 1500	T5-7;	Perennial herb	N	CITES II	Rocky outcrops	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Asparagus asparagoides</i>	(L.) Druce		K4,7; T7; Burundi, Zaire, S. Africa	Herb				LEAP	
LOBELIACEAE									
<i>Lobelia goetzei</i>	Engl.	800 -2400	K4; T2-4, 6-8; E. Zaire, Burundi, Zambia, Malawi, Zimbabwe and Mozambique.	Perennial herb			Forest floor or forest margins, often on rocks or stream banks in shade	FTEA	
<i>Lobelia gilgii</i>			Lukwangule plateau	Herb	E		Rocky and shallow soils an along streams		
<i>Lobelia graniticola</i>			Mkambaku Mt	Herb	E		Rocky and shallow soils streams		
<i>Lobelia lukwangulensis</i>	Thunb.	0 - 1780	K1, 4, 7; T1,3,4,6-8; Z; P; Ethiopia, Zimbabwe, Mozambique, Comoro Isl, Madagascar, Reunion, Brazil.	Perennial herb	E		Grassland, forest margins, roadsides, streamsides or on coastal sand, often in damp places.	FTEA	
LOGANIACEAE									
<i>Nuxia congesta</i>	Fresen.	1500 - 2100		Tree			Uppermontane forest	LEAP	
MALVACEAE									
<i>Hibiscus faulknerae</i>	Vollesen		K7; T6,8;	Herb				LEAP	
<i>Hibiscus surattensis</i>	L.	1450	U1-4; K3,7; T1,3,4,6,8; Mozambique, Malawi, Zambia, Burundi, Zaire.	Herb				LEAP	
<i>Sida javensis</i>	Cav.	50 - 1750	U1,2,3,4; K1-7; T7,8; Z; P; Zaire, Sudan, Ethiopia, Eritrea	Shrub				LEAP	
<i>Sida rhombifolia</i>	L.			Shrub					
MELASTOMATACEAE									
<i>Dissotis polyacantha</i>				Herb	N				

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Dissotis rotundifolia</i>	(Sm.) Triana	0 - 1900	U2-4; K7; T1,3,4, 6-8; Z; P; widespread in tropical Africa from Sierra Leone southwards to Angola nad extending eastwards through Zaire and E. Africa to Zimbabwe and Mozambique; introduced to Malaysia	Herb			Margins of rain-forest, riverine forest , flood plains and valley grassland, swamps, upland grassland in moist places.	FTEA	
<i>Memecylon jasminoides</i>	L.			Tree					
MELIACEAE									
<i>Khaya anthoceaca</i>	(Welw.) C.DC.	1200 - 1900		Tree			Moist forest or forest margins	LEAP	
<i>Trichilia emetica</i>	Vahl	10 - 1300	U1-3; K1, 3-7; T 1-8; Z	Tree			Coastal forest, drier types of riparian forest and riparian woodland; more rarely in rocky couptcops or in wooded grassland.	FTEA	
<i>Turraea holstii</i>	Gurke	300 - 450	T6; not known elsewhere.	Treelet			Lowland (groundwater) rain-forest on limestome;	FTEA	Kimboza F.R.
MONIMIACEAE									
<i>Xymalos monospora</i>	(Harv.) Baill. ex Warb.	900 - 2700	U1-4; K1, ?2; 3-7; T1-4, 6, 7; eastern Africa from Sudan Republic and eastern Congo Republic to South Africa, also Cameroon Highlands and Fernando Po.	Shrub or small tree			Lowland and upland rain forest, often a co-dominant in forests on isolated mountain-tops in dry country	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
MORACEAE									
<i>Dorstenia bicaudata</i>	Peter	800 - 900	T3; not known elsewhere.	Herb			Rain-forest.	FTEA	Lushoto District Derema-Ngambo
<i>Dorstenia bicaudata</i> spp Aff.	Peter			Herb					
<i>Dorstenia goetzi</i>				Herb	N				
<i>Dorstenia hildebrandtii</i>	Engl.	0 - 2100	U2-4; K1-7; T1-7; Zaire, Rwanda, Burundi, Mozambique	Herb	N		Granitic, coral and limestone outcrops from open forest of woodland, bushland and succulent thickets, often near streams or in local water catchment areas, sometimes in shaded forest sites.	FTEA	
<i>Dorstenia dionga</i>	Engl.	0 - 1300	U2,4; K7; T3,6,7; extending to Angola and Cameroon , also in W. Africa.	Shrub or under Shrub	N		Undergrowth of evergreen forests. Sometimes in secondary growth.	FTEA	
<i>Dorstenia schliebenii</i>	Mildbr.	300 - 2000	T 6-8; Malawi	Herb	N		Rain-forest, often among rocks.	FTEA	
<i>Ficus bussei</i>	Mildbr. & Burret	0 - 550	K7, T3, 5, 6, 8; Somalia, Mozambique, Malawi, Zambia, Zimbabwe.	Tree			Lowland forest, riverine, swamp forest and flood plains.	FTEA	
<i>Ficus sur</i>	Forssk	0 - 2300	U1-4; K1,3-7; T1-8; Z; P; extending to Yemen, Cape Verde Isl. Angola and South Africa.	Tree			Forest, riverine, wooded grassland, often left in cleared places.	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Ficus thonningii</i>	Blume	350 - 2500	U1-4; K1-7; T1-8; extending to Cape Verde Isl, Angola, Ethiopia and South Africa.	Tree			Forest, woodland, bushland and wooded grassland, sometimes along rivers nad lakes or among rocks, planted for ornament and bark cloth.	FTEA	
<i>Ficus vallis-choudae</i>	Del.	450 - 1800	U1,2,4; K1-7; T 2-7	Tree			Riverine, lakesides, ground water forest.	FTEA	
<i>Mesogyne insignis</i>	Engl.	500 - 1300	T3,6; S. Tome	Shrubs or trees.	N	Vu	Rain-forest;	FTEA	
<i>Myrianthus holstii</i>	Engl.	1200 - 2000		Shrub				LEAP	
MYRICACEAE									
<i>Agaurea salicifolia</i>	(Comm. Ex. Lam.) Hook.f.ex. Oliv.	1400 -2600		Shrub to tree			Uppermontane forest		
<i>Myrica salicifolia</i>		1900 - 2600		Tree			Moist forest or forest margins	FTEA	
MYRSINACEAE									
<i>Maesa lanceolata</i>		1600 - 2000		Tree			Moist forest or forest margins	LEAP	
<i>Myrsine sp</i>		1500 - 2200		Tree				FTEA	
<i>Rapanea melanophloeos</i>		1100 - 2100		Shrub to tree				LEAP	
MYRTACEAE									
<i>Syzygium cordatum</i>	Hochst. Ex. Krauss	200 - 2500		Shrub				FTEA	
<i>Syzygium cuminii</i>		1100 - 2600		Grass				LEAP	
<i>Syzygium guineense</i>	(Eilld.) DC.	1800 - 2600		Herbaceous climber				FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Syzygium parvulum</i>		1100 - 2600		Shrub	E			FTEA	
<i>Syzygium sclerophyllum</i>	Brenan	1200 - 2600		Tree				FTEA	
OCHNACEAE									
<i>Ochna holstii</i>	Engl.	200 - 2300		Tree			Moist forest or forest margins	FTEA	
OLACACEAE									
<i>Strombosia scheffleri</i>	Engl.	1500 - 2600		Herb				FTEA	
ORCHIDACEAE									
<i>Bulbophyllum</i> spp	Thouars			Herb					
OXALIDACEAE									
<i>Oxalis corniculata</i>	L.	10 - 2950	U1-4; K2-7; T1-4, 6-8; Z; P; widespread in most tropical and many temperate countries	Herb			Weed in cultivation, disturbed ground, lawns and roadsides.	FTEA	
PASSIFLORACEAE									
<i>Adenia lindiensis</i>	Harms	0 - 1200	K7; T3,6,8; not known elsewhere	Climber			Shrub layer and edges of evergreen forest and associated bushland	FTEA	
<i>Passiflora edulis</i>	Sims	0 - 2500	U4; K4; T2,3,6,7; widely cultivated.	Climber			Often cultivated for the flavoured fruit and escaped in forest edges, thickets and disturbed places.	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
PIPERACEAE									
<i>Peperomia blanda</i>	(Jacq.) Kunth	250 - 1800	U2,3; K4-7; T1-3, 6,7, from Yemen to South Africa west to Zaire, Madagascar, Mascarene Isl, India, Burma to South America	Erect plant			Bare bout often shady rocky places, evergreen scrub and 'dry' forest also margin of standing water and srpings, often with Aloe and Aeollanthus or in riverine thickets, rarely an epiphyte	FTEA	
<i>Peperomia trifoliata</i>	L. f.	650 - 2500	U2-4; K1,2,3-6,7; T1-4, 6-8; widespread in Africa from Sierra Leone to Cameroon, Rio Muni, Bioko, Sao Tome to Zaire, Twanda, Burundi, Sudan and Ethiopia south to Mozambique, Zimbabwe, Malawi Swaziland and South Africa.	Shrub			Forest undergrowth in wet places, swampy forest edges, mixed bamboo-forest also upland scrub and thicket near streams, grassland and tree clumps.	FTEA	
<i>Piper capense</i>				Shrub or subShrub					
<i>Piper umbellatum</i>	L.	(0-)150 - 1800 (- 2100)	U2-4; K1,3,4,5; T2-5,6,7; Z; Guinea Bissau to Angola, Zaire, Sao0 Tome, Bioko, So. Sudan, Moazambique, Malawi Zimbabwe, Seychelles, Madagascar, Mascareine is; pantropical	Shrub or woody herb			Evergreen forest undergrowth, swamp forest, elephant grass, river banks, old rubber plantations always in damp places	FTEA	
POACEAE									

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Andropogon contotus</i>		1100 - 2600		Grass				LEAP	
<i>Digitaria sp</i>		540-1350	T6, T7	Grass			Forest species	Not in LEAP	
<i>Panicum hirtum</i>	Kam. (Syn. <i>P. heterostachyum</i> Hack.)			Grass				Not in LEAP	
<i>Panicum lukwangulensis</i>				Grass	E				
PODOCARPACEAE									
<i>Podocarpus latifolius</i>	(Thunb.) R. Br. Ex Mirb.	1800 - 2600		Tree			Uppermontane forest	Lovett Guide Not ready yet	
POLYGALACEAE									
<i>Polygala macrostigma</i>	Chodat	1200	T3,4,6,8;	Herb				LEAP	
<i>Polygala sphenoptera</i>	Fresen.	1000 - 2200	U3; K2,3,5-7; T1-8; Zaire, Cameroon, Zimbabwe, Zambia	Herb				LEAP	
PROTEACEAE									
<i>Faurea saligna</i>	Harvey	1400 - 2100		Shrub			Uppermontane forest	Not in LEAP	
RHAMNACEAE									
<i>Maeopsis eminii</i> (exotic)	Engl.	300-1500		Tree			Forest		
ROSACEAE									
<i>Prunus africana</i>	(Hook. F.) Kalkm	1500 - 2600		Tree		CITES II	Uppermontane forest	Lovett Guide Not ready yet	
<i>Rubus albata</i> (exotic)				Shrub					
<i>Rubus pinnatus</i> (exotic)	Willd.			Shrub					
<i>Rubus rosifolius</i> (exotic)	Sm.	900 - 1450	U4; T2,3; a native of eastern Asia, introduced into Africa and quite commonly naturalised.	Scrambling Shrub			Edges of upland and lowland rain forests and plantations, secondary bushland, abandoned cultivations etc.	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Rubus sp</i> (exotic)				Shrub					
RUBIACEAE									
<i>Canthium oligocarpum captum</i>	Hiern	1350 - 2000	T3,6,7; Malawi and Mozambique (subsp range)	Shrub or tree			Forest	FTEA	
<i>Canthium nodulosa</i>				Tree					
<i>Canthium sp1</i>		Unknown		Shrub to tree			Moist forest or forest margins	FTEA	
<i>Canthium sp2</i>		Unknown		Shrub			Moist forest or forest margins		
<i>Canthium sp3</i>				Shrub					
<i>Canthium sp4</i>				Shrub					
<i>Catunaregam spinosa taylorii</i>	(Thunb.) Tirveng.	100 - 1915	T1-8; Zaire, Mozambique, Malawi, Zambia and Zimbabwe (sub-species range)	Shrub or small tree			Brachystegia woodland, open bushland and scrub, grassland with scattered trees, sometimes on rocky ground.	FTEA	
<i>Chassalia discolor</i>		1200 - 1900		Shrub	N		Moist forest or forest margins	Not in LEAP	
<i>Chassalia partifolia</i>		1230 - 2100		Shrub			Moist forest or forest margins	FTEA	
<i>Coffea pseudozaguebarica</i>				Tree	N	Vu			
<i>Didymosalpinx norae</i>	(Swynn.) Keay	190 - 810	K7; T3,6,8; Mozambique, Zimbabwe.	Shrub or small tree			Evergreen forest, secondary forest, forest edges.	FTEA	
<i>Gardenia posoquerioides</i>	S. Moore	250 - 1000	K7; T6; Zimbabwe; also cultivated in Puerto Rico and Florida.	Glabrous Shrub or small tree			Evergreen forest, Brachystegia woodland;	FTEA	
<i>Geophila repens</i>		1000-2101	T3,T8	Herb			Moist forest or forest margins	Not in LEAP	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Hallea robustipulata</i>		200- 1800		Woody climber				FTEA	
<i>Hedythyrus thamnoidea</i>		1230 - 1900		Shrub			Moist forest or forest margins	FTEA	
<i>Lamprothamnus zanguebarica</i>	Hiern			Tree					
<i>Lasianthus grandiflorius</i>		1200 - 2040		Tree	E	Vu	Montane rain forest shrub layer	Not in LEAP	
<i>Lasianthus kilimandcharicus</i>	E.A.Bruce	1000 - 2300	T6; not known elsewhere.	Shrub	N		Shrub layer of rain forest.	FTEA	Uluguru Mts
<i>Lasianthus macrocalyx</i>		1200 - 2400		Tree	E		Montane rain forest shrub layer	LEAP	
<i>Lasianthus microcalyx</i>		2100 - 2600		Tree	E		Montane rain forest shrub layer	LEAP	
<i>Lasianthus sp1</i>		Unknown		Shrub to tree			Moist forest or forest margins	FTEA	
<i>Lasianthus sp2</i>		1500 -1900		Tree				Lovett Guide Not ready yet	
<i>Lasianthus wallacei</i>		1100 - 1900		Tree	E	Vu	Montane rain forest shrub layer	LEAP	
<i>Leptactina platyphylla</i>	(Hiern) Wernham	45 - 1650	U2,4; K5,7; T3,4,6,7,?8; Cameroon, Central African Republic, Zaire, Burundi, Rwanda, Sudan, Mozambique, Malawi	Shrub or small tree			Evergreen forest, woodland, secondary bushland.	FTEA	
<i>Oxyanthus goetzei keniensis</i>	K. Schum.	610 - 1650	K4,7; T6,3; not known elsewhere.	Shrub			Forest	FTEA	Details for sub-species

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Oxyanthus speciosus stenocarpus</i>	DC.	750 - 2300	U1-3; K1, 3-7, T2,3,5-8; Rwanda, Ethiopia, Mozambique, Zimbabwe and South Africa	Shrub or small tree			Forest	FTEA	Details for sub-species
<i>Pavetta aff. sparsipila</i>	Bremek			Shrub	E	Vu	Forest		
<i>Pavetta crebilifolia var crebilifolia</i>		950 -1900		Shrub	N		Moist forest or forest margins	Lovett Guide Not ready yet	
<i>Pavetta holstii</i>	Schumm.	600 - 2000	T3, 6; not known elsewhere.	Shrub, scrambling Shrub or small tree			Evergreen forest.	FTEA	Lushoto District: E. Usambara Mts, Monga. Tanga District from Amani; Morogoro district: Nguru Mts, Manyangu Forest, Liwale Forest.
<i>Psychotria brucei</i>	Verdc.	300 - 1000	T3,6; not known elsewhere.	Herb	N	R	Rain forest	FTEA	E. Usambaras and Ulugurus
<i>Psychotria goetzei</i>		1100 - 1800		Shrub	N	Vu	Evergreen forest		
<i>Psychotria megalopus</i>		1140 - 1850	T6; T7	Tree	N	Vu	Evergreen forest; riverine forest		
<i>Psychotria schliebenii</i>		0 - 2000		Shrub	N	R	Evergreen forest		
<i>Psychotria sp 1</i>				Tree	E				
<i>Psychotria sp2</i>				Tree					
<i>Psychotria sp3</i>	(Chiov.) Bridson	45 - 960	K7; T3,6,8; Somalia	Shrub or small tree			Thicket or sometimes forest	FTEA	
<i>Psychotria sp4</i>		200 - 2500		Tree			Uppermontane forest	Lovett Guide Not ready yet	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Rothmannia urcelliformis</i>	(Lindl.) Dandy	(700-) 1050 - 1675	U1,2,4; T7,8; throughout west tropical Africa, the Zaire basin, Sudan, Malawi, Zambia and Angola	Shrub or small tree			Forest	FTEA	
<i>Rytigynia sp1</i>				Tree					
<i>Rytigynia sp2</i>		1300 - 1900		Tree				LEAP	
<i>Rytigynia bogoyensis</i>	(K. Schum.) Verdc. fortasse sp. nov.			Tree		Vu			
<i>Rytigynia lichenoxenos</i>	(K. Schumm.& K. Krause) Bullock	950 - 1830	K7; T3,6; not known elsewhere	Shrub or small tree	N	R, Vu	Open bushland in granite areas, submontane forest	FTEA	Taita Hills, E. Usambara Hills, W. Nguru Mountains above Maskati.
<i>Rytigynia uhligii</i>		1400-2101		Tree			Moist forest or forest margins	FTEA	
<i>Tricalysia ovalifolia</i>	Hiern	0 - 1000	K7; T3,6,8; Z; Madagascar, Somalia, Aldabra, Assumption, Comores, Madagascar	Shrub or small tree		Vu	Coastal evergreen or mixed formations, secondary vegetation, dry thickets, wooded grassland and evergreen forest	FTEA	
<i>Tricalysia pedicellata</i>	Robbr.	300 - 700	T6; not known elsewhere.	Shrub or small tree	N	Vu	Forest	FTEA	Kilosa District; Mikumi National Park, Vuma Hills, Nguru Moutnains, Kimboza FR
<i>Tricalysia pallens</i>		1100- 2600		Shrub to tree			Uppermontane forest	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
Unknown		Unknown		Shrub layer			Moist forest or forest margins	FTEA	
Unknown		Unknown		Shrub			Moist forest or forest margins	FTEA	
RUTACEAE									
<i>Clausena anisata</i>		1300 - 1600		Tree			Moist forest or forest margins		
<i>Teclea simplicifolia</i>	(Engl.) Verdoorn	1700 -2100		Tree			Montane forest	LEAP	
<i>Vepris trichocarpa</i>	(Kokwaro) Mziray			Tree					Not in LEAP
<i>Zanthoxylum gillettii</i>	(De Wild.) Waterm.	1700		Shrub		R	Moist forest or forest margins		
SAPINDACEAE									
<i>Allophylus abyssinica</i>		1400-2100		Tree		R	Moist forest or forest margins	FTEA	
<i>Allophylus abyssinica stipitatus</i>	Taub.	1000 - 2100	T 2,4,6,7; not known elsewhere.	Tree or Shrub			Steep forested ravines, forest edges	FTEA	Notes for variety. Speices more widespread
<i>Allophylus rubifolius</i>	(A.Rich.) Engl.	0 - 2250	U1-5; K1-7; T1-8; E. Zaire, Sudan, Ehtiopia and N. Somalia, south to South Africa.	Shrub or small tree			Grassland with scattered trees, rough grassland, thicket edges of cultivation, woodland sometimes riverine	FTEA	
<i>Deinbollia borbonica</i>	Scheff.	0 - 1050	K4,7; T2,3,5-8; Z; P; S. Somalia, Malawi, Mozambique and Comoro Is.	Shrub or small tree			Riverine acacia thorn bush and evegreen thicket. Combretum - Acacia woodland, low evergreen forest on limestone outcrops	FTEA	
<i>Zanha golungensis</i>		1200 - 1900		Shrub to tree					Not in LEAP

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
SAPOTACEAE									
<i>Englerophytum natalense</i>		1800- 2350		Tree			Moist forest or forest margins	LEAP	
<i>Kiggelaria africana</i>	L.	1600 - 2430		Shrub			Moist forest or forest margins	LEAP	
<i>Manilkara sp</i>				Tree					
<i>Mimusops schliebenii</i>	A. DC.	0 - 750	K7; T3,6,8; Z; P; Mozambique and Zimbabwe, also Comoro Is and Madagascar	Shrub or small tree			Lowland dry evergreen forest, riverine forest and coastal evegreen thickets.	FTEA	
Unknown		Unknown		Tree			Moist forest or forest margins		
SELAGINELLACEAE									
<i>Selaginella kraussiana</i>	(Kunze) A. Braun			Fern					
SOLANACEAE									
<i>Solanum schumannianum</i>	Dammer, forma	1450 - 2320	K4,6,7; T2,3,6,7	Shrub				LEAP	
STERCULIACEAE									
<i>Cola clavata</i>	Cav.		T2,3,5;	Tree	N			LEAP	
<i>Cola greenwayi</i>	Forssk	1050 - 2300	U2,4; T3,4,8; Rwanda, Burundi	Tree	N			LEAP	
<i>Cola scheffleri</i>	Vatke	100 - 750	K7; T6,8; Z;	Tree	N	Vu		LEAP	
<i>Cola stelechantha</i>	Brenan	500 - 1500	K7; T6	Tree				LEAP	
<i>Cola usambarensis</i>				Tree	N				
<i>Dombeya shupangae</i>	K. Schum.	600	T2,3,4; Madagascar	Tree	N			LEAP	
<i>Leptonychia usambarensis</i>	K. Schum.			Tree	N			Not in LEAP	
<i>Leptonychia sp</i>				Tree					
<i>Nesogordonia holtzii</i>		1200 - 2600		Tree			Uppermontane forest	LEAP	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Octolobus spectabilis</i>		1210 -1900		Tree			Moist forest or forest margins	Lovett Guide	
<i>Streblus usambarensis</i>		1300 -1900		Tree			Montane forest	Not ready yet	
THEACEAE								LEAP	
<i>Balthasaria schliebenii</i>	(Melch.) Verdc.	1300 -1900		Shrub to tree		R	Moist forest or forest margins	FTEA	
TILIACEAE									
<i>Grewia goetzeana</i>	K. Schum.			Tree				Not in LEAP	
<i>Triumfetta cordifolia</i>	A. Rich.	1290	U2,3; T1,4; Zaire, Rwanda	Tree				LEAP	
<i>Triumfetta rhomboidea</i>	Jacq.		T1-8;	Tree				LEAP	
ULMACEAE									
<i>Celtis whitii</i>		1500-2100		Tree			Moist forest or forest margins	FTEA	
<i>Dorstenia hildebrandtii</i>				Herb			Forest, clearings and margins	FTEA	
<i>Dorstenia veritifolia</i>		1600-2500		Herb			Moist forest or forest margins	FTEA	
UMBELLIFERAE									
<i>Embelia schimperi</i>		1500- 2400		Tree			Moist forest or forest margins	LEAP	
URTICACEAE									
<i>Elatostema paivaeaeum</i>	Wedd.	900 - 2100	T2,3,6,7; widespread in the wetter parts of tropical Africa, west to Guinea south to Malawi	Herb			Lowland rain forest or altitudinal transitional forest, in the moist ground cover, often along streams.	FTEA	
VIOLACEAE									
<i>Rinorea arborea</i>	(Thouars) Baill.	0 - 850	K7; T3,6,8; Z; Mozambique, Madagascar	Shrub or small tree			Lowland evergreen forest	FTEA	
<i>Rinorea elliptica</i>	(Oliv.) Kuntze	50 - 600	K7; T2,3,6,8; Mozambique, Malawi	Shrub or small tree			Lowland evergreen rain forest	FTEA	

Species	Author species	Altitudinal range	Distribution	Life form	Endemic status	Status of Threat	Habitat	Data source	Notes
<i>Rinorea ilicifolia</i> var. <i>amplexicaulis</i>	Grey-Wilson	1150	T1,4,6 not known elsewhere.	Shrub or small tree			Evergreen forest	FTEA	Details for variety. Species widespread. Nguru, Uluguru, Utwani Forest, Lamu District.
<i>Rinorea squamosa kaessneri</i>	(Engl.) Grey-Wilson	30 - 450	K7; T6; not known elsewhere	Shrub or small tree			Evergreen lowland and submontane forest.	FTEA	
<i>Rinorea trichocarpa</i>				Shrub					
VITACEAE									
<i>Cissus sciaphila</i>	Gilg.	0 - 450	K7; T3,6,8; Z; P; not known elsewhere	Climber			Lowland forest, riverine forest fringes, woodland slopes abover river valleys.	FTEA	Coastal thicket on old coral reefs, etc, bushland, wooded grassland, woodland, forest also in old cultivations.
<i>Cyphostemma buchananii</i>	(Planch.) Wild & Drummond	0 - 1125	K7; T3-8;Z; Zaire, Malawi, Mozambique, Zambia, Zimbabwe, Botwsana and South Africa.	Herb				FTEA	
ZAMIACEAE									
<i>Encephalartos hildebrandtii</i>	A. Br. & Bouche	0 - 600	U2; K7; T3,6; Z;	Tree	N	CITES I		LEAP	

Key to Appendix 8

Author

Altitudinal range (m)

This refers to the known range of altitudes from which this species has been recorded.

Distribution

The distribution records are based on the geographical divisions used by the Flora of Tropical East Africa (available at <http://www.rbk.org.uk/herbarium/fta/geograph.html>.) e.g. T3, T6, T8 represent Tanzania and K7 represents Kenya. Names of countries are the same as those given in the FTEA. As this has been published over several decades it includes a number of country names which have subsequently been changed e.g. Nyassaland is now Malawi etc.

Where the subspecies or variety is listed, the distribution refers to the sub-species or variety not the species.

Endemic status (based on Iversen 1991b)

E = Endemic: Occuring within the Uluguru mountains only

N = Near endemic: Species with limited ranges within the Eastern Arc mountains and / or East African lowland forests

W = Widespread distribution

Status of threat

Threat status IUCN:

VU = Vulnerable; high risk of extinction in the wild

Threat status CITES:

I = Threatened with extinction and excluded from commercial international trade

II = Not yet threatened with extinction, but may be so if trade is not regulated thus export permits are required

R = Rare, from Leap database, species found in less than two out of eight regions of Tanzania

Habitat

This describes the habitats in which this species is found.

Data source

Three data sources were used for information on the altitudinal range, distribution and habitat association.

FTEA: The Flora of Tropical East Africa was the preferred data source. The FTEA is a series published by the Royal Botanic Gardens, Kew. Descriptions are not yet available for all families.

LEAP: The List of East African Plants is published by the East African Herbarium.

TROPICOS provides new and improved access to the Missouri Botanical Garden's VAST nomenclatural database and associated authority files.

Generally this was only used in combination with either FTEA or LEAP

Appendix 9: Mammal data

9a Full list of mammals recorded in Uluguru South FR

Updated from Daggart et al (2005) with UCBS 2005 data. Taxonomy follows Kingdon (1997). Voucher specimens are currently under going formal taxonomic verification (Appendix 2). Highlighted are those new records for Uluguru South FR collected by UCBS.

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
COLOBIDAE						
<i>Colobus angolensis</i>	Black and white colobus	Widespread	F	DD	II	UCBS 2005
CERCOPITHECIDAE						
<i>Cercopithecus mitis</i>	Blue monkey	Widespread	F		II	UCBS 2005
GALAGONIDAE						
<i>Otolemur garnettii</i>	Small-eared galago	Coastal forests, Eastern Arc and Kilimanjaro	F		II	UMBCP 2000
<i>Galagoides orinus</i>	Usambara galago	Eastern Arc	FF	DD	II	UCBS 2005
PTEROPODIDAE						
<i>Stenonycteris lanosus</i>	Mountain fruit bat	Widespread	F			UCBS 2005
NYCTERIDAE						
<i>Nycteris thebaica</i>	Slit-faced bat	Widespread				Swynnerton and Hayman 1950
<i>Nycteris hispida</i>	Slit-faced bat	Widespread				Swynnerton and Hayman 1950
RHINOLOPHIDAE						
<i>Rhinolophus landeri lobatus</i>	Horseshoe bat	Widespread				Swynnerton and Hayman 1950
<i>Rhinolophus clivosus or fumigatus</i>	Horseshoe bat	Widespread				UCBS 2005
<i>Rhinolophus darlingi</i>	Horseshoe bat	Widespread				UCBS 2005
HIPPOSIDERIDAE						
<i>Hipposideros caffer caffer</i>	Leaf-nosed bat	Widespread				Swynnerton and Hayman 1950
VESPERTILIONIDAE						
<i>Myotis welwitschii venustus</i>	Hairy bat	Widespread				Swynnerton and Hayman 1950
<i>Kerivoula africana</i>	Woolly bat	Lowland E. Arc and Coastal Forests				Swynnerton and Hayman 1950
<i>Chalinolobus argentatus</i>	Butterfly bat	Widespread				Swynnerton and Hayman 1950

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
<i>Pipistrellus kuhlii fuscatus</i>	Pipistrelle	Widespread				Swynnerton and Hayman 1950
<i>Pipistrellus nanus</i>	Pipistrelle	Widespread				UCBS 2005
<i>Scotophilus viridis viridis</i>	House bats	Widespread				Swynnerton and Hayman 1950
<i>Miniopterus schreibersi</i>	Long-fingered bats	Widespread				Swynnerton and Hayman 1950
CHRYSOCHLORIDAE						
<i>Chrysochloris stuhlmanni</i>	Stuhlmann's golden mole	Sub-species endemic to Ulugurus				UCBS 2005
<i>tropicalis</i>						
SORICIDAE						
<i>Crocidura cf. nana/elongius</i>	White-toothed shrew					UCBS 2005
<i>Crocidura cf. hirta</i>	White-toothed shrew	Widespread				UCBS 2005
<i>Crocidura monax</i>	White-toothed shrew	Eastern Arc, Kilimanjaro and one other site	FF	VU		UCBS 2005
<i>Crocidura olivieri</i>	White-toothed shrew	Widespread				UCBS 2005
<i>Crocidura telfordii</i>	White-toothed shrew	Uluguru and Udzungwa	FF	CR		Stanley et al 1998
<i>Myosorex geata</i>	Mouse shrew	Uluguru	FF	EN		UCBS 2005
<i>Myosorex sp</i>	Mouse shrew					UCBS 2005
<i>cf. Sylvisorex howelli</i>	Climbing shrew	Usambara, Uluguru, Nguru, Nguu, Ukaguru	FF	VU		UCBS 2005
<i>cf. Sylvisorex megalura</i>	Climbing shrew	Widespread	FF			UCBS 2005
MACROSCOLIDINAE						
<i>Petrodromus tetradactylus</i>	Four toed elephant shrew	Widespread	F			UMBCP 2000
RHYNCHONCYONINAE						
<i>Rhynchocyon petersi</i>	Zanj elephant shrew	S. Pare, Usambara, Uluguru, Nguru?, Coastal Forests	F	EN		UCBS 2005
SCIURIDAE						
<i>Paraxerus lucifer</i>	Tanganyika mountain squirrel	Widespread	FF			UCBS 2005
<i>Paraxerus palliatus</i>	Red-bellied coast squirrel	Widespread	F	VU		Swynnerton and Hayman 1950
<i>Paraxerus ochraceus</i>	Ochre bush squirrel	Widespread	F			UMBCP 2000
<i>Paraxerus flavovittis</i>	Striped bush squirrel	Widespread	F			UCBS 2005
ANOMALURIDAE						
<i>Anomalurus derbianus</i>	Lord Derby's anomalure	Widespread	F			Swynnerton and Hayman 1950
DENDROMURINAE						
<i>Dendromus mesomelas</i>	Climbing mouse	Widespread	O			UCBS 2005

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
CRICETOMYINAE						
<i>Beamys hindei</i>	Lesser pouched rat	Usambara, Uluguru, Udzungwa, Nguru, Pare, Coastal forest and Southern rift	F	VU		UCBS 2005
<i>Cricetomys gambianus</i>	Giant pouched rat	Widespread	F			UCBS 2005
OTOMYINAE						
<i>Otomys denti</i>	Groove-toothed rat	Widespread	O			Swynnerton and Hayman 1950
MURIDAE						
<i>Lophuromys sikapusi</i>	Brush-furred mouse	Widespread	F			Swynnerton and Hayman 1950
<i>Lophuromys flavopunctatus</i>	Brush-furred mouse	Widespread	F			UCBS 2005
<i>Praomys sp</i>	Soft-furred rat	Widespread	F			UCBS 2005
<i>Hylomyscus denniae</i>	African wood mouse	Widespread	F			UCBS 2005
<i>Mastomys sp</i>	Multimammate rat	Widespread	F			UMBCP 2000
<i>Mus minutoides</i>	Common mouse	Widespread				UMBCP 2000
<i>Dasymys incomtus</i>	Shaggy swamp rat	Widespread	O			Swynnerton and Hayman 1950
<i>Lemniscomys sp</i>	Zebra mouse	Widespread				Swynnerton and Hayman 1950
<i>Pelomys fallax</i>	Creek rat	Widespread	O			Swynnerton and Hayman 1950
MUSTELIDAE						
<i>Aonyx capensis</i>	African clawless otter	Widespread	F		II	Swynnerton and Hayman 1950
HERPESTIDAE						
<i>Atilax paludinosus</i>	Water mongoose	Widespread	O			UCBS 2005
<i>Herpestes sanguinea</i>	Slender mongoose	Widespread	O			UCBS 2005
VIVERRIDAE						
<i>Genetta tigrina</i>	Blotched genet	Widespread	F			Swynnerton and Hayman 1950
<i>Civettictis civetta</i>	African civet	Widespread	F			Swynnerton and Hayman 1950
<i>Leptailurus serval</i>	Serval cat	Widespread	O		II	Swynnerton and Hayman 1950
NANDININAE						
<i>Nandinia binotata</i>	African palm civet	Widespread	F			UMBCP 2000
FELIDAE						
<i>Panthera pardus</i>	Leopard	Widespread	F		I	UMBCP 2000
PROCAVIDAE						
<i>Dendrohyrax validus</i>	Tree hyrax	Eastern Arc, Coastal forests, Kilimanjaro	FF	VU		UCBS 2005
SUIDAE						

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
<i>Potamochoerus larvatus</i> BOVIDAE	Bush pig	Widespread	F			UCBS 2005
<i>Tragelaphus scriptus</i>	Bushbuck	Widespread	F			Swynnerton and Hayman 1950
<i>Cephalophus monticola</i>	Blue duiker	Widespread	FF			UCBS 2005
<i>Cephalophus harveyi</i>	Harvey's duiker	Widespread	FF			UMBCP 2000
<i>Cephalophus spadix</i>	Abbot's duiker	Udzungwa, Usambara?, Uluguru, Rungwe and Kilimanjaro	FF	VU		UMBCP 2000
<i>Neotragus moschatus</i>	Suni	Widespread	F			Swynnerton and Hayman 1950

Key to Appendix 9

The habitat preference of each species is described in the habitat column as:

FF = Species dependent on primary forest only. It does not include forest edge or secondary forest 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.

O = These are species that do not normally occur in primary or secondary forest or forest edge.

Threat status IUCN:

CR = Critically endangered; *extremely* high risk of extinction in the wild

EN = Endangered; *very* high risk of extinction in the wild

VU = Vulnerable; high risk of extinction in the wild

DD = Data Deficient

Threat status CITES:

I = Threatened with extinction and excluded from commercial international trade

II = Not yet threatened with extinction, but may be so if trade is not regulated thus export permits are required

9b Small mammal numbers recorded from the UCBS zoological trapsites in Uluguru South FR following Kingdon (1997). Voucher specimens are currently under going formal taxonomic verification (Appendix 2).

Species	Common name	Numbers of individuals per site (recaptures)					KMH No.s
		zoo 1	zoo 2	zoo 3	zoo 4	zoo 5	
SORICIDAE							
<i>Crocidura cf hirta</i>	White-toothed shrew	0	2 (0)	2 (0)	1 (0)	8 (0)	26236, 26429, 26435, 26439
<i>Crocidura monax</i>	White-toothed shrew	2 (0)	0	1 (0)	0	0	26359, 26363, 26431
<i>Crocidura cf nana/elongius</i>	White-toothed shrew	0	0	11 (0)	8 (0)	12 (0)	26424, 26426, 26434, 26438
<i>Myosorex geata</i>	Mouse shrew	0	3 (0)	0	0	4 (0)	26337, 26370, 26443, 26445
<i>Myosorex sp</i>	Mouse shrew	2 (0)	0	7 (0)	2 (0)	0	26365, 26366, 26427, 26428, 26436, 26437
<i>cf Sylvisorex howelli</i>	Climbing shrew	5 (1)	1 (0)	13 (0)	5 (0)	5 (0)	26360, 26361, 26362, 26364, 26375, 26430, 26432, 26440, 26441, 26442, 26444
<i>cf Sylvisorex megalura</i>	Climbing shrew	0	2 (0)	1 (0)	7 (0)	0	26373, 26374, 26425, 26433
DENDROMURINAE							
<i>Dendromus mesomelas</i>	Climbing mouse	2 (0)	3 (0)	0	1 (0)	0	26067, 26071, 26072, 26074, 26085
CRICETOMYINAE							
<i>Beamys hindei</i>	Lesser pouched rat	0	0	0	0	1 (0)	26092
MURIDAE							
<i>Lophuromys flavopunctatus</i>	Brush-furred mouse	3 (0)	1 (0)	2 (1)	3 (0)	1 (0)	26233, 26069, 26021, 26079, 26082, 26084, 26086, 26093
<i>Praomys sp</i>	Soft-furred rat	20 (8)	9 (4)	40 (34)	13 (8)	38 (12)	26065, 26234, 26020, 26075, 26331, 26332, 26333, 26077, 26083, 26091
<i>Hylomyscus denniae</i>	African wood mouse	11 (7)	12 (1)	42 (17)	0	11 (6)	26064, 26066, 26068, 26073, 26078, 26080, 26088, 26089
		45 (16)	33 (5)	119 (52)	40 (8)	80 (18)	

Appendix 10: Bird data

10a Summary of bird survey work

Campsite	Coordinates	Altitude m asl	Habitat description	Duration of survey	Mist net time (mist net metre hours	Net metres
BC3, Nyingwa	07° 09' 20.4", 037° 39' 30.1"	2040m.	Upper montane forest with bamboo.	30/10/2004 - 07/11/2004	7383	153m
Sat Camp 3, Lanzi	07° 07' 25.9", 037° 41' 00.9"	1620m.	Submontane to montane forest	09/11/2004- 30/11/2004	2898	138m
BC4, Lukwangule Plateau	07° 07' 10.8", 037° 37' 16.9"	2450m.	Upper montane forest with grassland	20/11/2004- 30/11/2004	10,883	222m
BC5, Vinile	07° 02' 57.4", 037° 38' 41.7"	1660m	Submontane to montane Forest	06/12/2004- 13/12/2004	7236	201m

10b Forest birds species recorded within Uluguru South FR

Updated from Doggart et al (2005) with UCBS data. Recordings following Stevenson & Fanshawe (2002). Highlighted are those new records for Uluguru South FR collected by UCBS.

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
ANATIDAE						
<i>Anas sparsa</i>	Africa black duck	Widespread	F/FF			UCBS 2005
ACCIPITRIDAE						
<i>Accipiter tachiro</i>	African goshawk	Widespread	F		II	UCBS 2005
<i>Buteo oreophilus</i>	Mountain buzzard	Widespread in highlands of eastern half of the continent	F/FF		II	UCBS 2005
<i>Stephanoaetus coronatus</i>	African crowned eagle	Widespread	FF		II	UCBS 2005
NUMIDIDAE						
<i>Guttera pucherani</i>	Crested guineafowl	Widespread	F/O/FF			UCBS 2005
COLUMBIDAE						
<i>Turtur tympanistria</i>	Tambourine dove	Widespread	F/FF			UCBS 2005
<i>Columba delegorguei</i>	Eastern bronze-naped pigeon	Localised in eastern half of the continent	FF/F			UCBS 2005
<i>Columba arquatrix</i>	Olive pigeon	Widespread in highlands	FF/F			UCBS 2005
<i>Aplopelia larvata</i>	Lemon dove	Widespread	FF/F			UCBS 2005
MUSOPHAGIDAE						
<i>Tauraco livingstonii</i>	Livingstone's turaco	Widespread from C Kenya via Tanzania to E Zambia, Malawi to S Mozambique	FF		II	UCBS 2005
CUCULIDAE						
<i>Cercococcyx montanus</i>	Barred long-tailed cuckoo	Widespread	FF/F			UCBS 2005
STRIGIDAE						
<i>Strix woodfordii</i>	African wood owl	Widespread	F/FF		II	UCBS 2005
APODIDAE						
<i>Schoutedenapus myoptilus</i>	Scarce swift	Wide range but localised in highlands	F/FF			S&H 1995
CAPRIMULIDAE						
<i>Caprimulgus guttifer</i>	Usambara Nightjar	Usambara Mtns and highlands north of Lake Malawi	F/FF			UCBS 2005
TROGONIDAE						

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
<i>Apaloderma vittatum</i>	Bar-tailed trogon	Eastern Africa, Albertine Rift & Cameroon Mts	FF			UCBS 2005
BUCEROTIDAE						
<i>Tockus alboterminatus</i>	Crowned hornbill	Widespread	F/FF			UCBS 2005
<i>Bycanistes bucinator</i>	Trumpeter hornbill	Widespread	F/FF			UCBS 2005
<i>Bycanistes brevis</i>	Silvery-cheeked hornbill	Widespread in eastern half of the continent	F/FF			UCBS 2005
CAPITONIDAE						
<i>Stactolaema olivacea</i>	Green barbet	Very localised in a few coastal forests and mountains from SE Kenya, Tanz., N&S Malawi, N Moz. and Ngoye Forest in NE S. Africa	FF			UCBS 2005
<i>Pogoniulus leucomystax</i>	Moustached green tinkerbird	Localised in highlands from C Kenya, Tanz. to S Malawi	FF			UCBS 2005
<i>Pogoniulus bilineatus</i>	Yellow-rumped tinkerbird	Widespread	FF/F			UCBS 2005
INDICATORIDAE						
<i>Indicator variegatus</i>	Scaly-throated honeyguide	Widespread	FF/F			UCBS 2005
PICIDAE						
<i>Dendropicos griseocephalus</i>	Olive woodpecker	Widespread	FF			UCBS 2005
EURYLAIMIDAE						
<i>Smithornis capensis</i>	African broadbill	Widespread	FF			UCBS 2005
MOTACILLIDAE						
<i>Motacilla agiump*</i>	African pied wagtail	Widespread	F			UCBS 2005
<i>Motacilla clara</i>	Mountain wagtail	Widespread	F			UCBS 2005
PYCNONOTIDAE						
<i>Andropadus virens</i>	Little greenbul	Widespread	FF/F			UCBS 2005
<i>Andropadus masukuensis</i>	Shelley's greenbul	Eastern Arc / southern rift	FF			UCBS 2005
<i>Andropadus neumanni</i>	Uluguru Mountain greenbul	Endemic to Ulugurus	FF			UCBS 2005
<i>Andropadus olivaceiceps</i>	Olive-headed Greenbul	Widespread	FF/F			S&H 1995
<i>Phyllostrephus cabanisi</i>	Cabanis' Greenbul	Widespread	FF			UCBS 2005
<i>Phyllastrephus flavostriatus</i>	Yellow-streaked greenbul	Patchy distribution in eastern half of the continent incl. Albertine Rift	FF			UCBS 2005
TIMALIIDAE						

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
<i>Pseudoalcippe abyssinica</i>	African hill babbler	Localised in eastern half of of the continent & a isolated population in C Angola	FF			UCBS 2005
<i>Modulatrix stictigula</i>	Spot-throat	Eastern Arc & Mt Rungwe	FF			UCBS 2005
TURDIDAE						
<i>Pogonocichla stellata</i>	White-starred robin	Widespread	FF/F			UCBS 2005
<i>Sheppardia sharpei bangsi</i>	Sharpe's akalat	Usam., Ukaguru, Ulug., Udz., Nguus & Mt Rungwe. Uluguru endemic subspecies	FF			UCBS 2005
<i>Cossypha anomala</i>	Olive-flanked robin-chat	N Tanz. & C&S Eastern Arc, Southern highlands and S Malawi and N Moz.	FF			UCBS 2005
<i>Cossypha natalensis</i>	Red-capped robin-chat	Widespread	F/FF			S&H 1995
<i>Alethe fuelleborni</i>	White-chested alethe	Widespread	FF			UCBS 2005
<i>Zoothera gurneyi</i>	Orange ground thrush	Wide range but localised	FF			UCBS 2005
<i>Turdus olivaceus</i>	Olive thrush	Widespread	FF			UCBS 2005
MUSCICAPIDAE						
<i>Muscicapa adusta</i>	African dusky flycatcher	Widespread	FF/F			UCBS 2005
<i>Muscicapa caeruleus</i>	Ashy flycatcher	Widespread	F/FF			UCBS 2005
<i>Melaenornis fischeri</i>	White-eyed slaty flycatcher	Mainly highlands from S Sudan, via Tanz. to C Malawi & Albertine Rift	O/F			UCBS 2005
SYLVIIDAE						
<i>Camaroptera brachyura</i>	Grey-backed camaroptera	Widespread	F/O			S&H 1995
<i>Bathmocercus winifredae</i>	Mrs Moreau's warbler	Ukaguru, Ulug., Udz. & Rubeho Mts	FF	VU		UCBS 2005
<i>Phylloscopus umbrovirens fugglescouchmani</i>	Brown woodland warbler	Widespread, however very uncommon in the Eastern Arc's montane forests. Uluguru endemic subspecies	FF			UCBS 2005
<i>Phylloscopus ruficapillus</i>	Yellow-throated woodland warbler	Extreme S Kenya via Tanz, Malawi, E Zim. to S South Africa	FF			UCBS 2005
<i>Bradypterus mariae</i>	Evergreen forest warbler	Widespread	FF			UCBS 2005
<i>Apalis thoracica uluguru</i>	(Uluguru) Bar-throated apalis	Widespread. Uluguru endemic subspecies	FF			UCBS 2005
<i>Apalis chapini</i>	Chestnut-headed apalis	Highlands in Tanz. & Malawi	FF			UCBS 2005

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
<i>Apalis chariessa macpharsoni</i> *	White-winged apalis	Uluguru and Udzungwa mountains	FF	VU		UCBS 2005
<i>Orthotomus metopias altus</i>	Red-capped forest warbler / African Tailorbird	Usam., Nguru, Ukaguru, Ulug., Udz., Matego Highlands & Njesi Plateau. Uluguru endemic subspecies	FF			UCBS 2005
ZOSTEROPIDAE						
<i>Zosterops senegalensis</i>	Yellow white-eye	Widespread	FF/F			UCBS 2005
MONARCHIDAE						
<i>Trochocercus albonotatus</i>	White-tailed crested flycatcher	Widespread in eastern half of the continent incl. Albertine Rift	FF			UCBS 2005
<i>Terpsiphone viridis</i>	African paradise flycatcher	Widespread	FF/F			UCBS 2005
PLATYSTEIRIDAE						
<i>Batis mixta (sensu lato)</i>	Forest batis	Eastern Arc & Coastal forests	FF			UCBS 2005
MALACONOTIDAE						
<i>Malaconotus alius</i>	Uluguru bush-shrike	Uluguru endemic and very localised	FF			? 1981
<i>Malaconotus nigrifrons</i>	Black-fronted bush-shrike	Widespread	FF			UCBS 2005
<i>Telophorus quadricolor</i>	Four-coloured bush-shrike	Widespread in two large areas: Kenya-Tanz. and S Moz.-South Africa & Zimbabwe	F			Rodgers et al 1983
<i>Laniarius fuelleborni</i>	Fulleborn's black boubou	Eastern Arc and highlands of N Malawi	FF			UCBS 2005
CAMPEPHAGIDAE						
<i>Coracina caesia</i>	Grey cuckoo-shrike	Highlands of eastern half of the continent and Cameroon Mts	FF			UCBS 2005
DICRURIDAE						
<i>Dicrurus ludwigii</i>	Square-tailed drongo	Widespread	FF			UMBCP 2000
ORIOOLIDAE						
<i>Oriolus chlorocephalus</i>	Green-headed oriole	Very localised and disjunct pop from S Kenya via Tanz. to S Malawi & C Moz.	FF			UMBCP 2000
<i>Oriolus auratus</i> *	African golden oriole	Widespread	F			UCBS 2005
STURNIDAE						
<i>Poeoptera kenricki</i>	Kenrick's starling	Kenya C highlands through E Arc to S Tanz.	FF			UCBS 2005

<i>Onychognathus walleri</i>	Waller's starling	Eastern Africa, Albertine Rift & Cameroon Mts	FF			UCBS 2005
Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Most recent record
NECTARINIIDAE						
<i>Nectarinia olivacea</i>	Olive sunbird	Widespread	F/FF			UCBS 2005
<i>Nectarinia loveridgei</i>	Loveridge's sunbird	Uluguru endemic	FF	NT		UCBS 2005
PLOCEIDAE						
<i>Ploceus nicolli</i>	Tanzanian mountain weaver	Eastern Arc (but not Taita hills in Kenya) Tz endemic	FF	EN		UCBS 2005
ESTRILDIDAE						
<i>Cryptospiza salvadorii</i>	Abyssinian crimsonwing	Very localised over a wide range from Eth., via S Somalia, Albertine Rift, Kenya highlands, N Tanz & Uluguru Mts	FF/F			S&H 1995
<i>Cryptospiza reichenovii</i>	Red-faced crimsonwing	Localised in highlands of Tanz., Malawi, N Moz, E Zimbabwe, Albertine Rift, C Angola and Cameroon	FF			UCBS 2005
FRINGILLIDAE						
<i>Linurgus olivaceus</i>	Oriole finch	Eastern Arc and few highlands, S Somalia, N Malawi, Albertine Rift & Cameroon	FF			UCBS 2005

* Casual observations by field team, not ornithologist

10c Non-forest bird species, those recorded within Lukwangule plateau grassland, at forest edge or in the immediate surroundings.
Recordings following Stevenson & Fanshawe (2002).

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Area observed
SCOPIDAE						
<i>Scopus umbretta</i>	Hamerkop	Widespread	O			Lanzi and Bunduki villages
ACCIPITRIDAE						
<i>Polyboroides typus</i>	African harrier hawk	Widespread	F		II	Nyingwa & Vinile areas
<i>Buteo augur</i>	Augur Buzzard	Widespread	O		II	Forest edge at Lanzi, Nyingwa & Vinile
<i>Falco cuvieri</i>	African Hobby	Widespread	O		II	Forest edge at Lanzi
COLUMBIDAE						
<i>Treron calva</i>	Green pigeon	Widespread	F/O			Different small flocks at Vinile & Lanzi
CUCULIDAE						
<i>Cuculus solitarius</i>	Red-chested cuckoo	Widespread	O			Forest edge at Nyingwa & Vinile
<i>Chrysococcyx klaas</i>	Klaas's cuckoo	Widespread	F			Forest edge at Nyingwa, Lanzi & Vinile
<i>Centropus superciliosus</i>	White-browed coucal	Widespread	O/F			In <i>shamba</i> near forest at Vinile
APODIDAE						
<i>Apus affinis</i>	Little swift	Widespread	O			Common outside forest in all surveyed localities
(<i>Apus niansae</i>)	(Nyaza swift)	Localised in highlands of E and N Africa	O/F			(Some doubt over this record). Svendsen and Hansen 1995
<i>Apus aequatorialis</i>	Mottled swift	Widespread	O			Flocks common at Lukwangule & Vinile
COLIIDAE						
<i>Colius striatus</i>	Speckled mousebird	Widespread	O			Lanzi, Nyingwa, bunduki & Vinile
HIRUNDINIDAE						
<i>Hirundo angolensis</i>	Angola swallow	Common West of Great Rift Valley and locally common in E Tanz	O			Lukwangule plateau

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Area observed
<i>Psolidoprocne holomelas</i>	Black saw-wing	Widespread	O/F			Nyingwa, Lanzi, Lukwangule & Vinile
MOTACILLIDAE						
<i>Anthus cinnamoneus</i>	Grassland pipit	Widespread	O			Grassland at Lukwangule plateau
SYLVIIDAE						
<i>Phylloscopus trochilus</i>	Willow Warbler	Widespread. Common Palearctic visitor from late Sept – early May	O			Lukwangule plateau
<i>Cisticola woosnami</i>	Trilling cisticola	Widespread	O			Techenzema & Vinile
<i>Prinia subflava</i>	Tawny-flanked prinia	Widespread	O/F			Nyingwa, Techenzema & Vinile
MALACONOTIDAE						
<i>Laniarius aethiopicus</i>	Tropical boubou	Widespread	O/F			Nyingwa & Vinile
CORVIDAE						
<i>Corvus albicollis</i>	White-naped raven	Widespread	O			Recorded at all surveyed localities
STURNIDAE						
<i>Onychognathus morio</i>	Red-winged starling	Widespread	O/F/FF			Lanzi & Lukwangule
NECTARINIIDAE						
<i>Anthreptes collaris</i>	Collared sunbird	Widespread	O/F			Nyingwa & Techenzema
PLOCEIDAE						
<i>Ploceus bertrandi</i>	Bertram's weaver	Localised in highlands of Tanzania N to Ulugurus & south to S Malawi	O			Techenzema in <i>shamba</i>
<i>Ploceus subaureus</i>	Golden weaver	Widespread in Eastern half of the continent	O			Lanzi & Vinile
ESTRILDIDAE						
<i>Lagonosticta rubricata</i>	African firefinch	Widespread	O			Outside forest at all surveyed localities
<i>Estrilda astrild</i>	Common waxbill	Widespread	O			Outside forest at all surveyed localities

Species	Common name	Range	Habitat	Threat status IUCN	Threat status CITES	Area observed
<i>Lonchura cucullata</i>	Bronze mannikin	Widespread	O			Nyingwa, Lanzi & Techenzema
<i>Lonchura bicolor</i>	Red-backed mannikin	Widespread	O			Vinile
FRINGILLIDAE						
<i>Serinus hypostictus</i>	African citril	Widespread	O/F			Nyingwa, Lanzi, Techenzema & Vinile

Key to Appendix 10

The habitat preference of each species is described in the habitat column as:

FF = Species dependent on primary forest only. It does not include forest edge or secondary forest 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.

O = These are species that do not normally occur in primary or secondary forest or forest edge.

Threat status IUCN:

CR = Critically endangered; *extremely* high risk of extinction in the wild

EN = Endangered; *very* high risk of extinction in the wild

VU = Vulnerable; high risk of extinction in the wild

NT = Near threatened; taxa that do not qualify as Critically Endangered, Endangered or Vulnerable now, but it close to qualifying for or is likely to qualify for a threatened category in the near future

Threat status CITES:

I = Threatened with extinction and excluded from commercial international trade

II = Not yet threatened with extinction, but may be so if trade is not regulated thus export permits are required

10d Bird specimens collected from Uluguru South FR by UCBS

Species	Skins	DNA sample	Skeletons
<i>Caprimulgans guittifer</i>	1	2	0
<i>Ponogoniulus leucomystax</i>	0	3	0
<i>Hirundu angolensis</i>	0	2	0
<i>Anthus cinnamomeus</i>	1	2	0
<i>Andropadus virens</i>	0	4	0
<i>Andropadus masukuensis</i>	7	34	0
<i>Andropadus milanensis</i>	1	6	0
<i>Phyllastraptes cabanisi</i>	3	11	0
<i>Pogonochala stellata</i>	2	9	0
<i>Sheppardia sharpei</i>	3	4	0
<i>Alethe fuelleborni</i>	0	0	1
<i>Cossypha cafra</i>	1	1	0
<i>Cossypha anomala</i>	4	12	0
<i>Turdus olivaceus</i>	2	3	0
<i>Zoothera gurneyi</i>	2	2	0
<i>Modulatrix stictigula</i>	7	19	0
<i>Saxicola torquata</i>	0	1	0
<i>Bradypterus lopezi</i>	3	5	0
<i>Phylloscopus ruficapillus</i>	2	3	0
<i>Phylloscopus umbrovirens</i>	3	5	0
<i>Bathmorcercus winifredae</i>	3	10	0
<i>Orthotomus metopias</i>	2	14	0
<i>Apalis thoracica</i>	2	7	0
<i>Batis mixta</i>	9	17	0
<i>Trochocercus albonotatus</i>	0	0	0
<i>Pseudoalcipe abyssinica</i>	3	14	0
<i>Nectarinia loveridgei</i>	5	7	1
<i>Ponogoniulus leucomystax</i>	0	3	0
<i>Laniarius fuelleborni</i>	0	2	0
<i>Cryptospiza reichenovii</i>	4	16	0
Total	70	218	2

10e Numbers of individuals netted in each surveyed locality within Uluguru South FR

Species	BC 3	Sat camp3	BC4	BC5
	Nyingwa	Lanzi	Lukwangule	Bunduki
Net metre hours	7,383	2,898	10,883	7,236
<i>Caprimulgus guttifer</i>	0	0	1	0
<i>Pogoniulus leucomystax</i>	0	0	4	0
<i>Hirundo angolensis</i>	0	0	8	0
<i>Psolidoprocne holomelas</i>	0	0	1	0
<i>Anthus cinnamomeus</i>	0	0	2	0
<i>Andropadus virens</i>	0	0	0	2
<i>Andropadus neumanni</i>	0	0	6	1
<i>Andropadus masukuensis</i>	14	10	0	19
<i>Andropadus milanjensis</i>	0	0	0	5
<i>Phyllastrephus canabisi</i>	3	4	0	6
<i>Pogonocichla stellata</i>	14	6	13	21
<i>Sheppardia sharpei</i>	0	0	0	4
<i>Alethe fuelleborni</i>	1	2	0	0
<i>Cossypha caffra</i>	0	0	1	0
<i>Turdus olivaceus</i>	0	2	1	1
<i>Zoothera gurneyi</i>	2	0	0	0
<i>Modulatrix sricrigula</i>	4	3	8	4
<i>Saxicola torquata</i>	0	0	2	0
<i>Bradypterus cinnamomeus</i>	0	0	3	0
<i>Bradypterus lopezi</i>	7	1	4	3
<i>Sylvia borin</i>	0	0	1	7
<i>Phylloscopus ruficapillus</i>	4	0	0	2
<i>Phylloscopus umbrovirens</i>	0	0	4	0
<i>Bathmocercus winifredae</i>	0	0	4	5
<i>Orthotomus metopias</i>	7	2	4	7
<i>Apalis thoracica</i>	8	0	21	7
<i>Muscicapa adusta</i>	0	0	1	0
<i>Batis mixta</i>	5	1	4	88
<i>Terpsiphone viridis</i>	1	0	0	0
<i>Trochocercus albonotatus</i>	2	5	11	7
<i>Pseudoalcippe abyssinica</i>	3	2	2	7
<i>Nectarinia loveridgei</i>	44	9	23	28
Total	119	47	129	224

10f Opportunistic records of species observed to be breeding during the survey (October – December 2004) by the UCBS ornithologist

Mountain buzzard (*Buteo oreophilus*)
 Barred – tailed trogon (*Apaloderma vittatum*)
 Livingstone's turaco (*Tauraco livingstonii*)
 Moustached green tinkerbird (*Pogoniulus leucomystax*)
 Uluguru mountain greenbul (*Andropadus neumanni*)
 Shelley's greenbul (*Andropadus masukuensis*)
 White – starred robin (*Pogonocichla stellata*)
 Olive – flanked robin-chat (*Cossypha anamala*)
 Olive thrush (*Turdus olivaceus*)

Appendix 11: Reptile Data

11a. Reptile species recorded within Uluguru South FR.

Updated from Doggart et al (2005) with UCBS data. Recordings following Spawls et al (2002). Highlighted are those new records for Uluguru South FR collected by UCBS. Voucher specimens for snakes have been verified by Dr. Don. Boradley and the remaining specimens are currently undergoing taxonomic verification (Appendix 2).

Species	Common name	Range	Habitat	Threat status IUCN	Threat Status CITES	Most recent record
CHAMAELEONIDAE						
<i>Bradypodion fischeri uluguruensis</i>	Uluguru two-horned chameleon	Tanzania endemic, and sub-species endemic to Ulugurus	FF		II	UCBS 2005
<i>Bradypodion oxyrinum</i>	Uluguru one-horned chameleon	Eastern Arc endemic	FF		II	UMBCP 2000
<i>Chamaeleo cf. weneri</i>	Werner's three-horned chameleon	Uluguru, Udzungwa, Nguru and Ukaguru endemic	FF		II	UCBS 2005
<i>Rhampholeon brevicaudatus</i>	Bearded pigmy chameleon	Coastal Tanzania and Eastern Arc endemic	FF			UCBS 2005
<i>Rhampholeon uluguruensis</i>	Uluguru pigmy chameleon	Uluguru endemic	FF			UCBS 2005
TYPHLOPIDAE						
<i>Rhinotyphlops nigrocandidus</i>	Bi-coloured blind snake	South Eastern Arc endemic	F			UCBS 2005
COLUBRIDAE						
<i>Bufo procterae</i>	Uluguru forest-snake	Uluguru & Udzungwa endemic	FF			UCBS 2005

11b Reptile numbers recorded from the UCBS zoological trapsites, herpetological searches and casual collections in Uluguru North FR. Voucher specimens are currently under going formal taxonomic verification (Appendix 2).

Species	Common name	Numbers of individuals per zoo site* (casual)					KMH No.s
		Site 1	Site 2	Site 3	Site 4	Site 5	
CHAMAELEONIDAE							
<i>Bradypodion fischeri uluguruensis</i>	Uluguru two-horned chameleon	1 (2)	0	0	0	0	23600, 26207, 26208
<i>Chamaeleo cf. weneri</i>	Werner's three-horned chameleon	0	0	0 (1)	0 (1)	0 (3)	26211, 26213, 26214, 26215, 26218
<i>Rhampholeon brevicaudatus</i>	Bearded pigmy chameleon	0	0	0	0	0 (1)	26217
<i>Rhampholeon uluguruensis</i>	Uluguru pigmy chameleon	0	0 (1)	0	0	0	26210
TYPHLOPIDAE							
<i>Rhinotyphlops nigrocandidus</i> sp. nov.	Bi-coloured blind snake	1	0	0	0	0	20209
COLUBRIDAE							
<i>Buhome procterae</i>	Uluguru forest-snake	0	0	0 (1)	0	0 (2)	26212, 26216, 26219
		2 (2)	0 (1)	0 (2)	0 (1)	0 (6)	

* This includes captures from bucket pitfall traps and herpetological searches

Appendix 12: Amphibian Data

12a Amphibian species recorded within Uluguru South FR.

Updated from Duggart et al (2005) with UCBS data. Recordings following Spawls et al (2002). Highlighted are those new records for Uluguru South FR collected by UCBS. Voucher specimens are currently undergoing taxonomic verification (Appendix 2).

Species	Range	Habitat	Threat status IUCN	Threat Status CITES	Most recent record
ARTHROLEPTIDAE					
<i>Arthroleptis affinis</i>	Tanzania endemic, few coastal forests and Eastern Arc Mts	F/FF			UCBS 2005
<i>Arthroleptis cf reichei</i>	Mountains in Northern Malawi & Southern Tanzania	FF			UCBS 2005
<i>Arthroleptis cf affinis /reichei</i>		FF			UCBS 2005
<i>Arthroleptis xenodactyloides</i>	N Tanz., through Malawi, N&C Mozambique to E Zimbabwe	F			UCBS 2005
<i>Arthroleptis cf xenodactyloides</i>		F			UCBS 2005
<i>Arthroleptis cf. xenochirus</i>	Zambia, Southern DRC, Angola				UMBCP 2000
BUFONIDAE					
<i>Nectophrynoides cryptus</i>	Uluguru endemic	FF	EN	I	Howell 1993
<i>Nectophrynoides viviparus</i>	Tanzania endemic, Uluguru, Udzungwa, Rubeho & Mt Rungwe	F	VU	I	UCBS 2005
<i>Nectophrynoides laevis</i>	Uluguru endemic	FF			Mkonyi 2002
<i>Nectophrynoides cf. pseudotornieri</i>	Uluguru endemic	FF			UCBS 2005
<i>Nectophrynoides sp A</i>					UCBS 2005
<i>Nectophrynoides sp C</i>					UCBS 2005
<i>Nectophrynoides sp D</i>					UCBS 2005
<i>Nectophrynoides sp E</i>					UCBS 2005
<i>Nectophrynoides sp G</i>					UCBS 2005
HYPEROLIDAE					
<i>Hyperolius puncticulatus</i>	Localised from N. Tanz. through the Eastern Arc to S Malawi	F			UCBS 2005
<i>Leptopelis parkeri</i>	Tanzania endemic, Eastern Arc Usam., Uluguru & Udzungwa	FF	VU		UCBS 2005
MICROHYLIDAE					
<i>Probreviceps macrodactylus loveridgei</i>	Eastern Arc endemic, Uluguru and Udzungwa only	FF	VU		UCBS 2005
<i>Probreviceps uluguruensis</i>	Uluguru endemic	FF	VU		UCBS 2005

<i>Hoplophryne uluguruensis</i>	Tanzania Endemic, Usambara, Uluguru, Nguru & Nguu	FF	VU	UCBS 2005	
Species	Range	Habitat	Threat status IUCN	Threat Status CITES	Most recent record
RANIDAE					
<i>Arthroleptides yakusini</i>	Tanzania endemic, Uluguru and Udzungwa	FF	EN	UCBS 2005	
<i>Afrana angolensis</i>	Widespread	O		UCBS 2005	
<i>Strongylopus fuelleborni</i>	Highlands of Malawi and mountains of southern Tanzania	O		UCBS 2005	
CAECILIIDAE					
<i>Scolecophorus uluguruensis</i>	Uluguru endemic	FF		UCBS 2005	
<i>Scolecophorus vittatus or kirkii</i>		FF		UCBS 2005	

12b Amphibian numbers recorded from the UCBS zoological trapsites, herpetological searches and casual collections in Uluguru North FR. Voucher specimens are currently under going formal taxonomic verification (Appendix 2).

Species	Numbers of individuals per trapsite* (casual)					KMH No.s
	zoo 1	zoo 2	zoo 3	zoo 4	zoo 5	
ARTHROLEPTIDAE						
<i>Arthroleptis affinis</i>	0	0	0	0	0	
<i>Arthroleptis</i> cf <i>reichei</i>	0	0	2 (1)	0	0	26303, 26304, 26334
<i>Arthroleptis</i> cf <i>affinis</i> / <i>reichei</i>	0	0	0	0	0 (2)	26350, 26537
<i>Arthroleptis xenodactyloides</i>	0	0	3	0	0	26302
<i>Arthroleptis</i> cf <i>xenodactyloides</i>	0	0	1	0	0	26299
BUFONIDAE						
<i>Nectophrynoides pseudotornieri</i>	0	0	1	0	0	26305
<i>Nectophrynoides</i> cf <i>pseudotornieri</i>	0	0	1	0	0	26307
<i>Nectophrynoides viviparus</i>	4	11 (2)	7			23660, 23662, 23816, 23822, 23853, 23855, 23664, 23859, 26291
<i>Nectophrynoides</i> sp A	4	1 (1)	0	0 (7)	0	23817, 23819, 26192, 23663, 26290, 26338, 26339, 26341, 26344, 26345, 26347, 26349
<i>Nectophrynoides</i> sp C	0	0	0	0 (1)	0	26346
<i>Nectophrynoides</i> sp D	0	1	1	0	0	23858, 26306
<i>Nectophrynoides</i> sp E	1	0	0	0	0	23818
<i>Nectophrynoides</i> sp G	0 (1)	0	0	0	0	26297
HYPEROLIDAE						
<i>Hyperolius puncticulatus</i>	0	0	0	0	0 (1)	26538
<i>Leptopelis parkeri</i>	3	0	0	0	0	23820, 26293, 26295
MICROHYLIDAE						
<i>Probreviceps macrodactylus loveridgei</i>	1	7	40	2 (1)	0	23854, 23856, 23857, 23661, 23665, 23666, 26301, 26342, 26348
<i>Probreviceps uluguruensis</i>	0	0	6	0 (1)	0	26300, 26336
<i>Probreviceps</i> cf <i>uluguruensis</i>	0	0	0	6 (1)	0	26335, 26337
<i>Hoplophryne uluguruensis</i>	0	0	0 (1)	0	0	26298
RANIDAE						
<i>Arthroleptides yakusini</i>	0	0	0 (2)	0	0	26296, 26308
<i>Afrana angolensis</i>	2	0	0	0	1 (1)	23821, 26294, 26351, 26539
<i>Strongylopus fuelleborni</i>	0	0	0	1 (2)	0	26340, 26343
CAECILIIDAE						
<i>Scolecomorpus uluguruensis</i>	0	1 (1)	1	0	2 (2)	23349, 23350, 26404, 26406, 26407
<i>Scolecomorpus vittatus</i> or <i>kirkii</i>	0 (1)	0	1	0	0	23659, 26405
	15 (2)	21 (4)	64 (4)	9 (13)	3 (6)	

* This includes captures from bucket pitfall traps and herpetological searches

Key to Appendix 11 and 12

The habitat preference of each species is described in the habitat column as:

FF = Species dependent on primary forest only. It does not include forest edge or secondary forest 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.

O = These are species that do not normally occur in primary or secondary forest or forest edge.

Threat status IUCN:

CR = Critically endangered; *extremely* high risk of extinction in the wild

EN = Endangered; *very* high risk of extinction in the wild in the near future

VU = Vulnerable; high risk of extinction in the wild in the medium-term future

Threat status CITES:

I = Threatened with extinction and excluded from commercial international trade

II = Not yet threatened with extinction, but may be so if trade is not regulated thus export permits are required