



Tanzania Forest  
Conservation Group  
Shirika la Kuhifadhi  
Misu ya Asili Tanzania



# **TFCG Technical Paper 41**

## **The biodiversity and forest condition of Mamiwa-Kisara North Forest Reserve**

**By J. Gwegime, M. Mwangoka, E. Mulungu, J. Latham,  
R. E. Gereau and N. Doggart**

**Dar es Salaam, 2014**



© Tanzania Forest Conservation Group

**Suggested citation:**

Gwegime, J., M. Mwangoka, E. Mulungu, J. Latham, R.E. Gereau and N. Doggart (2014). The biodiversity and forest condition of Mamiwa-Kisara North Forest Reserve. TFCG Technical Paper 41. TFCG, DSM, Tz. 1-86 pp.

Cover photograph: Forest at the Nongwe Study Site by Justine Gwegime.

## Executive Summary

The Ukaguru Mountains encompass six catchment forest reserves within the Eastern Arc Mountains (Ikwamba, Mamboto, Mamboya, Mamiwa-Kisara North, Mamiwa-Kisara South and Uponera). Mamiwa-Kisara North and South comprise the largest forest block in the Ukaguru Mountains. The reserves cover 14,469 ha (Mamiwa-Kisara North is 8,203 ha and Mamiwa-Kisara South is 6,266 ha). The reserves are approximately 80 km from Kilosa and 20 km from Gairo. Mamiwa-Kisara forest is part of the Ukaguru Mountains Important Bird Area.

At least three strictly endemic and 14 Eastern Arc endemic vertebrate species are found in the Ukaguru Mountain forests (Rovero *et al.*, 2014). The forests also contain plants species that are either strictly endemic, such as *Lobelia sancta* (strictly endemic to Mamiwa-Kisara forest), or of restricted distribution, such as *Impatiens ukaguruensis* as well as *Allanblackia stuhlmannii*, *Schefflera lukwangulensis*, *Pavetta lynesii*, *Streptocarpus schliebenii* and *Arisaema uluguruense* (Lovett and Pocs, 1993). There is one newly discovered amphibian species known in Mamiwa-Kisara forest, *Nectophrynoideis paulae* (Rovero *et al.* 2014).

As part of its survey programme the Tanzania Forest Conservation Group (TFCG) has been conducting biodiversity and forest disturbance surveys in selected coastal and Eastern Arc forests, including Mamiwa-Kisara. A combination of both opportunistic and systematic surveys was used to survey plants and animals in the forest. For plants, botanical collections were also made for detailed further identification in the National Herbarium in Arusha. A total of five survey-sites were selected using satellite imagery based on forest condition. Survey sites were named using the village area nearest to the site location: Site 1 - Nongwe (good forest), Site 2 - Masenge (good forest), Site 3 - Mkobwe (good forest), Site 4 - Mtega East (deforested/good forest) and Site 5 - Mtega West (degraded).

Across the five survey sites, a total of 234 plant species, representing 198 genera and 92 families, were recorded. Three families were found to dominate: Rubiaceae (27 species) Asteraceae (10 species) and Euphorbiaceae (10 species). Of these, 12 taxa (species, subspecies, varieties) are endemic to the Eastern Arc Mountains. Species richness varied across the sites, Site 1 (220 species) was found to have the highest number of plant species whereas Site 3 (155 species) had the lowest. The number of plant taxa endemic to the Eastern Arc Mountains and adjacent coastal and mountain regions was highest at Site 2 (8 species).

A total of 76 bird species, representing 62 genera and 26 families, were recorded. Four species occupied all five of the survey sites: Livingstone's turaco, Mountain greenbul, Common stonechat and Yellow breasted apalis. At least seven near endemic (i.e they are found in at least one other African ecoregion) species were recorded. Species richness was highest at Site 1 (47 species), and lowest at Site 5 (19 species). The number of near endemic species was found to be highest at Sites 1 and 2 (6 species in each), and lowest at Site 5 (3 species).

Forest disturbance surveys included assessment of tree cutting (pole size and timber size) and other disturbances, such as agricultural encroachment, pitsawing, fire damage and footpaths or roads. A total of 55.49 disturbance events per hectare were recorded, with the lowest rate of disturbance recorded in Site 1 and the highest in Site 5 (Table 1).

**Table 1.** Detailed summary of disturbance events recorded in this survey in Mamiwa-Kisara forest.

Survey site	Category	Tree cutting		Other disturbances	Total disturbance events	Disturbance events/ha
		Poles	Timbers			
Site 1. Nongwe	Good forest	24	22	4	50	14.08
Site 2. Masenge	Good forest	121	109	31	261	87
Site 3. Mkobwe	Good forest	23	31	17	71	35.5
Site 4. Mtega East	Deforested/ good forest	57	13	6	76	50.67
Site 5. Mtega West	Degraded forest	100	77	17	194	114.12
<b>Total</b>					<b>652</b>	<b>55.49</b>

The level of disturbance at each site might explain the observed variation in plant and bird species richness recorded in the surveys. For example, Mtega West (Site 5) was found to have the lowest number of bird species while also having the highest rate of disturbance. Conversely, Nongwe (Site 1) has the lowest disturbance rate and had the highest number of bird and plant species.

It is recommended that further monitoring be conducted in Mamiwa-Kisara FR to determine the presence of key species, such as the Eastern Arc endemics previously recorded in the Ukaguru Mountains by Rovero *et al.* (2014), but not recorded in Mamiwa-Kasira FR during this survey. In addition, monitoring of mammal and invertebrate species is required. Effective patrolling and boundary marking is also required to reduce human encroachment and disturbance in the Forest Reserve. The Tanzania Forest Services Agency should proactively seek more management collaboration with local government and adjacent communities.

### **Tanzania Forest Conservation Group**

The Tanzania Forest Conservation Group (TFCG) is a Tanzanian non-governmental organization that has been promoting the conservation of Tanzania's forests since 1985. TFCG's mission is to conserve and restore the biodiversity of globally important forests in Tanzania for the benefit of the present and future generations. TFCG achieves this through capacity building, advocacy, research, community development and protected area management, in ways that are sustainable and foster participation, cooperation and partnership.

TFCG supports field-based projects promoting participatory forest management, environmental education, community development, advocacy and research in the Eastern Arc Mountain and Coastal Forests of Tanzania. TFCG also supports a community forest conservation network that facilitates linkages between communities involved in participatory forest management. To find out more about TFCG please visit our website <http://www.tfcg.org>.

### **Forest Justice in Tanzania**

Forest Justice in Tanzania (FJT) was a four-year project (2011-2014) that promoted improved governance and increased accountability in Tanzania's forest sector. The initiative was a partnership between the Community Forest Conservation Network of Tanzania, known as MJUMITA and the Tanzania Forest Conservation Group (TFCG). The project was financed by DfID through the Accountability in Tanzania programme (AcT).

For more information about the project, please visit <http://www.tfcg.org/forestJusticeTanzania.html> .

Images of the survey in Mamiwa Kisara



Aerial photograph of the Ukagurus in 2005 by D. Moyer

## Table of Contents

Executive Summary.....	iii
Acknowledgements.....	viii
<b>1 Introduction.....</b>	<b>1</b>
1.1 Background to the survey.....	1
1.2 Biodiversity and ecological value of Mamiwa–Kisara forest.....	1
1.3 Existing threats to Mamiwa-Kisara forest.....	1
<b>2 Forest Reserve Description.....</b>	<b>2</b>
2.1 General description.....	2
2.2 Vegetation.....	2
2.3 Climate.....	2
2.4 Survey sites.....	2
<b>3 Plants.....</b>	<b>4</b>
3.1 Background.....	4
3.2 Objectives.....	4
3.3 Methods.....	4
3.4 Results.....	4
3.5 Discussion.....	17
<b>4 Birds.....</b>	<b>18</b>
4.1 Background.....	18
4.2 Objectives.....	18
4.3 Methods.....	18
4.3.1 Observations/Oppportunistic survey.....	18
4.3.2 Mist netting.....	18
4.3.3 Sites.....	19
4.4 Results.....	21
4.5 Discussion.....	26
<b>5 Forest disturbance.....</b>	<b>27</b>
5.1 Background.....	27
5.2 Objectives.....	27
5.3 Methods.....	27
5.4 Results.....	31
5.4.1 Poles extraction.....	33
5.4.2 Timber extraction.....	34
5.4.3 Other disturbance.....	34
5.5 Discussion.....	36
<b>6 Conclusions &amp; Recommendations.....</b>	<b>37</b>
<b>7 References.....</b>	<b>38</b>
<b>8 Appendices.....</b>	<b>39</b>

## List of Tables

Table 1. Detailed summary of disturbance events recorded in this survey in Mamiwa-Kisara forest. ....	iii
Table 2. Botanical survey sampling intensity. ....	4
Table 3. Checklist of plants from Mamiwa-Kisara FR. ....	6
Table 4. Eastern Arc Mountain endemic and regionally endemic plant species recorded at each survey site in Mamiwa-Kisara Forest Reserve. ....	16
Table 5. Bird survey sampling intensity. ....	19
Table 6. Checklist of 76 bird species recorded in five different sites of Mamiwa-Kisara FR. ....	21
Table 7. Near endemic birds species recorded in Mamiwa-Kisara forest across five survey sites. ....	25
Table 8. Rates of pole and timber cutting recorded by FBD in 2005 in Mamiwa Kisara North FR (source FBD, 2005). ....	27
Table 9. Total number of disturbance transects carried out in Mamiwa-Kisara Forest Reserve. ....	28
Table 10. Details of disturbance transects including the length of each transect, start and end points, orientation and habitat types. ....	30
Table 11. Disturbance survey results. ....	31
Table 12. Other disturbances recorded in Mamiwa-Kisara forest at each transect per survey site. ....	34

## List of Figures

Figure 1. Location of Mamiwa-Kisara North Forest Reserve. ....	3
Figure 2. Location of vegetation sample sites. ....	5
Figure 3. Eastern Arc endemic and near-endemic plant species recorded at each survey site in Mamiwa Kisara Forest Reserve. ....	17
Figure 4. Location of bird survey sample sites. ....	20
Figure 5. Birds species richness at different survey sites in Mamiwa-Kisara Forest Reserve. ....	25
Figure 6. Forest and woodland cover change between 1975 and 2000 in the Ukaguru Mountains. ....	28
Figure 7. Location of disturbance transects. ....	29
Figure 8. Rate of cut poles recorded per hectare across survey sites in Mamiwa-Kisara Forest Reserve. ....	33
Figure 9. Rate of cut timber recorded per hectare across survey sites in Mamiwa-Kisara Forest Reserve. ....	34
Figure 10. Rate of other disturbance events recorded per hectare across survey sites in Mamiwa-Kisara Forest Reserve. ....	35

## **Acknowledgements**

### **Funding**

We are grateful DfiD through the '**Accountability in Tanzania program (ACT)**' for its support to the '**Forest Justice in Tanzania project**' including financial support for the forest disturbance and biodiversity survey to Mamiwa-Kisara Forest Reserve.

### **Permission**

This survey was conducted under permission from the Tanzania Forest Services Agency (TFS) of the Ministry of Natural Resource and Tourism, the Tanzania Wildlife Research Institute (TAWIRI), the Tanzania Commission of Science and Technology, Morogoro Regional Catchment Office, Gairo and Kilosa District Natural Resource Office.

### **Survey Team**

Team leader:	Justine Gwegime
Botanist:	Moses Mwangoka
Ornithologist:	Elia Mulungu
Forest disturbances surveyor:	Justine Gwegime
TFCG volunteer:	Habibu Said
Field assistants:	George Mziwanda, Wilson Msegu, Charles Kalaita and Majaliwa Mziwanda
Technical Advisor:	Nike Doggart
FJT Project Manager:	Elinasi Monga

Additionally we are extremely grateful to the people of Kilosa and Gairo districts specifically the communities surrounding Mamiwa-Kisara Forest Reserve for their co-operation in carrying out this research. We also thank: Mr Hilary Sagara (Kilosa District Administration Officer), Ms Hadija Haule (Assistant District Catchment Forest Manager), Mr Sebastian Malisa (Kilosa DFO), Hon Luic Mzee (Nongwe Ward Councilor) and Jackson Mbaigwa (Village Chairman-Masenge).

### **Report writing**

This report has been written by Justine Gwegime, Moses Mwangoka and Elia Mulungu.

### **Map preparation**

The maps included in this report were prepared by Sylvia Kalemera with technical support from Theron Morgan-Brown.

### **Report editing**

The overall report editing was carried out by Julia Latham and Nike Doggart. The botanical section and records were edited by Roy E. Gereau of the Missouri Botanical Gardens.



# 1 Introduction

## 1.1 Background to the survey

The Tanzania Forest Conservation Group (TFCG) has been carrying out biodiversity and forest condition surveys in selected forests in the Eastern Arc Mountain and Coastal Forests of Tanzania as part of the Forest Justice in Tanzania project. This survey aims to document the biodiversity values and the levels of resource use and disturbance in these targeted forests.

The overall objective of the survey in Mamiwa-Kisara North Forest Reserve was to provide an up-to-date assessment of the biodiversity value and condition of this forest. Specific objectives were: i) To assess the status of plants, and birds in Mamiwa-Kisara Forest Reserve and the extent of endemism supported by the forest; and ii) To evaluate the current extent of forest disturbance and make site-level recommendations for improved management and protection.

## 1.2 Biodiversity and ecological value of Mamiwa–Kisara forest

The Eastern Arc Mountain (EAM) forests have been long recognized for their outstanding biological importance (Rovero *et al.* 2014). The Ukaguru Mountains are one of the 13 EAM blocks. The Ukaguru Mountains comprise six catchment forest reserves (Ikwamba (889 ha), Mamboto (149 ha), Mamboya (204 ha), Mamiwa Kisara-North (8,203 ha), Mamiwa-Kisara South (6,266.4 ha), and Uponera (375 ha) that extend up to 2,264 m in altitude. The forests of the Ukaguru Mountains contain three strictly endemic vertebrate species, all amphibians, and 14 Eastern Arc endemic vertebrate species (Rovero *et al.* 2014).

Mamiwa-Kisara North Forest Reserve is an important area for biodiversity within the Ukaguru Mountains. The forest has high plant species diversity including many endemic and rare plant species (Lovett and Pocs, 1993). The forest contains plant species of conservation concern, including *Lobelia sancta* (strict endemic to Mamiwa–Kisara North) and *Impatiens ukaguruensis*, as well as other restricted-range species such as *Allanblackia stuhlmannii*, *Schefflera lukwangulensis*, *Pavetta lynesii*, *Streptocarpus schliebenii* and *Arisaema uluguruense* (Lovett and Pocs, 1993).

The forest is part of the Ukaguru Mountains Important Birds Area (BirdLife International 2012). Baker and Baker (2002) cite records for several vulnerable and near threatened bird species in the forest, such as Mrs Moreau's warbler *Bathmocercus winifredae* (Vulnerable), Iringa akalat *Sheppardia lowei* (Vulnerable) and Moreau's Sunbird *Nectarinia moreaui* (Near Threatened). Menegon *et al.* (2007) recorded two amphibian species from the family Bufonidae that are strictly endemic to Mamiwa-Kisara: *Nectophrynoides laticeps* (Endangered) and *Nectophrynoides paulae* (Critically Endangered). Channing and Stanley described the Critically Endangered *Churamiti maridadi* from Mamiwa Kisara in 2002 (Howell and Channing, 2004). The Eastern Arc endemic species, *Probrevices durirostris* (Endangered) was also recorded in Mamiwa-Kisara.

The Mamiwa-Kisara forest comprises an important part of the catchment area for the Gairo basin and the Lufukiri basin within the broader Wami River basin (Lovett and Pocs, 1993).

## 1.3 Existing threats to Mamiwa-Kisara forest

Between the 1970s-2000s, the forest area of the Ukaguru Mountains was reduced by 3%, with a total change in forest area of 540 ha (Burgess, 2005). Baker and Baker (2002) and Evans *et al.* (1992) highlight dependence on the forest for fuelwood for heating and cooking by communities living on the cold highland plateau. Baker and Baker (2002) also describe the clearance of 3,600 ha of lowland forest to grow exotic pines. FBD (2005) state that, 'current principal human forest threats include grazing, firewood collection and tree / pole cutting (Table 8). The former two are prevalent along the boundary and the latter inside the reserve'.

## 2 Forest Reserve Description

### 2.1 General description

**Name:** Mamiwa-Kisara North Forest Reserve.

Reserve Name	JB	Area (ha)	Government Notice Number and Date of Gazettement
Mamiwa Kisara North	2097	8,203	cap.132 p.1360

**Location:** 6°25'00"S and 36°57'00E

Kilosa District, Morogoro Region.

Mamiwa-Kisara North Forest Reserve lies 100 km from Kilosa town (Figure 1). Access is from Mandege Forest Station with the road from Mandege to Lufukiri, passing through the valley between Mamwira ridge to the west and Mnyera ridge to the east. Access to the southern part is from the Mvumi to Mandege road at Makwambe.

**Elevation:** 1,500 – 2,264 m a.s.l

**Management:** Central Government Forest Reserve

**Status:** Protective Forest Reserve.

**Major Threats:** Tree cutting for timber and poles, agricultural encroachment especially at Mtega, Masenge and Ng'one areas. Small-scale mining is becoming a serious emerging problem at the fringe of the forest.

**Villages:** Approximately six villages surround Mamiwa-Kisara North Forest Reserve including Nongwe, Mkobwe, Masenge, Mandege, Ng'one and Mtega.

**Previous projects:** International Council for Bird Preservation biodiversity survey in 1990 (Evans et al. 1992); Biodiversity Research and Awareness in Lesser Known Eastern Arc Mountains (BREAM), Frontier Tanzania Environmental Research.

### 2.2 Soil

Mamiwa-Kisara North Forest Reserve consists of Acidic lithosols on Precambrian gneiss and granulite basement rocks with extensive areas of exposed rocky cliffs (Lovett and Pocs, 1993).

### 2.2 Vegetation

Moist forests on the wetter eastern side, mainly on the ridge area, characterize the forest. Heath occurs on the summits with upper montane forest (e.g. *Polyscias stuhlmannii*, *Schefflera lukwangulensis*, *Garcinia volkensii*, *Ocotea usambarensis*). Montane forest (e.g. *Cussonia spicata*, *Dombeya burgessiae*, *Clerodendrum* sp., *Macaranga capensis*) and dry submontane forest (e.g. *Albizia gummifera*, *Allanblackia stuhlmannii*, *Bersama abyssinica*) mostly cover the lower slopes. Dry evergreen forests, bushes and wooded grasslands (e.g. *Acacia* spp., *Albizia versicolor*, *Annona senegalensis*, *Dombeya rotundifolia*) cover the drier southwest slopes of the ridge (Lovett and Pocs, 1993).

### 2.3 Climate

The forest experiences oceanic rainfall with oceanic temperatures. Approximately 1400 mm of rainfall falls per year (according to data recorded by Mwapwa Evergreen, Msowero Ginnery nearest stations), with a mist effect at higher altitudes. The dry season occurs June – Oct, with maximum temperatures of 21°C recorded in January and minimum temperatures of 17°C in July at lower altitudes (Lovett and Pocs, 1993).

### 2.4 Survey sites

Surveys were conducted at five sites in Mamiwa-Kisara Forest Reserve (Figure 2): Site 1 - Nongwe (good forest), Site 2 - Masenge (good forest), Site 3 - Mkobwe (good forest), Site 4 - Mtega-Eastern wing



### 3 Plants

#### 3.1 Background

Lovett and Pocs (1993) described the botanical values of Mamiwa Kisara North noting that 'One of the most remarkable plants in the reserve is the giant *Lobelia sancta*, a strict endemic found in a very small area and related to *L. lukwangulensis* of the Uluguru Mountains. The herb *Impatiens ukagarensis* is also very rare'.

#### 3.2 Objectives

Objectives of the botanical survey were as follows:

1. To provide an updated checklist of plant species present in Mamiwa-Kisara forest.
2. To identify and document endemic plant species in Mamiwa-Kisara forest
3. To identify invasive species present in Mamiwa-Kisara forest.

#### 3.3 Methods

Botanical surveys in Mamiwa-Kisawa Forest Reserve were conducted over a period of fifteen days between September and October 2012. In each of the five survey sites, botanical surveys were conducted within different vegetation types. Sampling was conducted in all five sites to allow for detailed identification of plant species (Table 2). At each site the transect number, altitudinal range, and vegetation type were recorded. Plant species were identified and recorded along transects 1 km long and 5 m wide either side. Identifications were made by Moses Mwangoka, and later verified and corrected by Roy Gereau.

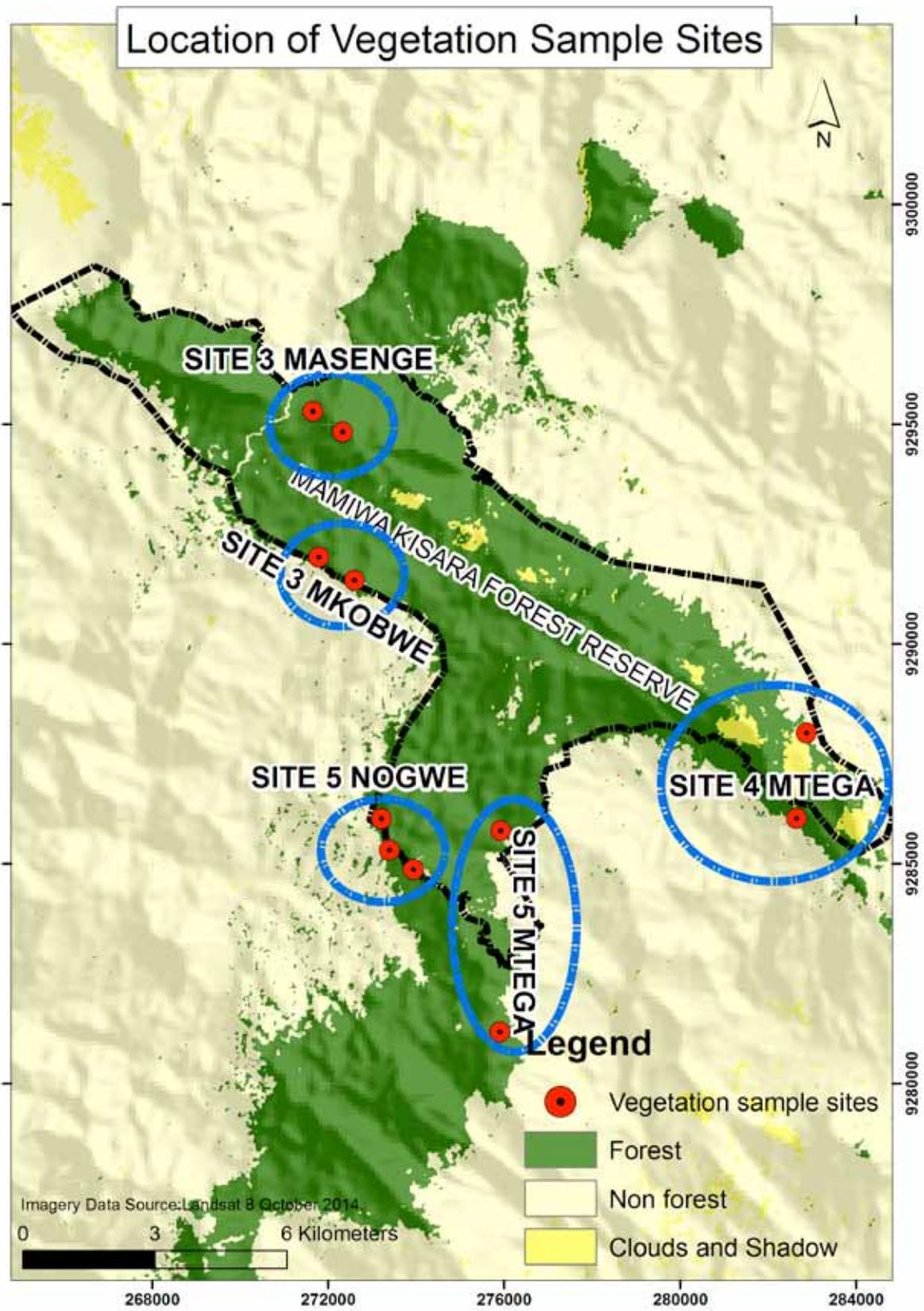
**Table 2.** Botanical survey sampling intensity.

Site name	Categories	Number of samples/site	Survey coordinates		Survey dates	Total number of collections/site
			X	Y		
Site 1. Nongwe	Good forest	237	273391	9285314	25 <sup>th</sup> – 27 <sup>th</sup> September 2012	168
			273943	9284880		
			273215	9286030		
Site 2. Masenge	Good forest	229	271656	9295296	5 <sup>th</sup> – 6 <sup>th</sup> October 2012	171
			272330	9294833		
Site 3. Mkobwe	Good forest	167	271787	9291982	7 <sup>th</sup> – 8 <sup>th</sup> October 2012	119
			272602	9291454		
Site 4. Mtenga- Eastern side	Deforested/ good forest	182	282883	9287988	1 <sup>st</sup> – 3 <sup>rd</sup> October 2012	131
			281075	9284946		
Site 5. Mtenga- Western side	Degraded	203	275905	9281186	28 <sup>th</sup> – 29 <sup>th</sup> September 2012	142
			275922	9285755		

#### 3.4 Results

In total, 234 species were recorded in the surveys, including 198 genera and 92 families (Table 3). The highest number of plant species was recorded at Site 1 - Nongwe (n=220), and the least in Site 3-Mkobwe (n=155) (Table 4). The majority of species were recorded in more than one of the five survey sites across the FR and three families dominated the sample: Rubiaceae (27 spp.), Asteraceae (10 spp.) and Euphorbiaceae (10 spp.).

Figure 2. Location of vegetation sample sites.



**Table 3.** Checklist of plants from Mamiwa-Kisara FR.

Site 1 = Nongwe (good forest); 2 = Masenge (Good forest); 3 = Mkobwe (good forest); 4 = Mtega East (deforested/good forest) and 5 = Mtega West (degraded forest).

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Acanthaceae	<i>Anisotes pubinervis</i>	Shrub	Forest	NA						AFR
Acanthaceae	<i>Brillantaisia cicatricosa</i>	Herb	Forest	MM 8158	1	1	1	1	1	AFR
Acanthaceae	<i>Hypoestes</i>	Herb	Forest	MM 8125	1	1	1	0	0	
Acanthaceae	<i>Justicia</i>	Herb	Forest	MM 8197	1	1	1	1	1	
Acanthaceae	<i>Mellera lobulata</i>	Herb	Forest	NA	1	1	1	1	1	AFR
Acanthaceae	<i>Phaulopsis imbricata subsp. imbricata</i>	Herb	Forest	MM 8186	1	1	1	1	1	WS
Acanthaceae	<i>Pseuderanthemum campylosiphon</i>	Shrub	Forest	MM 8192	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Acanthaceae	<i>Thunbergia alata</i>	Herb	Forest	MM 8259	1	1	1	1	0	WS
Alangiaceae	<i>Alangium chinense</i>	Tree	Forest	NA	1	0	0	1	1	WS
Amaranthaceae	<i>Achyranthes aspera</i>	Herb	Forest	NA	1	1	1	1	1	WS
Amaranthaceae	<i>Aerva lanata</i>	Herb	Forest	MM 8255	1	0	0	1	0	WS
Amaranthaceae	<i>Celosia schweinfurthiana</i>	Herb	Forest	NA	1	1	1	1	1	AFR
Amaranthaceae	<i>Cyathula</i>	Herb	Forest	MM 8178	1	1	1	1	1	
Amaryllidaceae	<i>Scadoxus multiflorus subsp. multiflorus</i>	Herb	Forest	NA	1	1	1	1	1	WS
Anacardiaceae	<i>Rhus longipes var. longipes</i>	Tree	Forest	MM 8217	1	1	1	1	1	AFR
Annonaceae	<i>Artabotrys</i>	Liane	Forest	MM 8149	1	1	0	0	0	
Annonaceae	<i>Artabotrys monteiroae</i>	Liana	Forest	MM 8193	1	1	0	0	0	WS
Annonaceae	<i>Monodora globiflora</i>	Tree	Forest	MM 8143	1	1	0	0	1	EAM: Ukaguru, Rubeho, Udzungwa
Anthericaceae	<i>Chlorophytum filipendulum subsp. filipendulum</i>	Herb	Forest	MM 8130	1	1	1	1	1	AFR
Apiaceae	<i>Agrocharis incognita</i>	Herb	Forest	MM 8254	1	1	1	0	0	AFR
Apiaceae	<i>Sanicula elata</i>	Herb	Forest	MM 8233	1	1	1	0	0	WS
Apocynaceae	<i>Carvalhoa campanulata</i>	S/Tree	Forest	MM 8185	1	1	1	1	1	AFR
Apocynaceae	<i>Landlophia kirkii</i>	Liana	Forest	NA	1	1	0	0	0	AFR
Apocynaceae	<i>Rauvolfia</i>	S/Tree	Forest	MM 8190	1	1	1	1	1	
Apocynaceae	<i>Rauvolfia caffra</i>	Tree	Forest	NA	1	1	1	1	1	AFR

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution	
					1	2	3	4	5		
Araceae	<i>Culcasia orientalis</i>	Herb	Forest	NA	1	1	1	1	1	1	AFR
Araliaceae	<i>Cussonia spicata</i>	Tree	Forest	NA	1	1	1	1	1	1	WS
Araliaceae	<i>Polyscias fulva</i>	Tree	Forest	NA	1	1	1	1	1	1	AFR
Araliaceae	<i>Schefflera lukwangulensis</i>	Tree	Forest	MM 8218	1	1	1	1	1	1	EAM+LN
Araliaceae	<i>Schefflera myriantha</i>	Liana	Forest	MM 8211	1	1	1	1	1	1	WS
Araceae	<i>Phoenix reclinata</i>	Tree	Forest	NA	1	1	1	1	1	1	WS
Asclepiadaceae	<i>Tacazzea conferta</i>	Liana	Forest	MM 8226	1	1	1	1	1	1	AFR
Asparagaceae	<i>Asparagus asparagoides</i>	Herb	Forest	MM 8078	1	1	1	1	1	1	WS
Asparagaceae	<i>Asparagus setaceus</i>	Herb	Forest	NA	1	1	1	1	1	1	AFR
Aspleniaceae	<i>Asplenium</i>	Fern	Forest	MM 8229	1	1	1	0	1	1	
Aspleniaceae	<i>Asplenium anisophyllum</i>	Fern	Forest	MM 8231	0	1	0	1	1	1	WS
Aspleniaceae	<i>Asplenium erectum</i>	Fern	Forest	MM 8162	1	1	1	1	1	1	WS
Aspleniaceae	<i>Asplenium friesiorum</i>	Fern	Forest	MM 8221	0		0	1	1	1	AFR
Aspleniaceae	<i>Asplenium gemmiferum</i>	Fern	Forest	MM 8111	1	1	1	1	1	1	AFR
Aspleniaceae	<i>Asplenium hypomelas</i>	Fern	Forest	MM 8161	1	1	1	1	1	1	AFR
Aspleniaceae	<i>Asplenium rutifolium</i>	Fern	Forest	MM 8151	1	1	1	1	1	1	WS
Asteraceae	<i>Anisopappus</i>	Herb	Forest	NA	1	0	0	0	0	0	
Asteraceae	<i>Bidens kilimandscharica</i>	Herb	Forest	MM 8120	1	1	1	1	1	1	AFR
Asteraceae	<i>Crassocephalum crepidioides</i>	Herb	Forest	MM 8142	1	1	1	0	1	1	AFR
Asteraceae	<i>Helichrysum forskahlii</i> var. <i>forskahlii</i>	Herb	Forest	MM 8105	1	1	0	0	0	0	WS
Asteraceae	<i>Helichrysum schimperi</i>	Herb	Forest	MM 8076	1	1	0	0	0	0	WS
Asteraceae	<i>Microglossa</i>	Herb	Forest	MM 8089	1	1	0	0	0	0	
Asteraceae	<i>Mikania chenopodiifolia</i>	Herb	Forest	MM 8188	1	1	1	1	1	1	WS
Asteraceae	<i>Senecio</i>	Herb	Forest	MM 8117	1	1	0	0	1	1	
Asteraceae	<i>Senecio</i>	Herb	Forest	MM 8205	1	1	0	1	1	1	
Asteraceae	<i>Solanecio mannii</i>	S/Tree	Forest	NA	1	1	0	0	0	0	AFR
Asteraceae	<i>Vernonia</i>	Herb	Forest	MM 8176	1	1	0	0	1	1	
Asteraceae	<i>Vernonia</i>	S/Tree	Forest	MM 8214	1	1	1	1	1	1	

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Asteraceae	<i>Vernonia</i>	Herb	Forest	MM 8234	1	1	0	1	1	
Asteraceae	<i>Vernonia myriantha</i>	S/Tree	Forest	NA	1	1	1	1	1	AFR
Balsaminaceae	<i>Impatiens</i>	Herb	Forest	MM 8199	1	1	1	1	1	
Balsaminaceae	<i>Impatiens nana</i>	Herb	Forest	MM 8240	1	1	0	0	0	EAM+NV
Balsaminaceae	<i>Impatiens pseudoviola</i>	Herb	Forest	MM 8237	1	1	1	1	1	AFR
Balsaminaceae	<i>Impatiens raphidothrix</i>	Herb	Forest	MM 8099	0	0	1	1	1	AFR
Basellaceae	<i>Basella alba</i>	Herb	Forest	MM 8159	1	1	1	1	1	WS
Begoniaceae	<i>Begonia meyeri-johannis</i>	Herb	Forest	MM 8091	1	1	0	0	1	AFR
Begoniaceae	<i>Begonia oxyloba</i>	Herb	Forest	NA	1	1	1	1	1	WS
Bignoniaceae	<i>Markhamia obtusifolia</i>	Tree	Forest	NA	1	1	0	0	0	AFR
Bignoniaceae	<i>Tecomaria capensis</i> subsp. <i>nyassae</i>	S/Tree	Forest	MM 8068	1	1	1	1	1	AFR
Boraginaceae	<i>Cynoglossum lanceolatum</i>	Herb	Forest	MM 8245	1	1	0	0	1	WS
Campanulaceae	<i>Lobelia giberroa</i>	Herb	Forest	NA	1	1	1	1	1	AFR
Campanulaceae	<i>Lobelia goetzei</i>	Herb	Grassland	MM 8100	1	1	0	0	1	AFR
Campanulaceae	<i>Lobelia goetzei</i>	Herb	Forest	MM 8100	1	1	0	0	0	AFR
Caryophyllaceae	<i>Drymaria cordata</i>	Herb	Forest	MM 8177	0	1	1	1	0	WS
Cecropiaceae	<i>Myrianthus holstii</i>	Tree	Forest	NA	1	1	1	1	1	AFR
Celastraceae	<i>Maytenus acuminata</i>	Tree	Forest	MM 8088	1	1	1	1	1	AFR
Celastraceae	<i>Maytenus undata</i>	Tree	Forest	NA	1	1	1	1	1	WS
Celastraceae	<i>Mystroxylon aethiopicum</i>	Tree	Forest	MM 8118	1	1	1	0	1	WS
Celastraceae	<i>Salacia erecta</i>	Liana	Forest	MM 8209	1	1	0	0	1	AFR
Celastraceae	<i>Salacia lehmbachii</i>	Tree	Forest	MM 8153	1	0	0	1	1	AFR
Celastraceae	<i>Simirestis goetzei</i>	Liana	Forest	MM 8180	0	1	1	0	1	AFR
Chrysobalanaceae	<i>Parinari excelsa</i>	Tree	Forest	NA	0	0	0	1	1	WS
Clusiaceae	<i>Allanblackia ulugurensis</i>	Tree	Forest	MM 8112	1	1	0	0	0	EAM: Nguru, Ukaguru, Uluguru, Udzungwa
Clusiaceae	<i>Garcinia kingaensis</i>	Tree	Forest	MM 8196	1	1	1	1	1	AFR
Clusiaceae	<i>Harungana madagascariensis</i>	Tree	Forest	NA	0	1	0	0	1	WS
Commelinaceae	<i>Anellema</i>	Herb	Forest	NA	1	1	0	0	1	



Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Connaraceae	<i>Agelaea pentagyna</i>	Liana	Forest	NA	1	0	1	0	1	WS
Connaraceae	<i>Rourea orientalis</i>	Tree	Forest	NA	1	0	1	0	1	WS
Convolvulaceae	<i>Ipomoea involucreta</i>	Herb	Forest	NA	1	1	1	1	1	AFR
Cornaceae	<i>Cornus volkensii</i>	Tree	Forest	NA	0	1	0	0	1	AFR
Crassulaceae	<i>Kalanchoe densiflora</i>	Herb	Grassland	NA	1	0	0	1	0	AFR
Cucurbitaceae	<i>Coccinia grandiflora</i>	Herb	Forest	NA	1	1	1	1	1	AFR
Cucurbitaceae	<i>Zehneria scabra</i>	Herb	Forest	MM 8247	1	1	1	1	1	WS
Cyatheaceae	<i>Cyathea manniana</i>	Fern	Forest	NA	1	1	1	1	0	AFR
Cyperaceae	<i>Carex</i>	Sedge	Forest	MM 8109	1	1	1	1	1	
Dennstaedtiaceae	<i>Blotiella stipitata</i>	Fern	Forest	MM 8126	1	1	1	1	1	AFR
Dracaenaceae	<i>Dracaena laxissima</i>	Shrub	Forest	NA	1	1	1	1	1	AFR
Dracaenaceae	<i>Dracaena steudneri</i>	Tree	Forest	NA	1	0	0	1	1	AFR
Ericaceae	<i>Agarista salicifolia</i>	Tree	Forest	MM 8067	1	1	1	1	1	WS
Ericaceae	<i>Erica benguelensis</i> var. <i>benguelensis</i>	Shrub	Forest	MM 8119	1	1	0	0	0	AFR
Euphorbiaceae	<i>Acalypha volkensii</i>	Shrub	Forest	MM 8074	1	1	1	1	1	AFR
Euphorbiaceae	<i>Alchornea hirtella</i>	Tree	Forest	MM 8104	1	1	1	1	1	AFR
Euphorbiaceae	<i>Bridelia bridelifolia</i>	Tree	Forest	MM 8092	1	1	1	1	1	AFR
Euphorbiaceae	<i>Bridelia micrantha</i>	Tree	Forest	NA	1	0	0	0	1	WS
Euphorbiaceae	<i>Clutia abyssinica</i> var. <i>usambarica</i>	Shrub	Forest	MM 8248	1	1	0	1	1	AFR
Euphorbiaceae	<i>Drypetes</i>	Tree	Forest	NA	0	1	0	0	1	
Euphorbiaceae	<i>Erythrococca ulugurensis</i>	Shrub	Forest	MM 8132	1	1	1	1	1	EAM+CF
Euphorbiaceae	<i>Erythrococca usambarica</i>	Shrub	Forest	MM 8098	1	1	1	1	1	AFR
Euphorbiaceae	<i>Euphorbia usambarica</i> subsp. <i>usambarica</i>	Sh/Tree	Forest	MM 8222	1	1	1	1	1	AFR
Euphorbiaceae	<i>Macaranga capensis</i> var. <i>kilimandscharica</i>	Tree	Forest	NA	1	1	1	1	1	AFR
Fabaceae	<i>Caesalpinia decapetala</i>	Liana	Forest	MM 8238	1	1	0	0	1	introduced
Fabaceae	<i>Crotalaria incana</i> subsp. <i>purpurascens</i>	Shrub	Forest	MM 8235	1	0	1	1	0	WS
Fabaceae	<i>Dalbergia lactea</i>	Liane	Forest	NA	1	1	1	1	1	AFR
Fabaceae	<i>Desmodium repandum</i>	Herb	Forest	NA	1	1	1	1	1	WS

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Fabaceae	<i>Eriosema montanum</i>	Shrub	Forest	NA	1	1	1	1	1	AFR
Fabaceae	<i>Milletia oblata</i> subsp. <i>intermedia</i>	Tree	Forest	MM 8165	1	1	1	1	1	EAM+CF+LN
Flacourtiaceae	<i>Aphloia theiformis</i>	Tree	Forest	MM 8072	1	1	0	1	1	WS
Flacourtiaceae	<i>Caloncoba welwitschii</i>	Tree	Forest	MM 8106	1	1	1	1	1	AFR
Flacourtiaceae	<i>Casearia battiscombei</i>	Tree	Forest	NA	1	0	1	1	0	AFR
Flacourtiaceae	<i>Gerrardina eylesiana</i>	Liana	Forest	MM 8083	1	1	0	0	1	AFR
Flacourtiaceae	<i>Kiggelaria africana</i>	Tree	Forest	NA	1	0	1	0	1	AFR
Flacourtiaceae	<i>Rawsonia reticulata</i>	Tree	Forest	MM 8086	1	1	1	1	1	AFR
Flacourtiaceae	<i>Scolopia rhamniphylla</i>	Tree	Forest	MM 8134	1	1	0	0	0	AFR
Gesneriaceae	<i>Streptocarpus schliebenii</i>	Herb	Forest	MM 8219	0	1	0	0	0	EAM: Nguru, Ukaguru, Udzungwa
Hamamelidaceae	<i>Trichocladus ellipticus</i> subsp. <i>malosanus</i>	Tree	Forest	NA	0	0	0	1	1	AFR
Icacinaceae	<i>Alsodeiopsis schumannii</i>	Tree	Forest	MM 8194	1	0	0	1	1	EAM: E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Udzungwa, Mahenge
Icacinaceae	<i>Apodytes dimidiata</i>	Tree	Forest	NA	1	1	0	0	1	WS
Iridaceae	<i>Aristea goetzei</i>	Herb	Forest	MM 8220	1	1	1	1	1	WS
Lamiaceae	<i>Leucas deflexa</i> var. <i>kondowensis</i>	Herb	Forest	MM 8167	1	1	0	0	0	AFR
Lamiaceae	<i>Plectranthus</i>	Herb	Forest	MM 8204	1	1	0	0	1	
Lamiaceae	<i>Plectranthus malawiensis</i>	Herb	Forest	MM 8208	1	1	0	0	1	AFR
Lamiaceae	<i>Plectranthus parvus</i>	Herb	Forest	MM 8241	1	1	1	1	0	AFR
Lamiaceae	<i>Salvia nitotica</i>	Herb	Forest	MM 8179	1	1	0	0	0	AFR
Lauraceae	<i>Cryptocarya liebertiana</i>	Tree	Forest	NA	1	0	1	1	1	AFR
Lauraceae	<i>Ocotea kenyensis</i>	Tree	Forest	MM 8136	1	1	0	0	0	AFR
Lauraceae	<i>Ocotea usambarensis</i>	Tree	Forest	MM 8215	1	1	1	1	0	AFR
Loganiaceae	<i>Anthocleista grandiflora</i>	Tree	Forest	NA	1	1	0	1	1	WS
Loganiaceae	<i>Buddleja pulchella</i>	Shrub	Forest	MM 8242	0	1	0	1	1	AFR
Loganiaceae	<i>Mostuea brunonis</i> var. <i>brunonis</i>	S/Tree	Forest	MM 8103	0	1	1	1	1	WS
Loganiaceae	<i>Nuxia congesta</i>	Tree	Forest	MM 8258	0	1	0	1	0	AFR
Loganiaceae	<i>Nuxia floribunda</i>	Tree	Forest	MM 8084	1	1	0	1	1	AFR

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Loranthaceae		Parasite	Forest	MM 8116	1	1	1	1	0	
Loranthaceae	<i>Agelanthus subulatus</i>	Parasite	Forest	MM 8181	1	1	1	0	1	AFR
Loranthaceae	<i>Englerina inaequilatera</i>	Parasite	Forest	MM 8123	1	1	0	0	0	AFR
Lycopodiaceae	<i>Lycopodium clavatum</i>	Fern	Forest	MM 8210	0	0	0	1	1	WS
Malvaceae	<i>Hibiscus fuscus</i>	Shrub	Forest	MM 8168	1	1	1	1	1	AFR
Malvaceae	<i>Pavonia urens</i>	Shrub	Forest	MM 8249	0	1	0	0	0	WS
Marattiaceae	<i>Marattia fraxinea</i>	Fern	Forest	NA	1	1	1	1	1	WS
Melastomataceae	<i>Dissotis aprica</i>	Shrub	Forest	MM 8081	1	1	0	0	0	EAM+CF
Melastomataceae	<i>Dissotis princeps</i> var. <i>candolleana</i>	Shrub	Forest	MM 8080	1	0	0	1	1	AFR
Melastomataceae	<i>Gravesia pulchra</i> var. <i>pulchra</i>	Shrub	Forest	NA	0	1	0	1	0	EAM: Ukaguru, Uluguru, Udzungwa, Mahenge
Melastomataceae	<i>Medinilla engleri</i>	Epiphyte	Forest	MM 8090	1	1	0	0	1	EAM: E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Melastomataceae	<i>Memeclon myrtilloides</i>	Tree	Forest	MM 8087	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho
Melastomataceae	<i>Warneckea</i>	Tree	Forest	MM 8163	1	1	1	1	1	
Meliaceae	<i>Lepidotrichilia volkensii</i>	Tree	Forest	NA	1	1	1	0	0	AFR
Meliaceae	<i>Turraea holstii</i>	Tree	Forest	MM 8148	1	1	1	1	1	WS
Meliaceae	<i>Bersama abyssinica</i> subsp. <i>abyssinica</i>	Tree	Forest	MM 8236	1	1	1	1	0	AFR
Meliaceae	<i>Bersama abyssinica</i> subsp. <i>abyssinica</i>	Tree	Forest	MM 8157	1	1	1	1	1	AFR
Menispermaceae	<i>Stephania abyssinica</i> var. <i>tomentella</i>	Herb	Forest	MM 8174	0	0	1	1	1	AFR
Monimiaceae	<i>Xymalos monospora</i>	Tree	Forest	MM 8085	1	1	1	0	0	AFR
Moraceae	<i>Dorstenia holstii</i> var. <i>longestipulata</i>	Herb	Forest	MM 8129	1	1	0	0	1	EAM+CF
Moraceae	<i>Ficus natalensis</i>	Tree	Forest	NA	0	0	0	1	0	AFR
Moraceae	<i>Ficus sycomorus</i>	Tree	Forest	NA	1	1	1	0	0	WS
Musaceae	<i>Ensete ventricosum</i>	Herb	Forest	NA	0	0	0	1	0	AFR
Myricaceae	<i>Morella salicifolia</i> subsp. <i>kilimandscharica</i>	Tree	Forest	MM 8069	0	0	0	0	0	AFR
Myrsinaceae	<i>Embelia schimperi</i>	Liane	Forest	MM 8079	1	1	1	1	1	AFR
Myrsinaceae	<i>Maesa lanceolata</i>	Tree	Forest	MM 8073	1	1	1	1	1	WS

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution		
					1	2	3	4	5			
Myrsinaceae	<i>Myrsine melanophloes</i>	Tree	Forest	NA	1	1	1	1	1	1	AFR	
Myrtaceae	<i>Syzygium cordatum</i>	Tree	Forest	NA	1	1	0	0	1	1	AFR	
Myrtaceae	<i>Syzygium guineense</i>	Tree	Forest	NA	1	1	1	1	1	1	WS	
Myrtaceae	<i>Syzygium micklethwaitii</i>	Tree	Forest	NA	1	1	0	0	0	0	EAM+NV	
Myrtaceae	<i>Syzygium micklethwaitii</i> subsp. <i>micklethwaitii</i>	Tree	Forest	MM 8150	0	1	1	1	1	0	EAM+NV	
Ochnaceae	<i>Ochna</i>	Tree	Forest	MM 8207	1	1	1	1	1	1		
Ochnaceae	<i>Ochna holstii</i>	Tree	Forest	NA	1	1	1	1	1	1	AFR	
Oleaceae	<i>Olea capensis</i> subsp. <i>macrocarpa</i>	Tree	Forest	MM 8230	0	1	0	1	0	0	WS	
Oleaceae	<i>Schrebera alata</i>	Tree	Forest	NA	1	1	0	0	1	1	AFR	
Orchidaceae	<i>Liparis</i>	Herb	Forest	MM 8155	1	0	0	1	1	1		
Orchidaceae	<i>Polystachya</i>	Herb	Forest	MM 8206	1	1	1	1	1	0		
Passifloraceae	<i>Adenia stolzii</i>	Liane	Forest	MM 8141	1	1	1	1	1	1	AFR	
Passifloraceae	<i>Passiflora edulis</i>	Liane	Forest	MM 8169	1	1	1	1	1	1	introduced	
Phytolaccaceae	<i>Phytolacca dodecandra</i>	Liana	Forest	MM 8166	0	0	0	1	1	1	WS	
Piperaceae	<i>Peperomia molleri</i> subsp. <i>ukagurensis</i>	Herb	Forest	MM 8202	1	1	1	1	1	1	EAM: Ukaguru	
Piperaceae	<i>Piper capense</i> var. <i>capense</i>	Shrub	Forest	MM 8108	1	1	1	1	1	1	WS	
Piperaceae	<i>Piper umbellatum</i>	Shrub	Forest	MM 8171	1	1	1	1	1	1	WS	
Poaceae	<i>Oplismenus hirtellus</i>	Grass	Forest	MM 8253	1	1	1	1	1	1	WS	
Podocarpaceae	<i>Afrocarpus</i>	Tree	Forest	MM 8198	1	1	0	1	1	1		
Polygonaceae	<i>Rumex bequaertii</i>	Herb	Forest	MM 8244	1	1	0	0	1	1	WS	
Polygonaceae	<i>Rumex usambarensis</i>	Herb	Forest	NA	0	0	0	1	1	1	AFR	
Polyodiaceae	<i>Lepisorus excavatus</i>	Fern	Forest	MM 8213	1	1	1	1	1	1	WS	
Pteridaceae	<i>Pteris catoptera</i> var. <i>catoptera</i>	Fern	Forest	MM 8135	1	1	1	1	1	1	WS	
Pteridaceae	<i>Pteris usambarensis</i>	Fern	Forest	MM 8144	1	1	1	1	1	1	EAM+CF	
Ranunculaceae	<i>Clematis hirsuta</i>	Liane	Forest	NA	1	1	1	1	1	1	AFR	
Ranunculaceae	<i>Thalictrum rhyncho carpum</i>	Herb	Forest	MM 8175	0	1	0	1	0	1	0	AFR
Rhamnaceae	<i>Gouania longispicata</i>	Liane	Forest	MM 8173	1	1	0	1	1	1	AFR	
Rhamnaceae	<i>Rhamnus prinoides</i>	S/tree	Forest	MM 8228	1	1	1	1	1	1	AFR	

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Rhamnaceae	<i>Scutia myrtina</i>	Tree	Forest	MM 8232	0	1	0	0	0	WS
Rhizophoraceae	<i>Cassipourea gummiflua</i>	Tree	Forest	NA	1	0	0	0	1	WS
Rhizophoraceae	<i>Cassipourea malosana</i>	Tree	Forest	MM 8160	1	1	1	1	1	AFR
Rosaceae	<i>Prunus africana</i>	Tree	Forest	NA	1	0	0	0	1	WS
Rosaceae	<i>Rubus keniensis</i>	Liane	Forest	NA	1	0	1	0	1	AFR
Rubiaceae	<i>Canthium oligocarpum</i>	Tree	Forest	NA	1	1	1	0	1	AFR
Rubiaceae	<i>Chassalia discolor</i> subsp. <i>discolor</i>	S/Tree	Forest	MM 8128	1	1	1	1	1	EAM+LN
Rubiaceae	<i>Chassalia discolor</i> subsp. <i>discolor</i>	Tree	Forest	MM 8191	1	1	1	1	1	EAM+LN
Rubiaceae	<i>Chassalia parvifolia</i>	Tree	Forest	MM 8114	1	1	1	0	1	AFR
Rubiaceae	<i>Chassalia parvifolia</i>	S/Tree	Forest	MM 8127	1	1	1	1	1	AFR
Rubiaceae	<i>Coffea canephora</i>	Shrub	Forest	MM 8195	1	1	0	0	1	introduced
Rubiaceae	<i>Coffea mufindiensis</i> subsp. <i>mufindiensis</i>	S/Tree	Forest	MM 8145	1	1	0	0	0	EAM+LN
Rubiaceae	<i>Cremaspora triflora</i> subsp. <i>triflora</i>	Tree	Forest	MM 8115	1	1	1	1	1	AFR
Rubiaceae	<i>Danais xanthorrhoea</i>	Liana	Forest	MM 8184	1	0	1	1	1	EAM: S Pare, E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Udzungwa
Rubiaceae	<i>Galiniera saxifraga</i>	Tree	Forest	MM 8095	1	1	1	1	1	AFR
Rubiaceae	<i>Galium brenanii</i>	Herb	Forest	MM 8097	1	0	0	1	1	EAM+NV
Rubiaceae	<i>Ixora scheffleri</i> subsp. <i>scheffleri</i>	Tree	Forest	MM 8113	1	1	0	0	0	AFR
Rubiaceae	<i>Keetia gueinzii</i>	Liane	Forest	MM 8122	1	1	1	1	1	AFR
Rubiaceae	<i>Lasianthus</i>	Tree	Forest	MM 8203	1	1	0	1	0	
Rubiaceae	<i>Margaritopsis abrupta</i>	Shrub	Forest	MM 8200	1	1	1	1	1	AFR
Rubiaceae	<i>Mitragyna rubrostipulata</i>	Tree	Forest	NA	1	1	1	1	1	AFR
Rubiaceae	<i>Mussaenda</i>	Tree	Forest	MM 8189	0	0	0	1	1	
Rubiaceae	<i>Oxyanthus speciosus</i> subsp. <i>stenocarpus</i>	Tree	Forest	NA	1	1	0	0	1	AFR
Rubiaceae	<i>Pauridiantha</i>	Tree	Forest	MM 8096	1	1	1	1	1	
Rubiaceae	<i>Pavetta hymenophylla</i>	Tree	Forest	MM 8131	1	1	1	1	1	AFR
Rubiaceae	<i>Pavetta lynesii</i>	Tree	Forest	NA	1	1	0	1	1	EAM+LN
Rubiaceae	<i>Pentas lanceolata</i> subsp. <i>quartiniana</i>	Herb	Forest	MM 8187	1	1	1	1	1	AFR

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Rubiaceae	<i>Psychotria</i>	Liana	Forest	MM 8147	1	1	1	1	1	
Rubiaceae	<i>Psychotria cyathicalyx</i>	Tree	Forest	MM 8121	1	1	1	1	1	EAM+CF+NV
Rubiaceae	<i>Psychotria elachistantha</i>	Tree	Forest	MM 8250	0	1	0	0	0	EAM: Ukaguru, Uluguru, Udzungwa
Rubiaceae	<i>Psychotria goetzei</i>	Tree	Forest	MM 8077	1	1	1	1	1	EAM+NV+LN
Rubiaceae	<i>Psychotria mahonii</i> subsp. <i>puberula</i>	Tree	Forest	MM 8133	1	1	1	1	1	AFR
Rubiaceae	<i>Rubia cordifolia</i> subsp. <i>conotricha</i>	Herb	Forest	NA	1	1	1	1	1	AFR
Rubiaceae	<i>Rutidea fuscescens</i> subsp. <i>fuscescens</i>	Liane	Forest	MM 8071	1	0	0	1	1	AFR
Rubiaceae	<i>Rytigynia pseudolongicaudata</i>	Tree	Forest	MM 8094	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Rutaceae	<i>Clausena anisata</i>	Tree	Forest	MM 8182	1	0	1	0	1	AFR
Rutaceae	<i>Toddalia asiatica</i>	Liana	Forest	MM 8239	1	1	1	1	1	WS
Rutaceae	<i>Vepris</i>	Tree	Forest	MM 8110	1	1	1	1	1	
Rutaceae	<i>Vepris trichocarpa</i>	Tree	Forest	MM 8140	1	1	0	0	1	AFR
Rutaceae	<i>Zanthoxylum deremense</i>	Tree	Forest	MM 8137	1	0	0	1	1	AFR
Santalaceae	<i>Thesium triflorum</i>	Herb	Forest	MM 8082	0	0	1	1	1	AFR
Sapindaceae	<i>Allophylus abyssinicus</i>	Tree	Forest	MM 8246	1	1	1	1	1	AFR
Sapindaceae	<i>Allophylus ferrugineus</i> var. <i>ferrugineus</i>	Tree	Forest	MM 8138	1	1	1	1	1	AFR
Sapindaceae	<i>Deinbolia kilimandscharica</i>	Tree	Forest	NA	1	0	0	1	0	AFR
Sapindaceae	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>	Tree	Forest	NA	1	1	1	0	1	WS
Sapotaceae	<i>Chrysophyllum</i>	Tree	Forest	MM 8183	1	1	1	1	1	
Sapotaceae	<i>Synsepalum</i>	Tree	Forest	MM 8201	1	1	0	0	0	
Sapotaceae	<i>Synsepalum msolo</i>	Tree	Forest	NA	1	1	0	0	0	AFR
Scrophulariaceae	<i>Halleria lucida</i>	Tree	Forest	MM 8101	1	1	1	1	1	WS
Smilacaceae	<i>Smilax anceps</i>	Liane	Forest	NA	1	1	1	1	0	WS
Solanaceae	<i>Solanum anguivi</i>	Shrub	Forest	MM 8224	1	1	1	0	0	WS
Sterculiaceae	<i>Dombeya torrida</i> subsp. <i>torrida</i>	Tree	Forest	MM 8164	1	1	0	0	0	WS
Thymelaeaceae	<i>Peddiea polyantha</i>	Tree	Forest	MM 8107	1	1	1	1	1	EAM+LN
Tiliaceae	<i>Grewia mildbraedii</i>	Tree	Forest	MM 8093	1	1	0	0	0	AFR

Family	Scientific name	Habit	Habitat	Coll. No	Survey sites					Distribution
					1	2	3	4	5	
Tiliaceae	<i>Sparrmannia ricinocarpa</i> var. <i>ricinocarpa</i>	Herb	Forest	MM 8243	1	1	0	1	1	WS
Tiliaceae	<i>Triumfetta rhomboidea</i>	Herb	Forest	MM 8251	0	1	1	0	1	WS
Ulmaceae	<i>Trema orientalis</i>	Tree	Forest	NA	1	1	1	1	1	WS
Urticaceae	<i>Boehmeria macrophylla</i>	S/Tree	Forest	NA	1	1	1	1	1	WS
Urticaceae	<i>Urena trinervis</i>	Liane	Forest	NA	1	1	1	1	1	WS
Verbenaceae	<i>Clerodendrum cephalanthum</i> subsp. <i>impensum</i>	Shrub	Forest	MM 8256						EAM+CF
Verbenaceae	<i>Rotheca sansibarensis</i> subsp. <i>sansibarensis</i>	Shrub	Forest	MM 8172	1	1	1	1	1	AFR
Verbenaceae	<i>Vitex</i>	Tree	Forest	NA	1	0	1	0	0	
Zingiberaceae	<i>Aframomum</i>	Herb	Forest	NA	1	1	1	1	1	
<b>TAXON RICHNESS</b>					<b>220</b>	<b>212</b>	<b>155</b>	<b>171</b>	<b>188</b>	

### Key to table 3

#### Geographical range

WS = widespread, in Eastern Arc and also outside continental Africa  
 AFR = in Eastern Arc and in continental Africa outside adjacent mountain areas and Coastal Forest zone  
 EAM = endemic to Eastern Arc Mountains  
 EAM+CF = endemic to combined Eastern Arc and Coastal Forest zone  
 EAM+NV = endemic to combined Eastern Arc and Neogene Volcanics of Tanzania  
 EAM+LN = endemic to combined Eastern Arc and Lake Nyasa Climatic Region of Tanzania  
 EAM+CF+LN = endemic to combined Eastern Arc, Coastal Forest zone, and Lake Nyasa Climatic Region  
 EAM+CF+NV = endemic to combined Eastern Arc, Coastal Forest zone, and Neogene Volcanics  
 EAM+NV+LN = endemic to combined Eastern Arc, Neogene Volcanics, and Lake Nyasa Climatic Region

**Coll No** = Number of the collection made

**NA** = No collection made

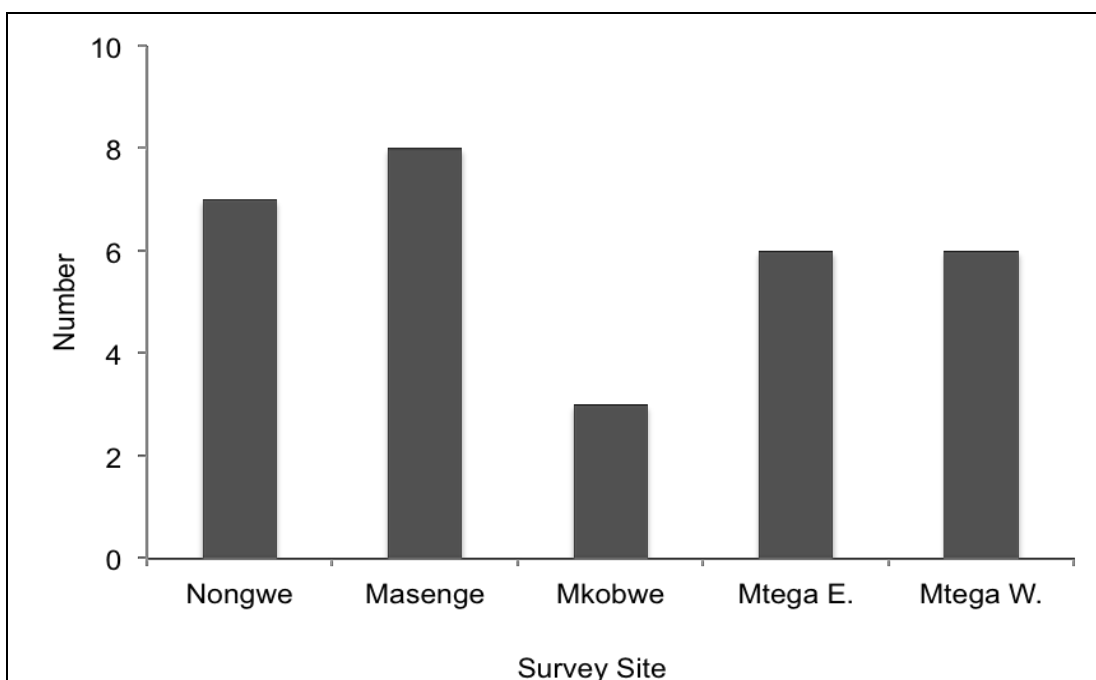
Of the total sample, 12 taxa (species, subspecies, varieties) were endemic to the Eastern Arc Mountains (EAM), and 15 were endemic to the combined Eastern Arc and Coastal Forest zone (CF) and/or adjacent mountain areas (NV = Neogene Volcanics of northern Tanzania, LN = Lake Nyasa Climatic Region of Tanzania) (Table 4; Figure 3).

**Table 4.** Eastern Arc Mountain endemic and regionally endemic plant species recorded at each survey site in Mamiwa-Kisara Forest Reserve.

Family	Scientific name	Habit	Habitat	Coll. No	1	2	3	4	5	Distribution
Acanthaceae	<i>Pseuderanthemum campylosiphon</i>	Shrub	Forest	MM 8192	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Annonaceae	<i>Monodora globiflora</i>	Tree	Forest	MM 8143	1	1	0	0	1	EAM: Ukaguru, Rubeho, Udzungwa
Araliaceae	<i>Schefflera lukwangulensis</i>	Tree	Forest	MM 8218	1	1	1	1	1	EAM+LN
Balsaminaceae	<i>Impatiens nana</i>	Herb	Forest	MM 8240	1	1	0	0	0	EAM+NV
Clusiaceae	<i>Allanblackia ulugurensis</i>	Tree	Forest	MM 8112	1	1	0	0	0	EAM: Nguru, Ukaguru, Uluguru, Udzungwa
Euphorbiaceae	<i>Erythrococca ulugurensis</i>	Shrub	Forest	MM 8132	1	1	1	1	1	EAM+CF
Fabaceae	<i>Millettia oblata</i> subsp. <i>intermedia</i>	Tree	Forest	MM 8165	1	1	1	1	1	EAM+CF+LN
Gesneriaceae	<i>Streptocarpus schliebenii</i>	Herb	Forest	MM 8219	0	1	0	0	0	EAM: Nguru, Ukaguru, Udzungwa
Icacinaceae	<i>Alsodeiopsis schumannii</i>	Tree	Forest	MM 8194	1	0	0	1	1	EAM: E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Udzungwa, Mahenge
Melastomataceae	<i>Dissotis aprica</i>	Shrub	Forest	MM 8081	1	1	0	0	0	EAM+CF
Melastomataceae	<i>Gravesia pulchra</i> var. <i>pulchra</i>	Shrub	Forest	NA	0	1	0	1	0	EAM: Ukaguru, Uluguru, Udzungwa, Mahenge
Melastomataceae	<i>Medinilla engleri</i>	Epiphyte	Forest	MM 8090	1	1	0	0	1	EAM: E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Melastomataceae	<i>Memecylon myrtilloides</i>	Tree	Forest	MM 8087	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho
Moraceae	<i>Dorstenia holstii</i> var. <i>longestipulata</i>	Herb	Forest	MM 8129	1	1	0	0	1	EAM+CF
Myrtaceae	<i>Syzygium micklethwaitii</i> subsp. <i>micklethwaitii</i>	Tree	Forest	MM 8150	0	1	1	1	0	EAM+NV
Piperaceae	<i>Peperomia molleri</i> subsp. <i>ukagurensis</i>	Herb	Forest	MM 8202	1	1	1	1	1	EAM: Ukaguru
Pteridaceae	<i>Pteris usambarensis</i>	Fern	Forest	MM 8144	1	1	1	1	1	EAM+CF
Rubiaceae	<i>Chassalia discolor</i> subsp. <i>discolor</i>	Tree	Forest	MM 8191	1	1	1	1	1	EAM+LN
Rubiaceae	<i>Coffea mufindiensis</i> subsp. <i>mufindiensis</i>	S/Tree	Forest	MM 8145	1	1	0	0	0	EAM+LN
Rubiaceae	<i>Danais xanthorrhoea</i>	Liana	Forest	MM 8184	1	0	1	1	1	EAM: S Pare, E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Udzungwa
Rubiaceae	<i>Galium brenanii</i>	Herb	Forest	MM 8097	1	0	0	1	1	EAM+NV
Rubiaceae	<i>Pavetta lynesii</i>	Tree	Forest	NA	1	1	0	1	1	EAM+LN
Rubiaceae	<i>Psychotria cyathicalyx</i>	Tree	Forest	MM 8121	1	1	1	1	1	EAM+CF+NV



Family	Scientific name	Habit	Habitat	Coll. No	1	2	3	4	5	Distribution
Rubiaceae	<i>Psychotria elachistantha</i>	Tree	Forest	MM 8250	0	1	0	0	0	EAM: Ukaguru, Uluguru, Udzungwa
Rubiaceae	<i>Psychotria goetzei</i>	Tree	Forest	MM 8077	1	1	1	1	1	EAM+NV+LN
Rubiaceae	<i>Rytigynia pseudolongicaudata</i>	Tree	Forest	MM 8094	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Thymelaeaceae	<i>Peddiea polyantha</i>	Tree	Forest	MM 8107	1	1	1	1	1	EAM+LN
Verbenaceae	<i>Clerodendrum cephalanthum</i> subsp. <i>impensum</i>	Shrub	Forest	MM 8256						EAM+CF
TOTAL					23	24	4	8	8	



**Figure 3.** Eastern Arc endemic and near-endemic plant species recorded at each survey site in Mamiwa Kisara Forest Reserve.

### 3.5 Discussion

A total of 234 species, including 198 genera and 92 families, were recorded in this survey. This comprises 6% of the 4122 total plants species recorded in the Eastern Arc (R.E. Gereau, unpubl. data). Moreover, 12 plant taxa (species, subspecies, varieties) endemic to the Eastern Arc Mountains were recorded, comprising 2% of the 608 known plant taxa endemic to the Eastern Arc Mountains (Gereau, unpubl. data).

Site 1 contained the highest number of plant species (n=220), followed by site 2 (n=212) and site 5 (n=188). This might be expected given the good forest condition and low levels of disturbance events in Site 1 (See section 5). However, high levels of plant regeneration were observed in Sites 2 and 5, especially along the fringe of the forest, despite the disturbed condition of the forest in these sites. This regeneration accounts for the high number plant species recorded in these sites.

## 4 Birds

### 4.1 Background

Rovero *et al.* (2014) described a total of 23 bird species as endemic to the Eastern Arc of which 11 are single-block endemics. Rovero *et al.* (2014) report records of four Eastern Arc endemic bird species from the Ukaguru Mountains: *Scepomycter winifredae*, Mrs Moreau's warbler (Vulnerable); *Nectarinia moreaui*, Moreau's sunbird (Near threatened); *Sheppardia aurantiithorax*, Rubeho Akalat (Endangered) and *Scepomycter rubehoepsis* (Not Listed).

The following 14 Eastern Arc near-endemic species (species that occur in the EAM and adjacent mountains) are listed as being present in the Ukaguru Mountains by Rovero *et al.* (2014):

*Arizelocichla chlorigula*  
*Arizelocichla masukuensis*  
*Arizelocichla milanjensis*  
*Apalis chapini*  
*Artisornis metopias*  
*Batis crypta*  
*Cisticola nigriloris*  
*Crithagra melanochrous*  
*Laniarius fuelleborni*  
*Lanius marwitsi*  
*Modulatrix stictigula*  
*Poeoptera kenricki*  
*Sheppardia sharpei*  
*Stactolaema olivacea*

Evans *et al.* (1992) provide a review of previous ornithological research in the Ukaguru Mountains citing surveys by Fuggles-Couchman (1939), Friedman and Stager (1964) Stuart and van der Willigen (1978) and a brief visit by Baker and Baker. From 45 forest species recorded by Stuart (1981), Evans *et al.* reported 51 forest species including Mrs Moreau's warbler.

### 4.2 Objectives

The main objective in this survey was to provide an updated checklist of birds in Mamiwa-Kisara North Forest Reserve with a special focus on threatened and Eastern Arc endemic species.

### 4.3 Methods

Two methods were used to assess bird fauna: mist netting and direct observations. These methods were adapted from Doggart *et al.* (2006).

#### 4.3.1 Observations/Oppportunistic survey

Oppportunistic surveys were carried out in the area over a total of eight days. At Sites 1, 3, 4 and 5, the bird specialist, Elia Mulungu, walked in different directions from camp to compile a list of bird species present in the forest. The recorder moved in four directions at each site (North, East, South and West). Every bird species seen or heard was recorded, and bird vocalizations were taped with an acoustic recording device. For each site, bird observation survey effort was 10 hours per day for each of the eight days of the survey, totalling 80 hours of observation.

#### 4.3.2 Mist netting

Mist nets were set up in the good forest at Site 2. Every day during sampling, mist nets were set at first light in the morning (6.30 am) and then checked frequently at 25-30 minute intervals throughout the day until sunset. Captured birds were removed from the net, identified and then immediately released. Birds were identified to the species level.

### 4.3.3 Sites

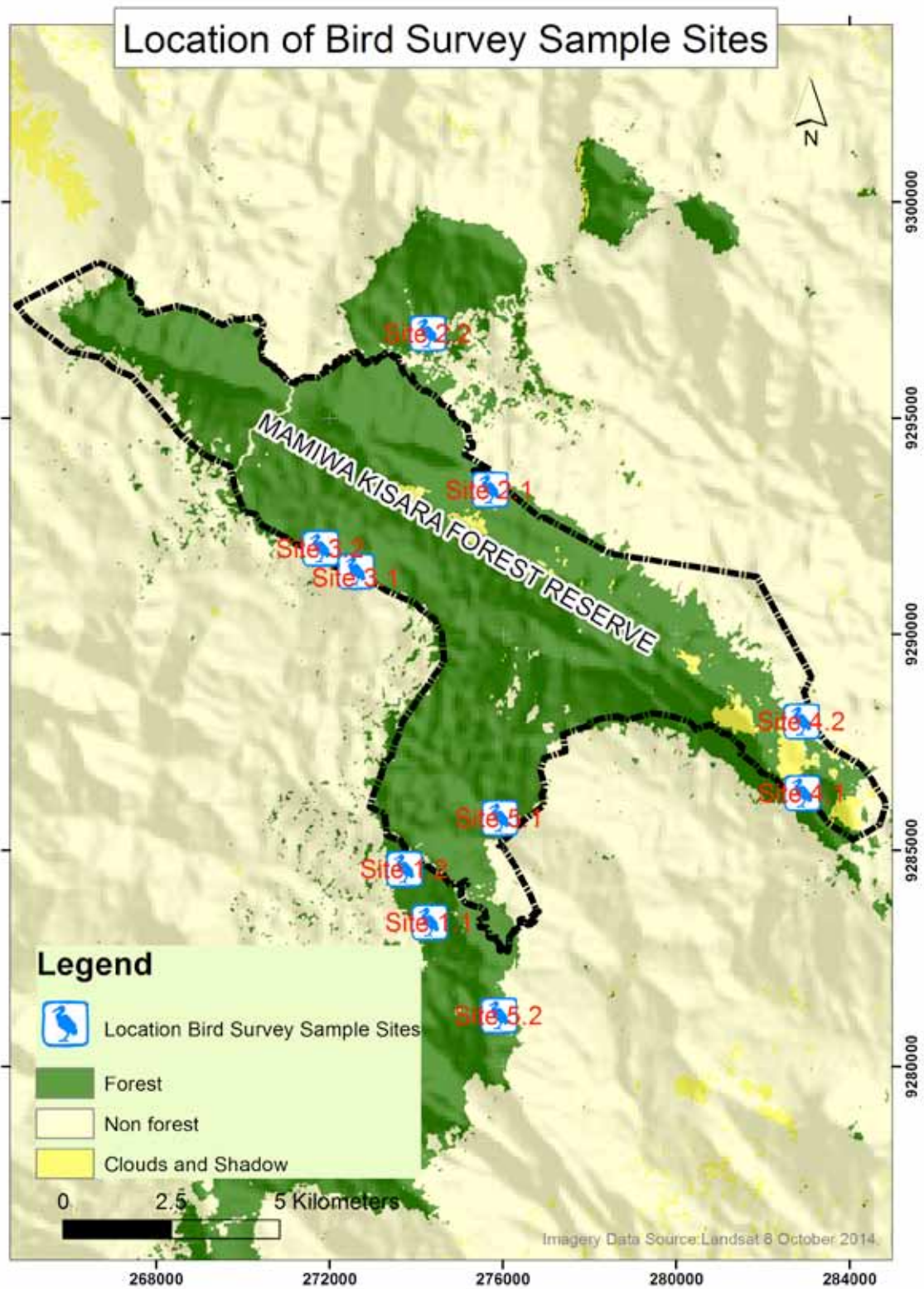
Five sites were surveyed as follows: Site 1 = Nongwe (good forest); Site 2 = Masenge (good forest); Site 3 = Mkobwe (good forest); Site 4 = Mtega- eastern wing (good forest/degraded) and Site 5 = Mtega (degraded) (Table 5 and Figure 4).

**Table 5.** Bird survey sampling intensity.

Survey site	Category	NMH	Survey methods	No. of observation days	Survey coord		Survey dates
					X	Y	
Site 1	Good forest	0	Opportunistic	3	274296	9283341	24 <sup>th</sup> – 26 <sup>th</sup> September 2012
Site 1	Good forest	0	Opportunistic		273720	9284572	
Site 2	Good forest	3456	Mistnetting	4	275696	9293340	1 <sup>st</sup> - 4 <sup>th</sup> October 2012
Site 3	Good forest	0	Opportunistic	2	272602	9291454	5 <sup>th</sup> - 6 <sup>th</sup> October 2012
Site 3	Good forest	0	Opportunistic		271787	9291982	5 <sup>th</sup> - 6 <sup>th</sup> October 2012
Site 4	Deforested/ good forest	0	Opportunistic	2	281075	9284946	29 <sup>th</sup> September & 7 <sup>th</sup> October 2012
Site 4	Deforested/ good forest	0	Opportunistic		282883	9287988	
Site 5	Degraded forest	0	Opportunistic	1	275922	9285755	28 <sup>th</sup> September 2012
Site 5	degraded	0	Opportunistic		275905	9281186	

**NB.**Net-Meter-Hours (NMH) = Total length of the net x numbers of hours the net was up in the field.

Figure 4. Location of bird survey sample sites.



#### 4.4 Results

A total of 76 bird species, including 62 genera and 26 families, were recorded during the survey (Table 6; Figure 5). Of these, four species were recorded in all five sites, Livingstone's turaco (*Tauraco livingstonii*), Mountain greenbul (*Andropadus nigriceps*), Common stonechat (*Saxicola torquatus*) and Yellow breasted apalis (*Apalis flavida*). Seven near endemic to EAM bird species were recorded in the survey, with the most near-endemic species being recorded in sites 1 (n=6) and 2 (n=6) and the least near-endemic species being recorded in sites 3 (n=3) and 5 (n=3) (Table 7). The number of species recorded closely reflects the level of observed disturbances across the survey sites (See section 5).

**Table 6.** Checklist of 76 bird species recorded in five different sites of Mamiwa-Kisara FR.

Scientific name	Common name	Author	H	R	RL	Survey sites					Total
						1	2	3	4	5	
<b>PYCNONOTIDAE</b>											
<i>Andropadus virens</i>	Little greenbul	Cassin 1858	FF	W	LC	1	1	0	1	1	4
<i>Andropadus masukuensis</i>	Shelley's greenbul	Shelley 1897	FF	EAN	LC	1	1	1	0	1	4
<i>Andropadus nigriceps</i>	Mountain greenbul	Shelley 1889	FF	W	LC	1	1	1	1	1	5
<i>Andropadus milanjensis</i>	Striped – cheeked greenbul	Shelley 1894	F	EAN	LC	1	1	0	1	0	3
<i>Nicator gularis</i>	Eastern nicator	Hartlaub and finsh 1870	F	W	LC	0	0	1	0	0	1
<b>TURDIDAE</b>											
<i>Zoothera gurneyi</i>	Orange ground thrush	Hartlaub 1864	FF	W	LC	1	1	0	1	0	3
<i>Turdus libonyanus</i>	Olive thrush	Linnaeus 1766	F	W	LC	0	0	1	0	0	1
<i>Saxicola torquatus</i>	Common stonechat*	Linnaeus 1766	O	W	LC	1	1	1	1	1	5
<i>Pogonocichla stellata</i>	White-starred robin	Vieillot 1818	FF	W	LC	1	1	0	1	1	4
<i>Cossypha anomala</i>	Olive-flanked robin-chat	Shelley 1893	F	W	LC	1	0	1	1	0	3
<i>Cossypha natalensis</i>	Red-capped robin-chat	Smith 1840	F	W	LC	1	1	1	1	0	4
<i>Alethe fuelleborni</i>	White-chested alethe	Reichenow 1900	FF	W	LC	1	0	1	1	0	3
<i>Cercotrichas leucophrys</i>	White-browed scrub-robin	Vieillot 1817	O	W	LC	1	0	1	0	0	2
<b>SYLVIIDAE</b>											
<i>Chloropeta similis</i>	Mountain yellow warbler	Richmond 1897	F	W	LC	1	0	1	0	0	2
<i>Phylloscopus ruficapilla</i>	Yellow-throated woodland	Sundevall 1850	FF	W	LC	1	0	0	0	0	1
<i>Bradypterus lopezi</i>	Evergreen forest warbler	Alexander 1903	FF	W	LC	1	1	1	1	0	4
<i>Apalis flavida</i>	Yellow-breasted apalis*	Strickland 1852	F	W	LC	1	1	1	1	1	5
<i>Apalis melanoce-</i>	Black-headed apalis	Fischer & Reichenow	FF	W	LC	1	1	1	0	0	3

Scientific name	Common name	Author	H	R	RL	Survey sites					Total
						1	2	3	4	5	
<i>phala</i>		1884									
<i>Apalis thoracica</i>	Bar-throated apalis	Shaw 1811	F	W	LC	1	1	0	1	1	4
<i>Apalis chapini</i>	Chapin's apalis	Friedmann 1928	FF	EAN	LC	1	1	0	1	1	4
<i>Artisornis metopias</i>	African tailorbird	Reichenow 1907	F	EAN	LC	1	0	1	0	1	3
<b>MUSCICAPIDAE</b>											
<i>Muscicapa adusta</i>	African dusky	Boie 1828	O	W	LC	1	1	0	1	0	3
<b>MONARCHIDAE</b>											
<i>Trochocercus albonotatus</i>	White-tailed crested flycatcher	Sharpe 1819	FF	W	LC	1	1	1	0	0	3
<i>Terpsiphone viridis</i>	Paradise flycatcher	Statius muller 1776	F	W	LC	1	0	0	1	0	2
<b>PLATYSTEIRIDAE</b>											
<i>Batis crypta</i>	Dark batis	Fjelds�, Bowie & Kiure, 2006	F	EAN	LC	1	1	0	1	0	3
<b>TIMALIIDAE</b>											
<i>Modulatrix stictigula</i>	Spot-throat	Reichenow 1906	F	EAN	LC	1	1	1	1	0	4
<i>Pseudoalcippe abyssinica</i>	African hill babbler	Ruppell 1840	F	W	LC	1	1	1	1	0	4
<b>ZOSTEROPIDAE</b>											
<i>Zosterops senegalensis</i>	Yellow white-eye	Bonaparte 1850	FF	W	LC	1	1	0	1	0	3
<b>NECTARINIIDAE</b>											
<i>Nectarinia olivacea</i>	Olive sunbird	Smith 1840	F	W	LC	1	1	1	1	0	4
<b>MALACONOTIDAE</b>											
<i>Telophorus nigrifrons</i>	Black-fronted bush boubou	Reichenow 1896	O	W	LC	1	0	1	0	1	3
<i>Telophorus quadricolor</i>	Four-coloured Bush-shrike	Cassin 1851	O	W	LC	1	1	0	1	1	4
<b>CORVIDAE</b>											
<i>Corvus albus</i>	Pied crow	Muller 1776	O	W	LC	0	0	1	0	0	1
<i>Corvus albicollis</i>	White-necked raven	Latham 1790	O	W	LC	0	1	0	0	0	1
<b>ORIOIIDAE</b>											
<i>Oriolus chlorocephalus</i>	Green-headed oriole	Shelley 1896	FF	EAN	LC	0	1	0	0	0	1
<i>Lonchura cucullata</i>	Bronze Mannikin	Swainson 1837	FF	W	LC	1	0	0	1	0	2
<b>PASSERIDAE</b>											
<i>Lonchura bicolor</i>	Black and white manikin	Fraser 1843	F	W	LC	1	0	0	1	0	2
<b>STURNIDAE</b>											
<i>Onychognathus morio</i>	Red-winged starling	Linnaeus 1766	O	W	LC	1	0	0	1	0	2
<i>Cinnyricinclus leucogaster</i>	Violet-backed starling	Boddaert 1783	O	W	LC	1	0	0	1	0	2
<b>PLOCEIDAE</b>											

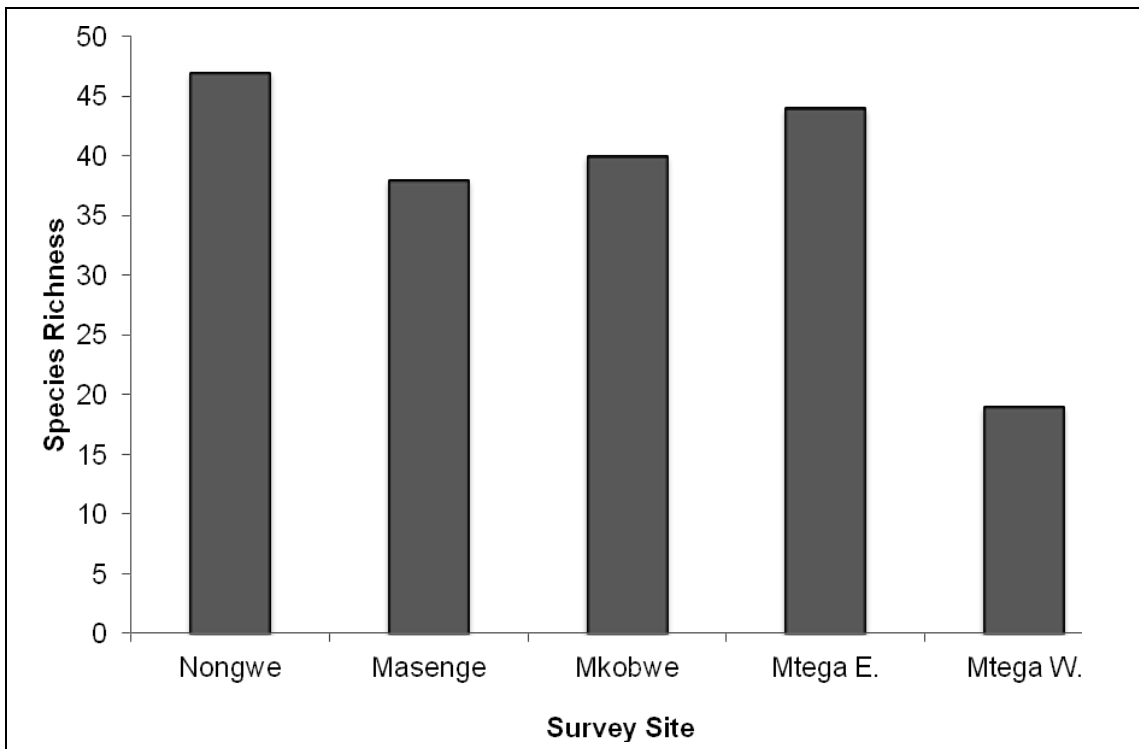
Scientific name	Common name	Author	H	R	RL	Survey sites					Total
						1	2	3	4	5	
<i>Ploceus ocularis</i>	Spectacled weaver	Smith 1839	O	W	LC	0	1	0	1	0	2
<i>Euplectes capensis</i>	Yellow bishop	Linnaeus 1766	O	W	LC	0	0	0	0	1	
<b>EMBERIZIDAE</b>											
<i>Hypargos niveoguttatus</i>	Peter's twinspace	Peters 1868	FF	W	LC		0	1	0	0	1
<i>Cryptospiza reichenovii</i>	Red-faced crimsonwing	Hartlaub 1874	FF	W	LC	1	1	1	1	0	4
<i>Estrilda melanotis</i>	Yellow-bellied waxbill	Temminck 1823	O	W	LC	1	0	0	1	0	2
<i>Estrilda astrild</i>	Common waxbill	Linnaeus 1758	O	W	LC	0	1	0	0	0	1
<i>Lonchura cucullata</i>	Bronze manikin	Swainson 1837	O	W	LC	1	0	0	1	0	2
<b>FRINGILLIDAE</b>											
<i>Serinus mozambicus</i>	Yellow-fronted canary	Muller 1776	O	W	LC	0	1	0	1	0	2
<i>Linurgus olivaceus</i>	Oriole finch	Fraser 1842	F	W	LC	0	1	0	1	0	2
<b>ACCIPITRIDAE</b>											
<i>Polyboroides typus</i>	African harrier hawk	Smith 1829	F	W	LC	0	0	0	1	0	1
<i>Accipiter tachiro</i>	African goshawk	Daudin 1800	F	W	LC	1	0	0	1	0	2
<i>Buteo oreophilus</i>	Mountain buzzard	Hartert & Neumann 1914	F	W	NT	1	0	1	1	0	3
<i>Stephanoaetus coronatus</i>	African crowned eagle	Linnaeus 1766	F	W	NT	1	0	1	1	0	3
<i>Buteo buteo</i>	Common buzzard	Linnaeus 1758	O	W	LC	0		1	0	0	1
<i>Hieraetus spilogaster</i>	African hawk-eagle	Bonaparte 1850	O	W	LC	0	0	1	0	0	1
<b>NUMIDIDAE</b>											
<i>Guttera pucherani</i>	Crested guineafowl	Hartlaub 1861	FF	W	LC	0	0	1	0	0	1
<b>COLUMBIDAE</b>											
<i>Columba delegorguei</i>	Eastern bronze-naped pigeon	Delegorgue 1847	F	W	LC	1	0	1	0	1	3
<i>Columba arquatrix</i>	Olive pigeon	Temminck 1809	F	W	LC	0	1	0	0	1	2
<i>Columba larvata</i>	Lemon dove	Temminck 1809	FF	W	LC	1		1	0	0	2
<i>Streptopelia semitorquata</i>	Red-eyed dove	Ruppell 1837	F	W	LC	0	1	0	1	0	2
<i>Turtur afer</i>	Blue-spotted wood dove	Linnaeus 1766	O	W	LC	1	0	1	0	0	2
<i>Turtur tympanistris</i>	Tambourine dove	Temminck 1809	F	W	LC	1	1	0	1	0	3
<i>Treron calvus</i>	African green pigeon	Temminck 1808	F	W	LC	0	1	0	1	0	2
<i>Tauraco livingstonii</i>	Livingstone's turaco	Gray 1864	F	W	LC	1	1	1	1	1	5
<b>CUCULIDAE</b>											

Scientific name	Common name	Author	H	R	RL	Survey sites					Total
						1	2	3	4	5	
<i>Cuculus solitarius</i>	Red-chested cuckoo	Stephens 1815	F	W	LC	0	1	0	1	0	2
<i>Chrysococcyx cupreus</i>	African emerald cuckoo	Shaw 1792	O	W	LC	0	1	0	0	1	2
<i>Centropus superciliosus</i>	White-browed coucal	Hemprich & Ehrenberg 1833	O	W	LC	0	0	0	0	1	1
<i>Ceuthochares aereus</i>	Yellowbill	Vieillot 1817	F	W	LC	0	0	1	0	1	2
<i>Centropus superciliosus</i>	Burchell's coucal	Hemprich & Ehrenberg 1833	O	W	LC	0	0	1	0	0	1
<b>STRIGIDAE</b>											
<i>Bubo lacteus</i>	Verreaux's eagle owl	Temminck 1820	F	W	LC	0	0	1	0	0	1
<i>Strix woodfordii</i>	African wood owl	Smith 1834	F	W	LC	0	0	1	0	0	1
<b>CAPRIMULGIDAE</b>											
<i>Caprimulgus poliocephalus</i>	Mountain nightjar	Ruppell 1840	O	W	LC	1	0	1	0	0	2
<i>Caprimulgus pectoralis</i>	Fiery-necked nightjar	Cuvier 1817	O	W	LC	0	0	1	0	0	1
<b>TROGONIDAE</b>											
<i>Apaloderma vittatum</i>	Bar-tailed trogon	Shelley 1882	FF	W	LC	0	1	1	1	0	3
<i>Phoeniculus purpureus</i>	Green wood-hoopoe	Miller 1784	O	W	LC	0	1	0	0	0	1
<b>CAPITONIDAE</b>											
<i>Pogoniulus leucomystax</i>	Moustached green tinkerbird	Sharpe 1892	FF	W	LC	1	1	1	1	0	4
<b>HIRUNDINIDAE</b>											
<i>Hirundo fuligula</i>	Rock martin	Lichtenstein 1842	O	W	LC	0	0	0	1	1	2
<i>Psalido-procne pristoptera</i>	Black saw-wing	Ruppell 1836	F	W	LC	1	0	1	1	0	3
<b>SPECIES RICHNESS</b>						<b>47</b>	<b>38</b>	<b>40</b>	<b>44</b>	<b>19</b>	<b>187</b>

### Key to table 6

H = Habitat with: F = Forest, FF = Strictly Forest Dependent, O = Open; R = Range with: W = Widespread, EAN = Near Endemic to Eastern Arc Mountains; RL = Red List status: LC = Least Concern, NT = Near Threatened; 1 indicates presence of a certain birds species in a given survey site and 0 indicates species absence.





**Figure 5.** Birds species richness at different survey sites in Mamiwa-Kisara Forest Reserve.

**Table 7.** Near endemic birds species recorded in Mamiwa-Kisara forest across five survey sites.

Scientific name	Common name	Author	H	R	RL	Survey sites					Total
						1	2	3	4	5	
<b>PYCNONOTIDAE</b>											
<i>Andropadus masukuensis</i>	Shelley's greenbul	Shelley 1897	FF	EAN	LC	1	1	1	0	1	4
<i>Andropadus milanjensis</i>	Striped-cheeked greenbul	Shelley 1894	F	EAN	LC	1	1	0	1	0	3
<b>SYLVIIDAE</b>											
<i>Apalis chapini</i>	Chapin's apalis	Friedmann 1928	FF	EAN	LC	1	1	0	1	1	4
<i>Arsitornis metopias</i>	African tailorbird	Reichenow 1907	F	EAN	LC	1	0	1	0	1	3
<b>PLATYSTEIRIDAE</b>											
<i>Batis crypta</i>	Dark batis	Fjeldsà, Bowie & Kiure, 2006	F	EAN	LC	1	1	0	1	0	3
<i>Modulatrix stictigula</i>	Spot-throat	Reichenow 1906	F	EAN	LC	1	1	1	1	0	4
<b>ORIIDAE</b>											
<i>Orilus chlorocephalus</i>	Green headed oriole	Shelley 1896	FF	EAN	LC	0	1	0	0	0	1
<b>SPECIES RICHNESS</b>						<b>6</b>	<b>6</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>22</b>

**Key to table 7**

H = Habitat with: F = Forest, FF = Strictly Forest Dependent; O = open;

R = Range with: W = Widespread, EAN = Near Endemic to the Eastern Arc Mountains;  
RL = Red List status: LC = Least Concern;  
1 indicates presence of a certain birds species in a given survey site and 0 indicates species absence.

#### 4.5 Discussion

Both endemic and IUCN red-listed bird species were observed in Mamiwa-Kisara Forest Reserve. This includes Shelley's greenbul (EAN), Green headed oriole (EAN), Forest batis (EAN), Chapin's apalis (EAN) and African tailorbird (EAN). Forest disturbance might be used as an indicator of bird species richness in the different survey areas. For example, the sites representing forests in good condition (Site 1–Nongwe and Site 4–Mtega-East) were found to have higher bird species richness (Figure 5). Conversely, the highly disturbed sites such as site 2–Masenge and Site 5–Mtega-West were found to have lower species richness. About 98% of the total species recorded in the survey were categorized as Least Concern as per IUCN categories of red listed species. Further research is required to confirm the presence or absence of more species of special conservation concern.

Of the four Eastern Arc endemic species reported as being present in the Ukaguru Mountains by Rovero *et al.* (2014), none were recorded during the current survey. Of the 14 Eastern Arc near-endemic species listed as being present in the Ukaguru Mountains by Rovero *et al.* 2014, six species were recorded but the following eight species were not recorded during the current survey:

*Arizelocichla chlorigula*  
*Cisticola nigriloris*  
*Crithagra melanochrous*  
*Laniarius fuelleborni*  
*Lanius marwitzi*  
*Poeoptera kenricki*  
*Sheppardia sharpei*  
*Stactolaema olivacea*

One Eastern Arc near endemic species was recorded in the Ukaguru by the current survey, which was not documented as being present in the Ukaguru Mountains in Rovero *et al.* (2004), *Oriolus chlorocephalus*.

## 5 Forest disturbance

### 5.1 Background

Mamiwa-Kisara North Forest Reserve faces a number of threats including grazing, firewood collection and tree / pole cutting (FBD, 2005). Fire is also a significant cause of disturbance. Rates of disturbance recorded by FBD in 2005 were lower than in many other forest reserves.

**Table 8.** Rates of pole and timber cutting recorded by FBD in 2005 in Mamiwa Kisara North FR (source FBD, 2005).

Trees/ poles	Total transect length (m)	Total area of transect (ha)	Total no.	Live % of total	Average live per ha	Dead % of total	Average dead per ha	Old cut % of total	Average old cut per ha	New cut % of total	Average new cut per ha
Trees	39000	3.9	2369	1690 (71.3)	433.3	572 (24.1)	146.7	107 (4.5)	27.4	0	0
Poles	39000	3.9	2302	1851 (80.4)	474.6	292 (12.7)	74.9	157 (6.8)	40.3	2 (0.1)	0.5

Howell *et al.* (2006) described fuel wood collection and timber extraction as the major threats in Mamiwa-Kisara South and agricultural encroachment, pitsawing, fire damages and poles extraction as threats to Mamiwa-Kisara North. Between 1975 and 2000, 51.2 % of the woodland and 4.8 % of the forest in the Ukaguru Mountains was cleared (FBD, 2006).

### 5.2 Objectives

Disturbance surveys were carried out to achieve the following aims:

1. To assess the level of disturbance in Mamiwa-Kisara Forest Reserves by documenting all observations of disturbance and their intensity.
2. To gain a general understanding of the level of threats to Mamiwa-Kisara forest and its fauna and flora.
3. To determine site-specific priorities for conservation and management.

### 5.3 Methods

A total of 13 disturbance transects were carried out at the five survey sites: four at Site 1; three at Site 2, and two at Sites 3, 4 and 5 (Table 9, Figure 7). Methods used were adapted from the TFCG survey manual (Doggart, 2006). The level of disturbance was measured by counting the number of incidents of pole cutting, timber cutting, traps and other disturbances in a 10 m strip (5m on either side of the transect line) along each 1 km transect. The disturbance transect was sub-divided into 50 m sections and data were recorded separately for each section. The longitude, latitude and altitude of the start and end points of each disturbance transect were marked with a GPS, and transect bearing was recorded and followed using a compass (Table 10).

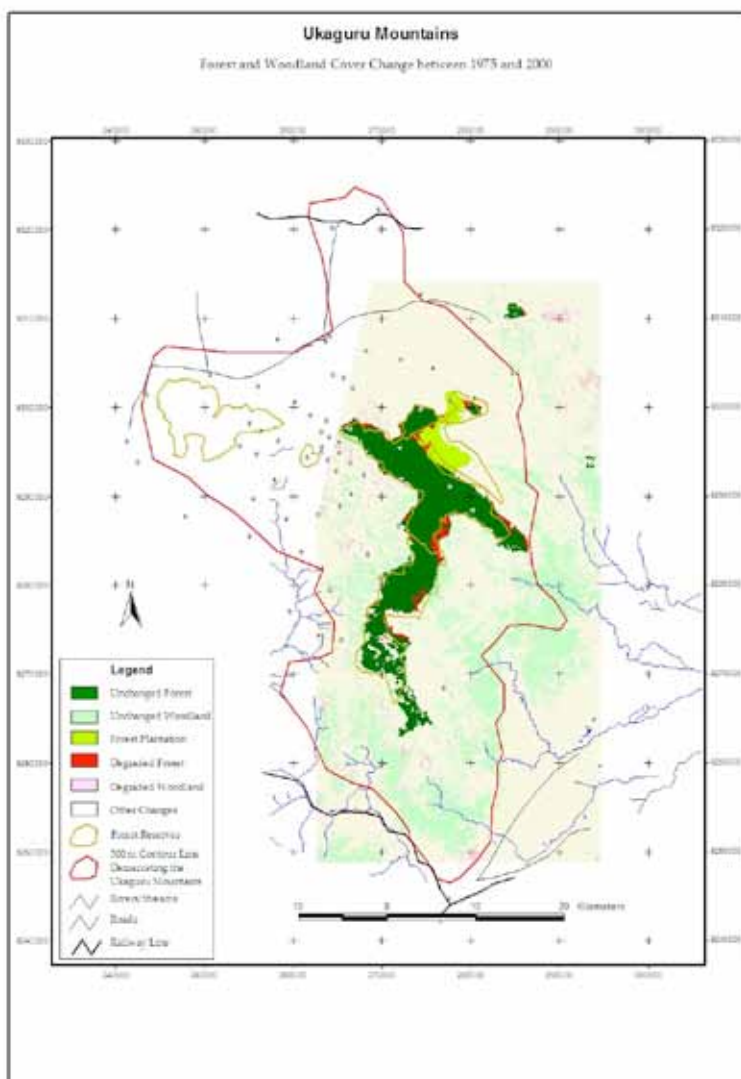
For the purpose of this survey, poles were defined as all trees with a diameter at breast height (DBH) of 5-15 cm. Timber trees were defined as all trees exceeding 15 cm DBH (see Appendices). All other forms of anthropogenic disturbance within 5 m of either side of each transect were also recorded for every 50 m section. These other forms of disturbance were defined as follows:

1. Fire damage: area affected by fire, demonstrated by burnt trees and ground vegetation.
2. Charcoal: area of charcoal burning evidenced by small patches of burnt ground with charcoal remains.
3. Pitsaw: area cleared for pitsaw activities, with pitsaw platform, or remains of such.
4. Timber/planks/poles: cut timber, planks or cut poles found on the ground ready for transport.
5. Trapping: animal traps of all varieties whether set or sprung.
6. Cultivation: evidence of crop cultivation (past or present).
7. Grazing: direct evidence or remains of cattle or goat grazing.

8. Footpath: including all human-used paths.
9. Clearing: well-established clearings within the forest as a consequence of human disturbance (usually short grassland, potentially previous settlement).

**Table 9.** Total number of disturbance transects carried out in Mamiwa-Kisara Forest Reserve.

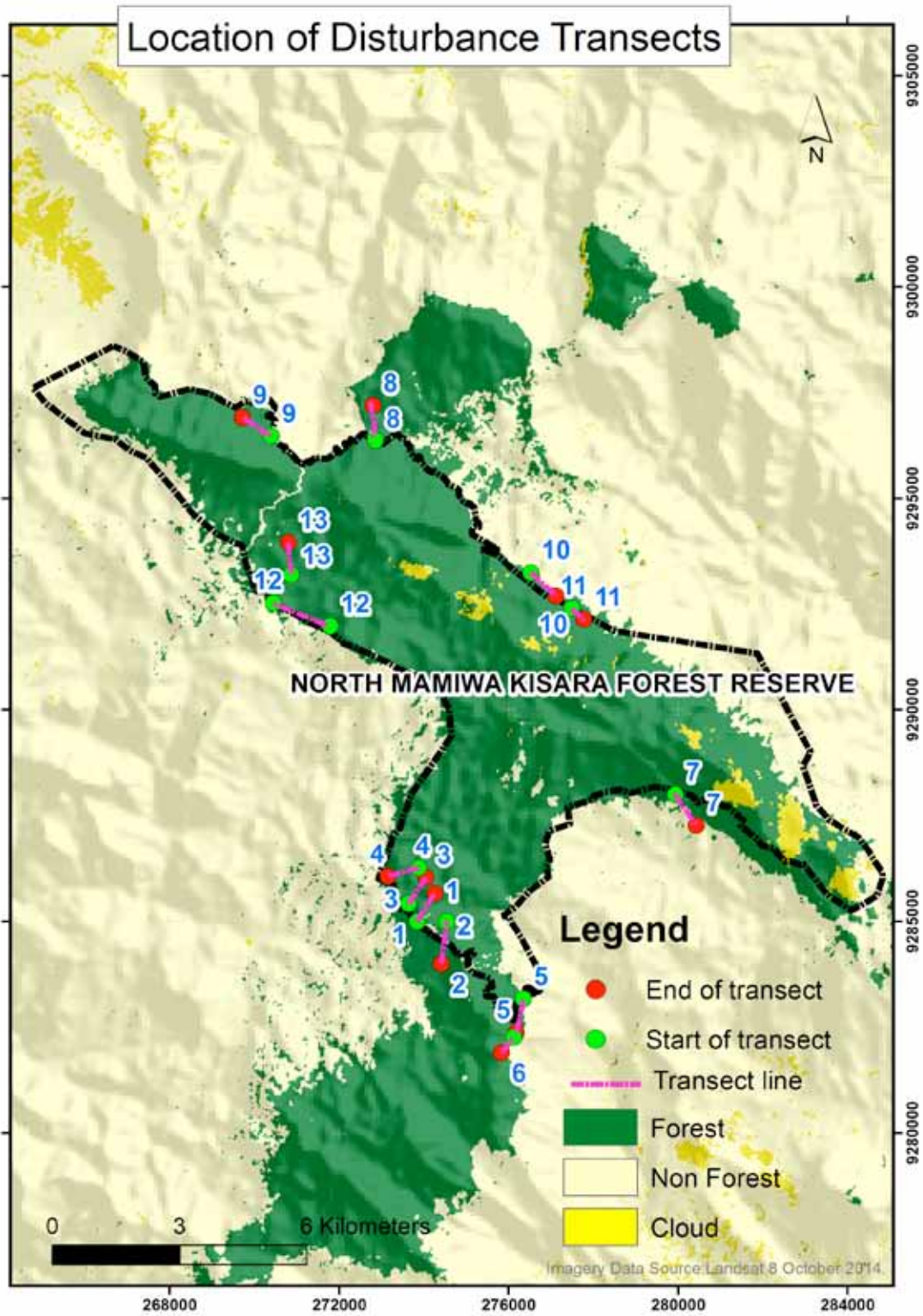
S/N	Site name	Category	No.of transect	Dates	General comments
1	Site 1 - Nongwe	Good forest	4	25-27/09/2012	Good forest
2	Site 2 - Masenge	Good forest	3	1-2/10/2012	Several disturbances especially tree cutting
3	Site 3 - Mkobwe	Good forest	2	3-4/10/2012	Several disturbances especially tree cutting
4	Site 4 - Mtega East	Degraded	2	29/09/2012 & 2/10/2012	Several disturbances especially tree cutting and agricultural encroachment
5	Site 5 – Mtega West	Good forest/ degraded	2	Sep. 28,2012	Several disturbances especially tree cutting and agricultural encroachment
<b>Total number of transects</b>			<b>13</b>		



**Figure 6.** Forest and woodland cover change between 1975 and 2000 in the Ukaguru Mountains.

The forest change analysis published by FBD (2006) shows considerable pressure on the northern and eastern borders of the Mamiwa-Kisara North Forest Reserve (Figure 6).

Figure 7. Location of disturbance transects.



**Table 10.** Details of disturbance transects including the length of each transect, start and end points, orientation and habitat types.

Site	Site name	Category	Transect	GPS coordinates (UTM)		Dates	Transect length (KM)	Transect area (ha)	Bearing	Elevation (M)	Total no. of transect/site	Veg type
				Start	End							
1	Nongwe	Good forest	1	273842/ 9284997	274261/ 9285663	25/09/ 2012	1	3.55	NE	1794/1770	4	EMF
1	Nongwe	Good forest	2	274542/ 9284997	274408/ 9283993	26/09/ 2012	0.55		SW	1686		EMF
1	Nongwe	Good forest	3	273643/ 9285422	274054/ 9286042	27/09/ 2012	1		NE	1801/1788		EMF
1	Nongwe	Good forest	4	273880/ 9286266	273155/ 9286066	27/09/ 2012	1		NW-W	1801/1782		EMF
2	Masenge	Good forest	8	272864/ 9296381	272796/ 9297197	1/10/ 2012	1	3	E	1624/1610	3	EMF (Disturbed)
2	Masenge	Good forest	9	270402/ 9296475	269722/ 9296914	1/10/ 2012	1		SE	1808/1812		EMF (Disturbed)
2	Masenge/ Mandege	Good forest	10	276525/ 9293248	277121/ 9292687	2/10/ 2012	1		NE	1449/1535		EMF (Disturbed)
3	Mkobwe	Good forest	12	271787/ 9291982	270621/ 9291311	3/10/ 2012	1	2	ESE	1731/1884	2	EMF
3	Mkobwe	Good forest	13	270876/ 9293200	270811/ 9293961	4/10/ 2012	1		N	1840/1885		EMF (Disturbed)
4	Mtega- East	Good forest	7	279931/ 9288000	280426/ 9287269	29/09/ 2012	1	1.5	S	1701/1493	2	EMF
4	Mtega- East	Degraded	11	277358/ 9292615	277586/ 9292307	2/10/ 2012	0.5		S	1607/1595		EMF (Disturbed)
5	Mtega - West	Degraded	5	276348/ 9283170	276184/ 9282375	28/09/ 2012	1	1.7	SSW	1588/1654	2	EMF (Disturbed)
5	Mtega - West	Degraded	6	276122/ 9282264	275828/ 9281893	28/09/ 2012	0.7		SW	1671/1751		EMF (Disturbed)
<b>Total</b>							<b>11.75</b>	<b>11.75</b>			<b>13</b>	

(EMF = Evergreen Mountain Forest)

#### 5.4 Results

A total of 6120 trees were sampled along the 13 transects at five sites, with an overall disturbance rate of 55.49 disturbance events/ha. Variation in disturbance intensity was found to vary between the five survey sites, with the most disturbances recorded in Site 5–Mtega-West and the least in Site 1–Nongwe (Table 11)

**Table 11.** Disturbance survey results.

Site number	Site Name	Categories	Transect	Number of trees < 15 cm				Number of trees ≥ 15 cm				Number of other disturbances	Total number of disturbances / Total rate of disturbance
				Live	Naturally dead	Cut	Fresh	Live	Naturally dead	Cut	Fresh		
1	Nongwe	Good forest	1	250	2	1	0	165	10	2	0	0	
1	Nongwe	Good forest	2	100	0	0	0	155	0	1	0	0	
1	Nongwe	Good forest	3	240	4	8	0	202	7	8	0	1	
1	Nongwe	Good forest	4	223	4	13	2	269	10	11	0	3	
<b>Subtotal – site 1</b>				<b>813</b>	<b>10</b>	<b>22</b>	<b>2</b>	<b>791</b>	<b>27</b>	<b>22</b>	<b>0</b>	<b>4</b>	<b>50</b>
<b>Disturbance subtotal/ha – site 1</b>						<b>6.2</b>	<b>0.56</b>			<b>6.2</b>	<b>0</b>	<b>1.13</b>	<b>14.08</b>
2	Masenge	Good forest	8	171	1	31	1	138	12	32	11	13	
2	Masenge	Good forest	9	143	0	60	2	190	2	49	2	9	
2	Masenge/Mandege	Good forest	10	190	2	18	9	214	11	9	6	9	
<b>Subtotal – site 2</b>				<b>504</b>	<b>3</b>	<b>109</b>	<b>12</b>	<b>542</b>	<b>25</b>	<b>90</b>	<b>19</b>	<b>31</b>	<b>261</b>
<b>Disturbance subtotal/ha – site 2</b>						<b>36.3</b>	<b>4</b>			<b>30</b>	<b>6.34</b>	<b>10.34</b>	<b>87</b>
3	Mkobwe	Good forest	12	285	0	17	3	314	2	18	1	8	
3	Mkobwe	Good forest	13	291	0	3	0	339	1	12	0	9	
<b>Subtotal – site 3</b>				<b>576</b>	<b>0</b>	<b>20</b>	<b>3</b>	<b>653</b>	<b>3</b>	<b>30</b>	<b>1</b>	<b>17</b>	<b>71</b>
<b>Disturbance subtotal/ha – site 3</b>						<b>10</b>	<b>1.5</b>			<b>15</b>	<b>0.5</b>	<b>8.5</b>	<b>35.5</b>

Site number	Site Name	Categories	Transect	Number of trees < 15 cm				Number of trees ≥ 15 cm				Number of other disturbances	Total number of disturbances / Total rate of disturbance
				Live	Naturally dead	Cut Old	Cut Fresh	Live	Naturally dead	Cut Old	Cut Fresh		
4	Mtega-East	Good forest	7	313	13	35	2	294	14	11	0	0	
4	Mtega-East	Degraded	11	122	2	19	1	131	10	1	1	6	
<b>Subtotal – site 4</b>				<b>435</b>	<b>15</b>	<b>54</b>	<b>3</b>	<b>425</b>	<b>24</b>	<b>12</b>	<b>1</b>	<b>6</b>	<b>76</b>
<b>Disturbance subtotal/ha – site 4</b>						<b>36</b>	<b>2</b>			<b>8</b>	<b>0.67</b>	<b>4</b>	<b>50.67</b>
5	Mtega-West	Degraded	5	151	3	51	2	132	7	59	0	14	
5	Mtega-west	Degraded	6	173	0	45	2	157	3	17	1	3	
<b>Subtotal – site 5</b>				<b>324</b>	<b>3</b>	<b>96</b>	<b>4</b>	<b>289</b>	<b>10</b>	<b>76</b>	<b>1</b>	<b>17</b>	<b>194</b>
<b>Disturbance subtotal/ha – site 5</b>						<b>56.48</b>	<b>2.35</b>			<b>44.7</b>	<b>0.59</b>	<b>10</b>	<b>114.12</b>
<b>Total</b>				<b>2652</b>	<b>31</b>	<b>301</b>	<b>24</b>	<b>2700</b>	<b>89</b>	<b>230</b>	<b>22</b>	<b>75</b>	<b>652</b>
<b>Total disturbance events per hectare</b>						<b>25.62</b>	<b>2.04</b>			<b>19.57</b>	<b>1.87</b>	<b>6.38</b>	<b>55.49</b>



### 5.4.1 Poles extraction

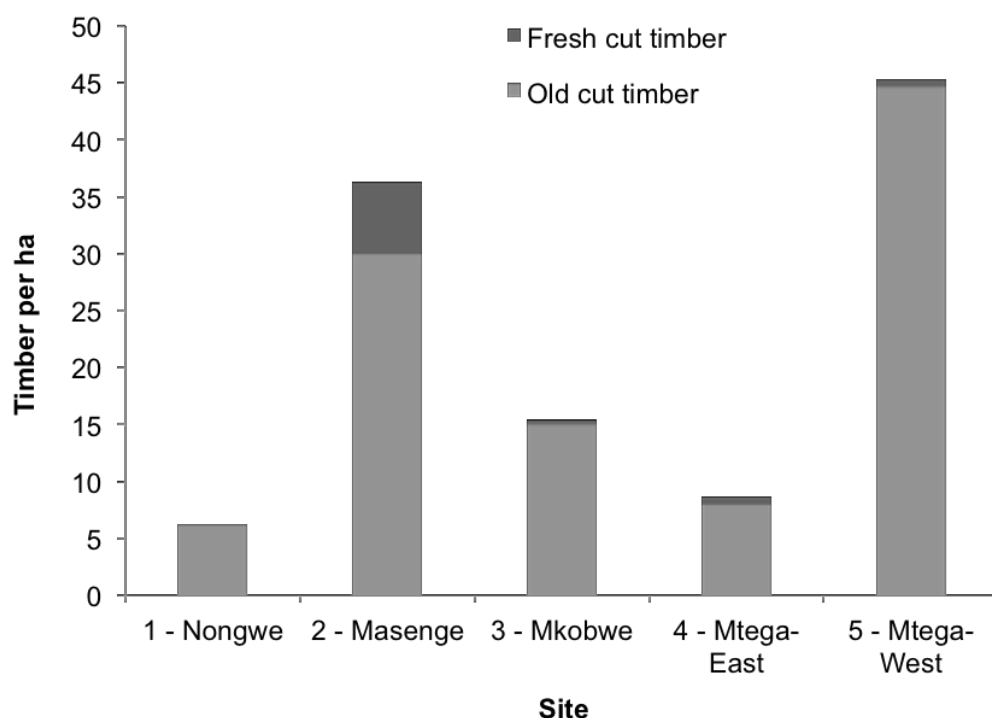
A total of 325 pole disturbance events were recorded. Of these, 93% (n = 301) were old cut poles and 7% (n = 24) were freshly cut poles. Site 5 – Mtega-West had the highest rate of total cut poles per hectare, and Site 1 – Nongwe the lowest (Figure 8).



**Figure 8.** Rate of cut poles recorded per hectare across survey sites in Mamiwa-Kisara Forest Reserve.

### 5.4.2 Timber extraction.

A total of 252 timber disturbance events were observed in Mamiwa-Kisara Forest Reserve. Of this, 91% was old cut timber (n = 230) and 9% (n = 22) was freshly cut timber. As recorded for pole disturbance, Site 5 – Mtega-West had the highest rate of total cut timber per hectare, and Site 1 – Nongwe the lowest (Figure 9).



**Figure 9.** Rate of cut timber recorded per hectare across survey sites in Mamiwa-Kisara Forest Reserve.

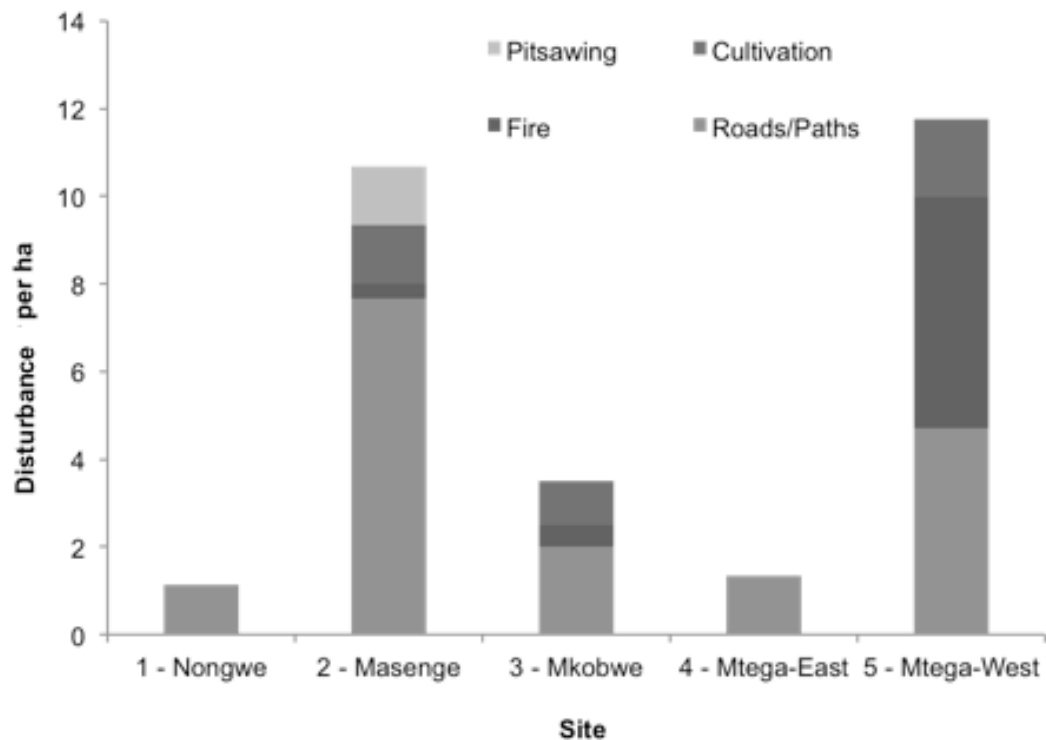
### 5.4.3 Other disturbance

In total, 75 other disturbance events were recorded across the survey area (Table 11). Of these, 68% (n = 51) were paths/roads, 15% (n=11) was fire damage, 5% (n=4) were pitsaw and 12% (n=9) was agriculture (cultivation). Again, Site 5 – Mtega-West had the highest rate of other disturbance events per hectare, and Site 1 – Nongwe the lowest (Figure 6).

**Table 12.** Other disturbances recorded in Mamiwa-Kisara forest at each transect per survey site.

Survey site	Transect	Disturbance type				Total other disturbance/ Total rate of disturbance
		Roads/Paths	Fire	Cultivation	Pitsawing	
Site 1-NNGW	1	0	0	0	0	0
	2	0	0	0	0	0
	3	1	0	0	0	1
	4	3	0	0	0	3
<b>Subtotal – site 1</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>Subtotal/ha – site 1</b>		<b>1.13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1.13</b>
Site 2-MSN	8	10	0	0	4	14
	9	9	0	0	0	9

Survey site	Transect	Disturbance type				Total other disturbance/ Total rate of disturbance
		Roads/Paths	Fire	Cultivation	Pitsawing	
	10	4	1	4	0	9
<b>Subtotal – site 2</b>		<b>23</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>32</b>
<b>Subtotal/ha – site 2</b>		<b>7.67</b>	<b>0.34</b>	<b>1.34</b>	<b>1.34</b>	<b>10.67</b>
Site 3-MKBW	12	8	0	0	0	8
	13	6	1	2	0	9
<b>Subtotal – site 3</b>		<b>14</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>17</b>
<b>Subtotal/ha – site 3</b>		<b>2</b>	<b>0.5</b>	<b>1</b>	<b>0</b>	<b>8.5</b>
Site 4- MTG -EAST	7	0	0	0	0	0
	11	2	0	0	0	2
<b>Subtotal – site 4</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>
<b>Subtotal/ha – site 4</b>		<b>1.34</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1.34</b>
Site 5-MTG-W	5	5	9	0	0	14
	6	3	0	3	0	6
<b>Subtotal – site 5</b>		<b>8</b>	<b>9</b>	<b>3</b>	<b>0</b>	<b>20</b>
<b>Subtotal/ha – site 5</b>		<b>4.7</b>	<b>5.29</b>	<b>1.76</b>	<b>0</b>	<b>11.76</b>
<b>Total</b>		<b>51</b>	<b>11</b>	<b>9</b>	<b>4</b>	<b>75</b>
<b>Total per hectare</b>		<b>4.34</b>	<b>0.94</b>	<b>0.77</b>	<b>0.34</b>	<b>6.38</b>



**Figure 10.** Rate of other disturbance events recorded per hectare across survey sites in Mamiwa-Kisara Forest Reserve.

## 5.5 Discussion

The types of disturbance observed within Mamiwa-Kisara Forest Reserve varied by survey site. However, Site 5 – Mtega-West consistently had the highest rate of disturbance per hectare, and Site 2 – Masenge the second highest. This might be due to easier accessibility, as both sites are close to the villages. Lack of boundary marking has resulted in agricultural encroachment into the reserve especially at Mtega-West and Masenge. Lovett and Pocs (1993) also observed the same types of disturbance within Mamiwa-Kisara Forest Reserve. Pitsawing was observed in the Masenge area. Human footpaths were a dominant type of other disturbance; these footpaths traverse the Forest Reserve facilitating access especially in the Masenge-North area.

The mean rate of tree cutting recorded in the reserve is significantly lower than the average rate recorded for Central Government Forest Reserves in 2004 (FBD, 2005). For example, the survey recorded a mean rate of 27.6 cut trees (old and new) per hectare compared with an average of 35.8 cut trees per hectare for 19 Central Government Forest Reserves. Similarly for poles, the rate recorded for Mamiwa-Kisara of 21.4 cut poles (old and new) per hectare is half the mean rate (42.1 cut poles per hectare) recorded in 2004. Although the mean rate is lower, the rate at Site 5 is significantly higher than the mean rate recorded in other reserves highlighting the need to concentrate management efforts in this area.

## 6 Conclusions & Recommendations

Literature indicates that the Mamiwa-Kisara forest is the most important forest in the Ukaguru Mountains in terms of its biodiversity values providing habitat for three Ukaguru-endemic vertebrate species and one Ukaguru-endemic plant species, including the charismatic and Critically Endangered tree toad, *Churamiti maridadi*. Global analyses by BirdLife International classify the Ukaguru Mountains as an Important Bird Area (IBA) and a Key Biodiversity Area (KBA).

The TFCG surveys recorded 234 plant and 76 bird species in Mamiwa-Kisara FR including 12 Eastern Arc endemic plant taxa and seven bird species endemic to the Eastern Arc and adjacent areas. Additional survey effort is required to assess the status of mammals, herpetofauna and invertebrates in the reserve.

Overall, the survey indicates high forest disturbances in terms of tree cutting, path/roads, clearance of forest for agriculture and pitsawing at Sites 5–Mtega-West and 2–Masenge.

Survey results indicate a negative correlation between species richness and the number of disturbance event in the forest. For example, site 1–Nongwe, which was less disturbed than other sites, was found to have high numbers of plant and bird species.

Additional management effort and investment is needed to prevent further forest and biodiversity loss from the reserve.

It is recommended that:

1. The Tanzania Forest Services Agency work closely with local government and adjacent communities to prevent further forest clearance and logging, particularly in the Mtega West and Masenge areas.
2. The Tanzania Forest Services Agency collaborates with adjacent communities and local government in order to establish equitable joint forest management.
3. Further research is carried out to understand the distribution, abundance and conservation status of flagship species that are rare and cryptic within the reserve.
4. Both biodiversity and threat monitoring are carried out to update knowledge of this forest. This is crucial to improve the biodiversity assessment of the forest, and to improve detection of changes in species abundance and distribution. This is especially true for species of conservation concern such as restricted range species and those that are IUCN Red Listed above Least Concern. It is recommended that such monitoring include methods to capture information on reptiles and small to medium mammals.
5. Proper forest boundary marking is necessary to reduce human encroachment in the forest. Forest boundaries are currently unclear, resulting in rapid encroachment by agriculture especially at Mtega, Ng'one and Mandege areas.
6. Awareness raising events should be organized involving adjacent communities and other stakeholders in order that there is a better understanding of the importance of the reserve and the threats that it is currently facing.

## 7 References

- Baker, N.E. and E.M. Baker (2002) Important Bird Areas in Tanzania. A first inventory. WCST.
- BirdLife International (2012). Important Bird Areas factsheet: Ukaguru Mountains forests. Downloaded from <http://www.birdlife.org> on 25/03/2013.
- Burgess, N.D. (2005). How many species are confined to the Eastern Arc Mountains? In The Arc Journal. Issue No.19. Tanzania Forest Conservation Group.
- CEPF (2008). Biodiversity Research and Awareness in the Lesser Known Eastern Arc Mountains: Mahenge, Rubeho, Ukaguru and Nguru (BREAM).Tanzania.
- Doggart, N. (2006). Filling the knowledge gap: Methods Manual. Tanzania Forest Conservation Group / Museo Tridentino di Scienze Naturali, Dar es Salaam, Tanzania. 79pp
- Evans, T.D. and G.Q.A. Anderson (eds.) 1992. A wildlife survey of the East Usambra and Ukaguru Mountains, Tanzania. Study Report No. 53. ICBP. Cambridge.
- Forestry and Beekeeping Division (2005). Forest condition assessment of the Eastern Arc Mountains Forests of Tanzania. Compiled by Madoffe, S.S. and P.K.T. Munishi for Conservation and Management of the Eastern Arc Mountain Forests, Forestry and Beekeeping Division, Dar es Salaam.
- Forestry and Beekeeping Division (2006). Forest Area Baseline for the Eastern Arc Mountains. Compiled by Mbilinyi, B.P., R.E. Malimbwi, D.T.K. Shemwetta, Songorwa, E. Zahabu, J.Z. Katani and J. Kashaigili for Conservation and Management of the Eastern Arc Mountain Forests, Forestry and Beekeeping Division, Dar es Salaam.
- Friedman, H. and K.E. Stager 1964. Results of the Cheney Tanganyika Expedition. Contributions in Science No. 84. Los Angeles County Museum.
- Fuggles-Couchman, N. R. 1939. Notes on some birds of the Eastern Province of Tanganyika Territory. – The Ibis 14: 76–106.
- Howell, K. and A. Channing (2004). Churamiti maridadi. The IUCN Red List of Threatened Species. Version 2014.2. [www.iucnredlist.org](http://www.iucnredlist.org). Downloaded on 14 November 2014.
- Lovett J. & Pócs T. (1993). Assessment of the condition of the Catchment Forest Reserves, a botanical appraisal. Morogoro Region, Tanzania. 58 pp.
- Menegon M., Salvadio S., Ngalason W. and Loader S. (2007). A new dwarf forest toad (Amphibia: Bufonidae: *Nectophrynooides*) from the Ukaguru Mountains, Tanzania. 1-10pp.
- Rovero, F., M. Menegon, J. Fjeldsa, L. Collett, N. Doggart, C. Leonard, G. Norton, N. Owen, A. Perkin, D. Spitale, A. Ahrends and Neil. D. Burgess. (2014). Targeted vertebrate surveys enhance the faunal importance and improve explanatory models within the Eastern Arc Mountains of Kenya and Tanzania. Diversity and Distributions, 1–12.

## 8 Appendices.

### Appendix 1. Botanical collection in Mamiwa–Kisara Forest Reserve.

Family	Scientific name	Habit	Habitat	Coll.No	Site 1	Site 2	Site 3	Site 4	Site 5	Distribution
Acanthaceae	<i>Brilliantaisia cicatricosa</i>	Herb	Forest	MM 8158	1	1	1	1	1	AFR
Acanthaceae	<i>Hypoestes</i>	Herb	Forest	MM 8125	1	1	1	0	0	
Acanthaceae	<i>Justicia</i>	Herb	Forest	MM 8197	1	1	1	1	1	
Acanthaceae	<i>Phaulopsis imbricata</i> subsp. <i>imbricata</i>	Herb	Forest	MM 8186	1	1	1	1	1	WS EAM: Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Acanthaceae	<i>Pseuderanthemum campylosiphon</i>	Shrub	Forest	MM 8192	1	1	1	1	1	
Acanthaceae	<i>Thunbergia alata</i>	Herb	Forest	MM 8259	1	1	1	1	0	WS
Amaranthaceae	<i>Aerva lanata</i>	Herb	Forest	MM 8255	1	0	0	1	0	WS
Amaranthaceae	<i>Cyathula</i>	Herb	Forest	MM 8178	1	1	1	1	1	
Anacardiaceae	<i>Rhus longipes</i> var. <i>longipes</i>	Tree	Forest	MM 8217	1	1	1	1	1	AFR
Annonaceae	<i>Aitobotrys</i>	Liane	Forest	MM 8149	1	1	0	0	0	WS
Annonaceae	<i>Artabotrys monteiroae</i>	Liana	Forest	MM 8193	1	1	0	0	0	WS
Annonaceae	<i>Monodora globiflora</i>	Tree	Forest	MM 8143	1	1	0	0	1	EAM: Ukaguru, Rubeho, Udzungwa
Anthericaceae	<i>Chlorophytum filipendulum</i> subsp. <i>filipendulum</i>	Herb	Forest	MM 8130	1	1	1	1	1	AFR
Anthericaceae	<i>Chlorophytum filipendulum</i> subsp. <i>filipendulum</i>	Herb	Forest	MM 8146	1	1	0	0	1	AFR
Apiaceae	<i>Agrocharis incognita</i>	Herb	Forest	MM 8254	1	1	1	0	0	AFR
Apiaceae	<i>Sanicula elata</i>	Herb	Forest	MM 8233	1	1	1	0	0	WS
Apocynaceae	<i>Carvalhoa campanulata</i>	S/Tree	Forest	MM 8185	1	1	1	1	1	AFR
Apocynaceae	<i>Rauvolfia</i>	S/Tree	Forest	MM 8190	1	1	1	1	1	
Araliaceae	<i>Scheffera lukwangulensis</i>	Tree	Forest	MM 8218	1	1	1	1	1	EAM+LN
Araliaceae	<i>Scheffera myriantha</i>	Liana	Forest	MM 8211	1	1	1	1	1	WS
Asclepiadaceae	<i>Tacazzea conferta</i>	Liana	Forest	MM 8226	1	1	1	1	1	AFR
Asparagaceae	<i>Asparagus asparagoides</i>	Herb	Forest	MM 8078	1	1	1	1	1	WS
Aspleniaceae	<i>Asplenium</i>	Fern	Forest	MM 8229	1	1	1	0	1	
Aspleniaceae	<i>Asplenium anisophyllum</i>	Fern	Forest	MM 8231	0	1	0	1	1	WS
Aspleniaceae	<i>Asplenium erectum</i>	Fern	Forest	MM 8162	1	1	1	1	1	WS
Aspleniaceae	<i>Asplenium friesiorum</i>	Fern	Forest	MM 8221	0		0	1	1	AFR
Aspleniaceae	<i>Asplenium gemmiferum</i>	Fern	Forest	MM 8111	1	1	1	1	1	AFR
Aspleniaceae	<i>Asplenium hypomelas</i>	Fern	Forest	MM 8161	1	1	1	1	1	AFR
Aspleniaceae	<i>Asplenium rutifolium</i>	Fern	Forest	MM 8151	1	1	1	1	1	WS

Family	Scientific name	Habit	Habitat	Coll.No	Site 1	Site 2	Site 3	Site 4	Site 5	Distribution
Asteraceae	<i>Bidens kilimandscharica</i>	Herb	Forest	MM 8120	1	1	1	1	1	AFR
Asteraceae	<i>Crassocephalum crepidioides</i>	Herb	Forest	MM 8142	1	1	1	0	1	AFR
Asteraceae	<i>Helichrysum forskalii</i> var. <i>forskalii</i>	Herb	Forest	MM 8105	1	1	0	0	0	WS
Asteraceae	<i>Helichrysum schimperii</i>	Herb	Forest	MM 8076	1	1	0	0	0	WS
Asteraceae	<i>Microglossa</i>	Herb	Forest	MM 8089	1	1	0	0	0	
Asteraceae	<i>Mikania chenopodiifolia</i>	Herb	Forest	MM 8188	1	1	1	1	1	WS
Asteraceae	<i>Senecio</i>	Herb	Forest	MM 8117	1	1	0	0	1	
Asteraceae	<i>Senecio</i>	Herb	Forest	MM 8205	1	1	0	1	1	
Asteraceae	<i>Vernonia</i>	Herb	Forest	MM 8176	1	1	0	0	1	
Asteraceae	<i>Vernonia</i>	S/Tree	Forest	MM 8214	1	1	1	1	1	
Asteraceae	<i>Vernonia</i>	Herb	Forest	MM 8234	1	1	0	1	1	
Balsaminaceae	<i>Impatiens</i>	Herb	Forest	MM 8199	1	1	1	1	1	
Balsaminaceae	<i>Impatiens</i>	Herb	Forest	MM 8212	1	1	1	1	1	
Balsaminaceae	<i>Impatiens nana</i>	Herb	Forest	MM 8240	1	1	0	0	0	EAM+NV
Balsaminaceae	<i>Impatiens pseudoviola</i>	Herb	Forest	MM 8237	1	1	1	1	1	AFR
Balsaminaceae	<i>Impatiens raphidothrix</i>	Herb	Forest	MM 8099	0	0	1	1	1	AFR
Basellaceae	<i>Basella alba</i>	Herb	Forest	MM 8159	1	1	1	1	1	WS
Begoniaceae	<i>Begonia meyeri-johannis</i>	Herb	Forest	MM 8091	1	1	0	0	1	AFR
Bignoniaceae	<i>Tecomaria capensis</i> subsp. <i>nyassae</i>	S/Tree	Forest	MM 8068	1	1	1	1	1	AFR
Boraginaceae	<i>Cynoglossum lanceolatum</i>	Herb	Forest	MM 8245	1	1	0	0	1	WS
Campanulaceae	<i>Lobelia goetzei</i>	Herb	Grassland	MM 8100	1	1	0	0	1	AFR
Campanulaceae	<i>Lobelia goetzei</i>	Herb	Forest	MM 8100	1	1	0	0	0	AFR
Caryophyllaceae	<i>Drymaria cordata</i>	Herb	Forest	MM 8177	0	1	1	1	0	WS
Celastraceae	<i>Maytenus acuminata</i>	Tree	Forest	MM 8088	1	1	1	1	1	AFR
Celastraceae	<i>Maytenus undata</i>	Tree	Forest	MM8124						WS
Celastraceae	<i>Mystroxylon aethiopicum</i>	Tree	Forest	MM 8118	1	1	1	0	1	WS
Celastraceae	<i>Salacia erecta</i>	Liana	Forest	MM 8209	1	1	0	0	1	AFR
Celastraceae	<i>Salacia lehmbackii</i>	Tree	Forest	MM 8153	1	0	0	1	1	AFR
Celastraceae	<i>Simirestis goetzei</i>	Liana	Forest	MM 8180	0	1	1	0	1	AFR
Clusiaceae	<i>Allanblackia ulugurensis</i>	Tree	Forest	MM 8112	1	1	0	0	0	EAM: Nguru, Ukaguru, Uluguru, Udzungwa
Clusiaceae	<i>Garcinia kingaensis</i>	Tree	Forest	MM 8154	1	1	1	1	1	AFR
Clusiaceae	<i>Garcinia kingaensis</i>	Tree	Forest	MM 8196	1	1	1	1	1	AFR
Crassulaceae	<i>Kalanchoe crenata</i> subsp. <i>crenata</i>	Herb	Forest	MM 8070						WS
Cucurbitaceae		Herb	Forest	MM 8170	1	1	0	1	0	



Family	Scientific name	Habit	Habitat	Coll.No	Site 1	Site 2	Site 3	Site 4	Site 5	Distribution
Cucurbitaceae	<i>Zehneria scabra</i>	Herb	Forest	MM 8247	1	1	1	1	1	WS
Cyperaceae	<i>Carex</i>	Sedge	Forest	MM 8109	1	1	1	1	1	
Dennstaedtiaceae	<i>Blotiella stipitata</i>	Fern	Forest	MM 8126	1	1	1	1	1	AFR
Ericaceae	<i>Agarista salicifolia</i>	Tree	Forest	MM 8067	1	1	1	1	1	WS
Ericaceae	<i>Erica benguelensis</i> var. <i>benguelensis</i>	Shrub	Forest	MM 8119	1	1	0	0	0	AFR
Ericaceae	<i>Erica benguelensis</i> var. <i>benguelensis</i>	Shrub	Forest	MM 8216	1	1	0	0	0	AFR
Euphorbiaceae	<i>Acalypha volkensii</i>	Shrub	Forest	MM 8074	1	1	1	1	1	AFR
Euphorbiaceae	<i>Alchornea hirtella</i>	Tree	Forest	MM 8104	1	1	1	1	1	AFR
Euphorbiaceae	<i>Bridelia brideliifolia</i>	Tree	Forest	MM 8092	1	1	1	1	1	AFR
Euphorbiaceae	<i>Clusia abyssinica</i> var. <i>usambarica</i>	Shrub	Forest	MM 8248	1	1	0	1	1	AFR
Euphorbiaceae	<i>Erythrococca ulugurensis</i>	Shrub	Forest	MM 8132	1	1	1	1	1	EAM+CF
Euphorbiaceae	<i>Erythrococca usambarica</i>	Shrub	Forest	MM 8098	1	1	1	1	1	AFR
Euphorbiaceae	<i>Euphorbia usambarica</i> subsp. <i>usambarica</i>	Sh/Tree	Forest	MM 8222	1	1	1	1	1	AFR
Fabaceae	<i>Caesalpinia decapetala</i>	Liana	Forest	MM 8238	1	1	0	0	1	introduced
Fabaceae	<i>Crotalaria incana</i> subsp. <i>purpureascens</i>	Shrub	Forest	MM 8235	1	0	1	1	0	WS
Fabaceae	<i>Milletia oblata</i> subsp. <i>intermedia</i>	Tree	Forest	MM 8165	1	1	1	1	1	EAM+CF+LN
Flacourtiaceae	<i>Aphloia theiformis</i>	Tree	Forest	MM 8072	1	1	0	1	1	WS
Flacourtiaceae	<i>Caloncoba welwitschii</i>	Tree	Forest	MM 8106	1	1	1	1	1	AFR
Flacourtiaceae	<i>Gerrardina eylesiana</i>	Liana	Forest	MM 8083	1	1	0	0	1	AFR
Flacourtiaceae	<i>Kiggelaria africana</i>	Tree	Forest	MM 8257						AFR
Flacourtiaceae	<i>Rawsonia reticulata</i>	Tree	Forest	MM 8086	1	1	1	1	1	AFR
Flacourtiaceae	<i>Rawsonia reticulata</i>	Tree	Forest	MM 8152	1	1	1	1	1	AFR
Flacourtiaceae	<i>Rawsonia reticulata</i>	Tree	Forest	MM 8225	1	1	1	1	1	AFR
Flacourtiaceae	<i>Scolopia rhamniphylla</i>	Tree	Forest	MM 8134	1	1	0	0	0	AFR
Gesneriaceae	<i>Streptocarpus schliebenii</i>	Herb	Forest	MM 8219	0	1	0	0	0	EAM: Nguru, Ukaguru, Udzungwa
Ilacinaeae	<i>Alsodeiopsis schumannii</i>	Tree	Forest	MM 8194	1	0	0	1	1	EAM: E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Udzungwa, Mahenge
Ilacinaeae	<i>Apodytes dimidiata</i>	Tree	Forest	MM 8102						WS
Iridaceae	<i>Aristea goetzei</i>	Herb	Forest	MM 8220	1	1	1	1	1	WS
Lamiaceae	<i>Leucas deflexa</i> var. <i>kondowensis</i>	Herb	Forest	MM 8167	1	1	0	0	0	AFR
Lamiaceae	<i>Plectranthus</i>	Herb	Forest	MM 8156	1	0	0	0	1	
Lamiaceae	<i>Plectranthus</i>	Herb	Forest	MM 8204	1	1	0	0	1	
Lamiaceae	<i>Plectranthus malawiensis</i>	Herb	Forest	MM 8208	1	1	0	0	1	AFR
Lamiaceae	<i>Plectranthus parvus</i>	Herb	Forest	MM 8241	1	1	1	1	0	AFR

Family	Scientific name	Habit	Habitat	Coll.No	Site 1	Site 2	Site 3	Site 4	Site 5	Distribution
Lamiaceae	<i>Salvia nilotica</i>	Herb	Forest	MM 8179	1	1	0	0	0	AFR
Lauraceae	<i>Cryptocarya liebertiana</i>	Tree	Forest	MM 8139						AFR
Lauraceae	<i>Ocotea kenyensis</i>	Tree	Forest	MM 8136	1	1	0	0	0	AFR
Lauraceae	<i>Ocotea usambarensis</i>	Tree	Forest	MM 8215	1	1	1	1	0	AFR
Loganiaceae	<i>Buddleja pulchella</i>	Shrub	Forest	MM 8242	0	1	0	1	1	AFR
Loganiaceae	<i>Mostuea brunonis</i> var. <i>brunonis</i>	S/Tree	Forest	MM 8103	0	1	1	1	1	WS
Loganiaceae	<i>Nuxia congesta</i>	Tree	Forest	MM 8258	0	1	0	1	0	AFR
Loganiaceae	<i>Nuxia floribunda</i>	Tree	Forest	MM 8084	1	1	0	1	1	AFR
Loranthaceae		Parasite	Forest	MM 8116	1	1	1	1	0	
Loranthaceae	<i>Agelanthus subulatus</i>	Parasite	Forest	MM 8181	1	1	1	0	1	AFR
Loranthaceae	<i>Englerina inaequilatera</i>	Parasite	Forest	MM 8123	1	1	0	0	0	AFR
Lycopodiaceae	<i>Lycopodium clavatum</i>	Fern	Forest	MM 8210	0	0	0	1	1	WS
Malvaceae	<i>Hibiscus</i>	Shrub	Forest	MM 8075						
Malvaceae	<i>Hibiscus fuscus</i>	Shrub	Forest	MM 8168	1	1	1	1	1	AFR
Malvaceae	<i>Pavonia urens</i>	Shrub	Forest	MM 8249	0	1	0	0	0	WS
Malvaceae	<i>Pavonia urens</i>	Shrub	Forest	MM 8252	0	0	0	0	1	WS
Melastomataceae	<i>Dissotis aprica</i>	Shrub	Forest	MM 8081	1	1	0	0	0	EAM+CF
Melastomataceae	<i>Dissotis princeps</i> var. <i>candolleana</i>	Shrub	Forest	MM 8080	1	0	0	1	1	AFR
Melastomataceae	<i>Medinilla engleri</i> Gilg	Epiphyte	Forest	MM 8090	1	1	0	0	1	EAM: E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Melastomataceae	<i>Memecylon myrtilloides</i>	Tree	Forest	MM 8087	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru,
Melastomataceae	<i>Warneckea</i>	Tree	Forest	MM 8163	1	1	1	1	1	Rubeho
Melastomataceae	<i>Warneckea</i>	Tree	Forest	MM 8227						
Meliaceae	<i>Lepidotrichilia volkensii</i>	Tree	Forest	MM 8223	1	1	1	1	0	AFR
Meliaceae	<i>Turraea holstii</i> Harms	Tree	Forest	MM 8148	1	1	1	1	1	WS
Meliastomataceae	<i>Bersama abyssinica</i> subsp. <i>abyssinica</i>	Tree	Forest	MM 8157	1	1	1	1	1	AFR
Meliastomataceae	<i>Bersama abyssinica</i> subsp. <i>abyssinica</i>	Tree	Forest	MM 8236	1	1	1	1	0	AFR
Menispermaceae	<i>Stephania abyssinica</i> var. <i>tomentella</i>	Herb	Forest	MM 8174	0	0	1	1	1	AFR
Monimiaceae	<i>Xymalos monospora</i>	Tree	Forest	MM 8085	1	1	1	0	0	AFR
Moraceae	<i>Dorstenia holstii</i> var. <i>longestipulata</i>	Herb	Forest	MM 8129	1	1	0	0	1	EAM+CF
Myricaceae	<i>Morella salicifolia</i> subsp. <i>kilimandscharica</i>	Tree	Forest	MM 8069	0	0	0	0	0	AFR
Myrsinaceae	<i>Embellia schimperii</i>	Liane	Forest	MM 8079	1	1	1	1	1	AFR
Myrsinaceae	<i>Maesa lanceolata</i>	Tree	Forest	MM 8073	1	1	1	1	1	WS
Myrtaceae	<i>Syzygium micklethwaitii</i> subsp. <i>micklethwaitii</i>	Tree	Forest	MM 8150	0	1	1	1	0	EAM+NV

Family	Scientific name	Habit	Habitat	Coll.No	Site 1	Site 2	Site 3	Site 4	Site 5	Distribution
Ochnaceae	<i>Ochna</i>	Tree	Forest	MM 8207	1	1	1	1	1	
Oleaceae	<i>Olea capensis</i> subsp. <i>macrocarpa</i>	Tree	Forest	MM 8230	0	1	0	1	0	WS
Orchidaceae	<i>Liparis</i>	Herb	Forest	MM 8155	1	0	0	1	1	
Orchidaceae	<i>Polystachya</i>	Herb	Forest	MM 8206	1	1	1	1	0	
Passifloraceae	<i>Adenia stolzii</i>	Liane	Forest	MM 8141	1	1	1	1	1	AFR
Passifloraceae	<i>Passiflora edulis</i>	Liane	Forest	MM 8169	1	1	1	1	1	introduced
Phytolaccaceae	<i>Phytolacca dodecandra</i>	Liana	Forest	MM 8166	0	0	0	1	1	WS
Piperaceae	<i>Peperomia molleri</i> subsp. <i>ukagurensis</i>	Herb	Forest	MM 8202	1	1	1	1	1	EAM: Ukaguru
Piperaceae	<i>Piper capense</i> var. <i>capense</i>	Shrub	Forest	MM 8108	1	1	1	1	1	WS
Piperaceae	<i>Piper umbellatum</i>	Shrub	Forest	MM 8171	1	1	1	1	1	WS
Poaceae	<i>Oplismenus hirtellus</i>	Grass	Forest	MM 8253	1	1	1	1	1	WS
Podocarpaceae	<i>Afrocarpus</i>	Tree	Forest	MM 8198	1	1	0	1	1	
Polygonaceae	<i>Rumex bequaertii</i>	Herb	Forest	MM 8244	1	1	0	0	1	WS
Polypodiaceae	<i>Lepisorus excavatus</i>	Fern	Forest	MM 8213	1	1	1	1	1	WS
Pteridaceae	<i>Pteris catoptera</i> var. <i>catoptera</i>	Fern	Forest	MM 8135	1	1	1	1	1	WS
Pteridaceae	<i>Pteris usambarensis</i>	Fern	Forest	MM 8144	1	1	1	1	1	EAM+CF
Ranunculaceae	<i>Thalictrum rhynchocarpum</i>	Herb	Forest	MM 8175	0	1	0	1	0	AFR
Rhamnaceae	<i>Gouania longispicata</i>	Liane	Forest	MM 8173	1	1	0	1	1	AFR
Rhamnaceae	<i>Rhamnus prinoides</i>	S/tree	Forest	MM 8228	1	1	1	1	1	AFR
Rhamnaceae	<i>Scutia myrtina</i>	Tree	Forest	MM 8232	0	1	0	0	0	WS
Rhizophoraceae	<i>Cassipourea malosana</i>	Tree	Forest	MM 8160	1	1	1	1	1	AFR
Rubiaceae	<i>Chassalia discolor</i> subsp. <i>discolor</i>	S/Tree	Forest	MM 8128	1	1	1	1	1	EAM+LN
Rubiaceae	<i>Chassalia discolor</i> subsp. <i>discolor</i>	Tree	Forest	MM 8191	1	1	1	1	1	EAM+LN
Rubiaceae	<i>Chassalia parvifolia</i>	Tree	Forest	MM 8114	1	1	1	0	1	AFR
Rubiaceae	<i>Chassalia parvifolia</i>	S/Tree	Forest	MM 8127	1	1	1	1	1	AFR
Rubiaceae	<i>Coffea canephora</i>	Shrub	Forest	MM 8195	1	1	0	0	1	introduced
Rubiaceae	<i>Coffea mufindiensis</i> subsp. <i>mufindiensis</i>	S/Tree	Forest	MM 8145	1	1	0	0	0	EAM+LN
Rubiaceae	<i>Cremaspora triflora</i> subsp. <i>triflora</i>	Tree	Forest	MM 8115	1	1	1	1	1	AFR
Rubiaceae	<i>Danais xanthorrhoea</i>	Liana	Forest	MM 8184	1	0	1	1	1	EAM: S Pare, E Usambara, W Usambara, Nguru, Ukaguru, Uluguru, Udzungwa
Rubiaceae	<i>Galinsyrea saxifraga</i>	Tree	Forest	MM 8095	1	1	1	1	1	AFR
Rubiaceae	<i>Galium brenanii</i>	Herb	Forest	MM 8097	1	0	0	1	1	EAM+NV
Rubiaceae	<i>Ixora schefferi</i> subsp. <i>schefferi</i>	Tree	Forest	MM 8113	1	1	0	0	0	AFR
Rubiaceae	<i>Keetia gueinzii</i>	Liane	Forest	MM 8122	1	1	1	1	1	AFR

Family	Scientific name	Habit	Habitat	Coll.No	Site 1	Site 2	Site 3	Site 4	Site 5	Distribution
Rubiaceae	<i>Lasianthus</i>	Tree	Forest	MM 8203	1	1	0	1	0	
Rubiaceae	<i>Margaritopsis abrupta</i>	Shrub	Forest	MM 8200	1	1	1	1	1	AFR
Rubiaceae	<i>Mussaenda</i>	Tree	Forest	MM 8189	0	0	0	1	1	
Rubiaceae	<i>Pauridiantha</i>	Tree	Forest	MM 8096	1	1	1	1	1	
Rubiaceae	<i>Pavetta hymenophylla</i>	Tree	Forest	MM 8131	1	1	1	1	1	AFR
Rubiaceae	<i>Pentas lanceolata</i> subsp. <i>quartiniana</i>	Herb	Forest	MM 8187	1	1	1	1	1	AFR
Rubiaceae	<i>Psychotria</i>	Liana	Forest	MM 8147	1	1	1	1	1	
Rubiaceae	<i>Psychotria cyathicalyx</i>	Tree	Forest	MM 8121	1	1	1	1	1	EAM+CF+NV
Rubiaceae	<i>Psychotria elachistantha</i>	Tree	Forest	MM 8250	0	1	0	0	0	EAM: Ukaguru, Uluguru, Udzungwa
Rubiaceae	<i>Psychotria goetzei</i>	Tree	Forest	MM 8077	1	1	1	1	1	EAM+NV+LN
Rubiaceae	<i>Psychotria mahonii</i> var. <i>puberula</i>	Tree	Forest	MM 8133	1	1	1	1	1	AFR
Rubiaceae	<i>Rutidea fuscescens</i> subsp. <i>fuscescens</i>	Liane	Forest	MM 8071	1	0	0	1	1	AFR
Rubiaceae	<i>Rytigynia pseudolongicaudata</i>	Tree	Forest	MM 8094	1	1	1	1	1	EAM: Nguru, Ukaguru, Uluguru, Rubeho, Udzungwa
Rutaceae	<i>Clausena anisata</i>	Tree	Forest	MM 8182	1	0	1	0	1	AFR
Rutaceae	<i>Toddalia asiatica</i>	Liana	Forest	MM 8239	1	1	1	1	0	WS
Rutaceae	<i>Vepris</i>	Tree	Forest	MM 8110	1	1	1	1	1	
Rutaceae	<i>Vepris trichocarpa</i>	Tree	Forest	MM 8140	1	1	0	0	1	AFR
Rutaceae	<i>Zanthoxylum deremense</i>	Tree	Forest	MM 8137	1	0	0	1	1	AFR
Santalaceae	<i>Thesium triflorum</i>	Herb	Forest	MM 8082	0	0	1	1	1	AFR
Sapindaceae	<i>Allophylus abyssinicus</i>	Tree	Forest	MM 8246	1	1	1	1	1	AFR
Sapindaceae	<i>Allophylus ferrugineus</i> var. <i>ferrugineus</i>	Tree	Forest	MM 8138	1	1	1	1	1	AFR
Sapotaceae	<i>Chrysophyllum</i>	Tree	Forest	MM 8183	1	1	1	1	1	
Sapotaceae	<i>Synsepalum</i>	Tree	Forest	MM 8201	1	1	0	0	0	
Scrophulariaceae	<i>Halleria lucida</i>	Tree	Forest	MM 8101	1	1	1	1	1	WS
Solanaceae	<i>Solanum anguivi</i>	Shrub	Forest	MM 8224	1	1	1	0	0	WS
Sterculiaceae	<i>Dombeya torrida</i> subsp. <i>torrida</i>	Tree	Forest	MM 8164	1	1	0	0	0	WS
Thymelaeaceae	<i>Peddiea polyantha</i>	Tree	Forest	MM 8107	1	1	1	1	1	EAM+LN
Tiliaceae	<i>Grewia mildbraedii</i>	Tree	Forest	MM 8093	1	1	0	0	0	AFR
Tiliaceae	<i>Sparmannia ricinocarpa</i> var. <i>ricinocarpa</i>	Herb	Forest	MM 8243	1	1	0	1	1	WS
Tiliaceae	<i>Triumfetta rhomboidea</i>	Herb	Forest	MM 8251	0	1	1	0	1	WS
Verbenaceae	<i>Clerodendrum cephalanthum</i> subsp. <i>impensum</i>	Shrub	Forest	MM 8256						EAM+CF
Verbenaceae	<i>Rotheca sansibarensis</i> subsp. <i>sansibarensis</i>	Shrub	Forest	MM 8172	1	1	1	1	1	AFR

## Appendix 2. Disturbance transect results

### Disturbance transect 1

<b>Names of recorders:</b>	Justine Gwegime & Habibu Said		
<b>Date of survey (dd/mm/yyyy):</b>	25/09/2012	<b>District:</b>	GAIRO
<b>Village:</b>	NONGWE	<b>Nearest sub-village:</b>	MKOBWE
<b>Village Forest Reserve:</b>	MAMIWA KISARA	<b>Transect Number:</b>	1
<b>Dominant vegetation:</b>		<b>Bearing:</b>	N-E
<b>Start point Longitude:</b>	273842	<b>Latitude:</b>	9284997
<b>End point Longitude:</b>	274261	<b>Latitude:</b>	9285663
		<b>Altitude (m):</b>	1794
		<b>Altitude (m):</b>	1770

### Key to disturbance categories

<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			old	fresh			old	fresh		
0-50	2	0	0	0	1	0	0	0	0	0
50-100	13	0	0	0	8	0	0	0	0	0
100-150	16	0	0	0	11	0	0	0	0	0
150-200	11	0	0	0	12	0	0	0	0	0
200-250	6	0	0	0	2	0	0	0	0	0
250-300	18	0	0	0	8	0	0	0	0	0
300-350	15	0	0	0	15	1	0	0	0	0
350-400	7	0	0	0	7	0	1	0	0	0
400-450	20	2	0	0	13	0	1	0	0	0
450-500	8	0	0	0	6	0	0	0	0	0
500-550	8	0	0	0	7	2	0	0	0	0
550-600	13	0	0	0	9	2	0	0	0	0

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			old	fresh			old	fresh		
600-650	10	0	0	0	7	1	0	0	0	0
650-700	16	0	0	0	12	1	0	0	0	0
700-750	16	0	0	0	10	1	0	0	0	0
750-800	15	0	0	0	10	1	0	0	0	0
800-850	5	0	0	0	5	0	0	0	0	0
850-900	19	0	0	0	8	0	0	0	0	0
900-950	18	0	0	0	10	0	0	0	0	0
950-1000	14	0	1	0	4	1	0	0	0	0
<b>Total</b>	<b>250</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>165</b>	<b>10</b>	<b>2</b>	<b>0</b>	<b>0</b>	

Key to topography					
<b>GLS</b>	Gentle lower slope	<b>GMS</b>	Gentle mid-slope	<b>GUS</b>	Gentle upper slope
<b>SLS</b>	Steep lower slope	<b>SMS</b>	Steep mid-slope	<b>SUS</b>	Steep upper slope
<b>Key to vegetation cover</b>					
<b>1 (&lt;10%)</b>		<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>	

Invasive alien species			
LC = Lantana camara	CO = Cedrela Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

High conservation values		
S = Stream or spring	M = Ming'oko	T = Threatened plant species
		E = Coastal forest or E. Arc endemic species
		O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Cobweb and Rabbit pellets

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
50-100	VF	3	2	2			Duiers/Rabit trail(3), Birds dung and Elephant shrew trail
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			Duikers pellets (2), Playing ground for rock hyraxes
200-250	GUS	3	2	2			High regeneration
250-300	GUS	3	2	2			Duikers foot path(3)
300-350	GUS	3	2	2			Duikers foot path
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			
550-600	GUS	3	2	2			Duikers trail(1)
600-650	GUS	3	2	2			Duikers trail(1), Dikdik(2)
650-700	GUS	3	2	2			Duikers trail(1), Dikdik(3)
700-750	GUS	3	2	2			Duikers trails(2), Beehive
750-800	GUS	3	2	2			Duikers trail(4)
800-850	GUS	3	2	2			
850-900	GUS	3	2	2			
900-950	GUS	3	2	2			Beehive, Duikers trail(4)
950-1000	GUS	3	2	2			Duikers trail(4), Duikers foot path

Notes:-

#### Disturbance Transect 2

<b>Names of recorders:</b>	Justine Gwegime		
<b>Date of survey (dd/mm/yyyy):</b>	26/09/2012	<b>District:</b>	GAIRO
<b>Village:</b>	NONGWE	<b>Nearest sub-village:</b>	MKOBWE
<b>Village Forest Reserve:</b>	MAMIWA KISARA	<b>Transect Number:</b>	2
<b>Dominant vegetation:</b>		<b>Bearing:</b>	SW
<b>Start point Longitude:</b>	274542	<b>Latitude:</b>	9284997
<b>End point Longitude:</b>	274408	<b>Latitude:</b>	9283993
		<b>Altitude (m):</b>	1686

Key to disturbance categories							
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			old	fresh			old	fresh		
0-50	20	0	0	0	12	0	0	0	0	0
50-100	19	0	0	0	11	0	1	0	0	0
100-150	6	0	0	0	10	0	0	0	0	0
150-200	11	0	0	0	23	0	0	0	0	0
200-250	0	0	0	0	20	0	0	0	0	0
250-300	7	0	0	0	19	0	0	0	0	0
300-350	10	0	0	0	14	0	0	0	0	0
350-400	6	0	0	0	9	0	0	0	0	0
400-450	10	0	0	0	8	0	0	0	0	0
450-500	7	0	0	0	15	0	0	0	0	0
500-550	4	0	0	0	14	0	0	0	0	0
550-600										
600-650										
650-700										
700-750										
750-800										
800-850										
850-900										
900-950										
950-1000										
<b>Total</b>	<b>100</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>155</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>

Key to topography	



<b>GLS</b>	Gentle lower slope	<b>GMS</b>	Gentle mid-slope	<b>GUS</b>	Gentle upper slope	CL	Cliffs
<b>SLS</b>	Steep lower slope	<b>SMS</b>	Steep mid-slope	<b>SUS</b>	Steep upper slope	VF	Valley floor
<b>Key to vegetation cover</b>	<b>1 (&lt;10%)</b>		<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>		

<b>Invasive alien species</b>			
LC = Lantana camara	CO = Cedrela Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

<b>High conservation values</b>			
S = Stream or spring	M = Ming'oko	T = Threatened plant species	E = Coastal forest or E. Arc endemic species
			O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			
50-100	GUS	3	2	2			
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			Duikers trail(2)
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			Beehive
550-600							
600-650							
650-700							
700-750							
750-800							
800-850							

850-900									
900-950									
950-1000									
OTHER NOTES:- We did not finished due to Elephant harassment									

### Disturbance Transect 3

<b>Names of recorders:</b>	Justine Gwegime				
<b>Date of survey (dd/mm/yyyy):</b>	27/09/2012		<b>District:</b>	GAIRO	
<b>Village:</b>	NONGWE		<b>Nearest sub-village:</b>	MKOBWE	
<b>Village Forest Reserve:</b>	MAMIWA - KISARA		<b>Transect Number:</b>	3	
<b>Dominant vegetation:</b>			<b>Bearing:</b>	N-E	
<b>Start point Longitude:</b>	273643	<b>Latitude:</b>	9285422	<b>Altitude (m):</b>	1801
<b>End point Longitude:</b>	274054	<b>Latitude:</b>	9286042	<b>Altitude (m):</b>	1788

### Key to disturbance categories

<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	11	0	0	0	8	0	0	0	R	
50-100	16	0	2	0	6	0	0	0	0	
100-150	7	0	2	0	7	0	2	0	0	
150-200	13	0	3	0	14	0	2	0	0	
200-250	3	0	0	0	2	0	0	0	0	
250-300	6	0	0	0	3	0	0	0	0	
300-350	11	2	0	0	3	0	0	0	0	

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
350-400	6	0	0	0	5	0	0	0	0	
400-450	16	0	0	0	13	1	0	0	0	
450-500	10	0	0	0	18	0	0	0	0	
500-550	7	0	0	0	15	1	0	0	0	
550-600	8	0	0	0	18	2	0	0	0	
600-650	22	0	0	0	12	0	0	0	0	
650-700	27	0	0	0	12	0	1	0	0	
700-750	7	0	0	0	8	0	0	0	0	
750-800	10	0	0	0	7	0	0	0	0	
800-850	13	0	0	0	10	1	1	0	0	
850-900	19	2	0	0	15	0	1	0	0	
900-950	12	0	1	0	9	2	1	0	0	
950-1000	16	0	0	0	17	0	0	0	0	
<b>Total</b>	<b>240</b>	<b>4</b>	<b>8</b>	<b>0</b>	<b>202</b>	<b>7</b>	<b>8</b>	<b>0</b>	<b>R(1)</b>	

Key to topography		Gentle lower slope		Gentle mid-slope		Gentle upper slope	
<b>GLS</b>		Gentle lower slope	<b>GMS</b>	Gentle mid-slope	<b>GUS</b>	CL	Cliffs
<b>SLS</b>		Steep lower slope	<b>SMS</b>	Steep mid-slope	<b>SUS</b>	VF	Valley floor
<b>Key to vegetation cover</b>							
<b>1 (&lt;10%)</b>		<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>			

Invasive alien species			
LC = Lantana camara	CO = Cedreia Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			<b>O = Other (specify)</b>

High conservation values			
<b>S</b> = Stream or spring	<b>M</b> = Ming'oko	<b>T</b> = Threatened plant species	<b>E</b> = Coastal forest or E. Arc endemic species
			<b>O</b> = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	SUS	3	2	2			
50-100	GUS	3	2	2			Trails for duikers and Pigs
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			Duikers trail (3)
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			Elephant shrew
350-400	GUS	3	2	2			Unidentified foot prints
400-450	GUS	3	2	2			Duikers trail (2)
450-500	GUS	3	2	2			Duikers trail (2), Elephant shrew trail (2)
500-550	GUS	3	2	2			Duikers trail (2), Palm civet dung
550-600	GUS	3	2	2			Duikers trail (1)
600-650	GUS	3	2	2			
650-700	GUS	3	2	2			Duikers trail (2)
700-750	GUS	3	2	2			
750-800	GUS	3	2	2			Duikers trail
800-850	GUS	3	2	2			Duikers trail
850-900	GUS	3	2	2			Beehive, Unidentified foot print
900-950	GUS	3	2	2			Wild pig dung, Wild pig foot print (4)
950-1000	GUS	3	2	2			
Other notes:-							

#### Disturbance Transect 4

Names of recorders:		Justine Gwegime & Habibu Said	
Date of survey (dd/mm/yyyy):	27/09/2012	District:	GAIRO
Village:	NONGWE	Nearest sub-village:	MKOBWE

<b>Village Forest Reserve:</b>	<b>MAMIWA KISARA</b>		<b>Transect Number:</b>	<b>4</b>
<b>Dominant vegetation:</b>	<b>NW-W</b>			
<b>Start point Longitude:</b>	<b>273880</b>	Latitude:	<b>9286266</b>	Altitude (m):
<b>End point Longitude:</b>	<b>273155</b>	Latitude:	<b>9286066</b>	Altitude (m):

<b>Key to disturbance categories</b>							
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

Section (m)	Qty of poles (5 – 15 cm)			Qty of timber (> 15 cm dbh)			Other disturbances	
	Live	Naturally dead	Cut	Live	Naturally dead	Cut	Within the transect (qty)	Outside the transect (qty)
0-50	9	0	0	10	0	0	0	
50-100	9	1	1	15	2	0	0	
100-150	14	0	0	10	1	0	R	
150-200	20	0	0	17	0	0	R	
200-250	20	0	0	17	0	0	0	
250-300	10	0	0	11	1	0	0	
300-350	13	0	0	9	1	0	R	
350-400	8	0	1	15	1	0	0	
400-450	5	0	2	9	2	0	0	
450-500	9	0	3	22	0	2	0	
500-550	5	1	0	18	0	1	0	
550-600	13	0	2	16	0	0	0	
600-650	16	1	0	12	0	1	0	
650-700	11	0	0	11	0	1	0	
700-750	15	0	1	13	0	1	0	
750-800	10	1	0	17	0	0	0	
800-850	10	0	0	10	0	1	0	
850-900	9	0	0	10	2	0	0	
900-950	8	0	0	14	0	2	0	
950-1000	9	0	3	13	0	2	0	
<b>Total</b>	<b>223</b>	<b>4</b>	<b>13</b>	<b>269</b>	<b>10</b>	<b>11</b>	<b>0</b>	<b>R(3)</b>

<b>Key to topography</b>						
<b>GLS</b>	Gentle lower slope	<b>GMS</b>	Gentle mid-slope	<b>GUS</b>	Gentle upper slope	<b>CL</b>
<b>SLS</b>	Steep lower slope	<b>SMS</b>	Steep mid-slope	<b>SUS</b>	Steep upper slope	<b>VF</b>
<b>Key to vegetation cover</b>		<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>		
<b>1 (&lt;10%)</b>						

<b>Invasive alien species</b>			
LC = Lantana camara	CO = Cedrela Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

<b>High conservation values</b>			
S = Stream or spring	M = Ming'oko	T = Threatened plant species	E = Coastal forest or E. Arc endemic species
			O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Duikers trail
50-100	GUS	3	2	2			
100-150	GUS	3	2	2			Elephant shrew trail(1)
150-200	GUS	3	2	2			
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			Beehives
300-350	GUS	3	2	2			
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			
550-600	GUS	3	2	2			
600-650	GUS	3	2	2			
650-700	GUS	3	2	2			Duikers trails(2)
700-750	GUS	3	2	2			
750-800	GUS	3	2	2			

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
800-850	GUS	3	2	2			
850-900	GUS	3	2	2			Duikers trail(2)
900-950	GUS	3	2	2			Duikers trail(1)
950-1000	GUS	3	2	2			

Notes:

### Disturbance Transect 5

<b>Names of recorders:</b>	Justine Gwemine		
<b>Date of survey (dd/mm/yyyy):</b>	28/09/2012	<b>District:</b>	GAIRO
<b>Village:</b>	MTEGA	<b>Nearest sub-village:</b>	NONGWE
<b>Village Forest Reserve:</b>	MAMIWA KISARA	<b>Transect Number:</b>	5
<b>Dominant vegetation:</b>		<b>Bearing:</b>	S/SW
<b>Start point Longitude:</b>	276348	<b>Latitude:</b>	9283170
<b>End point Longitude:</b>	276184	<b>Latitude:</b>	9282375
		<b>Altitude (m):</b>	1588
		<b>Altitude (m):</b>	1654

Key to disturbance categories					
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares
				<b>R</b>	Path or road
				<b>G</b>	Gunfire
				<b>O</b>	Other

section (m)	Qty of poles (5 – 15 cm)			Qty of timber (> 15 cm dbh)			Other disturbances	
	Live	Naturally dead	Cut	Live	Naturally dead	Cut	Within the transect (qty)	Outside the transect (qty)
0-50	5	0	2	0	0	6	F	
50-100	3	0	4	6	0	3	F	
100-150	4	0	0	1	2	10	F	
150-200	3	0	0	0	0	0	F	
200-250	5	1	0	8	0	1	F	
250-300	3	1	9	6	1	2	F & R	
300-350	6	1	4	8	2	6	F	
350-400	13	0	2	6	0	4	R	

section (m)	Qty of poles (5 – 15 cm)			Qty of timber (> 15 cm dbh)			Other disturbances	
	Live	Naturally dead	Cut	Live	Naturally dead	Cut	Within the transect (qty)	Outside the transect (qty)
400-450	8	0	0	4	0	1	F	
450-500	4	0	1	9	0	4	F & R	
500-550	1	0	0	9	0	2	F	
550-600	11	0	1	8	0	1	R	
600-650	19	0	2	12	0	0	O	
650-700	14	0	4	6	0	3	O	
700-750	14	0	0	7	0	3	O	
750-800	13	0	0	13	0	2	R	
800-850	9	0	7	12	0	2	R	
850-900	10	0	3	4	0	3	O	
900-950	2	0	6	8	0	6	O	
950-1000	4	0	6	5	2	0	O	
<b>Total</b>	<b>151</b>	<b>3</b>	<b>51</b>	<b>132</b>	<b>7</b>	<b>59</b>	<b>F(9)&amp;R(5)</b>	

Key to topography	Gentle lower slope		Gentle mid-slope		Gentle upper slope	
GLS			GMS		GUS	CL
SLS	Steep lower slope		SMS	Steep mid-slope	SUS	VF
Key to vegetation cover						
	1 (<10%)		2 (10-50%)		3 (>50%)	

Invasive alien species	CO = Cedreia Odorata		RU = Rubus spp		SJ = Stachytarpheta jamaicensis		O = Other (specify)	
LC =Lantana camara								

High conservation values	M = Ming'oko		T= Threatened plant species		E = Coastal forest or E. Arc endemic species	
S = Stream or spring						



Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Nest
50-100	GUS	3	2	2			
100-150	GUS	3	2	2			
150-200	GUS	3	2	2		S	
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			
550-600	GUS	3	2	2			
600-650	GUS	3	2	2			
650-700	GUS	3	2	2			
700-750	GUS	3	2	2			Medicinal plants
750-800	GUS	3	2	2			Medicinal plants
800-850	GUS	3	2	2			Medicinal plants
850-900	GUS	3	2	2			
900-950	GUS	3	2	2			
950-1000	GUS	3	2	2			

Notes:

### Disturbance Transect 6

<b>Names of recorders:</b>	Justine Gwegime			
<b>Date of survey (dd/mm/yyyy):</b>	28/09/2012	District:	GAIRO	
<b>Village:</b>	MTEGA	Nearest sub-village:	NONGWE	
<b>Village Forest Reserve:</b>	MAMIWA KISARA	Transect Number:	6	
<b>Dominant vegetation:</b>		Bearing:	SW	
<b>Start point</b> Longitude:	276122	Latitude:	9282264	Altitude (m): 1671
<b>End point</b> Longitude:	275828	Latitude:	9281893	Altitude (m): 1751

### Key to disturbance categories

<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
----------	--------	----------	------------	----------	-----------------------	----------	--------------

F C	Fire damage Cultivation	B		K		G	
		M	Mining	N	Traps or snares	O	Other

Section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	9	0	5	0	4	0	2	0	C	
50-100	2	0	1	0	15	0	1	0	0	
100-150	2	0	2	0	12	0	1	0	0	
150-200	15	0	5	0	5	1	1	0	C	
200-250	3	0	0	0	9	0	0	0	0	
250-300	6	0	3	2	25	0	1	0	R	
300-350	10	0	2	0	15	0	0	0	R	
350-400	12	0	7	0	7	1	4	1	C	
400-450	26	0	2	0	18	0	2	0	R	
450-500	19	0	6	0	12	0	1	0	0	
500-550	22	0	1	0	8	0	1	0	0	
550-600	14	0	0	0	10	0	0	0	0	
600-650	18	0	1	0	5	1	1	0	0	
650-700	15	0	10	0	12	0	2	0	0	
700-750										
750-800										
800-850										
850-900										
900-950										
950-1000										
<b>Total</b>	<b>173</b>	<b>0</b>	<b>45</b>	<b>2</b>	<b>157</b>	<b>3</b>	<b>17</b>	<b>1</b>	<b>R(3)&amp;C(3)</b>	

Key to topography		GMS		GUS	
GLS	Gentle lower slope	GMS	Gentle mid-slope	GUS	Gentle upper slope
SLS	Steep lower slope	SMS	Steep mid-slope	SUS	Steep upper slope
<b>Key to vegetation cover</b>		<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>	
<b>1 (&lt;10%)</b>					

Invasive alien species			
LC =Lantana camara	CO = Cedrela Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

High conservation values			
S = Stream or spring	M = Ming'oko	T= Threatened plant species	E = Coastal forest or E. Arc endemic species
			O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			
50-100	GUS	3	2	2			
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			Beehive
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			Elephant shrew trail
550-600	GUS	3	2	2			Elephant shrew playing ground
600-650	GUS	3	2	2			
650-700	GUS	3	2	2			
<b>Other notes:-</b>							

#### Disturbance Transect 7

<b>Names of recorders:</b>	Justine Gwegime & Habibu Said		
<b>Date of survey (dd/mm/yyyy):</b>	29/09/2012	<b>District:</b>	GAIRO
<b>Village:</b>	MTEGA	<b>Nearest sub-village:</b>	NONGWE
<b>Village Forest Reserve:</b>	MAMIWA KISARA	<b>Transect Number:</b>	7
<b>Dominant vegetation:</b>		<b>Bearing:</b>	S
<b>Start point Longitude:</b>	279931	<b>Latitude:</b>	9288000
<b>End point Longitude:</b>	280426	<b>Latitude:</b>	9287269
		<b>Altitude (m):</b>	1701
		<b>Altitude (m):</b>	1493

Key to disturbance categories							
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

Section (m)	Qty of poles (5 – 15 cm)			Qty of timber (> 15 cm dbh)			Other disturbances		
	Live	Naturally dead	Cut	Live	Naturally dead	Cut	Within the transect (qty)	Outside the transect (qty)	
0-50	20	0	2	24	2	1	0	0	
50-100	8	0	1	24	3	0	0	0	
100-150	15	0	0	23	1	0	0	0	
150-200	9	0	1	15	2	1	0	0	
200-250	11	4	2	16	0	0	0	0	
250-300	16	0	3	19	0	0	0	0	
300-350	14	1	3	26	0	0	0	0	
350-400	20	0	0	7	0	0	0	0	
400-450	26	4	1	17	0	1	0	0	
450-500	30	2	4	2	1	2	0	0	
500-550	27	0	7	12	0	2	0	0	
550-600	25	1	0	16	2	0	0	0	
600-650	21	0	0	16	0	0	0	0	
650-700	11	1	1	19	2	3	0	0	
700-750	12	0	3	19	0	0	0	0	
750-800	17	0	6	11	0	0	0	0	
800-850	8	0	0	8	0	1	0	0	
850-900	13	0	0	9	0	0	0	0	
900-950	5	0	0	7	0	0	0	0	
950-1000	5	0	1	4	1	0	0	0	
<b>Total</b>	<b>313</b>	<b>13</b>	<b>35</b>	<b>294</b>	<b>14</b>	<b>11</b>	<b>0</b>	<b>0</b>	

Key to topography			
<b>GLS</b>	Gentle lower slope	<b>GMS</b>	Gentle mid-slope
<b>SLS</b>	Steep lower slope	<b>SMS</b>	Steep mid-slope
		<b>GUS</b>	Gentle upper slope
		<b>SUS</b>	Steep upper slope
		CL	Cliffs
		VF	Valley floor

<b>Key to vegetation cover</b>					
1 (<10%)	2 (10-50%)	3 (>50%)			

<b>Invasive alien species</b>				
LC = Lantana camara	CO = Cedrela Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis	O = Other (specify)

<b>High conservation values</b>				
S = Stream or spring	M = Ming'oko	T = Threatened plant species	E = Coastal forest or E. Arc endemic species	O = Other e.g. edible mushrooms

Section (m)	Topograp hy	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Wildpig dung & trail
50-100	GUS	3	2	2			Wildpig dung & trail
100-150	GUS	3	2	2			Wildpig dung & trail
150-200	GUS	3	2	2			Wildpig trail
200-250	GUS	3	2	2			Wildpig dung & trail
250-300	GUS	3	2	2			Wildpig dung & trail
300-350	GUS	3	2	2			Wildpig trail
350-400	GUS	3	2	2			Wildpig trail
400-450	GUS	3	2	2			Wildpig trail
450-500	GUS	3	2	2			Wildpig dung and playing ground
500-550	GUS	3	2	2			Wildpig dung
550-600	GUS	3	2	2			
600-650	GUS	3	2	2			
650-700	GUS	3	2	2			Wildpig trail
700-750	GUS	3	2	2			Wildpig trail
750-800	GUS	3	2	2			Wildpig trail
800-850	GUS	3	2	2		S	
850-900	GUS	3	2	2			
900-950	GUS	3	2	2			

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
950-1000	GUS	3	2	2			Wildpig dung
Notes:							

### Disturbance Transect 8

Names of recorders:		Justine Gwegime & Habibu Said					
Date of survey (dd/mm/yyyy):	1/10/2012	District:		GAIRO			
Village:	MASENGE	Nearest sub-village:		MANDEGE			
Village Forest Reserve:	MAMIWA KISARA	Transect Number:		8			
Dominant vegetation:		Bearing:		E			
Start point Longitude:	272864	Latitude:		9296381	Altitude (m):		
End point Longitude:	272796	Latitude:		9297197	Altitude (m):		
					1624		
					1610		

Key to disturbance categories							
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

Section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	10	0	5	0	13	0	0	0	0	
50-100	20	0	5	0	3	2	0	0	0	
100-150	6	1	0	0	11	2	4	0	R	
150-200	15	0	3	0	2	0	1	0	R	
200-250	6	0	1	0	12	0	2	0	0	
250-300	7	0	1	0	8	1	2	0	0	
300-350	5	0	1	0	7	0	2	0	0	
350-400	13	0	5	0	7	0	5	0	0	
400-450	12	0	0	0	9	0	2	0	0	
450-500	12	0	0	0	11	0	3	0	0	
500-550	10	0	3	0	6	1	0	0	R	

Section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
550-600	13	0	1	0	1	0	2	0		
600-650	5	0	1	0	10	3	0	0	R(2)	
650-700	2	0	0	0	3	1	2	0	R(3)	
700-750	4	0	0	0	11	2	0	1	R	
750-800	2	0	5	1	3	0	4	3	R & P(2)	
800-850	1	0	0	0	5	0	0	4	R	
850-900	10	0	0	0	6	0	0	1	R	
900-950	9	0	0	0	4	0	3	2	R & P(1)	
950-1000	9	0	0	0	6	0	0	0	P	
<b>Total</b>	<b>171</b>	<b>1</b>	<b>31</b>	<b>1</b>	<b>138</b>	<b>12</b>	<b>32</b>	<b>11</b>	<b>R(10)&amp;P(4)</b>	

Key to topography						
GLS	Gentle lower slope	GMS	Gentle mid-slope	GUS	Gentle upper slope	CL
SLS	Steep lower slope	SMS	Steep mid-slope	SUS	Steep upper slope	VF
<b>Key to vegetation cover</b>						
1 (<10%)		2 (10-50%)		3 (>50%)		

Invasive alien species			
LC =Lantana camara	CO = Cedreia Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

High conservation values		
S = Stream or spring	M = Ming'oko	T= Threatened plant species
		E = Coastal forest or E. Arc endemic species
		O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			

50-100	GUS		3	2	2			Beehive
100-150	GUS		3	2	2			Wildpig trail
150-200	GUS		3	2	2			Wildpig trail
200-250	GUS		3	2	2			
250-300	GUS		3	2	2			Elephant shrew/ wildpig trail(2)
300-350	GUS		3	2	2			Sykes monkey heard, Duikers trail(1)
350-400	GUS		3	2	2			Wildpig trail
400-450	GUS		3	2	2			Beehive
450-500	GUS		3	2	2			
500-550	GUS		3	2	2			Vervet monkey
550-600	GUS		3	2	2			Beehive
600-650	GUS		3	2	2			Duikers trail
650-700	GUS		3	2	2			
700-750	GUS		3	2	2			
750-800	GUS		3	2	2			
800-850	GUS		3	2	2			
850-900	GUS		3	2	2			Beehive
900-950	GUS		3	2	2			
950-1000	GUS		3	2	2			

Notes:-

#### Disturbance Transect 9

<b>Names of recorders:</b>	Justine Gwegime							
<b>Date of survey (dd/mm/yyyy):</b>	1/10/2012		<b>District:</b>		GAIRO			
<b>Village:</b>	MASENGE		<b>Nearest sub-village:</b>		MANDEGE			
<b>Village Forest Reserve:</b>	MAMIWA KISARA		<b>Transect Number:</b>		9			
<b>Dominant vegetation:</b>			<b>Bearing:</b>		SE			
<b>Start point Longitude:</b>	270402		<b>Latitude:</b>		9296475		Altitude (m):	1808
<b>End point Longitude:</b>	269722		<b>Latitude:</b>		9296914		Altitude (m):	1812

Key to disturbance categories



section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	15	0	7	0	5	0	2	0	0	
50-100	3	0	1	0	10	0	2	0	R	
100-150	12	0	5	0	5	0	2	0	0	
150-200	4	0	3	0	4	1	0	0	R	
200-250	22	0	4	0	6	0	2	0	R	
250-300	12	0	3	0	15	0	1	0	R(3)	
300-350	5	0	2	0	10	0	0	0	R	
350-400	1	0	3	2	7	0	6	0	0	
400-450	11	0	0	0	4	0	0	0	0	
450-500	4	0	0	0	9	0	0	0	R	
500-550	4	0	0	0	8	0	7	0	0	
550-600	5	0	5	0	13	0	6	0	R	
600-650	5	0	3	0	15	0	0	0	0	
650-700	6	0	4	0	11	0	5	0	0	
700-750	4	0	2	0	16	0	2	1	0	
750-800	4	0	7	0	8	0	3	0	0	
800-850	4	0	0	0	13	0	2	1	0	
850-900	7	0	1	0	10	1	2	0	0	
900-950	5	0	10	0	11	0	4	0	0	
950-1000	10	0	0	0	10	0	3	0	0	
<b>Total</b>	<b>143</b>	<b>0</b>	<b>60</b>	<b>2</b>	<b>190</b>	<b>2</b>	<b>49</b>	<b>2</b>	<b>R(9)</b>	

Key to topography	Gentle lower slope		Gentle mid-slope		Gentle upper slope		CL	Cliffs
	GLS	GMS	GMS	GUS	GUS	CL		

SLS	Steep lower slope	SMS	Steep mid-slope	SUS	Steep upper slope	VF	Valley floor
<b>Key to vegetation cover</b>							
	1 (<10%)	2 (10-50%)	3 (>50%)				

<b>Invasive alien species</b>			
LC = Lantana camara	CO = Cedreia Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

<b>High conservation values</b>			
S = Stream or spring	M = Ming'oko	T = Threatened plant species	E = Coastal forest or E. Arc endemic species
			O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Beehive
50-100	GUS	3	2	2			Beehive
100-150	GUS	3	2	2			Beehive, Duikers trail(2), Wildpig trail(3)
150-200	GUS	3	2	2		S	
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			Beehive
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			Beehive
550-600	GUS	3	2	2			
600-650	GUS	3	2	2			Beehive, Wildpig trail & Medicinal plants
650-700	GUS	3	2	2			Pig dung
700-750	GUS	3	2	2			
750-800	GUS	3	2	2			Beehive
800-850	GUS	3	2	2			
850-900	GUS	3	2	2			

900-950	GUS	3	2	2	Beehive, Elephant shrew trail & Wildpig
950-1000	GUS	3	2	2	

Notes :-

### Disturbances Transect 10

<b>Names of recorders:</b>		Justine Gwegime			
<b>Date of survey (dd/mm/yyyy):</b>	2/10/2012	<b>District:</b>	GAIRO		
<b>Village:</b>	MANDEGE/MASENGE	<b>Nearest sub-village:</b>	UPONELA		
<b>Village Forest Reserve:</b>	MAMIWA KISARA	<b>Transect Number:</b>	10		
<b>Dominant vegetation:</b>		<b>Bearing:</b>	NE		
<b>Start point Longitude:</b>	276525	<b>Latitude:</b>	9293248	<b>Altitude (m):</b>	1449
<b>End point Longitude:</b>	277121	<b>Latitude:</b>	9292687	<b>Altitude (m):</b>	1535

### Key to disturbance categories

<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

Section (m)	Qty of poles (5 – 15 cm)			Qty of timber (> 15 cm dbh)			Other disturbances	
	Live	Naturally dead	Cut	Live	Naturally dead	Cut	Within the transect (qty)	Outside the transect (qty)
0-50	9	0	0	8	0	0	R	
50-100	17	0	3	14	0	4	O	
100-150	12	0	1	10	0	0	C	
150-200	5	0	1	4	0	0	C	
200-250	2	0	4	12	0	0	R	
250-300	10	1	0	15	0	0	O	
300-350	20	0	2	12	0	0	O	
350-400	10	0	0	12	0	0	C	

Section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
400-450	11	0	0	0	6	0	1	0	F	
450-500	4	0	0	0	8	0	0	0	O	
500-550	8	0	0	0	15	0	0	0	O	
550-600	5	0	0	0	4	0	0	0	O	
600-650	8	0	0	0	6	0	0	0	R	
650-700	15	0	1	0	10	0	0	0	O	
700-750	10	0	1	0	20	1	1	0	O	
750-800	15	0	1	0	12	0	1	0	O	
800-850	5	0	1	0	16	4	0	0	C	
850-900	6	0	0	0	10	4	2	0	R	
900-950	6	1	3	3	10	2	0	0	O	
950-1000	12	0	0	0	10	0	0	0	O	
<b>Total</b>	<b>190</b>	<b>2</b>	<b>18</b>	<b>9</b>	<b>214</b>	<b>11</b>	<b>9</b>	<b>6</b>	<b>R(4),F(1)&amp; C(4)</b>	

Key to topography		Gentle lower slope		Gentle mid-slope		Gentle upper slope	
<b>GLS</b>		Gentle lower slope		Gentle mid-slope		Gentle upper slope	CL
<b>SLS</b>		Steep lower slope		Steep mid-slope		Steep upper slope	VF
<b>Key to vegetation cover</b>							
	<b>1 (&lt;10%)</b>			<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>	

Invasive alien species			
LC = Lantana camara	CO = Cedreia Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			<b>O = Other (specify)</b>

High conservation values		
<b>S</b> = Stream or spring	<b>M</b> = Ming'oko	<b>T</b> = Threatened plant species
		<b>E</b> = Coastal forest or E. Arc endemic species
		<b>O</b> = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Duiker trail
50-100	GUS	3	2	2			
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			Duikers trail
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			
450-500	GUS	3	2	2			
500-550	GUS	3	2	2			Wild animals trail, Elephant shrew trail
550-600	GUS	3	2	2		S	Elephant shrew trail
600-650	GUS	3	2	2			Elephant shrew trail
650-700	GUS	3	2	2			
700-750	GUS	3	2	2			Duikers trail
750-800	GUS	3	2	2		S	Duikers trail,
800-850	GUS	3	2	2			
850-900	GUS	3	2	2			
900-950	GUS	3	2	2			
950-1000	GUS	3	2	2			Elephant shrew trail(3), Duikers and Wildpig trail(2)
Notes:							

#### Disurbance Transect 11

Names of recorders:	Justine Gwegime		
Date of survey (dd/mm/yyyy):	2/10/2012	District:	GAIRO
Village:	NG'ONE	Nearest sub-village:	UPONELA
Village Forest Reserve:	MAMIWA KISARA	Transect Number:	11
Dominant vegetation:		Bearing:	

<b>Start point Longitude:</b>	<b>277358</b>	Latitude:	<b>9292615</b>	Altitude (m):	1607
<b>End point Longitude:</b>	<b>277586</b>	Latitude:	<b>9292307</b>	Altitude (m):	1595

Key to disturbance categories							
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other

Section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	13	0	1	0	20	3	0	0	R	
50-100	16	0	2	0	15	0	0	0	O	
100-150	8	0	4	0	13	0	0	0	O	
150-200	5	1	0	0	7	1	0	0	O	
200-250	14	0	0	0	6	0	0	1	O	
250-300	13	0	0	1	10	0	0	0	O	
300-350	18	1	1	0	22	0	0	0	O	
350-400	6	0	5	0	10	5	0	0	R	
400-450	16	0	2	0	17	0	0	0	O	
450-500	13	0	4	0	11	1	1	0	O	
500-550										
550-600										
600-650										
650-700										
700-750										
750-800										
800-850										
850-900										
900-950										
950-1000										

Section (m)	Qty of poles (5 – 15 cm)			Qty of timber (> 15 cm dbh)			Other disturbances	
	Live	Naturally dead		Live	Naturally dead		Within the transect (qty)	Outside the transect (qty)
		Cut	Fresh		Cut	Fresh		
		Old	Fresh		Old	Fresh		
<b>Total</b>	122	2	19	1	131	10	1	R(2)

Key to topography		Key to vegetation cover		Key to soil		Key to other disturbances	
GLS	Gentle lower slope	GMS	Gentle mid-slope	GUS	Gentle upper slope	CL	Cliffs
SLS	Steep lower slope	SMS	Steep mid-slope	SUS	Steep upper slope	VF	Valley floor
Key to vegetation cover		Key to soil		Key to other disturbances			
1 (<10%)		2 (10-50%)		3 (>50%)			

Invasive alien species			
LC = Lantana camara	CO = Cedreia Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

High conservation values			
S = Stream or spring	M = Ming'oko	T = Threatened plant species	E = Coastal forest or E. Arc endemic species
			O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			
50-100	GUS	3	2	2			Elephant shrew & Duikers trail(2)
100-150	GUS	3	2	2		S	Duikers trail
150-200	GUS	3	2	2			Duikers trail(1)
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			
300-350	GUS	3	2	2			Duikers trail(1)
350-400	GUS	3	2	2			

400-450	GUS	3	2	2				Elephant shrew trail
450-500	GUS	3	2	2		S		
Notes:								



**Disturbance Transect 12**

<b>Names of recorders:</b>	Justine Gwegime		
<b>Date of survey (dd/mm/yyyy):</b>	3/10/2012		<b>District:</b>
<b>Village:</b>	MKOBWE		<b>GAIRO</b>
<b>Village Forest Reserve:</b>	MAMIWA KISARA		<b>NONGWE</b>
<b>Dominant vegetation:</b>			<b>12</b>
<b>Start point Longitude:</b>	271787	Latitude:	<b>EES</b>
<b>End point Longitude:</b>	270621	Latitude:	Altitude (m):
			1731
			Altitude (m):
			1884

<b>Key to disturbance categories</b>									
<b>P</b>	Pitsaw	<b>S</b>	Settlement	<b>T</b>	Timber, planks, poles	<b>R</b>	Path or road		
<b>F</b>	Fire damage	<b>B</b>	Bark or root harvesting	<b>K</b>	Charcoal kiln	<b>G</b>	Gunfire		
<b>C</b>	Cultivation	<b>M</b>	Mining	<b>N</b>	Traps or snares	<b>O</b>	Other		

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	15	0	0	0	10	0	1	0	R(1)	
50-100	15	0	0	0	10	0	1	0	R(1)	
100-150	15	0	1	0	20	0	2	0	R(2)	
150-200	13	0	0	0	25	0	2	0	R(1)	
200-250	10	0	0	0	15	1	0	0	R(1)	
250-300	14	0	1	1	15	0	0	0		
300-350	15	0	5	1	7	0	1	0		
350-400	15	0	1	0	15	0	0	0		
400-450	12	0	2	1	15	0	2	1	R(1)	
450-500	15	0	0	0	17	0	0	0		
500-550	15	0	1	0	18	0	0	0		
550-600	15	0	0	0	18	0	0	0		
600-650	13	0	0	0	15	0	2	0		
650-700	15	0	1	0	17	0	0	0		

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
700-750	19	0	0	0	15	1	0	0		
750-800	12	0	0	0	15	0	0	0		
800-850	15	0	0	0	15	0	2	0		
850-900	12	0	0	0	20	0	0	0		
900-950	15	0	0	0	12	0	0	0		
950-1000	15	0	5	0	20	0	5	0		
<b>Total</b>	<b>285</b>	<b>0</b>	<b>17</b>	<b>3</b>	<b>314</b>	<b>2</b>	<b>18</b>	<b>1</b>	<b>R(8)</b>	

Key to topography		Gentle lower slope		Gentle mid-slope		Gentle upper slope	
<b>GLS</b>		Gentle lower slope		Gentle mid-slope		Gentle upper slope	
<b>SLS</b>		Steep lower slope		Steep mid-slope		Steep upper slope	
<b>Key to vegetation cover</b>							
<b>1 (&lt;10%)</b>		<b>2 (10-50%)</b>		<b>3 (&gt;50%)</b>			

Invasive alien species			
LC = Lantana camara	CO = Cedrela Odorata	RU = Rubus spp	SJ = Stachytarpheta jamaicensis
			O = Other (specify)

High conservation values			
S = Stream or spring	M = Ming'oko	T = Threatened plant species	E = Coastal forest or E. Arc endemic species
			O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			
50-100	GUS	3	2	2			Duikers trail(2)
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			Elephant shrew trail(2)

Section (m)	Topogra phy	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
200-250	GUS	3	2	2			
250-300	GUS	3	2	2			Wildpig playing ground
300-350	GUS	3	2	2			Beehives(2)
350-400	GUS	3	2	2			Wildpig trail(2)
400-450	GUS	3	2	2			
450-500	GUS	3	2	2			Duikers trail(2)
500-550	GUS	3	2	2			Dikdik snare(1)
550-600	GUS	3	2	2			Elephant shrew trail(1)
600-650	GUS	3	2	2			Duikers trail(3)
650-700	GUS	3	2	2			
700-750	GUS	3	2	2			
750-800	GUS	3	2	2			Elephant shrew trail(1)
800-850	GUS	3	2	2			
850-900	GUS	3	2	2			Dikdik pellets and trail
900-950	GUS	3	2	2			
950-1000	GUS	3	2	2			

Notes :-

### Disturbance Transect 13

<b>Names of recorders:</b>	Justine Gwegime & Habibu Said	
<b>Date of survey (dd/mm/yyyy):</b>	3/10/2012	District: <b>GAIRO</b>
<b>Village:</b>	<b>MKOBWE</b>	Nearest sub-village: <b>MASENGE</b>
<b>Village Forest Reserve:</b>	<b>MAMIWA KISARA</b>	Transect Number: <b>13</b>
<b>Dominant vegetation:</b>		Bearing: <b>N</b>
<b>Start point</b> Longitude:	<b>270876</b>	Latitude: <b>9293200</b> Altitude (m): <b>1840</b>
<b>End point</b> Longitude:	<b>270811</b>	Latitude: <b>9293961</b> Altitude (m): <b>1885</b>

### Key to disturbance categories

P	S	T	R
Pitsaw	Settlement	Timber, planks, poles	Path or road

F C	Fire damage Cultivation	B		K		G	
		M	Mining	N	Traps or snares	O	Other

section (m)	Qty of poles (5 – 15 cm)				Qty of timber (> 15 cm dbh)				Other disturbances	
	Live	Naturally dead	Cut		Live	Naturally dead	Cut		Within the transect (qty)	Outside the transect (qty)
			Old	Fresh			Old	Fresh		
0-50	15	0	0	0	13	0	0	0	0	
50-100	12	0	0	0	22	0	0	0	0	
100-150	13	0	0	0	20	0	0	0	0	
150-200	10	0	3	0	20	1	1	0	R(1)	
200-250	16	0	0	0	20	0	1	0	0	
250-300	8	0	0	0	15	0	3	0	P(1)	
300-350	20	0	0	0	12	0	0	0	0	
350-400	20	0	0	0	17	0	3	0	R(1)	
400-450	15	0	0	0	16	0	0	0	0	
450-500	13	0	0	0	20	0	1	0	F & P(1)	
500-550	20	0	0	0	16	0	0	0	0	
550-600	9	0	0	0	17	0	0	0	0	
600-650	13	0	0	0	17	0	0	0	0	
650-700	15	0	0	0	19	0	0	0	0	
700-750	17	0	0	0	20	0	1	0	0	
750-800	19	0	0	0	14	0	0	0	0	
800-850	15	0	0	0	27	0	2	0	R(1)	
850-900	15	0	0	0	16	0	0	0	R(1)	
900-950	13	0	0	0	8	0	0	0	R(1)	
950-1000	13	0	0	0	10	0	0	0	R(1)	
<b>Total</b>	<b>291</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>339</b>	<b>1</b>	<b>12</b>	<b>0</b>	<b>R(6),F(1)&amp;P(2)</b>	

Key to topography		Gentle lower slope		Gentle mid-slope		Gentle upper slope		Cliffs	
GLS		GMS	GUS	CL					

<b>SLS</b>	Steep lower slope	<b>SMS</b>	Steep mid-slope	<b>SUS</b>	Steep upper slope	VF	Valley floor
<b>Key to vegetation cover</b>							
	1 (<10%)	2 (10-50%)	3 (>50%)				

<b>Invasive alien species</b>		
LC = Lantana camara	CO = Cedreia Odorata	RU = Rubus spp
	SJ = Stachytarpheta jamaicensis	O = Other (specify)

<b>High conservation values</b>		
S = Stream or spring	M = Ming'oko	T = Threatened plant species
	E = Coastal forest or E. Arc endemic species	O = Other e.g. edible mushrooms

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
0-50	GUS	3	2	2			Duikers snare (2), Duikers trail (3)
50-100	GUS	3	2	2			
100-150	GUS	3	2	2			
150-200	GUS	3	2	2			Bird snare (2)
200-250	GUS	3	2	2			Bird snare (2)
250-300	GUS	3	2	2			Pitsaw (1)
300-350	GUS	3	2	2			
350-400	GUS	3	2	2			
400-450	GUS	3	2	2			Snare-Bird
450-500	GUS	3	2	2			Bird snares (2), Pitsaw (1)
500-550	GUS	3	2	2			Bird snares (2), Beehive (1)
550-600	GUS	3	2	2			Elephant shrew trail (1)
600-650	GUS	3	2	2			Elephant shrew trail (4)
650-700	GUS	3	2	2			
700-750	GUS	3	2	2			

Section (m)	Topography	Canopy cover	Shrub layer	Ground layer	Invasive alien species	High conservation values	Other observations
750-800	GUS	3	2	2			
800-850	GUS	3	2	2			
850-900	GUS	3	2	2			
900-950	GUS	3	2	2			
950-1000	GUS	3	2	2			P(2)

Notes :-



