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Semdoe Forest Reserve

A biodiversity survey

**Frontier Tanzania
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East Usambara Conservation Area Management Programme

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Semdoe Forest Reserve

A biodiversity survey

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East Usambara Conservation Area Management Programme (EUCAMP)

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

The University of Dar es Salaam (UDSM)

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

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Frontier Tanzania Forest Research Programme (FT FRP)

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

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TABLE OF CONTENTS

TABLE OF CONTENTS.....	v
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
EXECUTIVE SUMMARY.....	ix
FOREWORD.....	x
ACKNOWLEDGEMENTS.....	1
1.0 INTRODUCTION.....	2
1.1 THE EAST USAMBARA MOUNTAINS AND FOREST DIVERSITY	2
1.2 REPORT STRUCTURE.....	4
1.3 MAPS	5
1.4 DATA AND MONITORING.....	5
1.5 SURVEY PERIOD AND PERSONNEL.....	5
2.0 AIMS OF THE SURVEY	6
3.0 DESCRIPTION OF THE FOREST	7
3.1 GENERAL DESCRIPTION	7
3.1.1 <i>Description</i>	7
3.1.2 <i>Location</i>	7
3.1.3 <i>Land use</i>	7
3.1.4 <i>Topography</i>	7
3.1.5 <i>History and Status</i>	8
4.0 VEGETATION.....	11
4.1 INTRODUCTION.....	11
4.2 METHODS.....	11
4.2.1 <i>Forest composition</i>	11
4.3 RESULTS.....	13
4.3.1 <i>Quantitative vegetation analysis</i>	13
4.3.2 <i>Disturbance transects</i>	29
4.4 DISCUSSION.....	34
5.0 FAUNA.....	36
5.1 INTRODUCTION.....	36
5.2 METHODS.....	36
5.2.1 <i>Mammals</i>	36
5.2.2 <i>Birds</i>	37
5.2.3 <i>Reptiles</i>	37
5.2.4 <i>Amphibians</i>	37
5.2.5 <i>Invertebrates</i>	37
5.3 TRAPPING SITES AND SAMPLING INTENSITY	39
5.4 RESULTS.....	41
5.4.1 <i>Mammals</i>	41
5.4.2 <i>Bats</i>	43
5.4.3 <i>Birds</i>	44
5.4.4 <i>Reptiles</i>	45
5.4.5 <i>Amphibians</i>	47
5.4.6 <i>Invertebrates</i>	50

5.5	DISCUSSION.....	52
5.5.1	<i>Species richness and abundance</i>	52
5.5.2	<i>Ecological type</i>	53
5.5.3	<i>Endemic Status</i>	53
5.5.4	<i>IUCN Status</i>	54
6.0	CONCLUSIONS	55
6.0	REFERENCES	57
	APPENDIX 1: GENERAL PLOT INFORMATION	61
	APPENDIX 2: TAXONOMIC VERIFICATION	62

LIST OF TABLES

Table 1. Summary of biodiversity of taxa surveyed.	ix
Table 2. Forest area in the East Usambaras (based on Johansson and Sandy 1996).	3
Table 3. Land use distribution (Johansson & Sandy, 1996).	7
Table 4. Checklist of trees and shrubs.	13
Table 5. Species recorded exclusively in the regeneration layer.	16
Table 6. Summary of opportunistic botanical records.	16
Table 7. Tree and shrub species found outside their previously recorded range in the East Usambara mountains.	17
Table 8. Summary of ecological type for tree and shrub species (based on Table 4).	18
Table 9. Summary of habitat for tree and shrub species (based on Table 4).	18
Table 10. Submontane species in lowland areas and the altitudes where they were recorded.	18
Table 11. Summary of endemic status for tree and shrub species (based on Table 4).	19
Table 12. The abundance of selected timber species.	19
Table 13. Disturbance transect results for pole counts in Semdoe Forest Reserve (1997).	29
Table 14. Disturbance transect results for timber counts in Semdoe Forest Reserve (1997).	31
Table 15. Summary descriptions of trapping sites.	39
Table 16. Sampling intensity by trap night (number of nights x number of traps).	39
Table 17. Summary of bat-netting sites.	39
Table 18. Summary of small mammals recorded in Semdoe Forest Reserve.	41
Table 19. Abundance of duiker, bushbuck and hyrax dung.	42
Table 20. Summary of dung survey in Semdoe Forest Reserve.	42
Table 21. Summary of mammal observations in Semdoe Forest Reserve.	43
Table 22. Summary of bird species observed in Semdoe Forest Reserve.	44
Table 23. Summary of reptiles.	45
Table 24. Summary of reptile observations.	46
Table 25. Ranges for near-endemic reptile species recorded.	46
Table 26. Summary of amphibians.	47
Table 27. Ranges for near-endemic amphibian species recorded.	48
Table 28. Summary of butterflies.	50
Table 29. Summary of faunal families and species.	52
Table 30. Summary of capture locations of faunal species by plot number.	53
Table 31. Summary of ecological type of mammal, bird, reptile, amphibian and butterfly species.	53
Table 32. Summary of endemic status of mammal, bird, reptile and amphibian species.	54

LIST OF FIGURES

Figure 1	The location of Semdoe Forest Reserve in relation to other East Usambara forests.	9
Figure 2	Topographical map.	10
Figure 3	Location of vegetation plots and disturbance transects.	12
Figure 4	Species accumulation rates of recorded species by vegetation plot.	17
Figure 5	Distribution of forest dependent tree and shrub individuals in Semdoe F.R.	20
Figure 6	Distribution of forest dependent tree and shrub species in Semdoe F.R.	21
Figure 7	Distribution of non-forest tree and shrub species in Semdoe F.R.	22
Figure 8	Distribution of submontane tree and shrub individuals in Semdoe F.R.	23
Figure 9	Distribution of submontane tree and shrub species in Semdoe F.R.	24
Figure 10	Distribution of near-endemic tree and shrub individuals in Semdoe F.R.	25
Figure 11	Distribution of near-endemic tree and shrub species in Semdoe F.R.	26
Figure 12	Vegetation map of Semdoe forest reserve.	27
Figure 13	Botanical species richness in Semdoe F.R.	28
Figure 14	Cut and naturally fallen poles recorded by transect.	29
Figure 15	Distribution of pole cutting/hectare in Semdoe F.R.	30
Figure 16	The relative abundance of live, naturally dead and cut timber in Semdoe Forest Reserve.	31
Figure 17	Distribution of timber cutting/hectare in Semdoe F.R.	32
Figure 18	Areas of highest disturbance in relation to the distribution of tree and shrub individuals that are both forest dependent and near-endemic in Semdoe Forest Reserve.	33
Figure 19	Location of trapping sites in Semdoe F.R.	40
Figure 20	Distribution of forest dependent and near-endemic amphibian species in Semdoe F.R.	49

EXECUTIVE SUMMARY

Semdoe Forest Reserve, in the East Usambara Mountains in north-east Tanzania was gazetted in 1999. It is situated in Muheza District, Tanga Region and covers 950 ha between 160 – 520 m asl, encompassing lowland and riverine forest.

As part of the East Usambara Catchment Forest Project (from 1999 East Usambara Conservation Area Management Programme, EUCAMP), Frontier-Tanzania conducted a biological survey of Semdoe Forest Reserve in March 1996 and between August - December 1997, for a total of 70 research-days. All parts of the reserves were surveyed systematically at a 0.25% sampling intensity for the vegetation survey, the zoological survey focused on five trapping sites. This report provides an inventory of the trees, shrubs, herbs, mammals, reptiles, amphibians, birds and butterflies recorded during the survey. The report also describes patterns of human disturbance within the reserve. The species richness, endemism and ecological affinities of the taxa recorded are summarised as Table 1.

Table 1. Summary of biodiversity of taxa surveyed.

Taxon	Total no. of species	% forest dependent	No. of non-forest species	No. of endemics	No. of near-endemics	No. of forest dependent endemics and near-endemics
Trees and shrubs	105	22	7	1	26	8
Mammals	17	12	2	0	2	0
Birds	14	86	0	0	3	3
Reptiles	17	8	1	0	1	1
Amphibians	11	36	0	0	3	3
Butterflies	68	26	6	0	5	4
Total	229		16	1	40	19

Semdoe Forest Reserve is significant in terms of conservation as a corridor between Kambai Forest Reserve and the Segoma forests. Semdoe is not as botanically species rich as other reserves surveyed and is dominated by *Diospyros natalensis*. One tree species endemic to the Usambara mountains was recorded, *Uvariadendron oligocarpum*.

In terms of fauna, the reserve is home to one endangered species and five vulnerable species according to IUCN categories. Relative to other forest reserves in the East Usambaras its species richness is below average for mammals, reptiles and amphibians but above average for butterflies.

Semdoe Forest Reserve has come under intense pressure from fire and from tree cutting. Pole and timber cutting were recorded on all transects and signs of fire were recorded in all plots. Trapping is also occurring within the reserve. Local people are concerned at the lack of agricultural land into which they can expand.

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

FOREWORD

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

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

The surveys have been carried out over ten-week field phases. The programme involves short-term expatriate volunteer research assistants, permanent EUCAMP, Frontier-Tanzania, University of Dar es Salaam, and Tanzania Forestry Research Institute staff, as well as an international network of taxonomists and other experts. The surveys have become progressively more systematic and quantitative, and have already resulted in the discovery of several previously unknown taxa. This will further raise awareness of the unique conservation values of the East Usambaras. EUCAMP has also commissioned the development of a biodiversity database, work that also contributed the maps of these reports. All data collected during the surveys is entered into this database, which is linked to the national biodiversity database.

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

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1.0 INTRODUCTION

1.1 The East Usambara Mountains and forest diversity

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

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

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

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

The latest survey of the East Usambaras, shows that approximately 45,137 ha of the East Usambaras remain as natural forest Johansson & Sandy (1996). This can be divided into two types: submontane rain forest and lowland forest. Altitude is the factor differentiating these two forest types (Hamilton, 1989), with submontane forest

generally occurring above 850 m. The area recorded as forest in the East Usambaras according to these categories is described in Table 2.

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

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

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

There are at least 11 species of reptiles and amphibians endemic to the East and West Usambaras (Howell, 1993). The East Usambara Biodiversity Surveys provide further information on new species and species' range extensions. A new species of snake, *Prosymna semifasciata*, was recently found in Kwamgumi Forest Reserve (Broadley, 1995) and an recently described species of *Stephopaedes usambarae* sp. nov. (Poynton & Clarke, 1999) has been recorded by the surveys in Mtai and Kwamgumi Forest Reserves.

The forest avifauna of the East Usambaras has a high diversity with at least 110 species (Stuart, 1989). Six species occurring in the lowland forests are considered 'Vulnerable' to global extinction: Sokoke Scops Owl, *Otus ireneae*; the endemic Usambara Eagle Owl, *Bubo vosseleri*; Swynnerton's Robin, *Swynnertonia swynnertoni*; East Coast Akalat, *Sheppardia gunningi*; Amani Sunbird, *Anthreptes pallidigaster* and the Banded Green Sunbird, *Anthreptes rubritorques* (IUCN, 1996).

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

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

1.2 Report structure

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

Ecological requirements are defined in terms of:

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

Levels of endemism are defined in terms of:

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

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

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

This refers to the habitat in which they are typically found in East Africa rather than to where they have been recorded in the reserve. These three criteria are used to analyse the uniqueness of the biodiversity of the reserve and its vulnerability to disturbance.

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

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

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

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

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

1.3 Maps

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

1.4 Data and monitoring

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

1.5 Survey period and personnel

The survey of Semdoe Forest Reserve was conducted in March 1996 and between August and December 1997 for a total of 70 research-days. The survey was conducted by Frontier-Tanzania staff, Catchment Forest Officers, volunteers and local people from Maramba and Semdoe.

2.0 AIMS OF THE SURVEY

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

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

Furthermore, the aims of the survey methods applied are:

- to sample the vegetation and tree species composition of six forests of the East Usambaras using systematic sampling techniques along systematically located vegetation transects, which sample approximately 0.25% of the area of each forest reserve;
- to assess levels of disturbance by systematically sampling the incidence of tree cutting, animal trapping and other illegal activities along the vegetation transects;
- to use standardised and repeatable methods to record biodiversity values of the forest in terms of small mammal, reptile, amphibian, and invertebrate species;
- to collect opportunistic data on all other groups of vertebrate and invertebrates. Species lists resulting from this will be compared against IUCN categories of threat and other conservation criteria in order to assess the overall biodiversity values of each forest;
- to undertake a socio-economic appraisal of the impact of resource-use activities by human communities in the vicinity of each forest and produce a brief assessment of how these activities affect the integrity of the forests.

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

3.0 DESCRIPTION OF THE FOREST

3.1 General description

3.3.1 Description

Name:	Semdoe Forest Reserve Muheza District, Tanga Region, Tanzania.
Area:	980 ha;
Status:	Central Area Forest Reserve Gazetted 1999 Gazettement Notice 547 (1999)
Maps:	Ordnance Survey topographic maps Y742 (DOS 422) Sheet 110/3 'Hemagoma'. Forest Division map: JB.2261

3.1.2 Location

Grid reference: 38°41'E - 38°43'E, 4°56' - 4°58' S

Elevation 95 – 520 m a.s.l.

Semdoe Forest Reserve is situated in the north of the East Usambaras (Figure 1). Semdoe Forest Reserve is contiguous on its western border with Kambai Forest Reserve. In the east the reserve is divided from Segoma Forest Reserve by a narrow strip of public land around the Muzi River. The northern border of the reserve is the Semdoe River. To the south there is agricultural land. The southern border was poorly marked at the time of the survey.

3.1.3 Land use

The latest survey of the area was carried out by Hyytiäinen (1995), and updated by Johansson & Sandy (1996). The results for Semdoe Forest Reserve are summarised in Table 3 below. Semdoe Forest Reserve was described as entirely consisting of cultivation under lowland forest. However this was not the finding of the current survey and many areas appear to be lowland forest without cultivation.

Table 3. Land use distribution (Johansson & Sandy, 1996).

Semdoe Forest Reserve	Area (ha)	Percent (%)
Cultivation under lowland forest	970	100
Total for the reserve:	970	100.0

3.1.4 Topography

Semdoe Forest Reserve lies in the Sigi-Muzi river valley. Three tributaries of the Muzi River flow through the reserve. Along the northern border flows the Semdoe river, further south the Mazingara river runs north-eastwards and the most southerly

tributary flows parallel to the Mazingara. The elevation of the reserve rises gently from east to west, the steepest slopes being along the western border. The highest point, at Semdoe Peak in the north-west of the reserve rises to 520m asl.

3.1.5 History and Status

It was first proposed to gazette Semdoe as a Catchment Forest in 1994. Prior to this, the area was a part of the Kambai Public Lands. It was recognised by the EUCAMP that Semdoe is an important corridor between the Kwamgumi-Segoma forest block and the forests further west such as Kambai. The forest was therefore gazetted during the second phase of the EUCAMP.

As public land, the forest was highly disturbed primarily for fuel collection. A small area under cultivation was incorporated into the reserve and the family relocated.

Formerly a road passed through the reserve allowing access between Kwamtili and Kambai. This road was passable until 1996. It is now overgrown and impassable by vehicle having deteriorated significantly during the heavy rains of 1997.

Other research conducted in the reserve includes a visit by the Cambridge-Tanzania Rainforest Project (1994).

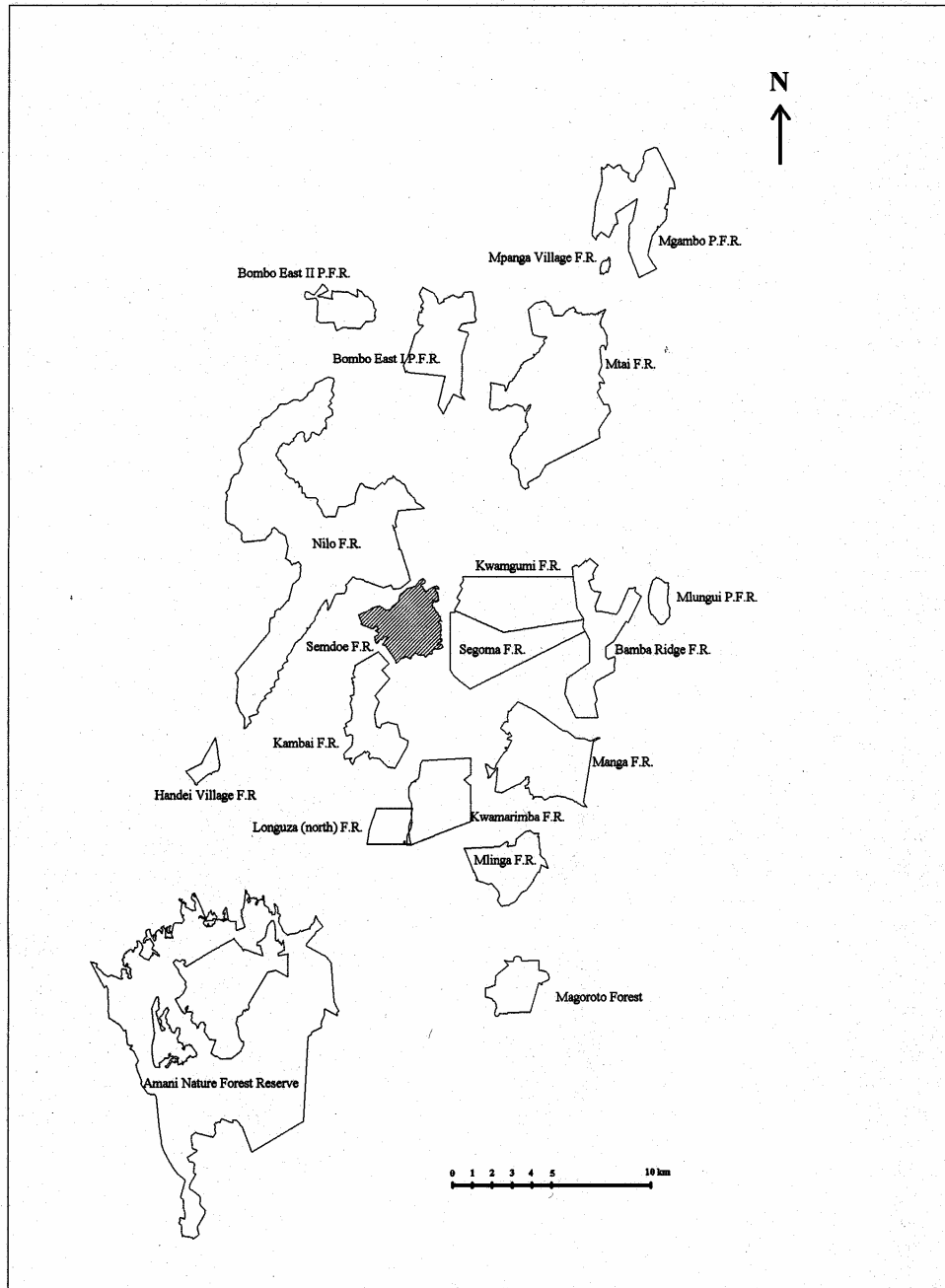


Figure 1 The location of Semdoe Forest Reserve in relation to other East Usambara forests.

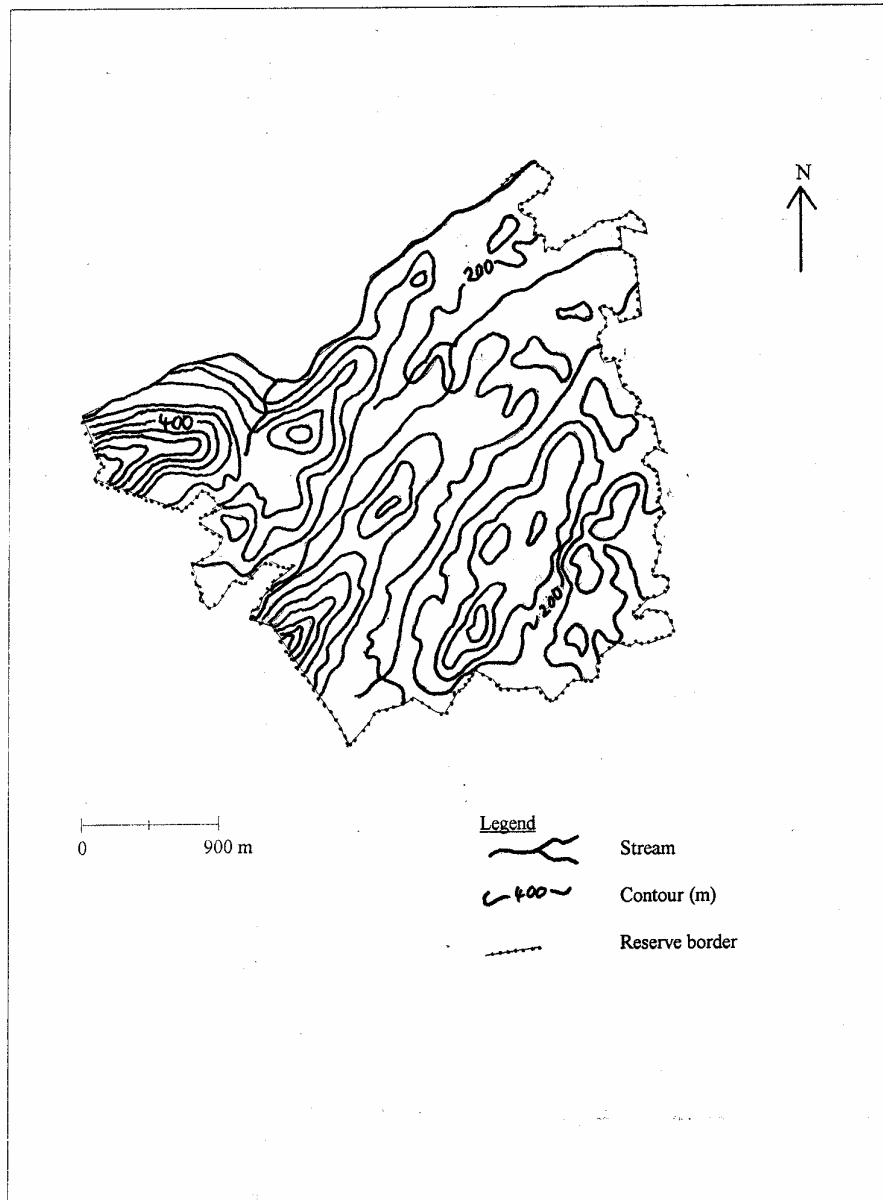


Figure 2 Topographical map.

4.0 VEGETATION

By Nike Doggart, Albert Ntemi, Raymond Kilenga and Kathryn Doody.

4.1 Introduction

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

4.2 Methods

The forest block is divided into a grid of numbered rectangles marked in the field by tagged transects. All methods are based on this grid system and are detailed in the FT FRP methodologies report (SEE, 1998). A brief description is presented below. The location of vegetation plots and disturbance transects are illustrated in Figure 3.

4.2.1 Forest composition

Three methods were used to analyse forest composition: (1) quantitative vegetation analysis, (2) opportunistic observations and (3) disturbance transects.

4.2.1.1 Quantitative vegetation analysis

The botanical survey was based on a 450 m x 900 m grid marked in the field using tagged transect lines. One plot 50 m x 20 m was sampled in each grid square, giving an approximate sampling intensity of 0.25%. Within each sample plot, every tree with a dbh (diameter at breast height) of 10 cm and over was recorded, labelled and identified. Botanists from the Tanzanian Forestry Research Institute (TAFORI) and from the UDSM provided the field identification of plant species.

4.2.1.2 Disturbance transects

Disturbance transects were used to record the intensity of pole cutting and logging in a forest block. The disturbance transects were based on the 450 m x 900 m grid prepared for the vegetation plots. Each transect running north-south was sampled from border to border. Disturbance was recorded by 50 m section along the transect.

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

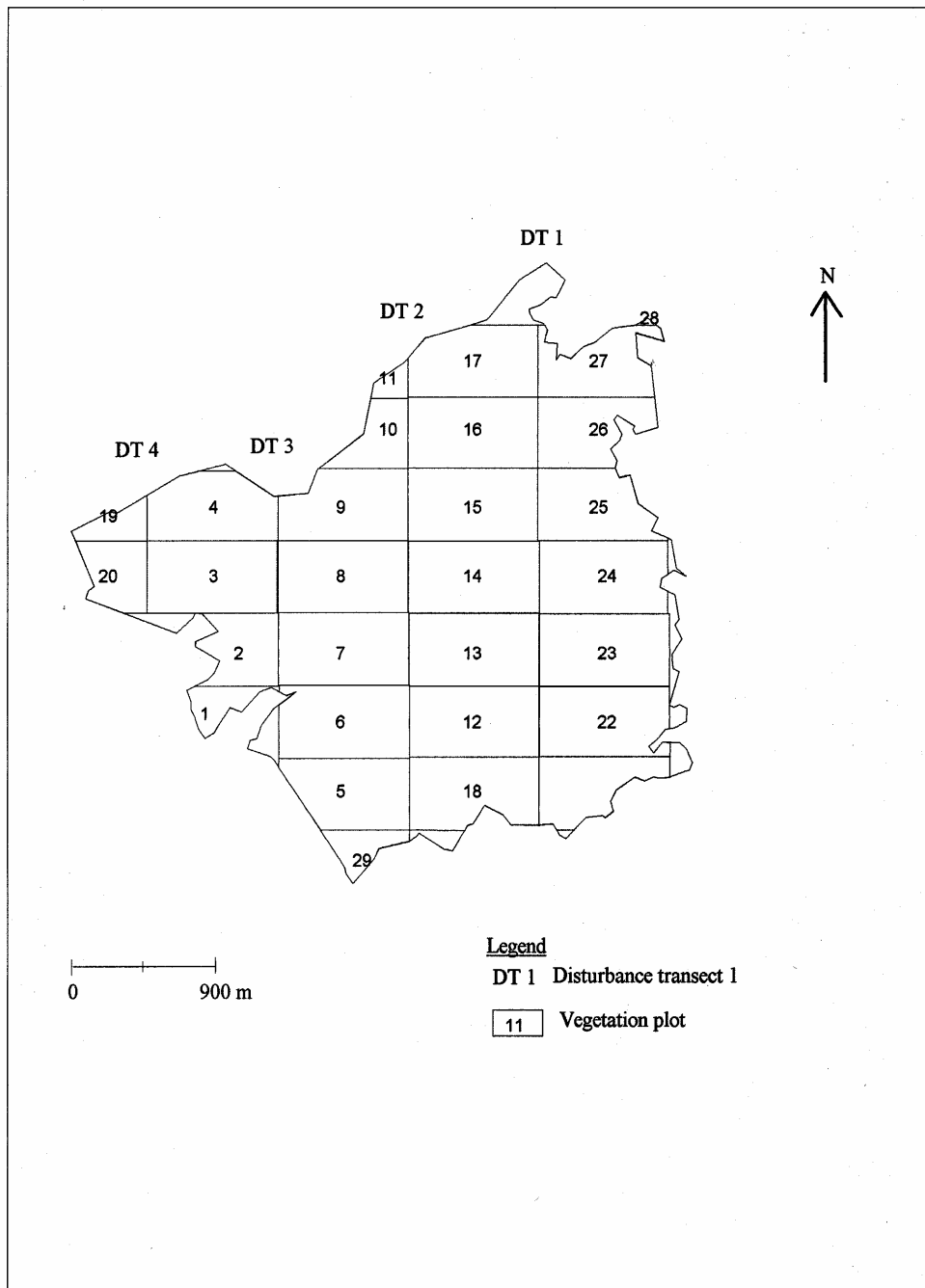


Figure 3 Location of vegetation plots and disturbance transects.

4.3 Results

4.3.1 Quantitative vegetation analysis

Table 4 presents a checklist of the tree and shrub species recorded in the 20 m x 50 m vegetation plots. Species are described, where adequate information exists, in terms of their ecological type, their habitat and their endemic status. Nomenclature follows Iversen (1991a) and the Flora of Tropical East Africa.

Table 4. Checklist of trees and shrubs.

Species	Ecological type	Habitat ²	Endemic Status
ANACARDIACEAE			
<i>Lannea welwitschii</i>	F	L	N
* <i>Sorindeia madagascariensis</i>	f	S&L	W (N)
ANNONACEAE			
<i>Lettowianthus stellatus</i> ¹	f	L&S	N
<i>Monodora grandidieri</i>	f	L&S	N
* <i>Xylopiya parviflora</i>	f	L	W
APOCYNACEAE			
<i>Holarrhena pubescens</i>	O	L	W
ARALIACEAE			
<i>Cussonia zimmermannii</i>	f	L	N
BIGNONIACEAE			
<i>Fernandoa magnifica</i>	f	L	N
* <i>Markhamia lutea</i>	f	L&S	W
BOMBACACEAE			
<i>Bombax rhodognaphalon</i>	f	L	N
<i>Ceiba pentandra</i>	F	S	W
BUSERACEAE			
<i>Commiphora eminii zimmermannii</i>	f	L	W
CELASTRACEAE			
<i>Maytenus undata</i>	f	S	W
COMBRETACEAE			
<i>Combretum schumannii</i>	f	L	N
* <i>Terminalia sambesiaca</i>	f	L	W
DRACAENACEAE			
<i>Dracaena steudneri</i> ¹	F	S	W
EBENACEAE			
<i>Diospyros kabuyeana</i>	f	S	N
<i>Diospyros mespiliformis</i>	f	L	W
* <i>Diospyros natalensis</i>	f	L	W
<i>Diospyros squarrosa</i> ¹	f	L	W
EUPHORBIACEAE			
<i>Bridelia micrantha</i>	f	L&S	W
<i>Drypetes usambarica</i>	f	S	N
<i>Margaritaria discoidea</i> var. <i>fagifolia</i>	f	S	W
* <i>Mildbraedia carpinifolia</i>	f	L&S	N
<i>Neoboutonia macrocalyx</i>	f	S	W
* <i>Ricinodendron heudelotii</i>	f	L	W
<i>Sapium ellipticum</i>	f	L&S	W
LEGUMINOSAE: CAESALPINIACEAE			
<i>Afzelia quanzensis</i>	f	L	W

Table 4. cont.

Species	Ecological type	Habitat ²	Endemic Status
<i>*Dialium holtzii</i>	f	L	N
<i>Julbernardia magnistipulata</i>	f	L	N
<i>*Scorodophloeus fischeri</i>	f	L	N
LEGUMINOSAE: MIMOSOIDEAE			
<i>Acacia mellifera</i> ¹	O	S	W
<i>Albizia glaberrima</i>	f	L	W
<i>Albizia gummifera</i>	f	S&L	W
<i>Albizia zimmermannii</i>	f	L	W
<i>Newtonia paucijuga</i>	F	L	N
LEGUMINOSAE: PAPILIONOIDEAE			
<i>Angylocalyx braunii</i>	F	L	N
<i>Erythrina caffra</i> ¹	O	S	W
<i>Lonchocarpus bussei</i>	O	L&S	W
<i>Millettia oblata intermedia</i>	F	S	N
<i>Millettia sacleuxii</i>	f	L	N
<i>*Millettia usaramensis</i>	f	L&S	W
<i>Pterocarpus mildbraedii</i>	F	L	N
<i>Pterocarpus tinctorius</i>	F	S&L	W
MORACEAE			
<i>Antiaris toxicaria</i>	f	L&S	W
<i>Ficus exasperata</i>	f	L&S	W
<i>Ficus</i> sp.	?	?	?
<i>*Ficus sycomorus</i> ¹	f	L	W
<i>Ficus vallis-choudae</i>	f	L	W
<i>Milicia excelsa</i>	f	L&S	W
<i>*Trilepisium madagascariensis</i>	f	L&S	W
OCHNACEAE			
<i>Ouratea sacleusii</i> ¹	?	?	?
RUBIACEAE			
<i>Leptactina platyphylla</i>	f	S	W
<i>Rothmannia manganjae</i>	F	L&S	W
<i>Tarenna nigrenscens</i>	f	L	W
<i>Tarenna pavettoides</i>	F	L&S	W
<i>Tricalysia anomala</i>	F	S	N
RUTACEAE			
<i>Teclea nobilis</i>	f	S	W
SAPINDACEAE			
<i>Allophylus callophylus</i> ¹	f	(L&) S	W
<i>Allophylus</i> sp.	?	?	?
<i>*Lecaniodiscus fraxinifolius</i>	f	L&S	W
<i>Melanodiscus oblongus</i> ¹	f	L&S	W
<i>Zanha golungensis</i>	F	L&S	W
SAPOTACEAE			
<i>Malacantha alnifolia</i>	f	L	W
<i>Manilkara obovata</i>	f	S	W
<i>*Manilkara sulcata</i>	f	L	W
<i>Mimusops kummel</i>	f	L	W
<i>Mimusops</i> sp.	?	?	?
<i>Synsepalum msolo</i>	F	L&S	W
STERCULIACEAE			
<i>*Cola clavata</i> ¹	F	L	W
<i>Cola greenwayi</i>	F	S	W
<i>Pterygota mildbraedii</i> ¹	?	?	?

Table 4. cont.

Species	Ecological type	Habitat ²	Endemic status
STERCULIACEAE			
<i>Sterculia appendiculata</i>	F	L	W
TILIACEAE			
<i>Grewia goetzeana</i>	f	L	N
<i>Grewia holstii</i>	f	?	N
<i>Nersogordonia holstii</i> ¹	?	L&S	N
ULMACEAE			
<i>Celtis africana</i>	F	L	W
<i>Celtis mildbraedii</i>	F	L&S	W
<i>Celtis phillipensis</i>	f	L&S	W
VERBENACEAE			
<i>Vitex amaniensis</i>	f	S&L	N
VIOLACEAE			
<i>Rinorea ferruginea</i>	F	S	W

¹ Species which do not appear in Iversen (1991b). Summary information is based on Ruffo *et al.* (1989), Lovett (1993) or the *Flora of Tropical East Africa*.

² Information is based on Ruffo *et al.* (1989).

KEY TO ABBREVIATIONS FOR TABLE 4

Ecological type: (based on Iversen, 1991b)

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

Habitat: (based on Hamilton, 1989)

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

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

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

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

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

? Insufficient data

Regeneration Layer

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

In Table 5, six species are listed which were recorded in the regeneration layer but not in the larger vegetation plots.

Table 5. Species recorded exclusively in the regeneration layer.

Species	Ecological type	Habitat	Endemic status
ANACARDIACEAE			
<i>Lannea schweinfurthii</i>	f	L&S	W
MORACEAE			
<i>Milicia excelsa</i>	f	L & S	W
OCHNACEAE			
<i>Ochna</i> sp.	?	?	?
RUBIACEAE			
<i>Tarrena</i> sp.	?	?	?
SAPINDACEAE			
<i>Blighia unijugata</i>	F	L&S	W
ULMACEAE			
<i>Trema orientalis</i>	f	L&S	W

Table 6. Summary of opportunistic botanical records.

Species	Ecological type	Habitat	Endemic status
ANNONACEAE			
<i>Uvariadendron oligocarpum</i>	F	S	E(EU&WU)
APOCYNACEAE			
<i>Funtumia africana</i>	F	L&S	W
BIGNONIACEAE			
<i>Markhamia obtusifolia</i>	O		W
BORAGINACEAE			
<i>Ehretia cymosa</i>	f	(L)&S	W
COMBRETACEAE			
<i>Pteleopsis myritifolia</i>	f	L	W
EUPHORBIACEAE			
<i>Bridelia cathartica</i>	f	L&S	W
<i>Croton sylvaticus</i>	f	L	W
<i>Suregada zanzibarensis</i>	f	L	W
LECYTHIDACEAE			
<i>Barringtonia racemosa</i>	f	L	W
LEGUMINOSEAE: PAPILIONOIDEAE			
<i>Millettia stuhlmannii</i>	O	L&S	W
MELIACEAE			
<i>Khaya anthotheica</i>	F	L&S	W
OCHNACEAE			
<i>Ochna macrocalyx</i>	O		W
RUBIACEAE			
<i>Galiniera saxifraga</i>	F	S	W
RUTACEAE			
<i>Citris aurantium</i>	O		W
<i>Teclea simplicifolia</i>	f	S	W
SAPOTACEAE			
<i>Englerophytum natalense</i>	f	L&S	W
<i>Chrysophyllum</i> sp.			
STERCULIACEAE			
<i>Nesogordonia holtzii</i>		L	N

Species accumulation rates:

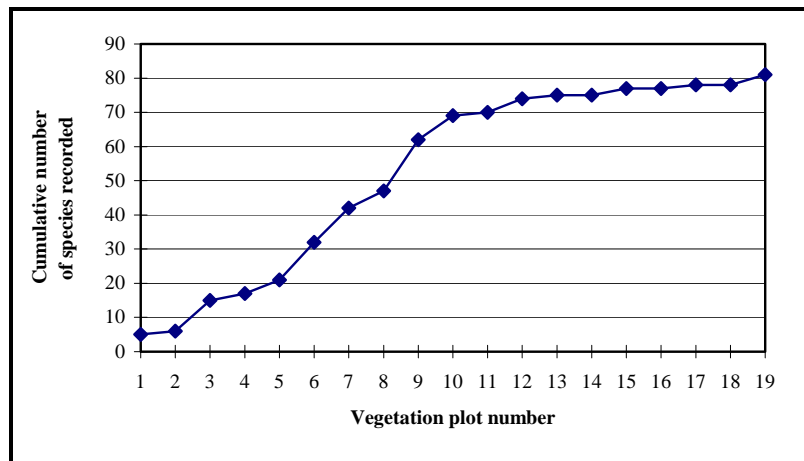


Figure 4 Species accumulation rates of recorded species by vegetation plot.

In 1986 - 1987 a botanical survey was conducted in the East Usambaras (Ruffo et al. 1989). Twenty-six species recorded in Semdoe by the current survey were not recorded by Ruffo *et al.* in Semdoe although they were recorded elsewhere in the Usambaras. These are listed in Table 7.

Table 7 Tree and shrub species found outside their previously recorded range in the East Usambara mountains.

Species	Location as previously recorded ¹
<i>Azelia quanzensis</i>	Longuza Forest Reserve
<i>Albizia zimmermannii</i>	Mhinduro and Mtai
<i>Angylocalyx braunii</i>	Mhinduro, Mtai and southern part of main range
<i>Celtis phillipensis</i> syn <i>C. wightii</i>	Longuza F.R., Mhinduro, Mtai and southern part of main range
<i>Cola clavata</i>	Marimba F.R. and Mhinduro
<i>Cussonia zimmermannii</i>	Mhinduro and Mtai
<i>Dialium holtzii</i>	Longuza F.R., Mhinduro, Mtai and southern part of main range
<i>Diospyros mespiliformis</i>	Mhinduro and southern part of main range
<i>Diospyros natalensis</i>	Mhinduro and Mtai
<i>Fernandoa magnifica</i>	Marimba F.R., Mlinga, Mhinduro and southern part of main range
<i>Ficus sycomorus</i> ¹	Mhinduro, Mtai and southern part of main range
<i>Ficus vallis-choudae</i>	Mlinga and southern part of main range
<i>Grewia holstii</i>	Longuza F.R.
<i>Julbernardia magnistipulata</i>	Longuza F.R. and southern part of main range
<i>Leptactina platyphylla</i>	Southern part of main range
<i>Lettowianthus stellatus</i> ¹	Magunga Estate
<i>Manilkara obovata</i>	Kwamkoro F.R.
<i>Mildbraedia fallax</i>	Marimba F.R.
<i>Mimusops kummel</i>	Kwamgumi F.R.
<i>Monodora grandidieri</i>	Zigi valley area
<i>Ouratea sacleusii</i> ¹	Longuza F.R.

Table 7. Cont.

Species	Location as previously recorded ¹
<i>Pterocarpus mildbraedii</i>	Longuza F.R., Mhinduro and southern part of main range
<i>Teclea nobilis</i>	Mhinduro and southern part of main range
<i>Tricalysia anomala</i>	Southern part of main range
<i>Vitex amaniensis</i>	Mhinduro and southern part of main range
<i>Xylopia parviflora</i>	Longuza F.R., Mhinduro and southern part of main range

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

Ecological type (refer to figures 5,6 and 7):

Table 8. Summary of ecological type for tree and shrub species (based on Table 4).

Ecological type	Number of species	% of total number of species	Number of individuals	% of total number of individuals
(F) Forest dependent species	19	23.5	96	14.1
(f) Non-forest dependent species	52	64.2	573	84.3
(O) Non-forest species	4	4.9	4	0.6
Unknown	6	7.4	7	1.0
Total:	81	100.0	680	100.0

Habitat (refer to Figures 8 and 9):

Table 9. Summary of habitat for tree and shrub species (based on Table 4).

Habitat	Number of species	% of total number of species	Number of individuals	% of total number of individuals
(L) Lowland species	56	69.1	594	87.4
(S) Submontane species	20	24.7	75	11.0
Unknown	5	6.2	11	1.6
Total:	81	100.0	680	100.0

Table 10. Submontane species occurring in lowland areas and the altitudes where they were recorded.

Species	Lowest Recorded Altitude (metres)
<i>Acacia mellifera</i> ¹	180
<i>Albizia gummifera</i>	140
<i>Ceiba pentandra</i>	140
<i>Cola greenwayi</i>	140
<i>Diospyros kabuyeana</i>	140
<i>Dracaena steudneri</i> ¹	140
<i>Drypetes usambarica</i>	140
<i>Erythrina caffra</i> syn. <i>E. lysistemon</i> ¹	240
<i>Leptactina platyphylla</i>	350
<i>Manilkara obovata</i>	270
<i>Margaritaria discoidea</i> var. <i>fagifolia</i>	155
<i>Maytenus undata</i>	135
<i>Millettia oblata intermedia</i>	140

Table 10 Cont.

Species	Lowest Recorded Altitude (metres)
<i>Neoboutonia macrocalyx</i>	140
<i>Pterocarpus tinctorius</i>	145
<i>Rinorea ferruginea</i>	140
<i>Sorindeia madagascariensis</i>	135
<i>Teclea nobilis</i>	155
<i>Tricalysia anomala</i>	155
<i>Vitex amaniensis</i>	230

Endemic status (refer to figures 10, 11):

Table 11. Summary of endemic status for tree and shrub species (based on Table 4).

Endemic status	Number of species	% of total number of species	Number of individuals	% of total number of species
(E) Endemic	0	0.0	0	0.0
(N) Near Endemic	25	30.9	138	20.3
(W) Widespread	52	64.2	538	79.1
Unknown	4	4.9	4	0.6
Total:	81	100.0	680	100.0

Timber value

Formerly logging was permitted in Semdoe Forest Reserve. Table 12 lists the most commonly extracted trees (Ruffo, 1989) to give an indication of the recovery of the remaining populations of these species.

Table 12. The abundance of selected timber species.

Species	Number of plots in which present	% of plots in which present	Total individuals	% of all stems
<i>Azelia quanzensis</i>	1	5	1	0.1
<i>Albizia glaberrima</i>	1	5	1	0.1
<i>Albizia gummifera</i>	1	5	5	0.7
<i>Albizia zimmermanii</i>	2	11	2	0.3
<i>Bombax rhodognaphalon</i>	3	16	3	0.4
<i>Diospyros mespiliformis</i>	1	5	1	0.1
<i>Khaya anthotheica</i>	0	0	0	0.0
<i>Milicia excelsa</i>	4	21	14	2.0
<i>Nersogodonia holstii</i>	2	11	2	0.3
<i>Newtonia buechananii</i>	0	0	0	0.0
<i>Newtonia paucijuga</i>	1	5	1	0.1
<i>Pterocarpus mildbraedii</i>	2	11	3	0.4
<i>Pterocarpus tinctorius</i>	2	11	3	0.4
<i>Terminalia sambesiaca</i>	6	32	11	1.6
<i>Zanha golungensis</i>	1	5	1	0.1

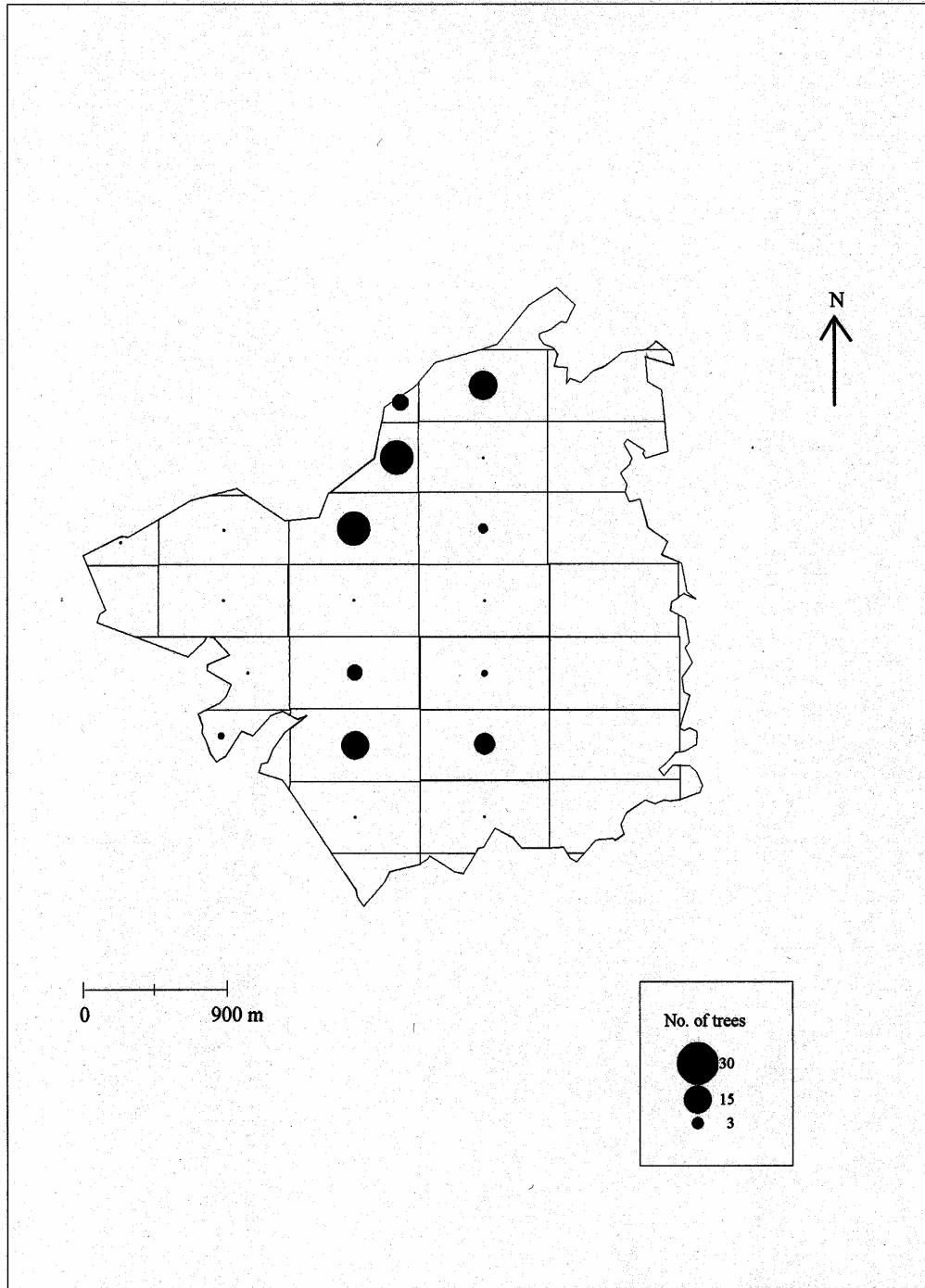


Figure 5 Distribution of forest dependent tree and shrub individuals in Semdoe F.R.

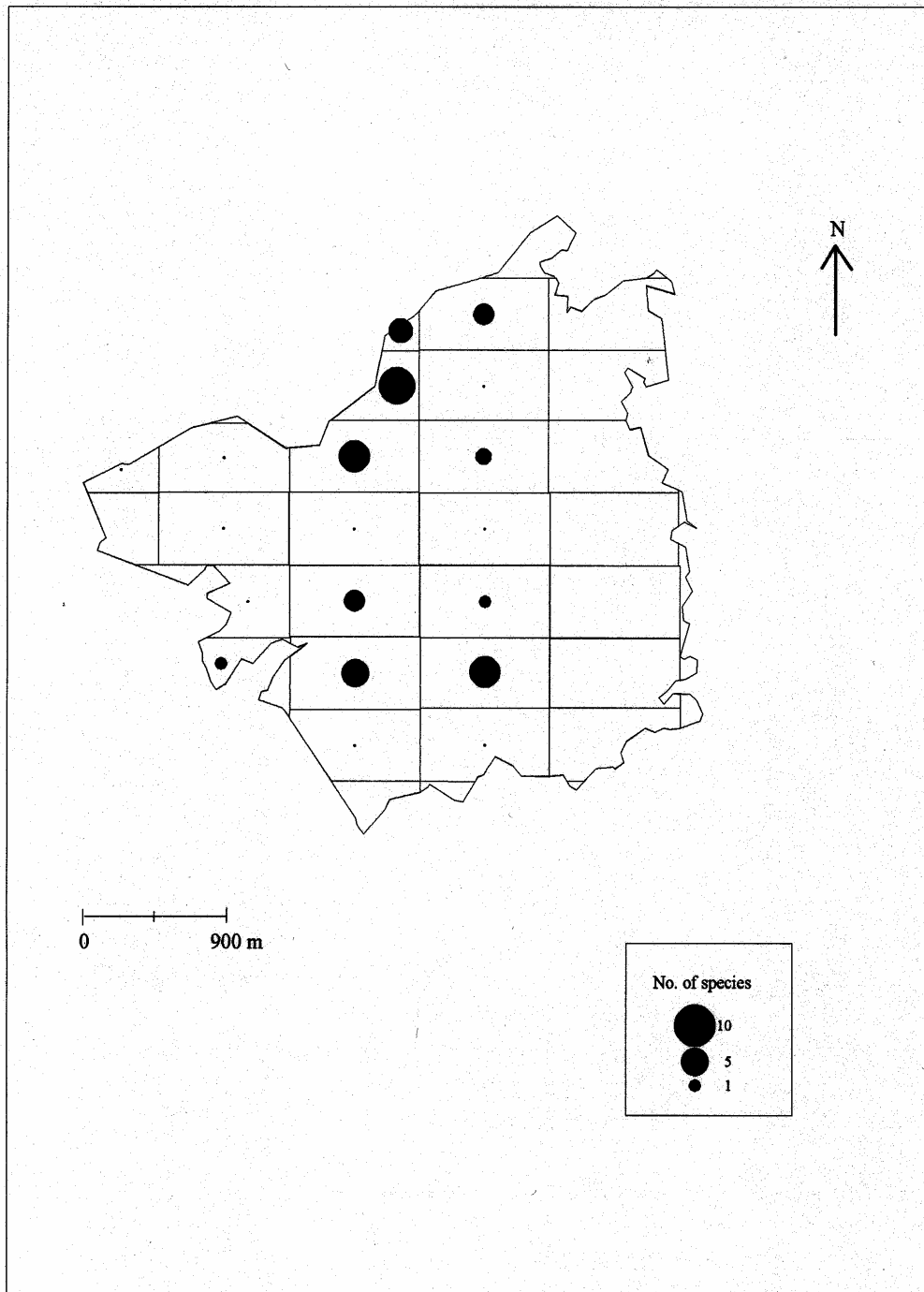


Figure 6 Distribution of forest dependent tree and shrub species in Semdoe F.R.

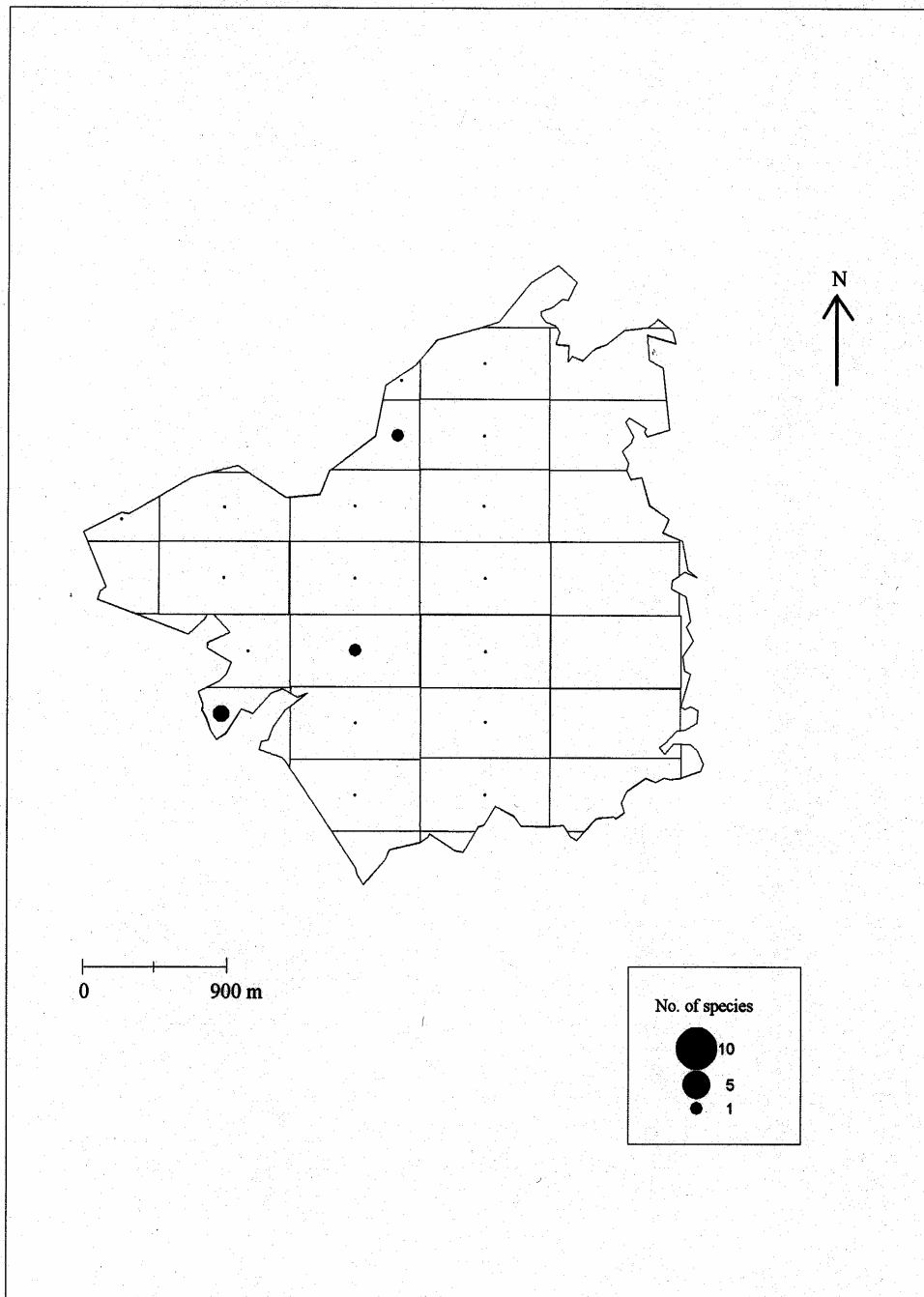


Figure 7 Distribution of non-forest tree and shrub species in Semdoe F.R.

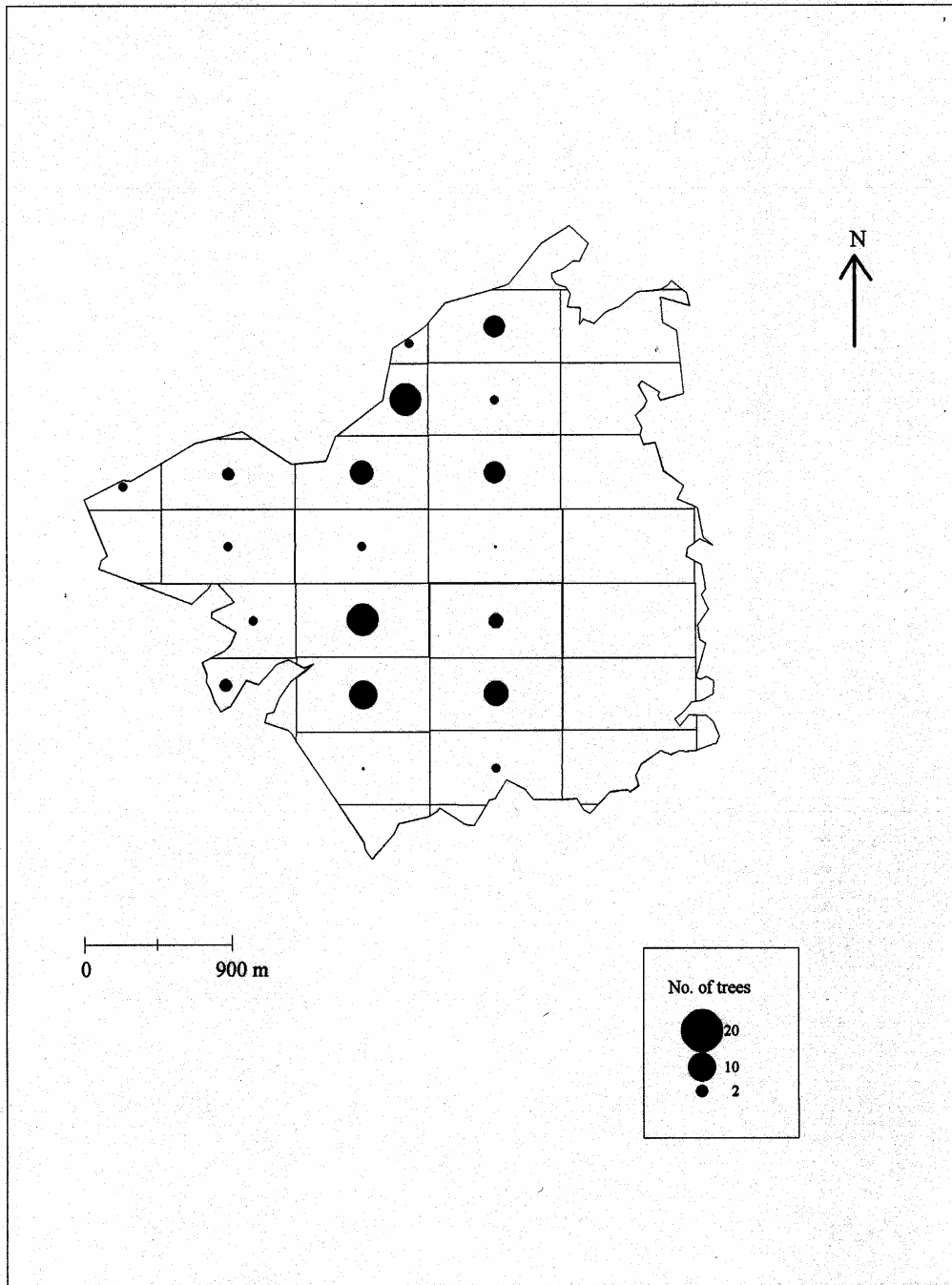


Figure 8 Distribution of submontane tree and shrub individuals in Semdoe F.R.

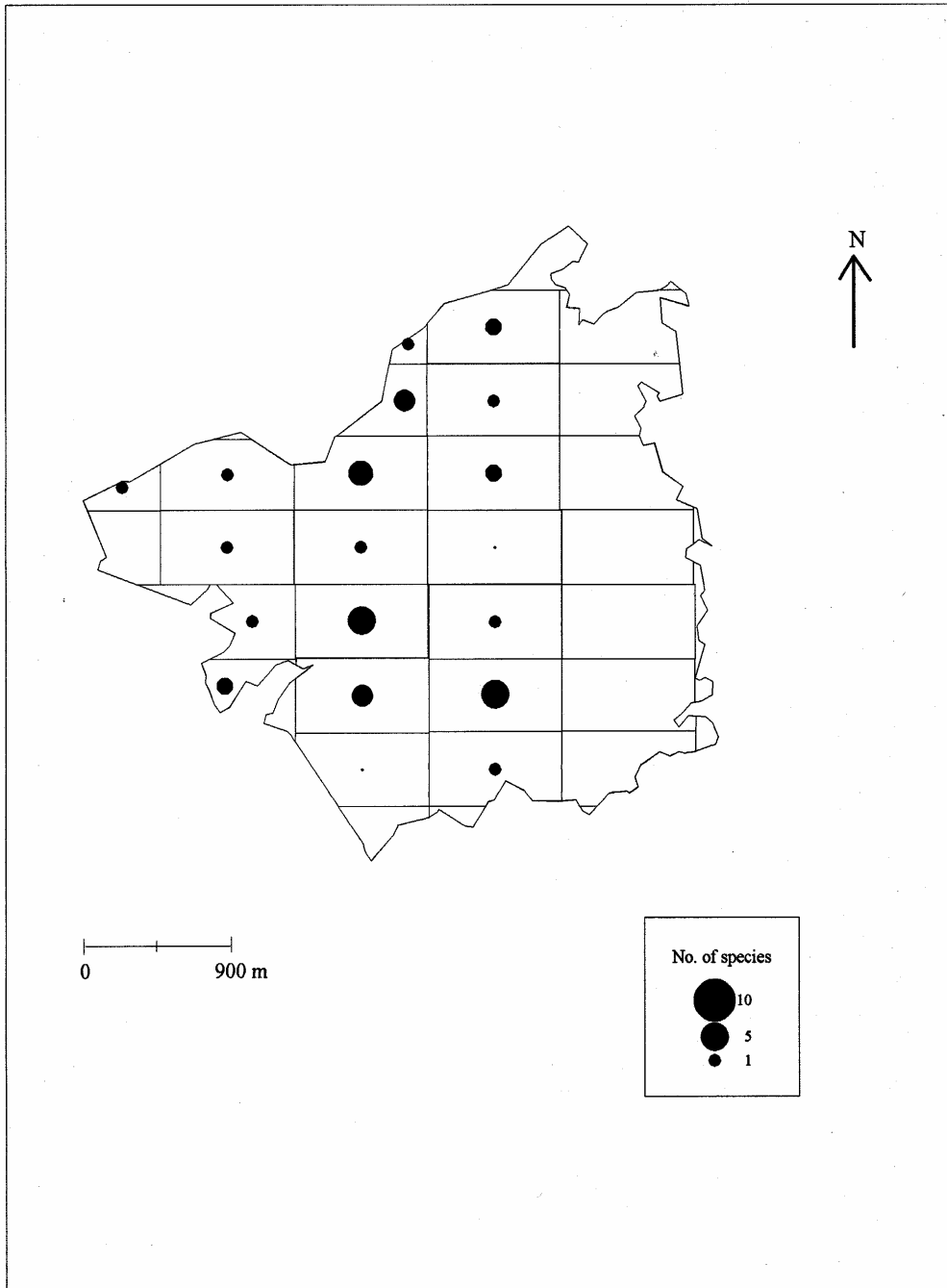


Figure 9 Distribution of submontane tree and shrub species in Semdoe F.R.

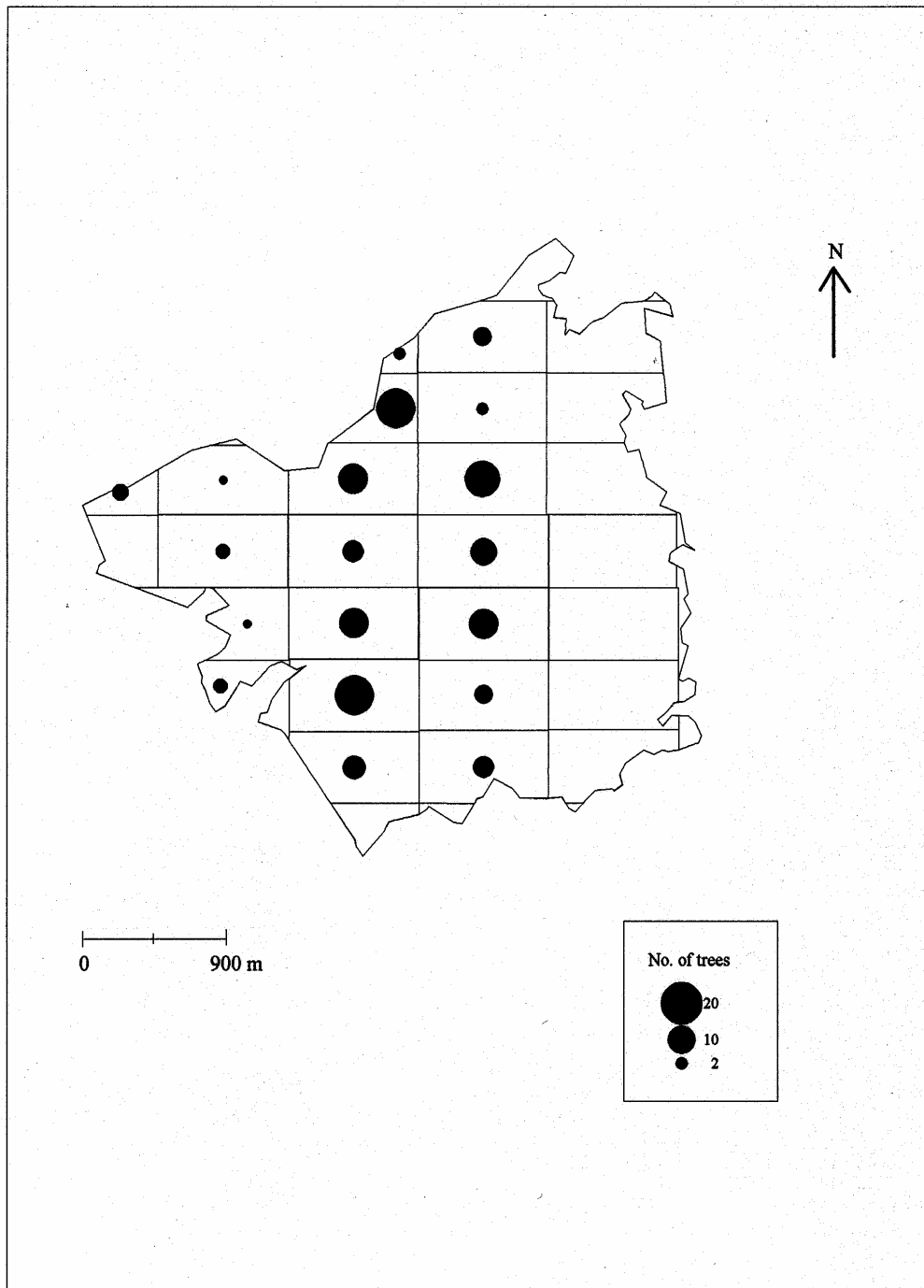


Figure 10 Distribution of near-endemic tree and shrub individuals in Semdoe F.R.

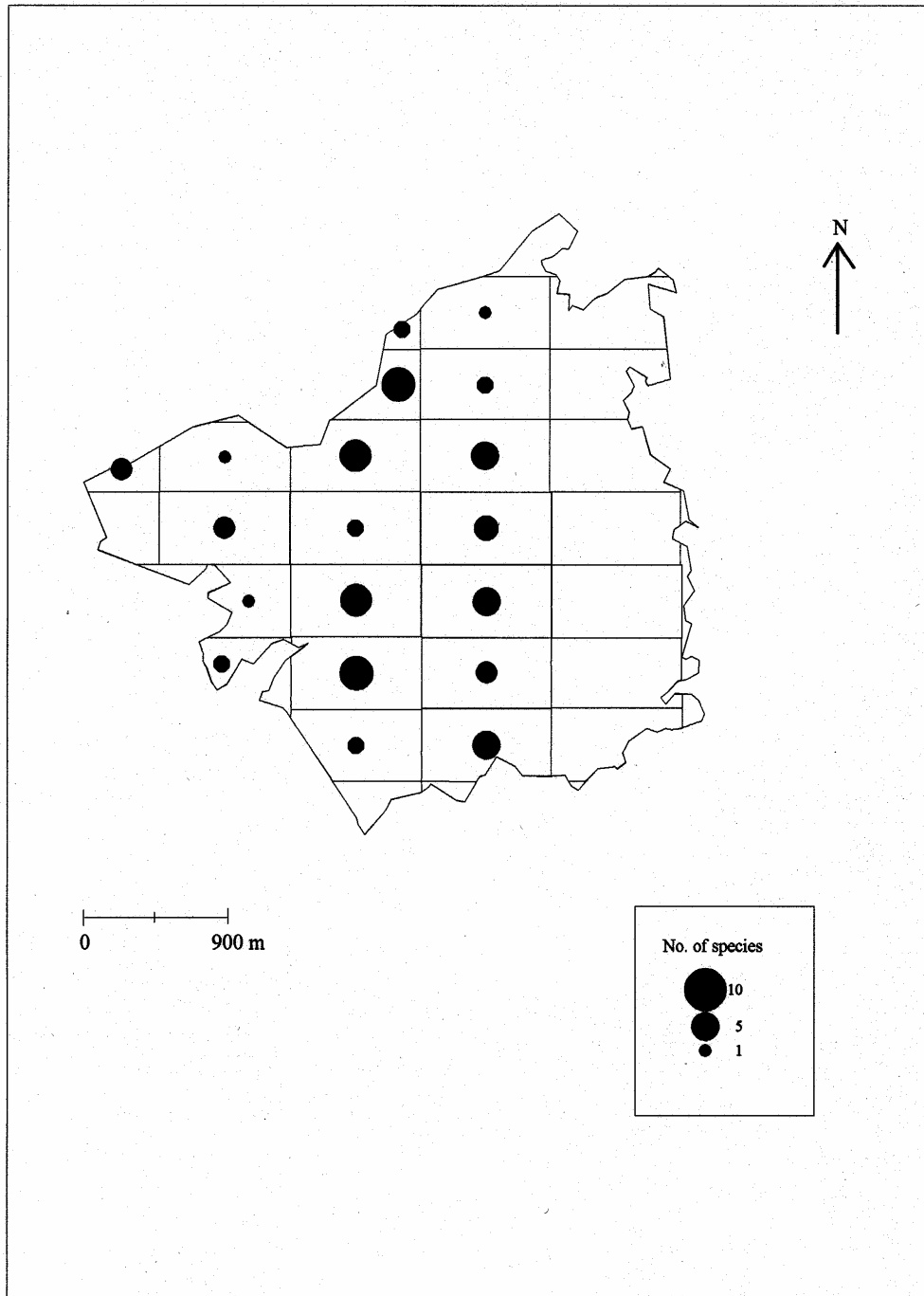


Figure 11 Distribution of near-endemic tree and shrub species in Semdoe F.R.

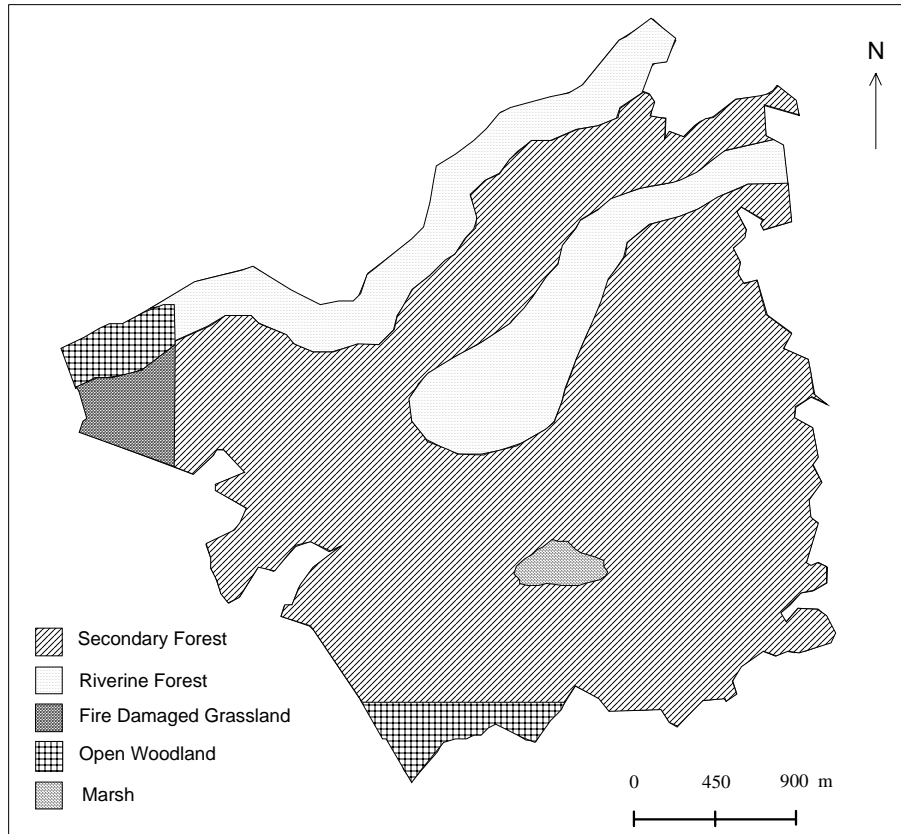


Figure 12 Vegetation map of Semdoe F.R.

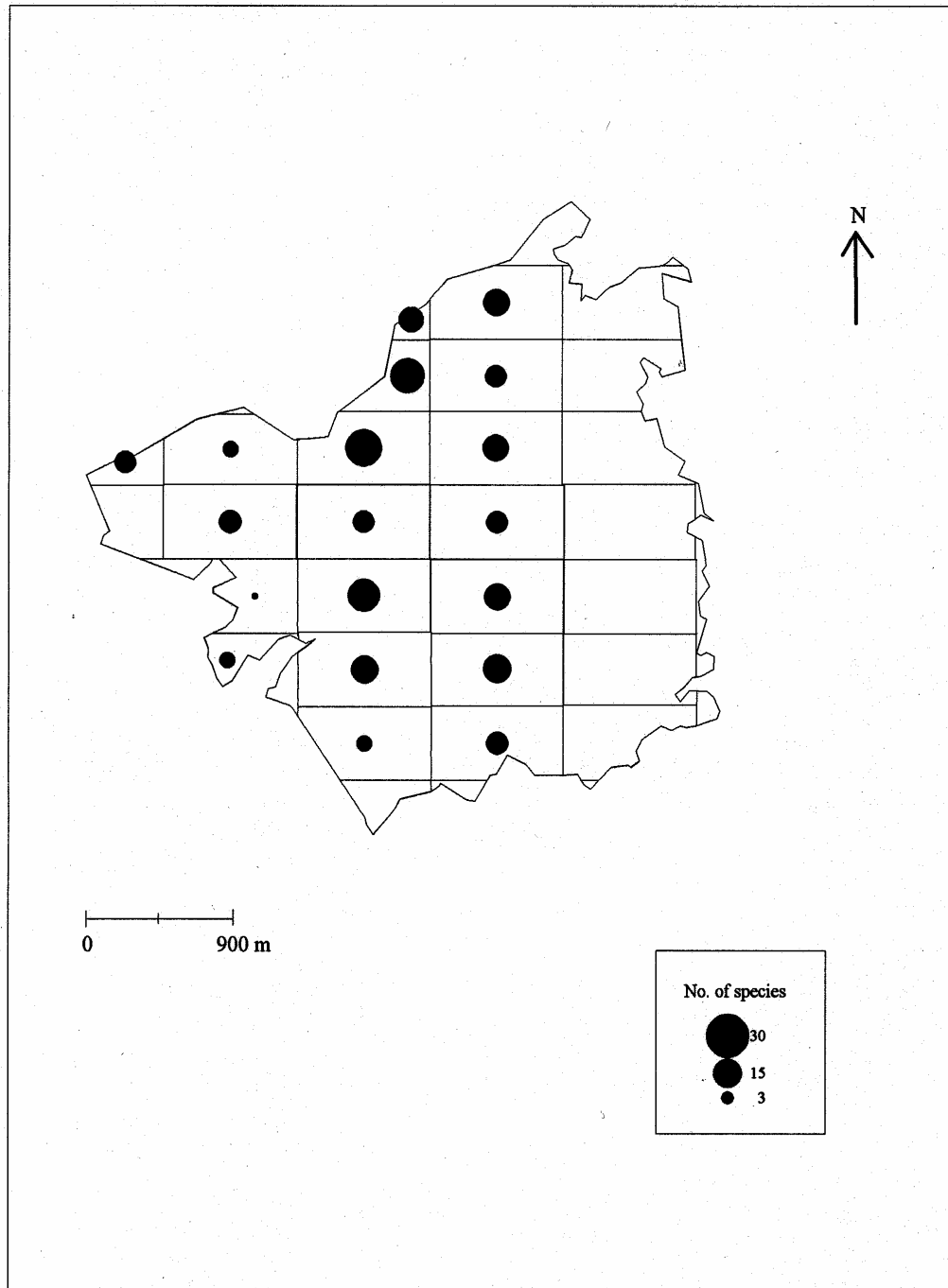


Figure 13 Botanical species richness in Semdoe F.R.

4.3.2 Disturbance transects

Pole and timber extraction was recorded along all transects. The results of the disturbance transects are summarised in Table 13 for poles and Table 14 for timber. The term pole refers to all stems 5 – 15 cm dbh, the term timber refers to stems > 15 cm dbh. Other disturbances recorded systematically are discussed in the summary.

Table 13. Disturbance transect results for pole counts in Semdoe Forest Reserve (1997).

Transect number	Length of transect (m)	Total poles recorded	Standing poles	Cut poles	Average cut poles per ha	Naturally fallen poles	Average fallen poles per ha
1	3015	1957	1600	72	24	285	95
2	3000	1959	1523	58	19	378	126
3	1695	1089	616	42	25	431	254
4	780	354	266	6	8	82	105

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

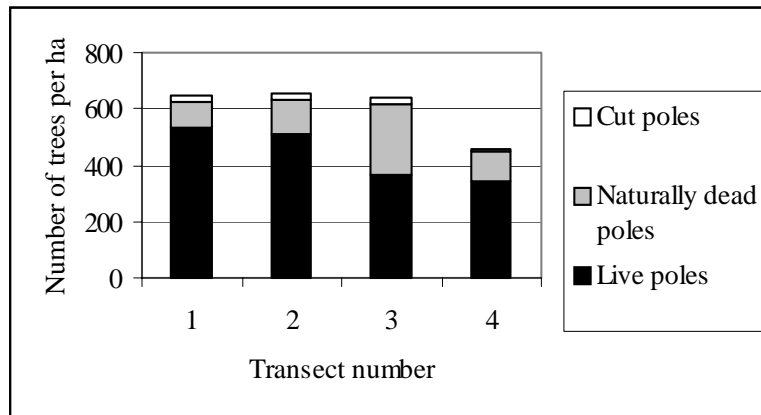


Figure 14 Cut and naturally fallen poles recorded by transect.

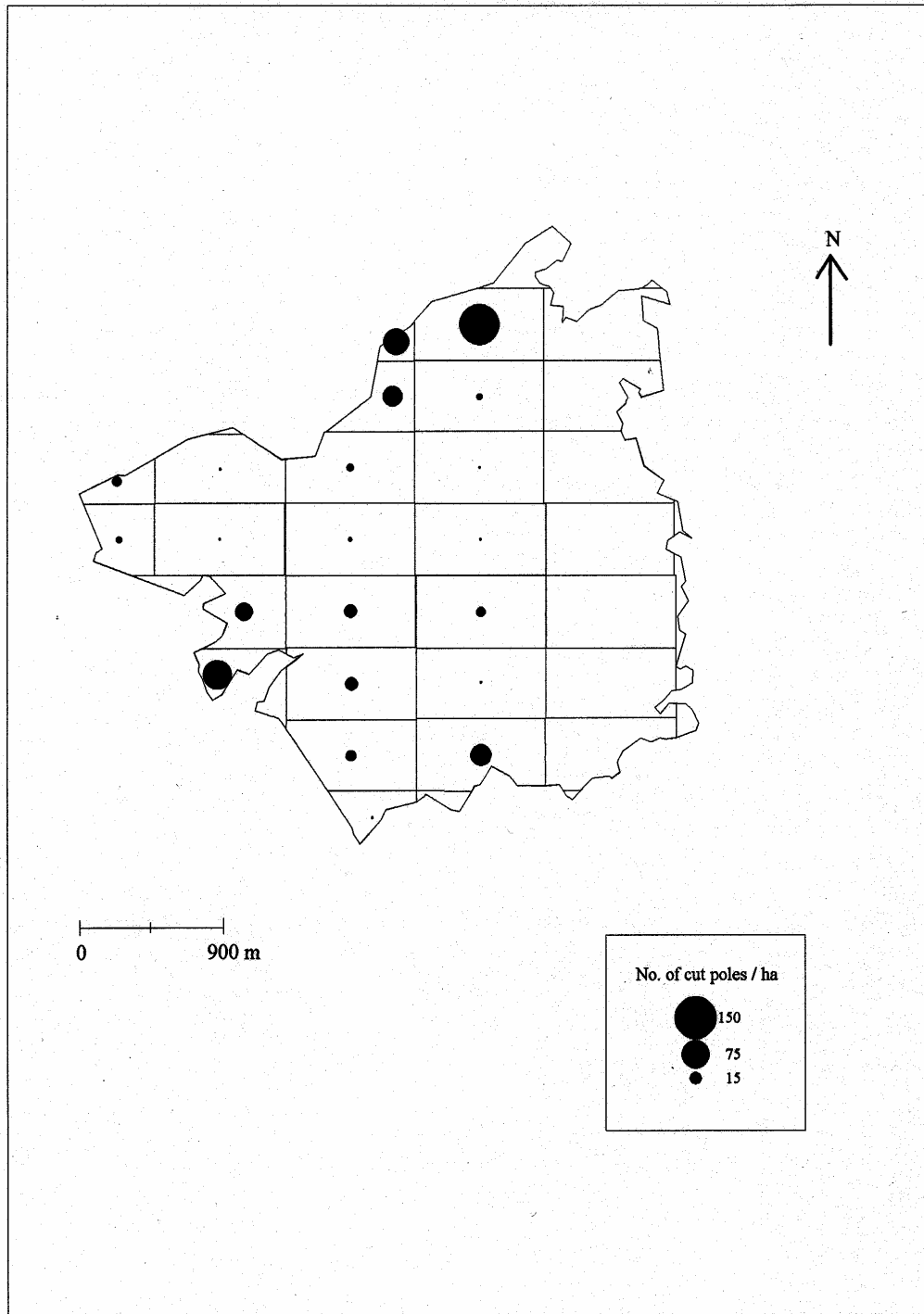
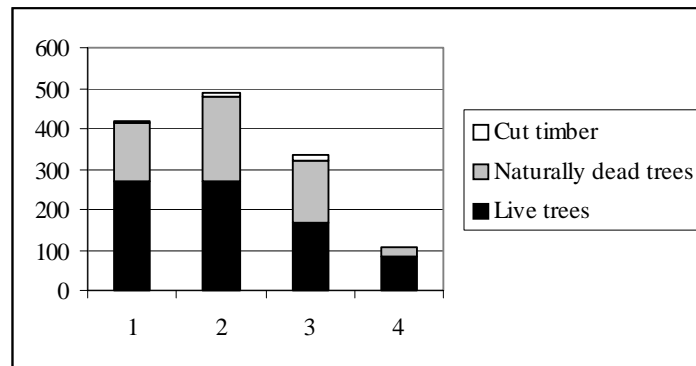


Figure 15 Distribution of pole cutting/hectare in Semdoe F.R. (1997).

Table 14. Disturbance transect results for timber counts in Semdoe Forest Reserve (1997).

Transect number	Length of transect (m)	Total timber sampled	Standing timber	Cut timber	Average per ha	Naturally fallen timber	Average per ha
1	3015	968	820	6	2	142	47
2	3000	1030	810	10	3	210	70
3	1695	451	284	14	8	153	90
4	780	89	66	1	1	22	28

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

**Figure 16** The relative abundance of live, naturally dead and cut timber in Semdoe Forest Reserve (1997).

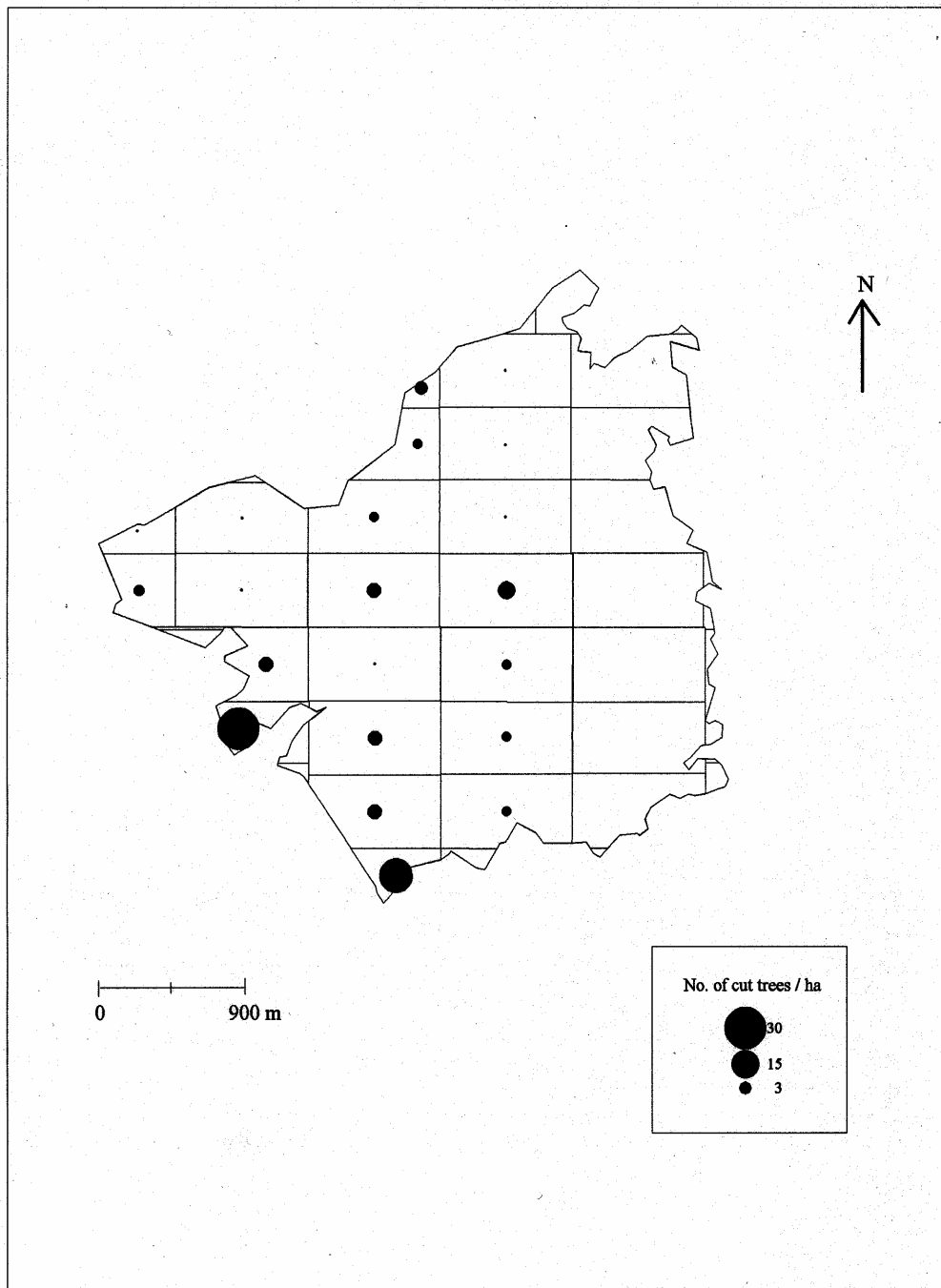


Figure 17 Distribution of timber cutting/hectare in Semdoe F.R. (1997).

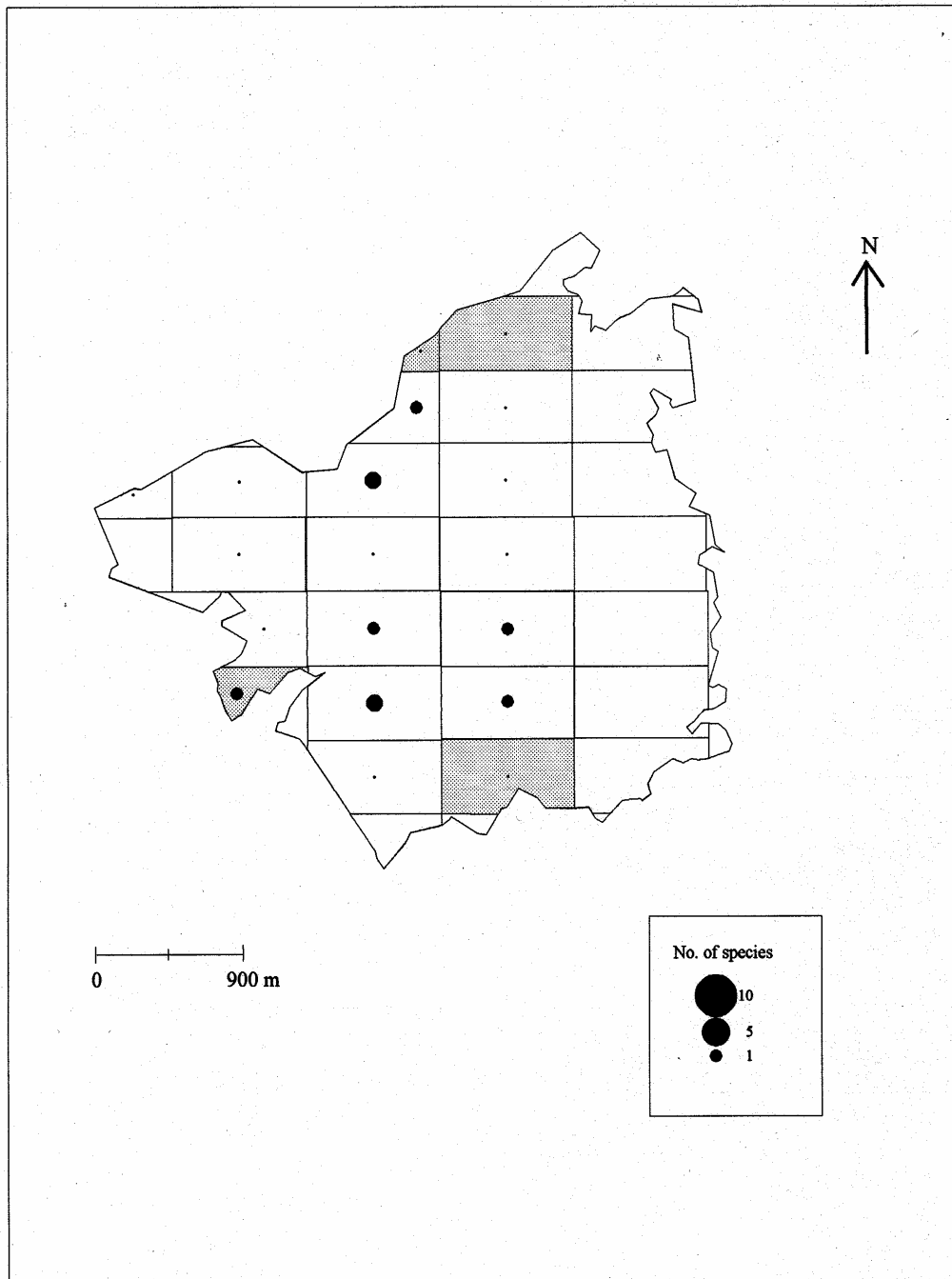


Figure 18 Areas of highest disturbance in relation to the distribution of tree and shrub individuals that are both forest dependent and near-endemic in Semdoe Forest Reserve (1997).

4.4 Discussion

Semdoe forest reserve covers an area of 970 ha with altitudes ranging from 95 to 520m.

Species richness

In the systematic vegetation plots 685 trees and shrubs were surveyed, representing 81 species from 26 families. An additional six species were recorded in the regeneration plots. Casual observations from outside of the vegetation plots recorded an additional 18 species from 14 families including three families not previously recorded. In total 105 species from 40 families were recorded.

Of the 19 plots systematically surveyed, 17 (89.5%) of the plots analysed were recorded as lowland forest, 1 (5.25%) as grassland, and 1 (5.25%) as scrub/thicket/bush.

The forest is dominated by *Diospyros natalensis*, a small tree characteristic of dry forest. This species accounts for 27% of recorded individuals.

Relative to other forest reserves in the East Usambaras, Semdoe has a below average botanical species richness and number of restricted range species.

Species Accumulation Rates

The species accumulation rate (see Figure 4) for the 50 m x 20 m subplots increases rapidly initially then begins to level off, suggesting that the majority of tree species were recorded.

Ecological Type

Forest dependent species defined as limited to primary forest only were recorded 96 times. This represents 14% of all trees and shrubs recorded. Forest dependent individuals were present in 10 of the 19 vegetation plots. The most common forest dependent tree is *Synsepalum msolo*. Six of the forest dependent species are also endemic or near-endemic to the Usambaras.

Four species typical of more open habitats were recorded in 3 of the 19 plots. These are *Holarrhena pubescens*, *Acacia mellifera*, *Erythrina caffra* and *Lonchocarpus bussei*. All four species were only recorded once.

Habitat

Of the tree species recorded with known altitude characteristics, 69.1% were considered to be typical of lowland forest and 24.7% are considered typical of submontane forest. Submontane species occur in 89.5% of the plots surveyed in the lowland forest. This data indicates the variability in the ecological requirements and niches of these submontane species. The most common submontane species is *Sorindeia madagascariensis*.

Endemic Status

Of the plant species recorded, 52 (64.2%) have widespread distributions. Near-endemics contribute 25 species (30.9%) from 14 families to the floristic composition of the reserve. These near-endemics are found in all plots and account for 138 of the surveyed specimens or 20.1% of all recorded trees and shrubs in the reserve. Of the 19 plots surveyed, 6 were found to have greater than 10 near-endemics. The most common near-endemic species in the reserve is *Dialium holtzii*. Of the 25 near-endemic species, 6 species are also considered to be forest dependent.

No species endemic to the Usambaras were recorded in the systematic survey although the tree *Uvariadendron oligocarpum* which is endemic to the East and West Usambaras was recorded through casual observations.

Regeneration

18.5% of species found in the main vegetation plots were recorded within the regeneration plots. These species are marked with * in table 4.

Only two of the commonly harvested timber species were found regenerating within the reserve, *Milicia excelsa* and *Terminalia sambesiaca*. The remaining eleven species were not recorded in the regeneration layer.

Disturbance

Disturbance by pole and timber extraction was recorded at lower rates than naturally fallen trees. The pattern of pole and timber extraction was similar, being greatest on Transect 3 on the western side of the reserve. Evidence of pitsawing was observed on about half of the transects in the reserve.

Signs of fire were recorded in every plot and therefore on every transect. Signs of animal trapping were recorded on Transect 2.

The invasive species *Maesopsis eminii* was not recorded in the vegetation plots or casually in Semdoe Forest Reserve. Since its introduction into the area this species has spread rapidly in the Usambara Mountains particularly around Amani where there is concern that it may begin to dominate the forest (Binggeli 1989). However chilli and tomato plants were abundant in Semdoe particularly along paths and at the forest edge although it is not clear what their ecological impact might be.

5.0 FAUNA

By Nike Doggart and Liana Joseph

5.1 Introduction

The faunal biodiversity of Semdoe forest reserve was studied using systematic and replicable survey methods. An inventory was compiled of mammal, reptile, amphibian and selected invertebrate species. The results of the inventory were analysed to assess the biodiversity value of the reserve.

5.2 Methods

Methods used during the survey are described in detail in the FT FRP methodologies report (SEE, 1996). A brief description is presented below. The locations of trap sites are presented in Figure 19.

5.2.1 Mammals

The aim of this survey was to compile a species list of the reserve's mammals. Five different methods are used to sample mammals within Semdoe forest reserve: (1) snap trap lines, (2) bucket pitfalls, (3) bat netting (4) dung surveys and (5) opportunistic observations. Unless otherwise indicated, specimens were identified by Prof. K. M. Howell or by Dr. D. Kock (see Appendix 2). Specimens are deposited at the Department of Zoology and Marine Biology, University of Dar es Salaam and at the Frankfurt Zoological Museum.

5.2.1.1 Snap-trap lines

Rodents were sampled using large break-back traps (snap-traps). Typically the traps were set out in three lines of approximately 33, with traps positioned at least 2 m apart. The traps were set each evening and checked early the following morning. Fifty percent of the traps were baited with fried coconut rolled in peanut butter, 25% with fish and 25% with oatmeal and peanut butter. Each mammal caught was weighed and measured and detailed habitat notes were recorded. Trapping and biometric data was recorded on standardised data sheets.

5.2.1.2 Bucket pitfall trapping

The bucket pitfall traps consisted of three lines of eleven 20 litre plastic buckets sunk flush to ground level in a linear transect. These were positioned approximately 5 m apart. A continuous piece of plastic sheeting ran perpendicular to the ground across the centre of each bucket forming a 'drift fence'. A lip of plastic sheeting was kept on the ground onto which soil and leaf litter was placed. Animals were channelled along the plastic to one of the buckets. The bucket pitfalls, acting as live traps, were designed to sample shrews within the forest. Each mammal captured was weighed and measured. Trapping and biometric information was recorded on standardised data sheets.

5.2.1.3 Bat netting

Nocturnal mist netting was used to sample the forest's bats. Mist nets were placed near potential roost sites and across flight "corridors", such as paths and rivers. Nets were set up at dusk, observed continuously throughout the night and closed shortly

before dawn for 3 nights. Each bat caught was weighed and measured at the netting site. Trapping and biometric information was recorded on standardised data sheets.

5.2.1.4 Dung survey

The aim of this study is to provide baseline information on the population size of the reserve's more cryptic mammals particularly duiker.

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

5.2.1.5 Mammal observations

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

5.2.2 Birds

Birds were observed on a casual basis. The list is a provisional list only as no netting was carried out.

5.2.3 Reptiles

The aim of this study was to compile a species list of the reserve's reptiles. Ground-dwelling reptiles were sampled using bucket pitfall traps (see 6.2.1.2 above). Opportunistic captures were also made by hand, or with a snake stick where necessary. Unless otherwise indicated, taxonomic identifications were made by Prof. Kim Howell or Dr. Don Broadley (see Appendix 2). Specimens are deposited at the Department of Zoology and Marine Biology, University of Dar es Salaam and at the Natural History Museum of Zimbabwe.

5.2.4 Amphibians

The aim of this study was to compile a species list of the reserve's amphibians. Ground-dwelling amphibians were sampled using the bucket pitfall method (see 6.2.1.2 above). Opportunistic captures were also made, particularly of tree frogs. After rain, typical amphibian habitats were targeted for sampling. Unless otherwise indicated, taxonomic identifications were made by Prof. K. Howell or by Prof. J. Poynton (see Appendix 2). Specimens are deposited at the Department of Zoology and Marine Biology, University of Dar es Salaam and at the British Natural History Museum.

5.2.5 Invertebrates

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

5.2.5.1 Butterflies

The aim of this study was to compile a species list of the reserve's butterflies. Butterflies were sampled using Blendon-style traps set in the tree canopy. Rotting banana was used as bait. Traps were checked at midday. Five traps are set for 10 nights in each of the five trapping sites. Unless otherwise indicated, taxonomic identifications were

made by Steve Collins (see Appendix 2). Specimens are deposited at the African Butterfly Research Institute.

5.2.5.2 Mollusc

The aim of this study was to compile a species list of the reserve's molluscs. At each trapping site three sites with representative microhabitats were selected. At each of these sites a 1m x 1m quadrat was established. In this square, the leaf litter and the first 3 cm of soil was searched carefully for molluscs. All specimens were collected. Identifications were not available at the time of publication of this report. Specimens are held at the Zoological Museum of the University of Copenhagen.

5.2.5.3 Millipedes

The aim of this study was to compile a species list of the reserve's millipedes. At each trapping site three sites with representative microhabitats were selected. At each of these sites a 3m x 3m quadrat was established. In this square, the leaf litter and the first 3 cm of soil was searched carefully for millipedes. All specimens were collected. Identifications were not available at the time of publication of this report. Specimens are deposited at the Virginia Museum of Natural History.

5.3 Trapping sites and sampling intensity

Five trapping sites were conducted in representative habitats. Table 15 describes the sites and Tables 16 and 17 summarise the sampling intensity for each site and for each trapping method.

Table 15. Summary descriptions of trapping sites.

Plot number	Vegetation type	Altitude (m)	Topography	Slope (degrees)
4	Riverine and lowland forest	230-240	Valley floor and gentle lower slope	2 – 15
5	Lowland forest	155	Gentle-mid slope	4 - 10
8	Riverine and lowland forest	160-180	Valley floor and gentle-mid slope	4 - 24
16	Lowland forest	160	Gentle lower slope	0 – 5
20	Grassland and lowland forest	400	Hill top and steep-upper slope	3 – 30

Table 16. Sampling intensity by trap night (number of nights x number of traps).

Trapping method	Plot 5	Plot 8	Plot 20	Plot 4	Plot 16
Date	Oct 17 - 26 1997	Oct 27–Nov 6 1997	Nov 8 – 17 1997	Nov 19 - 28 1997	Nov 30-Dec 9 1997
snap traps	970	985	960	992	978
bucket pitfall*	330	330	330	330	330
butterfly traps	50	50	50	50	50
molluscs**	3	3	3	3	3
millipedes**	3	3	3	3	3

* Each bucket represents one trap night.

**This represents plots sampled not trap nights.

Table 17. Summary of bat-netting sites.

Site description	Sampling intensity (hours)	Altitude	Topography
Riverine forest close to Semdoe waterfall	60	240	Valley floor

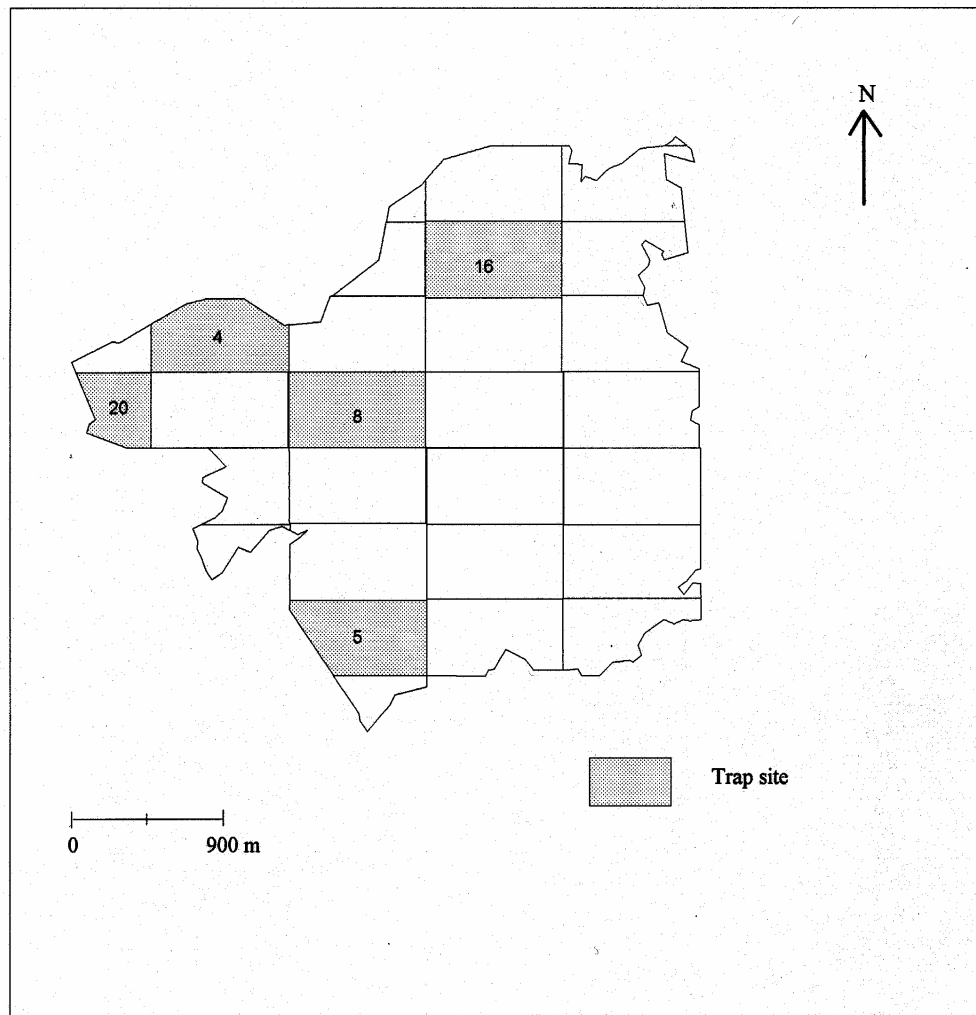


Figure 19 Location of trapping sites in Semdoe F.R.

5.4 Results

5.4.1 Mammals

5.4.1.1 Small mammals

A total of 158 specimens were retained for taxonomic purposes. These represent at least four species from three families. Many have yet to be identified to species level. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (UDSM, 1996), IUCN (1996) and Kingdon (1989). Nomenclature follows Kingdon (1997).

Table 18. Summary of small mammals recorded in Semdoe Forest Reserve.

Species	Ecological type	Endemic status	IUCN status	Capture location by plot and number collected					Total	
				4	5	8	16	20		
CRICETIDAE										
Lesser pouched rat										
<i>Beamys hindei</i>	f	N	V		1					1
MURIDAE										
Soft-furred mice										
<i>Praomys</i> sp.		W			26	20		2		48
Black rat										
<i>Rattus rattus</i>	O	W			2					2
SORICIDAE										
White-toothed shrews										
<i>Crocidura</i> sp.		W		1						1
As yet unidentified by taxonomist				5	13	35	15	38		106

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

Ecological type:

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

Endemic status:

- N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests;
- W - Widespread distribution.

IUCN status:

- V - vulnerable

5.4.1.2 Dung survey

Dung from at least five mammal species was recorded however in total little dung was found during the survey. This is probably due to the unusually heavy rain throughout the survey period. Identifications were made based on a reference collection, discussions with local hunters and using Walker (1993). A summary of dung specimen identifications is presented in table 20. It is difficult to determine the dung of particular duiker species and so the differentiation between *Cephalophus monticola* and *Sylvicapra grimmia* may not be reliable.

Table 19. Abundance of duiker, bushbuck and hyrax dung.

Transect	Transect length (m)	Duiker		Bushbuck		Hyrax	
		Dung sightings	Rate / ha	Dung sightings	Rate / ha	Dung sightings	Rate / ha
1	3015	0	0	0	0	0	0
2	3000	1	1.2	0	0	0	0
3	1695	4	2.7	0	0	1	0.7
4	780	0	0	0	0	0	0

Table 20. Summary of dung survey in Semdoe Forest Reserve.

Species	Ecol. Type	End. Status	IUCN status	Times encountered	Altitudinal range (m)
THRYONOMYIDAE					
Cane rat					
<i>Thryonomys</i> sp		W		1	150
PROCAVIIDAE					
Eastern tree hyrax					
<i>Dendrohyrax validus</i>	f	N	V	1	150
SUIDAE					
Bush pig					
<i>Potamochoerus larvatus</i>	f	W		1	270
BOVIDAE					
Blue duiker					
<i>Cephalophus monticola</i>	f	W		1	150
Bush duiker					
<i>Sylvicapra grimmia</i>	O	W		4	140 - 270

KEY TO ABBREVIATIONS FOR TABLE 20 (Definitions based on those described in Section 1.2)

Ecological type:

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

Endemic status:

- N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests;
- W - Widespread distribution.

IUCN status:

- V - Vulnerable

5.4.1.3 Mammal observations

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

Table 21. Summary of mammal observations in Semdoe Forest Reserve.

Species	Certainty	Ecological type	Endemic status	IUCN status	Observation location
COLOBIDAE					
Angola pied colobus <i>Colobus angolensis</i>	definite	F	W		Plot 7
CERCOPITHECIDAE					
Gentle monkey <i>Cercopithecus mitis</i>	definite	f	W		Plot 10
GALAGONIDAE					
Small-eared galago <i>Otolemur crassicaudatus</i>	definite	f	W		Plot 28
SCIURIDAE					
Ochre bush squirrel <i>Paraxerus ochraceus</i>	probable	f	W		Plot 9
Red-bellied coast squirrel <i>Paraxerus palliatus</i>	probable	F	W		
ANOMALURIDAE					
Lord Derby's anomalure <i>Anomalurus derbianus</i>	definite	f	W		Plot 10
MACROSCOLIDIDAE					
Four-toed elephant shrew <i>Petrodromus tetradactylus</i>	definite	f	W		Plot 8
HERPESTIDAE					
Bushy-tailed mongoose <i>Bdeogale crassicaudata</i>	probable	f	W		Plot 27
SUIDAE					
Bush pig <i>Potamochoerus larvatus</i>	probable	f	W		Plot 7
BOVIDAE					
Blue duiker <i>Cephalophus monticola</i>	probable	f	W		Plot 14

KEY TO ABBREVIATIONS FOR TABLE 21 (Definitions based on those described in Section 1.2).

Ecological type:

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

Endemic status:

- W - Widespread distribution.

5.4.2 Bats

Due to the heavy rain it was only possible to trap for bats on three nights. No bats were caught.

5.4.3 Birds

A total of 14 species from 11 families. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (1997), IUCN (1996) and Zimmerman *et al.* (1996). Nomenclature follows Zimmerman *et al.* (1996).

Table 22. Summary of bird species observed in Semdoe Forest Reserve.

Species	Common name	Ecological type	Endemic Status	IUCN Status
ACCIPITRICAЕ				
<i>Circaetus fasciolatus</i>	Southern banded snake eagle	F	W	NT
COLUMBIDAE				
<i>Columba delegorguei</i>	Bronze-naped pigeon	F	W	
CUCULIDAE				
<i>Cercococcyx montanus</i>	Barred long-tailed cuckoo			
STRIGIDAE				
<i>Otus ireneae</i>	Sokoke scops owl	F	N	NT
PICIDAE				
<i>Campethera mombassica</i>	Mombasa woodpecker	f	W	
MALACONOTIDAE				
<i>Malaconotus nigrifrons</i>	Many-coloured bush shrike	F	W	
TURDIDAE				
<i>Sheppardia gunningi</i>	East coast akalat	F	W	NT
<i>Swynnertonia swynnertoni</i>	Swynnerton's robin	F	N	NT
SYLVIIDAE				
<i>Hyliota australis</i>	Southern hyliota	F	W	
PLATYSTEIRIDAE				
<i>Bias musicus</i>	Black-and-white flycatcher	F	W	
NECTARINIIDAE				
<i>Anthreptes neglectus</i>	Uluguru violet-backed sunbird	F	W	NT
<i>Anthreptes reichenowi</i>	Plain-backed sunbird	F	W	
<i>Anthreptes rubritorques</i>	Banded green sunbird	F	N	
ESTRILDIDAE				
<i>Spermophaga ruficapilla</i>	Red-headed bluebill	F	W	

KEY TO ABBREVIATIONS FOR TABLE 22 (Definitions based on those described in Section 1.2).

Ecological type:

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

Endemic status:

- N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests;
- W - Widespread distribution.

IUCN status:

- NT - Near-threatened

5.4.4 Reptiles

A total of 26 individuals were retained for taxonomic purposes. These specimens represent 13 species from 6 families. An additional four species were observed but not collected. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (1996), Broadley & Howell (1991), Howell (1993), and Branch (1994).

Table 23. Summary of reptiles.

Species	Ecological type	Endemic status	IUCN status	Capture location				Plots with single individuals	Total
				by plot and number collected					
				5	8	20	4		
GEKKONIDAE									
Tropical house gecko									
<i>Hemidactylus mabouia</i>	f	W				1			1
Baobab gecko									
<i>Hemidactylus platycephalus</i>	f	W				2			2
Uluguru forest gecko									
<i>Cnemaspis barbouri</i>	F	N	E			1	1		2
SCINCIDAE									
Speckle-lipped skink									
<i>Mabuya m. maculilabris</i>	f	W	V	1	1	3	2	16	8
Peter's writhing skink									
<i>Lygosoma afrum</i>	f	W				2			2
LACERTIDAE									
Eastern serrate-toed tree-lizard									
<i>Holaspis guentheri</i>	f	W	LC				1		1
CORDYLIDAE									
Yellow-throated plated-lizard									
<i>Gerrhosaurus flavigularis</i>	f	W				1			1
Southern tawny plated-lizard									
<i>Gerrhosaurus m. major</i>	f	W					1		1
East African spiny-tailed lizard									
<i>Cordylus t. tropidosternum</i>	f	W					1		1
LEPTOTYPHLOPIDAE									
Merker's worm-snake									
<i>Leptotyphlops scutifrons merkeri</i>	f	W	LC				2	27, 26	4
Worm snake									
<i>Leptotyphlops macrops</i>	f	W	V					1	1
ELAPIDAE									
Forest cobra									
<i>Naja melanoleuca</i>	f	W				1			1
Green mamba									
<i>Dendroaspis angusticeps</i>	f	W				1			1

Table 24. Summary of reptile observations.

Species	Certainty	Ecological type	Endemic status	Observation location
PELOMEDUSIDAE				
<i>Pelusios</i> sp.	Definite		W	28
TESTUDINIDAE				
Southeastern hinge-back tortoise				
<i>Kinixys belliana</i>	Definite	f	W	20
VARANIDAE				
Nile monitor				
<i>Varanus niloticus</i>	Definite	f	W	28
BOIDAE				
Northern African python				
<i>Python sebae sebae</i>	Definite	O	W	16

KEY TO ABBREVIATIONS FOR TABLE 23 & 24 (Definitions based on those described in Section 1.2).

Ecological type:

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

Endemic status:

- N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests;
- W - Widespread distribution.

IUCN status:

- EN - Endangered
- V - Vulnerable
- LC - Least concern

? - No data available

Table 25. Ranges for near-endemic reptile species recorded.

Near-endemic Species	Range
GEKKONIDAE	
<i>Cnemaspis barbouri</i>	Uluguru and Usambara Mountains

5.4.5 Amphibians

A total of 272 individuals were retained for taxonomic purposes. These specimens represent 11 species from six families. Ecological type, endemic status and IUCN status were compiled from the National Biodiversity Database (UDSM, 1996), Howell (1993) and Poynton & Broadley (1991). Common names are taken from Passmore and Carruthers (1995).

Table 26. Summary of amphibians.

Species	Ecological type	Endemic status	IUCN status	Capture location by plot and number collected							Total	
				4	5	8	9	10	16	17		20
ARTHOLEPTIDAE												
Shovel-footed squeaker												
<i>Arthroleptis stenodactylus</i>	f	W		3	56	65			3		2	129
<i>Arthroleptis</i>	f	W			6	5					9	20
<i>?xenodactyloides</i>												
<i>Arthroleptis</i> sp.	?	?			6	11					16	33
BUFONIDAE												
Flat-backed toad												
<i>Bufo brauni</i>	F	N	V	1	3	30	1	1	1		1	38
Guttural toad												
<i>Bufo gutturalis</i>	f	W			5	2					2	9
<i>Mertensophryne micranotis</i>	F	N	E							1	1	2
HYPEROLIDAE												
<i>Leptopelis flavomaculatus</i>	F	W								1		1
RANIDAE												
East African puddle frog												
<i>Phrynobatrachus acridoides</i>	f	W		1					1			2
<i>Phrynobatrachus</i> sp.							2		1			3
HEMISIDAE												
Mottled shovel-nosed frog												
<i>Hemisis marmoratus</i>	f	W			21	5						26
PIPIDAE												
Tropical platanna												
<i>Xenopus muelleri</i>	f	W		1		2						3

KEY TO ABBREVIATIONS FOR TABLE 26 (Definitions based on those described in the botanical section of this report).	
<u>Ecological type:</u>	
• F - Forest dependent species: This is defined as primary forest only. It does not include forest edge or secondary forest;	
• f - Forest dwelling but not forest dependent: Species occurring in primary forest as defined above as well as other vegetation types. Thus these are not forest-dependent species.	
<u>Endemic status:</u>	
• N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests;	
• W - Widespread distribution.	
<u>IUCN status:</u>	
• E - Endangered	? - No data available
• V - Vulnerable	

Table 27. Ranges for near-endemic amphibian species recorded.

Species	Range
<i>Arthroleptides martiensseni</i>	Usambara, Magarotto, Uluguru, Nguru and Udzungwa Mountains.
<i>Bufo brauni</i>	East and West Usambaras, Ulugurus, Udzungwas
<i>Mertensophryne micranotis</i>	East Usambaras, Ulugurus and coastal forests

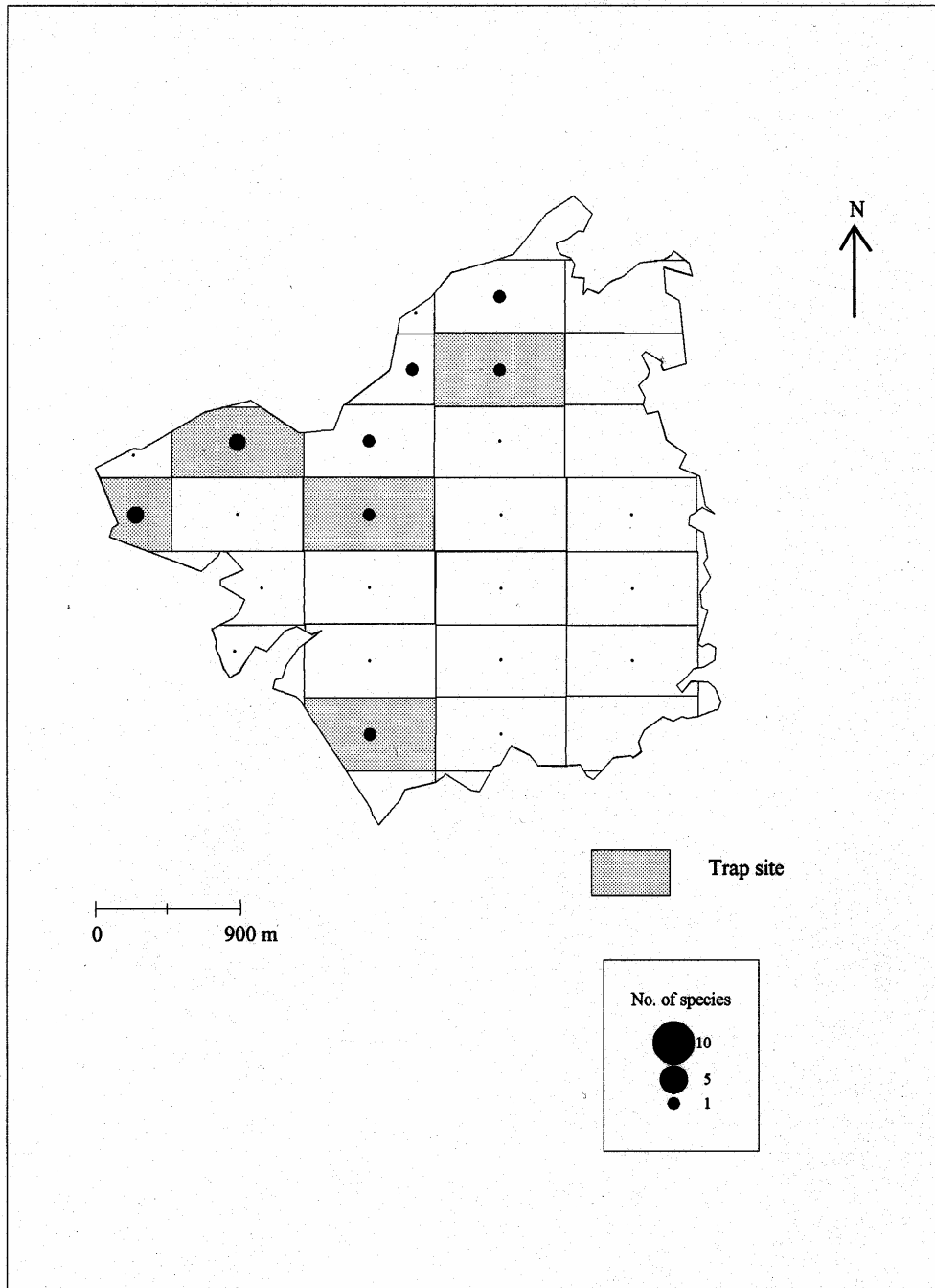


Figure 20 Distribution of forest dependent and near-endemic amphibian species in Semdoe F.R.

5.4.6 Invertebrates

5.4.6.1 Butterflies

A total of 592 specimens were retained for taxonomic purposes. These represent 68 species from seven families. Ecological type and endemic status were compiled from Kielland (1990) and Larsen (1996). Identifications were provided by Steve Collins from the African Butterfly Research Institute. Nomenclature follows Kielland (1990).

Table 28. Summary of butterflies.

Species	Ecological type	Endemic status	Capture location by plot and number collected					Total
			4	5	8	16	20	
PAPILIONIDAE								
<i>Graphium antheus</i>	O	W					1	1
<i>Graphium colonna</i>	f	W	2					2
<i>Graphium philinoe</i>	f	W					1	1
<i>Papilio dardanus</i>	f	W	1	2				3
<i>Papilio demodocus</i>	f	W					2	2
<i>Papilio nireus</i>	f	W					1	1
PIERIDAE								
<i>Belenois aurota</i>	f	W					1	1
<i>Belenois thysa</i>	f	W					1	1
<i>Catopsilla florella</i>	f	W					2	2
<i>Colotis evippe</i>	f	W		3				3
<i>Eurema brigitta</i>	O	W					1	1
<i>Eurema floricola</i>	O	W	3		1			4
<i>Eurema senegalensis</i>	F	W		1	1			2
<i>Leptosia alcesta</i>	f	W	2	6	4	1		13
DANAIDAE								
<i>Amauris niavus</i>	f	W		1				1
SATYRIDAE								
<i>Bicyclus campinus</i>	f	W	2	15	1	41	5	64
<i>Bicyclus safitza</i>	f	W	21	46	8	101	64	240
<i>Melanitis leda</i>	f	W	6	8	1	22	11	48
NYMPHALIDAE								
<i>Apaturopsis cleocharis</i>	F	W	9	5	1	2	4	21
<i>Bebearia chriemhilda</i>	F (coastal)	N				1		1
<i>Byblia anvataria</i>	f	W					1	1
<i>Catuna sikorana</i>	F	W	2					2
<i>Charaxes achaemenes</i>	f	W					2	2
<i>Charaxes acuminatus</i>	F	W		2	1	1	1	5
<i>Charaxes baumanni</i>	f	W				1		1
<i>Charaxes brutus</i>	f	W					4	4
<i>Charaxes candiope</i>	f	W	2		1		4	7
<i>Charaxes castor</i>	f	W			1		3	4
<i>Charaxes contrarius</i>	f	N	3			3	3	9
<i>Charaxes ethalion</i>	f	W	2					2
<i>Charaxes jahlusa</i>	O	W			1		2	3
<i>Charaxes lasti</i>	F (coastal)	N	5	6	3	7	2	23
<i>Charaxes pollux mirabilis</i>	F	W			1		1	2
<i>Charaxes protoclea</i>	F	W					2	2

Table 28. Cont

Species	Ecological type	Endemic status	Capture location by plot and number collected					Total
			4	5	8	16	20	
NYMPHALIDAE cont.								
<i>Charaxes pythodoris</i>	f	W					1	1
<i>Charaxes tavetensis</i>	f	W					1	1
<i>Charaxes violetta</i>	F (coastal)	W	4	3		1		8
<i>Charaxes xiphares</i>	F	W	1	1	2	5		9
<i>Charaxes zoolina</i>	f	W				1	1	2
<i>Euphaedra neophron</i>	F	W	3				1	4
<i>Euptera kinungnana</i>	F (coastal)	W	1					1
<i>Eurytela dryope</i>	f	W	4	11	6	12		33
<i>Euxanthe wakefieldi</i>	F (coastal)	W		1	1	1	2	5
<i>Hypolimnias anihedon</i>	f	W		3				3
<i>Hypolimnias deceptor</i>	f	W		1				1
<i>Junonia oenone</i>	O	W					6	6
<i>Neptidopsis ophione</i>	f	W		2				2
<i>Neptis saclava</i>	f	W		2				2
<i>Neptis serena</i>	f	W			1			1
<i>Pseudacraea lucretia</i>	F	W		1	1	1		3
<i>Sallya moranti</i>	f	W	2	2	1			5
ACRAEIDAE								
<i>Acraea encedon</i>	O	W					1	1
<i>Acraea esebria</i>	f	W					2	2
<i>Acraea insignis</i>	f	W		1				1
<i>Acraea johnstoni</i>	f	W					1	1
<i>Acraea pharsalus</i>	f	W	2	3	3			8
<i>Acraea satis</i>	F	W	2					2
<i>Acraea sotikensis</i>	f	W		1				1
<i>Acraea zonata</i>	F	W		1				1
<i>Bematistes adrasta</i>	F	N	1					1
<i>Bematistes agamice</i>	f	W	1		1			2
<i>Bematistes aganice</i>	f	W	1					1
LYCAENIDAE								
<i>Alaena picata</i>	f	W			1			1
<i>Leptotes natalensis</i>	f	W	1					1
<i>Leptotes pirithous</i>	f	W					1	1
HESPERIIDAE								
<i>Ceratrachia bonga</i>	F	N	1					1
<i>Metisella orientalis</i>	f	W					1	1

KEY TO ABBREVIATIONS FOR TABLE 28 (Definitions based on those described in Section 1.2).

Ecological type:

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

Endemic status:

- N - Near endemic: Species with limited ranges usually only including coastal forest and/or East African lowland forests;
- W - Widespread distribution.

5.5 Discussion

5.5.1. Species richness and abundance

In this section, species are examined in terms of how frequently they were recorded. Those species which have been captured or observed three or more times during the survey are considered locally common. An assumption is made that the frequency with which an animal is recorded reflects its abundance. It is recognised that some species are highly cryptic and so are easily overlooked. Such cryptic species may therefore be more abundant than is suggested by this survey. However the objective of this discussion is to identify species which may of concern as well as broadly to describe the typical fauna of the forest.

Table 29. Summary of faunal families and species.

Taxon	Number of families	Number of species
Mammals	13	17
Birds	11	14
Reptiles	6	13
Amphibians	6	11
Butterflies	7	68

Relative to other forest reserves in the East Usambaras the species richness of Semdoe FOREST RESERVE is below average for mammals (24), reptiles (21) and amphibians (16) but is above average for butterflies (50).

5.5.1.1 Mammals

The most common small mammal species are the soft-furred mice, *Praomys* sp.

5.5.1.2 Reptiles

The most common reptile species is *Mabuya m. maculilabris* which was recorded eight times. The snake *Leptotyphlops scutifrons merkeri* is also locally common.

5.5.1.3 Amphibians

The most commonly caught amphibian species was *Arthroleptis stenodactylus* which was recorded 129 times. Other species which appear to be locally common are *Arthroleptis xenodactyloides*, *Bufo brauni*, *Bufo maculatus*, *Bufo gutturalis*, *Phrynobatrachus* sp., *Hemisus marmoratus* and *Xenopus muelleri*.

5.5.1.4 Butterflies

The most commonly caught butterfly species was *Bicyclus safitza* that was recorded 240 times. Other species which are locally common are *Papilio dardanus*, *Colotis evippe*, *Eurema floricola*, *Leptosia alcesta*, *Bicyclus campinus*, *Melanitis leda*, *Apaturopsis cleochares*, *Charaxes acuminatus*, *C. brutus*, *C. candiope*, *C. castor*, *C. contrarius*, *C. jahlnusa*, *C. lasti*, *C. violetta*, *C. xiphares*, *Euphaedra neophron*, *Eurytela dryope*, *Euxanthe wakefieldi*, *Hypolimnas anthedon*, *Junonia oenone*, *Pseudacraea lucretia*, *Sallya moranti* and *Acraea pharsalus*.

5.5.1.5 Endemics and near-endemics

Of the six mammal, reptile and amphibian species which are endemic or near-endemic to the Usambaras and were recorded during this survey, only the toad *Bufo brauni* is locally common, as it was recorded at least three times during the survey.

5.5.1.6 Forest dependent species

Of the seven mammal, reptile and amphibian species which are dependent on primary forest and were recorded during the survey one is locally common. This is the toad, *Bufo brauni*.

5.5.1.7 High risk species

There are two locally uncommon species that are both forest dependent and near-endemic. They should be of conservation concern due to their low population density and restricted range. These species are *Cnemaspis barbouri* and *Mertensophryne micranotis*.

Table 30. Summary of capture locations of faunal species by plot number.

Taxon	4*	5*	8*	9	10	16*	17	20*	26	27	28
small mammal**	2	3	1					1			
reptile	4	2	6			2		6	1	1	2
amphibian	4	8	8	2	1	4	1	6			1

*Trap site

**this includes rodents and shrews only.

5.5.2. Ecological type

Refer to table 31. Of the forest dependent species, two are mammals, 12 are birds, one is a reptile, four are amphibians and 18 are butterflies.

Of the three non-forest vertebrate species two are mammals, one is a reptile and six are butterflies.

Table 31 Summary of ecological type of mammal, bird, reptile, amphibian and butterfly species.

Ecological type	No. of species	% of total species recorded
(F) Forest dependent	37	29
(f) Forest dwelling but not forest dependent	76	61
(O) Non-forest species	9	7
Unknown	4	3
Total:	126	

5.5.3. Endemic Status

Refer to table 32. No endemic species were recorded from the reserve and 89% of species are widespread.

Table 32. Summary of endemic status of mammal, bird, reptile and amphibian species.

Endemic status	No. of species	% of total species recorded
(E) Endemic to the Usambara Mountains	0	0
(N) Near-Endemic: ranges in restricted locations	14	11
(W) Widespread	112	89
Unknown	0	0
Total:	126	

5.5.4. IUCN Status

According to IUCN criteria, two animal species found in Semdoe Forest Reserve are endangered. These are the gecko *Cnemaspis barbouri* and the frog *Mertensophryne micranotis*.

According to IUCN criteria the following five species are vulnerable to extinction: *Dendrohyrax validus*, *Mabuya maculilabris*, *Leptotyphlops macrops*, *Bufo brauni* and *Arthroleptides martiensseni*.

6.0 CONCLUSIONS

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

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

Semdoe forest, gazetted as a forest reserve in 1999, covers an area of 980 ha in the central area of the East Usambara range. With altitudes between 160m and 520m it consists of lowland forest with small patches of woodland and grassland.

Disturbance

Poles and timber continue to be taken illegally from the reserve. Cutting is most intensive close to the edge in the south-west and the north of the reserve. Disturbance from fire was recorded in all plots and the fires of early 1997 had extensively damaged the forest. Animal trapping was also recorded.

Species Richness

The forest reserve was found to contain a minimum of 105 species of trees and shrubs; 17 mammal, 14 bird, 13 reptile, 11 amphibian and 68 species of butterfly.

Flora

One tree species was recorded which is endemic to the Usambara mountains and 26 species have ranges restricted to the Eastern Arc and/or East African lowland forests. Nineteen species are dependent on primary forest, and of these species, eight are also near endemic to the Usambara mountains. Four tree and shrub species, characteristic of open habitats, were recorded in the reserve.

Fauna

No species were recorded which are endemic to the Usambara Mountains however 14 species were recorded as near-endemics, having restricted ranges limited to the Eastern Arc and/or East African lowland forests. Thirty-six species are dependent only on primary forest, and of these species 11 are also endemic or near endemic to the Usambara mountains. Nine animal species, characteristic of open habitats, are found in Semdoe Forest Reserve.

Conservation

The forests of the East Usambara Mountains are recognised as being part of a Biodiversity Hotspot, (Mittermeier *et al*, 1999), an Endemic Bird Area (ICBP, 1992), a Centre of Plant Diversity (WWF and IUCN) and a Globally Important Ecoregion (WWF). They are a conservation priority due to their floral and faunal diversity and to the high number of endemic species. The forests also have a direct value to surrounding communities as a principle water catchment area and as a source of fuelwood and medicinal plants.

The forests of the East Usambara Mountains have been reduced to fragments within a matrix of agricultural land. Little forest remains outside of the gazetted forest reserves. For those species which are forest dependent the forest reserves now provide almost the only available habitat.

There are differences in the perceived value of the forests between the villagers and the Forest and Beekeeping Division. Alternative sources of building material and fuel are required in order to meet the needs of surrounding villages while ensuring the protection of the forests.

Although Semdoe Forest Reserve has been damaged extensively by fire and is less species rich than other forests it is of strategic importance to the East Usambaras as a forested corridor between the central Segoma forests and the western forests around Kambai. Degradation and further fragmentation of Semdoe forest may lead to local extinctions of populations of those species identified as being at high risk.

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Appendix 1: General Plot Information

Plot Number	Topography	Altitude (metres)	Slope (degrees)	Vegetation Condition	Canopy Height (metres)
1	RT	240	14	LF	<10
2	VF	210	13	GL	<10
3	GM	230	14	LF	10 – 20
4	SU	270	22	LF	10 – 20
5	GL	178	58	LF	10 – 20
6	GL	145	4	LF	>30
7	VF	140	6	LF	10 – 20
8	GM	140	15	LF	>30
9	GU	155	20	LF	10 – 20
10	GL	180	19	LF	20 – 30
11	GL	200	10	S	<10
12	GL	140	21	LF	10 – 20
13	GU	155	23	LF	
14	GM	140	17	LF	10 – 20
15	GL	140	6	LF	>30
16	SM	140	18	LF	10 – 20
17	VF	135	12	LF	20 – 30
18	GL	165	7	LF	10 – 20
19	GM	360	25	LF	10 – 20

KEY TO ABBREVIATIONS

Topography

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

Vegetation Condition

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

Appendix 2: Taxonomic Verification

BOTANY

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ZOOLOGY - VERTEBRATES

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