Darwin Initiative Award 15/036: Monitoring and Managing Biodiversity Loss in South-East Africa's Montane Ecosystems

MT MABU, MOZAMBIQUE:

BIODIVERSITY AND CONSERVATION

November 2012

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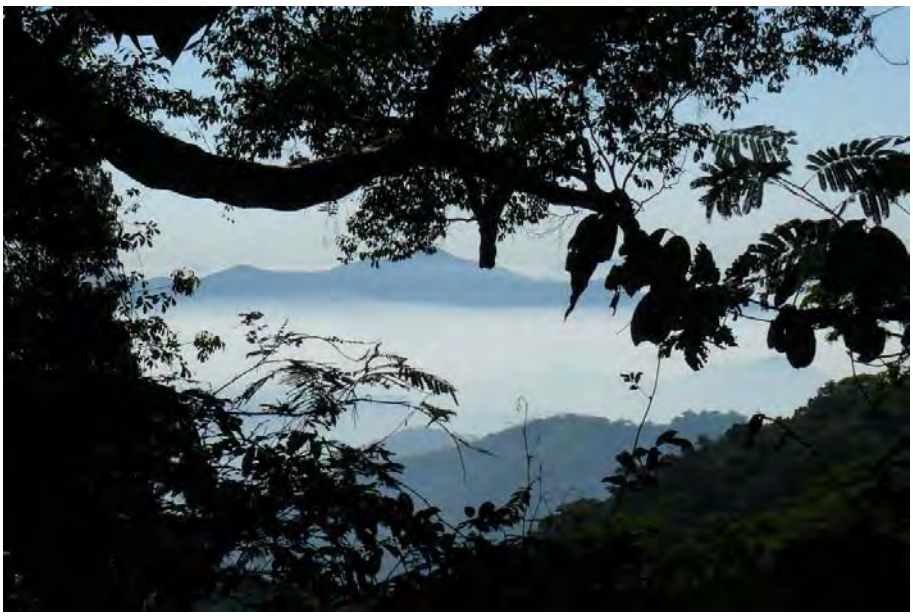

Front cover: Main camp in lower forest area on Mt Mabu (JB).

Frontispiece: View over Mabu forest to north (TT, top); Hermenegildo Matimele plant collecting (TT, middle L); view of Mt Mabu from abandoned tea estate (JT, middle R); butterflies (*Lachnoptera ayresii*) mating (JB, bottom L); *Atheris mabuensis* (JB, bottom R).

Photo credits: JB – Julian Bayliss; JT – Jonathan Timberlake; TH – Tim Harris; CS – Camila de Sousa; TT – Tom Timberlake

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SUMMARY

Located in north-central Mozambique, 95 km south-east of Mt Mulanje in southern Malawi, Mt Mabu is a granitic massif rising to 1700 m. Much of it is covered in exceptionally well-developed and little-disturbed moist forest. It was first explored biologically in 2005 as part of a Kew-led project funded through the UK's Darwin Initiative, followed by a large expedition under the same project in 2008. Initially done with the help of Google Earth imagery, discovery of the extensive forest and the subsequent expedition gave rise to much international media coverage, some of which is outlined here. This report describes the area and its history, and outlines the main biological findings made under the project.

Covering an estimated area of 7880 ha, with around 5270 ha of this at medium altitude (1000–1400 m), the forests on Mt Mabu are some of the most extensive of this type in southern Africa. Mid-altitude forests are now increasingly rare as so many have been cleared for agriculture. In addition, Mabu's forest is also remarkably little disturbed, probably as it is mostly found on very steep and rugged terrain. Moist woodland (*Syzygium cordatum*, *Pterocarpus angolensis*, *Xylopia aethiopica*) and gully forest (*Albizia adianthifolia*, *Erythrophleum suaveolens*, *Newtonia buchananii*) are found below 1000 m, along with abandoned tea estates on the southern and south-eastern slopes. The main area of mid-altitude moist forest, perhaps the biologically richest and most important area, is characterised by large trees 40–50 m high of *Strombosia scheffleri*, *Newtonia buchananii*, *Chrysophyllum gorungosanum* and *Maranthes goetzeniana*, with extensive clumps of the bamboo *Oreobambos buchwaldii* in gullies. Much moister Afromontane forest, 20–25 m high, is found above 1350–1400 m altitude, typically with *Olea capensis*, *Rapanea melanophloeos*, *Aphloia theiformis*, *Faurea racemosa* and *Podocarpus latifolius*. Emerging from the Afromontane forest at 1600–1700 m are relatively small areas of granitic (syenite) rock with patches of montane shrubland and clumps of the sedge *Coleochloa setifera*, a common habitat in this region of inselbergs.

Surveys carried out under the Darwin project yielded 249 plant species above 800 m altitude, of which two (a mistletoe *Helixanthera schizocalyx* and the shrub *Vepris* sp. nov.) are new to science and an additional 11 are significant range extensions from the Chimanimani Mountains or Tanzania's Southern Highlands and/or new records for Mozambique.

Zoological findings of vertebrates were even more impressive with 126 bird species being recorded, including the discovery of significant populations of Cholo Alethe and the race *belcheri* of Green Barbet, along with smaller populations of Dapple-throat, Spotted Ground Thrush, Namuli Apalis (previously believed to be endemic to Mt Namuli) and Swynnerton's Robin. Of the 12 bat species recorded, one is new (*Rhinolophus mabuensis*) and two are new records for the country. A total of 15 reptile and 7 amphibian species were found, including three new species (the Mabu forest viper *Atheris mabuensis*, a chameleon *Nadzikambia baylisii* and a pygmy chameleon *Rhampholeon*). Two other snakes and a frog may also be new to science.

Much effort went into surveying the butterflies, with 203 species on the checklist including 39 new country records. Four of these are new species (*Baliochila* sp. nov., *Cymothoe* sp. nov., *Epamera* sp. nov., *Leptomyrina* sp. nov.) with a further three new subspecies.

At present the threats to the forests of Mt Mabu are not particularly great, with the great majority of it showing very little sign of human disturbance apart from hunting/snaring for bushmeat. However, there is a notable impact on the forest–woodland margin from fire and clearance for subsistence agriculture. Logging and clearance for commercial agriculture remain potential threats, especially with the recent marked expansion of agriculture in Mozambique and new ownership of the abandoned tea estates. At present the Mabu area is not formally protected, although there are moves to gazette it at a Provincial level and develop a conservation project through a local NGO, Justica Ambiental, and Fauna and Flora International.

Twelve recommendations for both management and further research are given. At this stage it is not our technical or scientific knowledge on Mabu's biodiversity that is the limiting factor for focussed conservation action, but the development of management plans and implementation of such action on the ground. As with many forests, the forests on Mt Mabu are still able to regenerate and maintain themselves if the underlying ecological factors (rainfall, soils, regeneration microclimate and availability of propagules) remain functional. And on Mt Mabu these attributes are, at present, still healthy.

1. INTRODUCTION

The discovery in 2005 of a large expanse of forest on Mt Mabu in north-central Mozambique and the subsequent 2008 expedition, gave rise to much interest nationally and internationally – some said a "lost Eden", others called it the "Google Forest" as it was first noted using Google Earth imagery. In truth, the mountain had already been mapped and named and the forest was, of course, known to the local population. It is just that early explorers and, more recently, scientists and similar professionals had not recorded or visited it. But the large extent and relatively little-disturbed nature of the forest was indeed a very significant find, as were the number of new species found.

Lying just west of the district centre of Tacuane in Zambézia Province, about 80 km south-east of the Malawi border near Mt Mulanje, Mt Mabu is one of a series of granitic blocks or inselbergs rising above the surrounding coastal lowlands. The country is sufficiently rugged that it has attracted little agriculture except on the more gentle footslopes, where tea and other plantations were established during the Portuguese colonial period.

Mt Mabu and its forests had no formal protection, nor was it in any way recognised as an area worthy of conservation before this project's major expedition in October 2008. It is hoped that its now greatly increased profile will lead to sustainable conservation initiatives.

1.1 Background

Under a collaborative project – "Monitoring and Managing Biodiversity Loss on South-East Africa's Montane Ecosystems" funded by a UK Government Darwin Initiative grant – various trips were made to Mt Mabu area from 2005 to 2010 (Table 1), in particular a major expedition was undertaken in October 2008 (see Bayliss 2009). This was followed subsequently by a smaller trips in 2009–2010 looking at butterflies and reptiles and for natural history filming. Most of these trips were a collaborative effort between the Royal Botanic Gardens Kew (RBG Kew), the Instituto de Investigação Agraria de Moçambique (IIAM), the Maputo Natural History Museum (MHN), the Mulanje Mountain Conservation Trust (MMCT), the Forest Research Institute of Malawi (FRIM), the African Butterfly Research Institute (ABRI) in Kenya, and BirdLife International. A full list of participants on the main 2008 expedition is given in Annex 1. Additional persons who contributed to sections of this report are listed in the Acknowledgements.

The objectives of the study and expeditions were:

1. To undertake botanical and vegetation field survey of Mt Mabu,
2. To gather additional zoological information on the mountain, particularly on birds, reptiles and butterflies,
3. To train a team of Mozambican and Malawian biologists in botanical and vegetation survey techniques,
4. To assess the extent, status and threats to the moist forest and other biodiversity on the mountain,
5. Based on gathered field data, to develop species and habitat recovery plans.

This report presents and discusses findings from the main 2008 expedition, reconnaissance and subsequent trips, but also attempts to place these in a broader context as well as draw conclusions relevant to Mabu's conservation. Detailed species lists for plants, birds and butterflies are presented, along with partial data on bats, reptiles and other groups. In addition

to the species lists we give the first detailed account of the vegetation, and discuss the threats to all biodiversity. Particular attention has been paid to endemic, rare or threatened species. Our main attention was given to areas and species above 800 m altitude, as below this height much of the vegetation has already been transformed.

Table 1. Main visits to Mt Mabu, 2005–2010.

dates	**taxa recorded**	**persons involved**
Dec 2005	birds, plants, herps, butterflies	J. Bayliss, C. Spottiswoode, E. Herrmann, H. Patel
Jan 2006	butterflies, herps	J. Bayliss and others
Sept-Oct 2008	herps, plants, butterflies	J. Bayliss, H. Patel and others
Oct 2008	plants, birds, herps, small mammals, butterflies	main Darwin project expedition
May 2009	butterflies, herps	J. Bayliss, W. Branch, ABRI and others
Oct-Nov 2010	butterflies, herps	J. Bayliss, ABRI, FFI
Nov-Dec 2010	butterflies, herps	J. Bayliss, BBC filming

1.2 Media Coverage

Unlike other expeditions to mountains in northern Mozambique and Malawi carried out under this Darwin Initiative project, the 2008 trip to Mt Mabu gave rise to a phenomenal amount of international media attention. This coverage and interest – which still continues in 2012 – is outlined in Annex 2, along with a selection of references to some of the main articles and web links, including videos.

2. DESCRIPTION OF STUDY AREA

2.1 Geography and Geology

The highest of a series of blocks, Mt Mabu rises above the surrounding lowland plains at around 350–450 m altitude, just north of the Rio Lugela in Zambézia Province, north-central Mozambique. It is centred on 16°17'S, 36°24'E, with the 1710 m summit at 16°17'56.5"S, 36°23'44.3"E. Situated within the District of Lugela, it lies some 95 km south-east of Mt Mulanje in southern Malawi, 120 km south-west of Mt Namuli and 200 km from the Provincial Capital of Quelimane on the Indian Ocean coast (Figure 1). The district centre of Lugela is 40 km away, while the larger town of Mocuba, at the confluence of the Lugela and Licungo rivers, is 85 km to the south-east.

The Mabu massif is essentially a complex of granitic inselbergs ('whalebacks') or ancient igneous intrusions, exposed by millions of years of subsequent erosion. It is significantly smaller than the Namuli complex (see Timberlake *et al.* 2009) and, unlike that massif, does not include any substantive area of upland plateau. The rock forming the Mabu massif is syenite, similar to granite, an igneous intrusion of the younger Precambrian Namarroi series dating from 850–1100 Mya (Instituto Nacional de Geologia 1987). This intrusion is surrounded by migmatites, also of the Namarroi series.

Lugela District contains four Posto Administrativos and 16 Localidades – Mabu is in the Posto Administrativo (P.A.) of Tacuane, Mabu Localidade. The nearest main administrative centre is Tacuane 15 km away (Figure 2), with the lesser administrative post of Limbuè lying on the southern footslopes of Mabu. The population of P.A. Tacuane in January 2005 was 18,191 persons (Ministério da Administração Estatal 2005), a relatively low number. Population pressure is not high in this area, although the area may well have been more populous during the colonial period when the tea estates were providing employment. Areas visited by the 2008 expedition overlain by contours are shown in Figure 3.

A GIS-based altitudinal analysis of the Mt Mabu area by J. Bayliss showed that out of a broad study area surrounding the Mabu massif of around 300 km^2, 8308 ha lies above 1000 m (Table 2), which is around the lower limit of true moist forest (at least on the eastern slopes), although lowland gully forest can be found below this (see Section 4.3.3).

Table 2. Extent of area above 1000 m by altitudinal class for the Mt Mabu massif.

Altitude (m)	extent (ha)	%
1000–1200	3527	42.5
1200–1400	3723	44.8
1400–1600	1031	12.4
1600+	27	0.3
Total	**8308**	100.0

Although the forest on Mt Mabu was first noted on Google Earth (Figure 4a), and has sometimes been called the "Google Forest", there are some inaccuracies present on the webpage images (accessed January 2012). The main one is that the peak of Mt Mabu is shown on Google Earth as being 18 km east of its actual location – the peak shown as "Mt Mabu" is a wooded area away from the main massif. Secondly, on the ground it is clear that the peak is along a bare open ridge south-west of the main rock outcrop, but the highest point appearing on Google Earth imagery is 1651 m, not 1710 m as on all cadastral maps, and is

apparently situated on a vegetated lower ledge some 600 m to the south-east. This could be an artefact resulting from cloud cover.

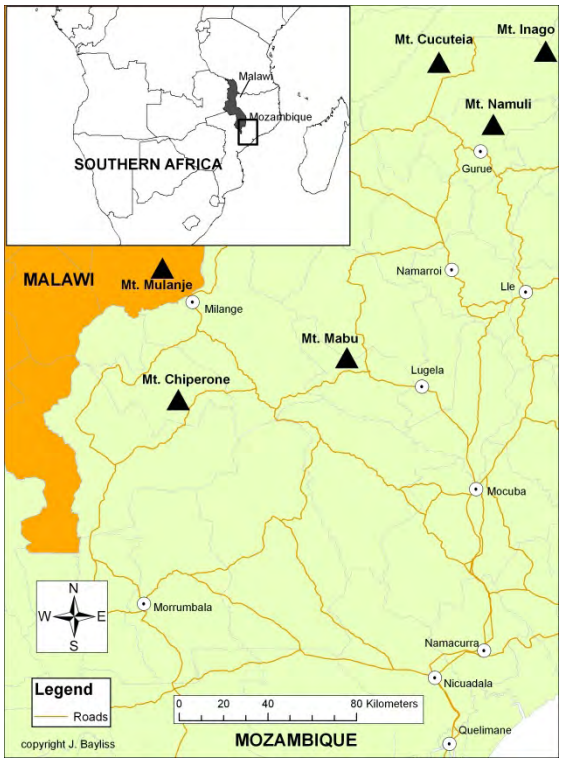

Fig. 1. Montane areas in N Mozambique studied under the Darwin Initiative project [JB].

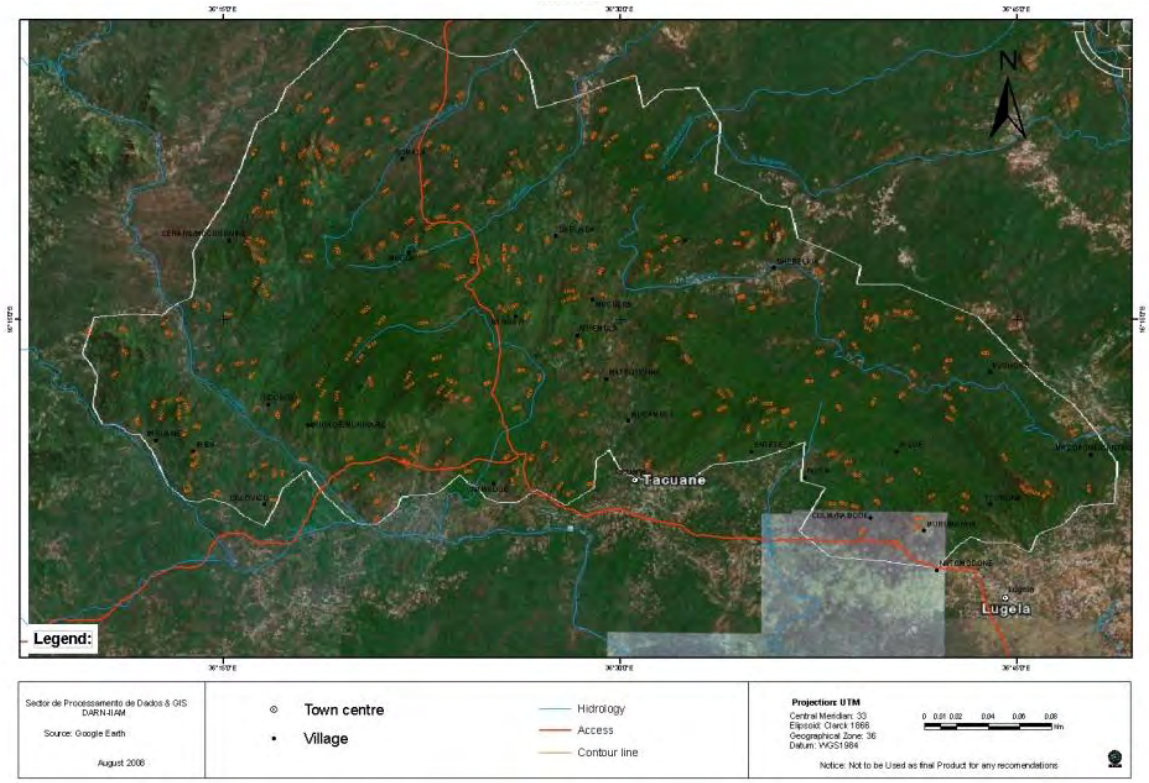

Fig. 2. Google Earth image of Tacuane area showing Mt Mabu (centre left) and roads (Aug 2006)[JF].

2.2 Climate

Climate data from the Mabu massif itself above 1000 m altitude are not available, but data for the Madal tea estates near Tacuane (16°21'S, 36°22'E, 400 m altitude), possibly at Limbuè just

7 km away, is summarised in Kassam *et al.* (1981). These data are for only 16 years and probably date from the mid-1960s.

Mean annual rainfall is given as 2119.1 mm, ranging from a monthly mean of 34.2 mm in September to 362.3 mm in January. The main rainfall months are November to April (1793.1 mm over 6 months or 84.6% of annual total), while the four months from December to March have a mean of 1410.9 mm (66.6% of total). Over the 16 years recorded the wettest months were March (mean 381.1 mm) and January (mean 362.3 mm).

Mean annual temperature was 23.7°C, ranging from 21.0 in July to 25.5°C in October. The mean maximum of 32.9°C was in October with a mean minimum of 14.9°C in July. Unlike the situation on Mt Namuli (Timberlake *et al.* 2009), the occurrence of frost is likely to be rare. Evapotranspiration (Penman) was 1252.6 mm/year ranging from 63.7 mm in June to 142.5 in October. During the cooler winter months potential evapotranspiration is roughly equivalent to rainfall, but in October it is more than three times monthly rainfall.

According to Reddy (1984) in his overview of Mozambique's climate, rainfall in the area should be around 1500 mm/year (surprisingly less than shown by actual rainfall records) with a low variation of only 20%. The winter rainfall index (30) indicates that some winter cropping is possible. In a national context the Cha Madal area is a relatively high rainfall area similar to Mt Namuli (zone 1–2a, moderately cool; national climatic resources inventory, Voortman & Spiers 1982), with the possibility of two rainfed growing periods in 10% of years, perhaps with a 300 day growing period each year.

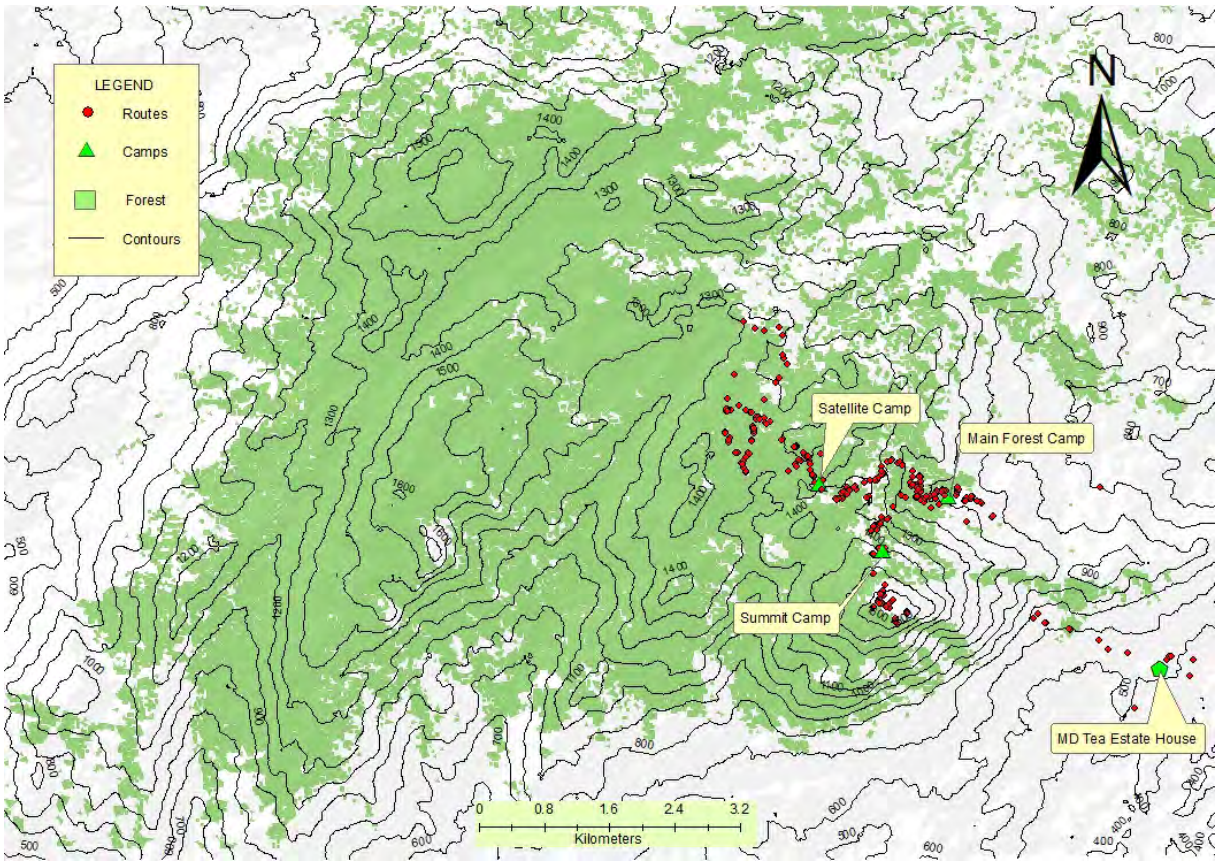

Fig. 3. Map of Mt Mabu area showing forest extent and main localities visited (Oct 2008)[JB].

2.3 Aerial Photos

The only aerial photos apparently available are from August 1965 and June 1969 at a given scale of around 1:43,000, although subsequent analysis and measurements from the 1:50,000 map sheet suggest the scale is actually around 1:35,000. Owing to distortion, all area determinations were made using satellite imagery.

Aerial photos of Mt Mabu, ±1:43,000 scale:
row 418/062–072 (north), 17 August 1965
row 3111/076–086 (mid), 15 June 1969
row 418/118–111 (south), 17 August 1965

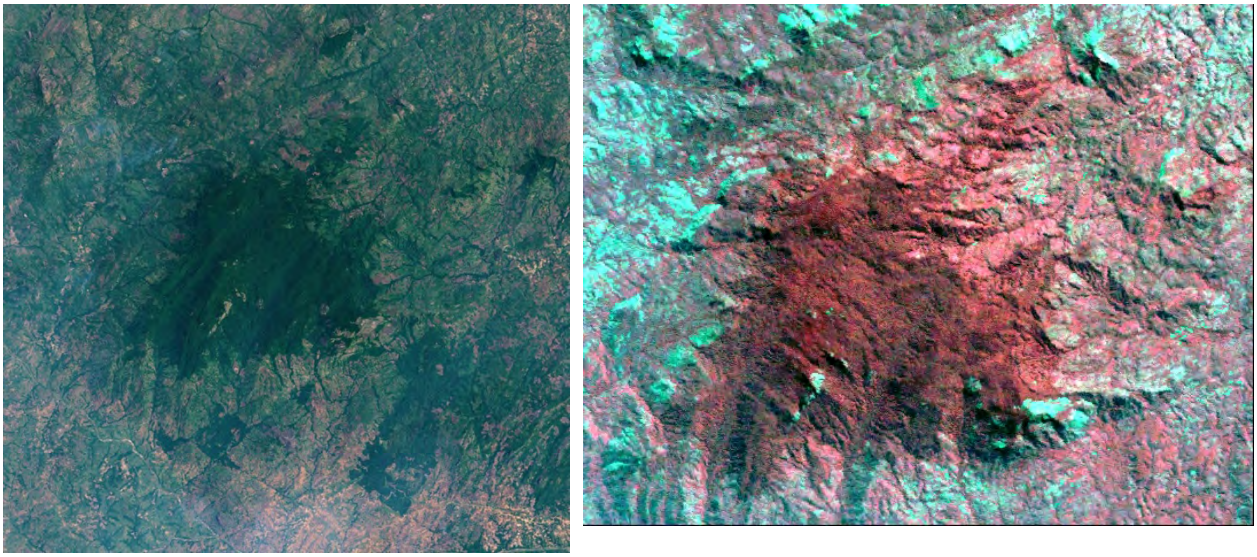

Fig. 4a,b. Google Earth image of Mt Mabu massif from 2006 (left) showing forest + dense woodland cover in dense green and abandoned tea plantations in paler blue-green (lower right and lower centre, with straight lines) and false-colour Landsat image (right) from July 2005 with dense vegetation cover shown in red.

3. HISTORY AND EARLY COLLECTING

3.1 Early History

We have not been able to find any reports of early colonial explorers noting or visiting the Mabu massif, at least in the British sources that describe the exploration of Mt Namuli and travels across northern Mozambique to southern Malawi in the latter 19th and first half of the 20th century (e.g. Johnson 1884, O'Neill 1884, Last 1887, Vincent 1933a).

Joseph Last, an intrepid 19th Century British traveller, carried out a lengthy journey in 1885–1887 from the southern Tanzania coast to Blantyre in what is now Malawi, around parts of southern Malawi and then down to the coast at Quelimane and back to Blantyre (Last 1887, 1890, Timberlake *et al.* 2009). Part of this long trip involved a foot safari from Mt Namuli down along the Rio Licungo to the coast and then, in mid-December 1886 after a few days rest in Quelimane, upstream along the Rio Licungo to what is now Mocuba, along the Rio Lugela and through the hilly country north of Lugela town to what is now Namarroi. From there he walked along the Rio Luo entering Malawi just south of Lake Chilwa (Chirwa) and north of Mt Mulanje, arriving in Blantyre on 14 January 1887. Unfortunately, in the account published by his sponsors, the Royal Geographical Society (Last 1887), he hardly mentions the Lugela leg of this trip. The route he took is shown on a subsequent map (Last 1890, portion shown in Figure 5). However, despite attempts to match the Lugela portion with present 1:250,000 and 1:50,000 map sheets, his route could not be traced except in fairly broad terms.

All that can be said is that Last left the Rio Lugela heading north upstream of present-day Mocuba (not marked on his map) somewhere between Mt Cuba/Murra (16°40'S, 36°50'E) and just upstream of the Xilusi–Lugela confluence (16°32'S, 36°38'E). From there he made his way between the hills west of Mt Mavigue ("Mavugwe", 16°22'S, 36°45'E), passing east of what is now Muabana but west of Mt Muiane ("Mwiani",16°02'S, 36°37'E), and then crossing the present-day Rio Mucodi soon after, some 30 km west of Namarroi, before travelling along the Rio Luo. Thereafter he followed the Luo westwards towards Malawi, which he entered just south of Lake Chilwa (Chirwa).

In those days, fixing longitude was not easily done and distances were estimated from time spent walking, so many distortions are apparent in the 1890 map (Figure 5). Thus it has not been possible to identify more than a very few of the hills or other points it shows, and the relative positions of peaks seem highly distorted compared to present-day maps. However, although it seems fairly certain that of the early recorded travellers Last perhaps came closest, he did not pass close to Mt Mabu or see it (despite an intriguingly-named peak "Mapu H"[hill] on his 1890 map), or travel along the route of the present-day Tacuane–Muabana road. Unfortunately, in his account there is also no mention of the type of country he passed through, the people or the life in these areas, or even whom he went with.

Earlier, in 1884, Daniel Rankin and H.E. O'Neill (then the British Consul on Mozambique Island) plus 23 porters, walked from Blantyre to Quelimane along an existing and significant trade route to see how quick and effective that route was to the coast (Rankin 1885). It took them just 39 days. At the time there was concern that the Rio Zambezi was becoming less passable to boats owing to river silting, and that this route into the important new settlements of Blantyre and Zomba in southern Malawi could be easily cut by hostile forces. Their route passed south of the Mulanje massif, across the headwaters of the Rio Lugela but kept to higher ground until it met the Rio Tetema. From here it followed the river down to the Munguze ("Mulongusi") confluence and then down the Rio Licuare ("Likwati") to Quelimane. However, this route, also shown on Last's map (Last 1990), passes quite a long way south of Mt Mabu.

Fig. 5. Map showing route of Joseph Last from Malawi to Quelimane, 1887.

Another book by an early traveller (Maugham 1910) on the whole Zambezia area does not mention Mabu or the area around, focussing more on the coastal strip. Although the Namuli area is clearly shown on his map, the Mabu area is almost omitted (Figure 6).

Hence despite a significant amount of trading and travelling in this part of north-central Mozambique, it appears that the Mabu area was continually by-passed, perhaps because of its rugged terrain, poor agricultural potential, thus scattered and low human population.

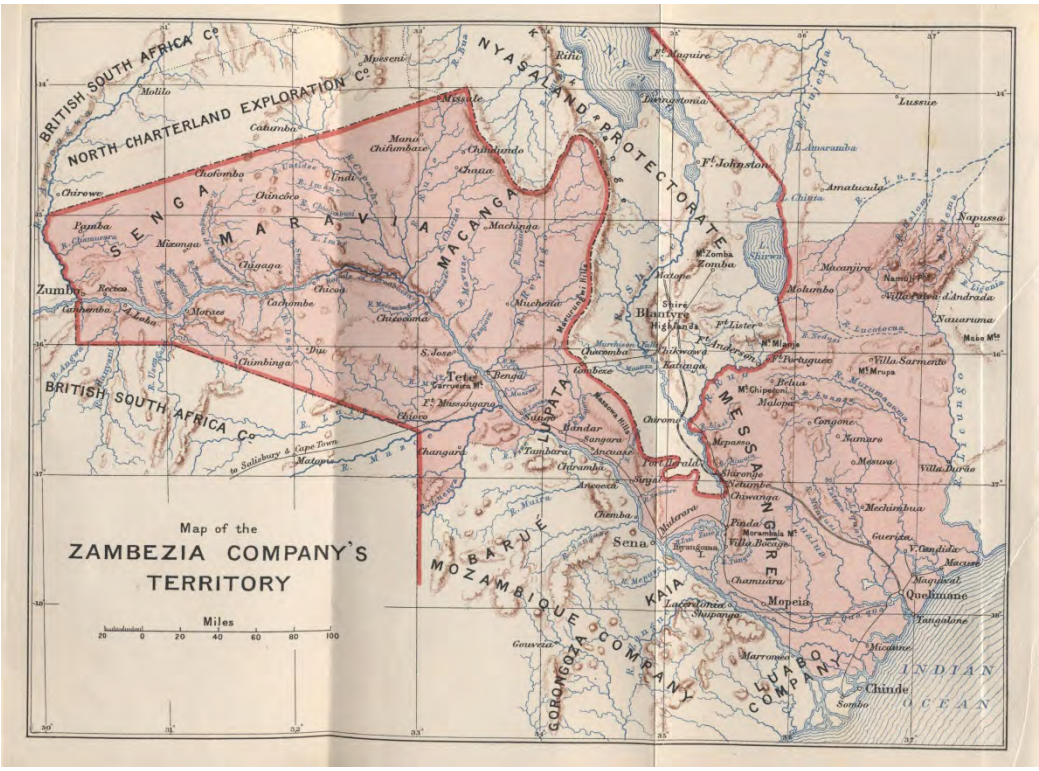

Fig. 6. Map of Zambezi Company territory (from Maugham 1910).

3.2 Recent History

The first major economic development in the area appears to have been the establishment of tea plantations in what was then Tacuane District on the lower slopes of Mt Mabu in the 1930s (Wilson, Smithett & Co. 1962). By 1961 there were three tea estates in the area and two tea factories, compared to 14 estates and 11 factories in the Gurué area around Mt Namuli and 7 estates and 3 factories in the Milange area just across the border from Mt Mulanje in Malawi. Details of the three Tacuane estates are given in Table 3. From these records it appears that the estate where the present Darwin expedition was initially based – Cha Madal – was by far the largest.

Table 3. Tea enterprises in the Mt Mabu area, with 1960 production figures (from Wilson, Smithett & Co. 1962).

Company	altitude (m)	Company	area under tea (ha)	tea production (kg)
Cha Madal	400	Sociedade Agricola do Madal	607.5	444,466
Cha Tacuane	700	Manuel Nunes	342.2	182,217
Cha Lugela	700	João Martins	93.2	(no factory)
			1042.9	626,683

The area under tea in northern Mozambique in the 1960s was surprisingly large at 15,010 ha, greater than that in Malawi (12,110 ha) or Kenya (14,950 ha). Mozambique's total tea production in 1961 was 23,368,000 lbs [pounds] (10,609,072 kg), with exports being 21,362,000 lbs (9,698,348 kg), compared to production of 31,518,000 lbs (14,309,172 kg) in Nyasaland [Malawi], 27,869,000 lbs in Kenya, 9,830,000 lbs in Tanganyika [Tanzania] and 2,379,000 lbs in Southern Rhodesia [Zimbabwe]. Hence production per hectare in Mozambique at 706.9 kg/ha was significantly less than that in Malawi (1182 kg/ha) or Kenya (847 kg/ha) (all figures from Wilson, Smithett & Co. 1962). Tea production was obviously a

major economic and agricultural activity in the area in the 1960s, but probably declined significantly in the 1970s with the Independence struggle and subsequent civil war.

At the base of Mt Mabu on the southeastern side is the now-derelict Cha Madal Tea Estate, until recently owned by Madal (now Rift Valley Holdings), a large Mozambican company best known for its coconut plantations on the coast near Quelimane. In 1961 the estate manager was John Edge (Wilson, Smithett & Co. 1962). It was obviously a large estate, with an extensive factory, out-buildings, workers' and managers' housing. What was presumably the Estate Manager's house (16°18'20.5"S, 36°25'28.8"E, Figure 7a,b) was a large, spreading, opulent building with a wonderful view over the surrounding plains. The estate was abandoned in August 1982 as fighting in the area reached a stage where tea production was no longer viable; the tea estate later became a Renamo base.

Fig. 7a,b. Base camp at abandoned tea estate manager's house, Cha Madal (left TH, right CS).

Around the Estate Manager's house many exotic tree species were planted, presumably both for utilitarian purposes and for shade and beautification. These included *Artocarpus heterophylla* (Jackfruit), *Eucalyptus* cf. *grandis* (probably for fuelwood and construction), *Vernicia montana* (Tung oil), *Grevillea robusta*, *Delonix regia*, *Ceiba pentandra* (Kapok), *Encephalartos* cycads and *Ficus elastica* (India Rubber tree).

The area of plantation tea can be clearly seen in the satellite imagery as a vegetation block south-east of the main forest area (Figure 4a). The estate was planted with over 600 ha of China hybrid tea (*Camellia sinensis* cultivar.), of which 520 ha were in production as of June 1961 (Wilson, Smithett & Co. 1962). As it has not been managed for almost 30 years, the tea bushes have grown up to 15 m forming an almost solid-canopy forest. Apparently, it may still be commercially viable if pruned, and could be linked to neighbouring tea-producing areas in Gurué or even in Mulanje in southern Malawi. Recently, a senior Madal representative suggested that the planned rehabilitation of the estate may take the form of removing the tea and replanting with other, more viable crops. However, Madal have now (2011 or early 2012) sold the estate to a company called Mozambique Holdings.

There is a Soviet map of the area, possibly forming part of a national 1:250,000 series produced in the late 1970s or early 1980s. The section of the sheet covering Mabu is shown in Figure 8. It gives a bit more detail than is available on the national Dinegeca 1:250,000 scale map series, and seems to have been derived separately, possibly from more recent aerial photos.

On the summit of Mt Mabu we noted the destroyed remains of a trigonometrical point (presumably from which the spot height of 1710 m was determined), and this was

subsequently borne out by David Scott (pers. comm., Feb. 2009) who reported constructing such a point with the Mozambique mapping agency Dinegeca in 1995.

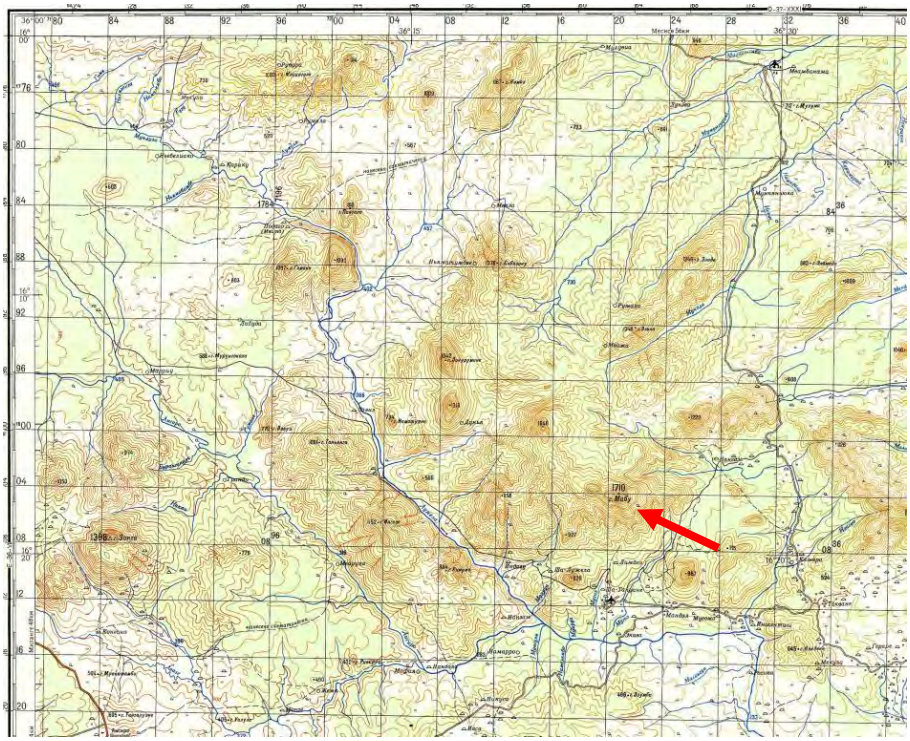

Fig. 8. Soviet map of Mt Mabu and Tacuane area, 1:250,000 scale (probably late 1970s). Mt Mabu indicated with red arrow.

4. VEGETATION

4.1 Previous Studies

It seems that there have been no previous studies on, or even recognition of, the vegetation of Mt Mabu or the immediate area. However, as mentioned earlier, the presence of a number of tea estates on the lower slopes means that the surrounding vegetation must have been known to agriculturalists, even if it appears not to have been formally documented.

On a continental or regional scale, the Mabu area is shown by White (1983) as forest patches of the East African coastal mosaic (type 16b) surrounded by Wetter Zambezian miombo woodland (type 21). White is wrong in his assertion that these forests are linked to those on the East African coast as they are clearly montane and medium altitude forests, very similar to those found on mountains in southern Malawi and Eastern Zimbabwe. The more detailed study by Wild & Barbosa (1968), on which White's study for this area was based, maps the Mabu area as Moist Evergreen Forest at low and medium altitudes (Type 1) surrounded by *Brachystegia spiciformis* (high rainfall) woodland (Type 21).

The more detailed (and earlier) map of Zambézia Province by Barbosa (1952) shows the Mabu massif as Unit 1 "Floresta higrófila tropical altimontana, de chuvas e nevoeiros" (moist high-altitude rain and cloud forest), the same as Mt Namuli, surrounded by Unit 2 "Floresta sub-higrófila, das altitudes medias, de *Brachystegia spiciformis* com elementos da floresta higrófila" (medium-altitude sub-moist forest [woodland] with *Brachystegia spiciformis* and moist forest patches). They describe the moist status due to incoming rain and clouds, with a transition to xerophytic cold-adapted vegetation higher up. A few forest species are listed.

A subsequent, more detailed study by Pedro & Barbosa (1955) looked at vegetation across the whole country from an agro-ecological viewpoint. The accompanying map shows Mabu ("Alto Lugela") as unit 79 (Zonas altimontanas da Zambézia–Niassa) occurring between 1000–1800 m. However, they mention that these zones have not been visited by them so they can not say much, and no species are listed.

4.2 Vegetation Mapping

Vegetation description of Mt Mabu was carried out by us in two ways – determination of the possible extent of forest using satellite imagery supported by the use of historical panchromatic aerial photos, and categorisation of vegetation types seen up the altitudinal gradient to the peak in the south-eastern part of the massif.

Two separate studies were done for area determination. One was carried out in 2006 using Landsat 7 ETM+ image (reference S-37-15-2000, 30 m resolution) from the year 2000 viewed through very near infra-red (VNIR) filters (Bayliss in Spottiswoode *et al.* 2008). This was not a supervised classification. The second area determination was done by Julian Bayliss in 2011 using a supervised classification based on locations noted in the field during October 2008 (see below).

Results from the first, Spottiswoode *et al.* study, although not rigorous, suggested an area of dense vegetation above 1000 m altitude – which was assumed to be moist forest, but this had not been confirmed at that stage – of between 5000 and 7000 ha, excluding the fairly obvious extent of old tea plantation (about 2000 ha, seen through the presence of straight margins, Figure 4a).

The second determination of forest extent (J. Bayliss) – the one which we are using here – was done by making a draft vegetation map based on an unsupervised classification using Erdas Imagine (maximum likelihood algorithm applied to a 6-band stack image) of a Landsat ETM+ image with 30 m resolution from July 2005 (path 166, row 071). Twelve classes in 9 broad habitat types were recognised, including an 'unclassified' class.

Following fieldwork a final vegetation map was developed using a supervised classification of the same Landsat image with radiometric and geometric correction, in which four broad habitat types were separated out – moist forest, woodland, agriculture, rock and bare ground (Figure 9). Based on this latter interpretation, it was calculated that 6937.4 ha of moist forest were present on Mt Mabu, most of it above 1000 m; a substantial buffer of woodland is also shown. Although the figure for forest extent may be an overestimate as the difference between moist forest and dense woodland is not clear-cut and shadow effects may be significant, it is thought to be the best estimate possible at this stage without more detailed interpretation and field survey. Using these figures, forest covers 66% of the total area above 1000 m (see Table 2).

This forested area was divided into altitudinal classes (see Table 4). Out of a total (planimetric) forest area of 6937.4 ha, 4563.6 ha lies between 1000 and 1400 m, which we consider to be primarily mid-altitude moist forest, and an additional 919.5 ha lies above 1400 m, which we consider to be high altitude or Afromontane moist forest. In addition, there is a significant amount of forest below 1000 m, but much of this is riverine or gully forest and perhaps some is overgrown plantation. The main forest block is that area above 1000 m altitude, which is 5483 ha.

Table 4. Extent of forest area by altitudinal class for the Mt Mabu massif (derived from J. Bayliss supervised classification, 2011).

Altitude (m)	measured planimetric extent (ha)	%	estimated extent using slope correction factors (ha)
below 1000	1454.3	21.0	1600
1000–1200	1719.9	24.8	5270
1200–1400	2843.7	41.0	
1400+	919.5	13.2	1010
Total	**6937.4**	100.0	**7880**

What should be also taken into account is that these forests are mostly on steep slopes, hence the actual area covered is significantly larger than the planimetric figures given above. Using an approximation of a 30^{o} slope between 1000–1400 m (not an unreasonable assumption given the steep slopes there) and an estimated 15^{o} slope below 1000 m and above 1400 m, coupled with tangent tables, a rough rounded estimate of forest area in these various altitudinal bands is shown in the right-hand column of Table 4. The forest extent in the 1000–1400 m band is 5270 ha, higher than the cumulative planimetric figure of 4564 ha. Coupled with the forest extent above and below on less steep slopes, this gives a total forest cover on the mountain (excluding the tea plantations) of around 7880 ha.

In totally separate exercises, the National Land Cover map of Mozambique gives the total extent (planimetric) of forest cover in the Mabu area as around 5500 ha (J. Francisco, pers. comm. 2010), while Susana Baena (RBG Kew GIS Unit) did an initial partially supervised classification using 26 ground control points derived from a reconnaissance in June 2008 that arrived at a more conservative figure of 5998 ha (see Figure 10).

All these studies show that the area of moist forest is very extensive for the region (between 5500 and 7900 ha) with the great majority of it being found between 1000 and 1400 m. Such mid-altitude forest is increasingly rare in the southern African region as these areas have often been cleared in the past 100 years for timber and agriculture. We believe that it represents perhaps the largest extent of moist forest at such altitudes in southern Africa; in addition these forests are in excellent condition and little disturbed.

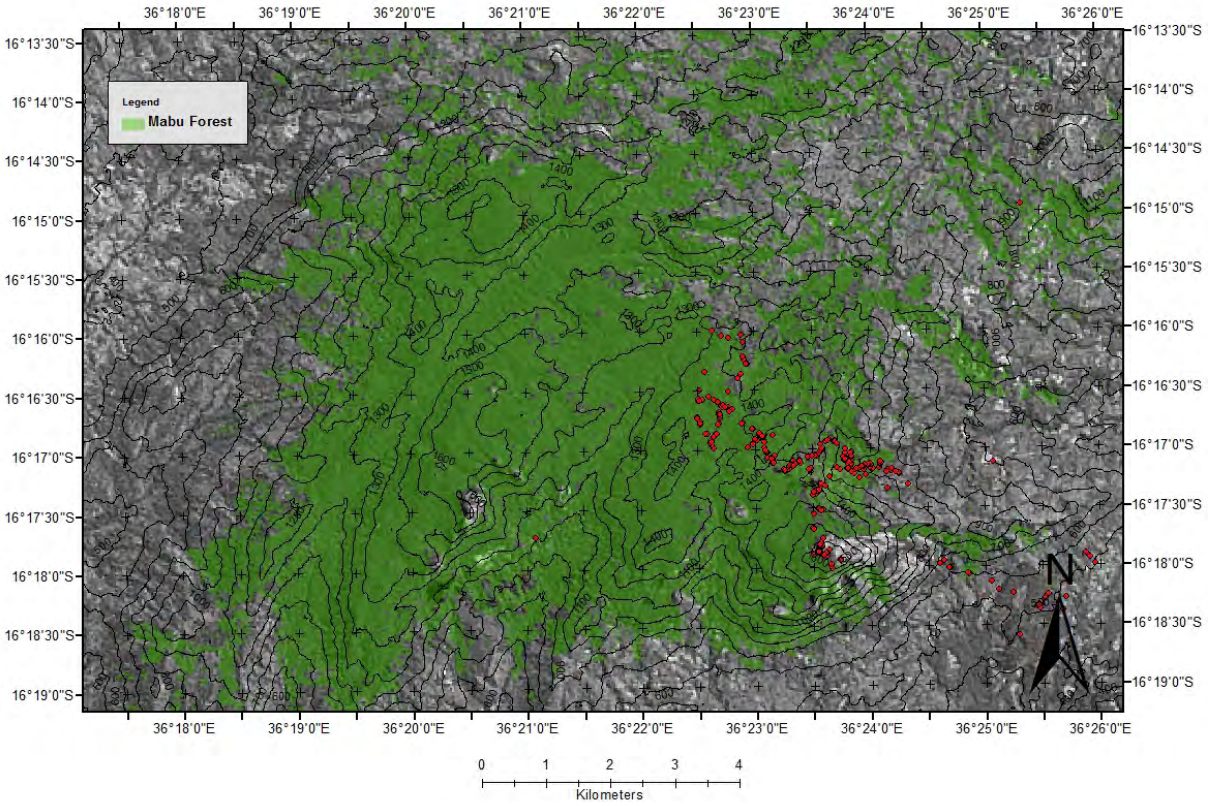

Fig. 9. Supervised classification of Mt Mabu forest vegetation, 2011 (J. Bayliss). Red dots indicate routes travelled on 2008 expedition.

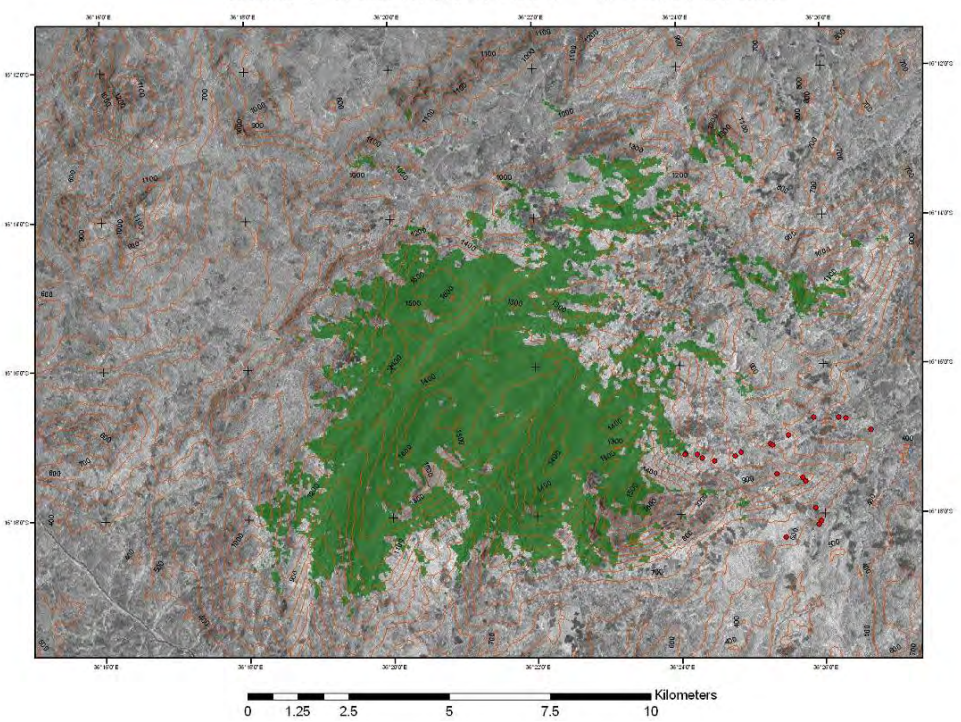

Fig. 10. Partially-supervised classification of Mt Mabu forest vegetation, early 2008 (S. Baena, RBG Kew). Red dots indicate path used in 2006.

4.3 Vegetation Types

As the expedition only studied vegetation of the lower slopes in the south-eastern corner above the abandoned tea estate, and was not able to visit the majority of the forested area of Mt Mabu, any account of the vegetation must be limited in scope. The account below covers primarily the south-eastern side of the mountain that was extensively visited. Vegetation types and patterns on the drier western and northern slopes appear to be somewhat different from those described here (see Section 4.3.5).

Above 600 m altitude vegetation on the Mabu massif can be classified into three main groups – woodland, forest, and scrub/sedge patches on bare rock. Below this altitude abandoned plantations and secondary vegetation are found, along with patches of lowland riparian forest. Above 800 m the forest group can be further subdivided into tall riparian forest, tall medium altitude forest and shorter high altitude ("montane") forest (sub-montane in the classification of Müller 1999), but within which there was significant variation.

The great majority of the area studied was under forest, the main vegetation type of interest. In our study less emphasis was placed on woodland and the vegetation of rocky outcrops around the summit. Boundaries between the different vegetation types were sometimes surprisingly clear-cut, e.g. between montane forest and low scrub on the summit, and in places between woodland and medium altitude forest. These 'hard' boundaries may in part be due to fire.

The main vegetation types are characterised and described below in terms of their structure (height, cover, etc.), species composition and ecology. This was done both through general observation and through the recording of 48 vegetation survey plots, each of around 0.25 ha extent (forest) to 0.5 ha (more open habitats), placed subjectively in what were considered to be representative sites. A GPS point was recorded for each. Additional clarification was obtained from viewing old aerial photographs (see Section 2.3) and the use of 0.04 ha forest mensuration plots (see Section 4.4). The descriptions follow an altitudinal sequence. Additional details on vegetation are given in Dowsett-Lemaire and Dowsett (2009).

4.3.1 Plantations (400–600 m)

Around the ruined tea estate manager's house (16°18'20.5"S, 36°25'28.8"E, 550 m) there are a number of overgrown plantations of tea (*Camellia sinensis*) and *Eucalyptus* cf. *grandis*. Tea bushes, originally kept to around 1.5 m in height, have now grown up to 12–14 m high, many 2–3 stemmed with stems 10–15 cm in diameter. These are overtopped by *Albizia adianthifolia*, locally forming a closed canopy. Other native trees found here include *Macaranga capensis*.

Much of the planted and secondary growth around this area contains exotics (*Grevillea robusta*, *Delonix regia*, *Eucalyptus* cf. *grandis* and *Vernicia montana*) mixed with pioneer forest trees such as *Macaranga capensis*. Other exotics planted near the estate manager's house include *Ceiba pentandra*, *Artocarpus heterophyllus* (jackfruit) and *Ficus lutea*.

4.3.2 Woodland (600–1000 m)

This type was not examined in detail, but on the lower sections of the main path up to Mt Mabu the woodland is clearly dominated by *Pterocarpus angolensis*. Other common trees include *Pteleopsis myrtifolia* and *Vitex doniana*, while *Pericopsis angolensis* and *Stereospermum kunthianum* were noted occasionally. The woodland is underlain by a carpet of *Aframomum albiflorum*; clumps of *Oxytenanthera abyssinica* bamboo often grow at the ecotone between woodland and dry forest or near dry streams. With increasing altitude, *Syzygium cordatum* becomes more common until it is locally dominant above 800 m (Figure 11), forming pure stands sometimes closed enough to be called forest. *Aframomum* remains

common under *Syzygium* and the number of low-level epiphytes (ferns and orchids, also *Rhipsalis*) at 800–950 m suggests a high level of humidity for much of the year.

At 900 m the transitional woodland–forest on the ridge is drier, being dominated by *Syzygium cordatum* and *Xylopia aethiopica*. Other species noted were emergent *Newtonia buchananii*, *Albizia adianthifolia* and *Macaranga capensis*, with an understorey of *Craterispermum schweinfurthii*, *Cussonia arborea*, *Englerophytum magalismontanum*, *Erythroxylum emarginatum*, *Oxyanthus speciosus*, *Phoenix reclinata*, *Synsepalum cerasiferum* and *Tabernaemontana ventricosa*. Lianas were mainly *Dalbergia lactea*, *Landolphia kirkii* and *Urera trinervis*.

Fig. 11. Moist woodland (*Syzygium cordatum*) at forest margin (JT).

Fig. 12 a,b. Burnt woodland in agricultural zone on lower SE slopes of Mt Mabu (left, TH); woodland at forest margin showing boundary (right, JT).

4.3.3 **Moist Forest** (400–1650 m)

The following categories of forest can be recognized: lowland riparian forest (400–900 m), mid-altitude moist forest (980 to 1350–1400 m) and Afromontane moist forest (from 1350–1400 m to 1650 m). Only the latter two were extensively studied by us.

a) Lowland riparian forest (400–1000 m)

This forest type occurs over a significant altitudinal range and is fairly narrow in extent, so varies greatly in its composition and structure.

Lower down, in patches of lowland riparian forest at 400–500 m near the tea estate managers's house (16°18'26"S, 36°25'39"E), large (40–50 m high) trees of *Albizia adianthifolia* (dominant), *Erythrophleum suaveolens*, *Khaya anthotheca*, *Macaranga*

capensis, *Newtonia buchananii*, *Parkia filicoidea*, *Pteleopsis myrtifolia* and *Synsepalum cerasiferum* were noted in the canopy. Edge or pioneer species included *Bridelia micrantha*, *Harungana madagascariensis*, *Trema orientalis* and *Vitex doniana*, while understorey species included *Dracaena mannii*, *Celtis gomphophylla*, *Clausena anisata*, *Ensete ventricosum* and various lianes.

Lowland riparian forest at 800–900 m near the path to the main forest camp was characterised by 45 m high emergent trees of *Newtonia buchananii* (*Khaya anthotheca* was rarely seen), with other canopy trees being *Albizia adianthifolia*, *Anthocleista grandiflora*, *Erythrophleum suaveolens*, *Macaranga capensis*, *Parinari excelsa*, *Synsepalum cerasiferum* and *Xylopia aethiopica*, with *Pteleopsis myrtifolia*, *Vitex doniana* and, locally, *Shirakiopsis* (*Sapium*) *elliptica* at the edges. The commonest understorey species were *Craterispermum schweinfurthii* and *Erythroxylum emarginatum*; others include *Dracaena mannii*, *Oxyanthus speciosus*, *Englerophytum magalismontanum*, *Tabernaemontana ventricosa*, small trees and saplings of *Cryptocarya liebertiana*, *Cussonia spicata* and *Polyscias fulva* (from 850 m). *Oreobambos buchwaldii* bamboo was fairly common, and locally the palm *Phoenix reclinata*. The tree fern *Cyathea dregei* occurs along the main streams, the large fern *Marattia fraxinea* is frequent, and the shrub *Carvalhoa campanulata* grows in light gaps. The commonest canopy liana by far is *Millettia lasiantha*, found with various Apocynaceae (*Dictyophleba*, *Landolphia kirkii*, *Saba comorensis*), *Combretum paniculatum*, *Dalbergia lactea* and *Urera trinervis*.

b) Mid-altitude moist forest (980–1400 m) (Figures 13, 14)
This is found between the altitudes of 980–1000 m and 1350–1400 m, after which a sudden change in the dominant canopy species occurs.

From the forest plots (see Section 4.4) and general observation, the main forest canopy trees in terms of basal area in the lower parts of medium-altitude forest were *Strombosia scheffleri*, *Newtonia buchananii*, *Chrysophyllum gorongosanum* and *Maranthes goetzeniana*. In addition, *Cryptocarya liebertiana*, *Ficus sansibarica* and *Trichila dregeana* were also seen. Occasional large trees of *Cassia angolensis* were noted elsewhere. Large strangling figs at 1000–1350 m belong to two species, *Ficus sansibarica* and *Ficus thonningii*, replaced at higher elevations by *Ficus scassellatii*. Away from the stream gullies the forest canopy is usually closed, except for small gaps caused by tree-falls.

The main sub-canopy trees (often with more stems but alower basal area) were *Drypetes gerrardii*, *Drypetes natalensis*, *Funtumia africana*, *Garcinia kingaensis*, *Rawsonia lucida*, *Tabernaemontana ventricosa* and a number of Rubiaceae including *Heinsenia diervilleoides*, *Aidia micrantha*, *Tricalysia acocantheroides* (all the way to the top) and *Tricalysia pallens*. Other sub-canopy trees and shrubs seen included *Allophylus chaunostachys*, *Blighia unijugata*, *Cola greenwayi*, *Diospyros abyssinica* (starts appearing just above 1100 m), *Myrianthus holstii*, *Oxyanthus speciosus*, *Vepris nobilis* and *Zanthoxylum gilletii*. *Haplocoelum foliolosum* is common from 1150–1300 m and the first big *Tabernaemontana stapfiana* appear on the ridge at 1200–1250 m. Canopy lianas are dominated by *Millettia lasiantha*, with *Acacia pentagona*, *Agelaea heterophylla*, *Combretum paniculatum*, *Dictyophleba lucida*, *Landolphia kirkii*, *Oncinotis tenuiloba* and *Urera trinervis* also common.

Enormous clumps of *Oreobambos buchwaldii* bamboo to 18–20 m tall are frequent all the way up to 1400 m, particularly on dry slopes and in gullies.

At around 1000 m near the main forest camp (16°17'10"S, 36°24'01"E), tall trees reach an impressive height of 40–45 m (see front cover), with *Strombosia scheffleri* being the

commonest (largest between 45–50 m tall, 90 cm DBH). Apart from *Strombosia*, common canopy large trees here were *Newtonia buchananii* (largest seen 50 m tall, 140 cm DBH), *Chrysophyllum gorungosanum* (over 45 m) and *Maranthes goetzeniana* (40 m, 35 cm DBH).

At about 1100 m altitude, beyond a large rocky stream (16°17'05"S, 36°23'44"E) on a gentle slope, the forest is very impressive with the tallest trees (at least 40 m) including many *Strombosia*. Several *Chrysophyllum gorungosanum*, *Maranthes goetzeniana* and *Newtonia buchananii* were noted, with one or two tall *Cryptocarya liebertiana, Trichilia dregeana* and strangling figs (*Ficus sansibarica*). In the subcanopy *Drypetes gerrardii*, *Garcinia kingaensis* and *Myrianthus holstii* were seen. Smaller trees include *Drypetes natalensis* (also conspicuous along the stream, with arching branches), *Pavetta gurueënsis*, *Rawsonia lucida*, *Rinorea ferruginea*, *Vepris* sp. nov. and *Synsepalum muelleri.*

Steep, wide gullies with permanent streams contain more light-demanding tree species such as *Albizia adianthifolia*, *Macaranga capensis*, *Newtonia* and *Polyscias fulva* (the latter becoming bigger and more frequent with increasing altitude). Also found here were *Anthocleista grandiflora*, *Funtumia africana* and medium-sized *Bridelia micrantha*, *Englerophytum magalismontanum*, *Xylopia aethopica* and small *Bersama abyssinica*. Tree ferns (*Cyathea dregei*) occur along streams to at least 1400 m while *Dracaena fragrans* is common in humid hollows and on some slopes.

Fig. 13 a,b. Medium altitude moist forest, near Mt Mabu campsite (JB).

Fig. 14. Medium altitude moist forest canopy, Mt Mabu (JT).

c) Afromontane forest (1350–1650 m) (Figures 15, 16)
This forest type with its lower canopy height and much moister aspect is found up to 1650 m. The change from medium-altitude to high altitude forest is fairly abrupt at about 1350–1400

m, at least on the south-eastern slopes, and is seen in the dropping out of *Newtonia buchananii*, the replacement of *Albizia adianthifolia* by *A. gummifera*, and in *Olea capensis* becoming a conspicuous tall tree.

Canopy trees in the lower parts of Afromontane forest include *Strombosia scheffleri*, *Chrysophyllum gorungosanum*, *Maranthes goetzeniana* and *Newtonia buchananii*, with *Cola greenwayi*, *Garcinia kingaensis*, *Heinsenia diervilleoides*, *Myrianthus holstii*, *Tabernaemontana stapfiana* and *Vepris nobilis* in the sub-canopy. Small *Cassipourea malosana* and the understorey tree *Lasiodiscus usambarensis* appear around 1300 m, while *Maytenus acuminata* and *Eugenia capensis* subsp. *nyassensis* are common between 1300–1400 m. Higher up *Podocarpus latifolius* becomes increasingly common. *Anthocleista grandiflora* and *Polyscias fulva* are found in openings or gaps.

One site on a ridge in the transition zone (16°17'31"S, 36°23'34"E, 1400 m), had several large *Newtonia*, *Olea capensis*, *Parinari excelsa* and *Polyscias fulva* (30–35 m tall), with *Aphloia theiformis* in the gaps. Other trees present included *Chrysophyllum gorungosanum*, *Maranthes goetzeniana*, *Strombosia scheffleri* and *Zanthoxylum gilletii* in the canopy, and *Cola greenwayi*, *Craibia brevicaudata*, *Garcinia kingaensis*, *Myrianthus holstii*, *Tabernaemontana stapfiana* and *Vepris nobilis* in the subcanopy. Common small trees and shrubs were *Alchornea hirtella*, *Heinsenia diervilleoides*, *Carissa bispinosa*, *Chassalia parvifolia*, *Clausena anisata*, *Diospyros abyssinica*, *Dovyalis macrocalyx*, *Dracaena laxissima*, *Drypetes natalensis*, *Erythrococca polyandra*, *Eugenia capensis* subsp. *nyassensis*, *Lasianthus kilimandscharicus*, *Maytenus acuminata*, *Mostuea brunonis*, *Pauridiantha paucinervis*, *Pavetta gurueënsis*, *Peddiea fischeri*, *Psychotria zombamontana*, *Rinorea angustifolia*, *Rytigynia uhligii*, *Synsepalum muelleri*, *Tricalysia acocantheroides*, *Vepris* sp. nov., *Vepris nobilis* and *Memecylon* sp. (FD-L 2538, 2–4 m tall).

At the upper end of the forest at 1600 m, the taller trees (to 25 m high) are *Olea capensis* and *Rapanea melanophloeos*, with lower trees of *Aphloia theiformis*, *Bersama abyssinica*, *Cassine aethiopica*, *Cassipourea malosana*, *Cryptocarya liebertiana*, *Faurea racemosa*, *Macaranga capensis*, *Nuxia congesta*, *Ochna holstii*, *Pittosporum viridiflorum*, *Podocarpus latifolius*, *Polyscias fulva*, *Prunus africana* and *Syzygium guineense* subsp. *afromontanum*. Conspicuous lianas at the forest edge include *Rutidea orientalis* and *Schefflera goetzenii*, which are already common around 1400 m, and *Canthium gueinzii*.

Lower down at 1550–1600 m the following small understorey trees and shrubs were noted: *Carissa bispinosa*, *Chassalia parvifolia*, *Diospyros abyssinica*, *Diospyros whyteana* (at edges), *Dovyalis macrocalyx*, *Dracaena laxissima*, *Erythroxylum emarginatum*, *Eugenia capensis*, *Lasianthus kilimandscharicus*, *Maytenus acuminata*, *Mostuea brunonis*, *Pavetta gurueënsis*, *Rinorea angustifolia*, *Rytigynia uhligii*, *Tricalysia acokantheroides*, *Memecylon* sp. (FD-L 2538) and *Vepris nobilis*.

Fig. 15. Montane forest on upper slopes of Mt Mabu (TT).

Fig. 16. View over montane forest on Mt Mabu (JB).

4.3.4 Montane Shrubland (1600–1700 m) (Figures 18, 19, 20)
At 1600–1700 m just below the peak there is a limited area of montane shrubland where large boulders and rocky slopes are covered by scattered tufts of grass and sedge. Above this the summit is exposed and vegetation comprises mostly sedges and shrubby herbs. Such vegetation appears to be very typical of exposed granitic peaks across the region. Less time was spent exploring this habitat, which covers just a few hectares on the rounded peaks.

Much of the area is bare rock with patches of small trees and shrubs in sheltered or more moisture-rich sites. In these patches *Rapanea melanophloeos* is the most frequent small tree, next to a few stunted *Syzygium cordatum*, *Aphloia theiformis*, *Maytenus acuminata*, *Aeollanthus buchnerianus*, *Tetradenia riparia* and *Dissotis* sp. Scattered *Aloe arborescens* were also seen.

In somewhat more exposed sites, the dominant low shrub, 0.5–2.5 m high is *Aeschynomene nodulosa*, along with *Kotschya recurvifolia*. Common prostrate or semi-prostrate herbs include *Ipomoea involucrata*, *Corrigola drymerioides*, *Indigofera* sp. and *Lobelia trullifolia*. The dominant feature, however, is large clumps of the sedge *Coleochloa setifera* (Figure 17), with smaller clumps of the grasses (?)*Danthoniopsis* sp. and *Helictotrichon elongatum* and the sedge *Cyperus fischerianus*. Many of the large clumps had an abundance of the small pink-flowered orchid, *Polystachya songaniensis* (Figure 22).

Fig. 17. *Coleochloa* 'grassland' on rocky slopes near summit of Mt Mabu (TT).

Fig. 18. Upper forest margin with montane shrubland and *Coleochloa* 'grassland' (JT).

Fig. 19. Montane shrubland near summit of Mt Mabu (JT).

Fig. 20. Montane shrubland near summit of Mt Mabu (JT).

4.3.5 Vegetation of the Drier Western and Northern Slopes

In the western parts of the massif, which lie in the rain shadow and away from the prevailing oceanic moisture-bearing air currents, aerial photographs and study of Google Earth imagery suggest that the lower limit of moist forest is around 1200–1250 m, although extending lower to 1050 m on sheltered slopes and along drainage lines and gullies. On the northern boundary the lower limit is around 1400 m. Below the forest on this drier side is what appears to be woodland and bushland. However, as these areas were not visited it is not possible to confirm this. This compares to a lower forest limit of 950 m in gullies and valleys on the southern and eastern slopes.

There appears to be a marked break on the western side of Mabu between higher altitude forest (smooth texture, low canopy height) and medium altitude forest (rough texture, varying canopy height and colour) at around 1350–1400 m. This disjunction is not so apparent on the moister eastern slopes.

4.4 Forest Plots

In order to help characterise forest composition and density, nine 20 × 20 m (0.04 ha) enumeration plots were recorded. These were all sited within 1 km of the main campsite, 8 in medium-altitude forest and one in adjacent woodland near a small stream. All trees were identified to species, and diameter breast height (dbh) for trees above 5 cm dbh recorded along with an estimated height. Summarised results are shown in Table 5.

In the eight forest plots, the main large canopy trees in terms of basal area were (in declining order of importance): *Newtonia buchananii* (primarily in Plot 5), *Strombosia scheffleri*, *Chrysophyllum gorongosanum* and *Maranthes goetzeniana*. The main sub-canopy trees (often with more stems but lower basal area) were *Drypetes gerrardii*, *Funtumia africana*, *Rawsonia lucida*, *Drypetes natalensis* and a number of Rubiaceae (many being unidentified species but also *Heinsenia diervilleoides* and *Aidia micrantha*). Plot 1 was situated in the main campsite.

The total number of stems over 5 cm dbh recorded in the forest plots was 279, giving a mean stem density of around 872 stems/ha. Figures for each plot ranged from 50 (= 1250 stems/ha) down to 20 (= 500 stems/ha).

Mean basal area of all trees above 5 cm dbh for the eight forest plots was 29.94 (= 93.56 m^2/ha), ranging from 1.97 m^2 (= 49.32 m^2/ha) to 5.72 m^2 (= 143.0 m^2/ha). Of this figure, the four main canopy trees comprised over 76%, while the main sub-canopy trees (including unidentified Rubiaceae) contributed a further 16%, giving a combined total of over 92%.

In the woodland plot (Plot 9) the major trees were *Syzygium cordatum* and *Parinari excelsa*, both in terms of number of stems in the plot (11 and 8 respectively) and basal area (equivalent to 36.55 and 8.61 m^2/ha, respectively). Total basal area was 2.0782 (= 51.96 m^2/ha). There were only 4 tree species in the woodland plot in comparison to the forest plots, which had from 9 to 17 species (mean 14.5).

4.5 Observations on Tree Fruiting

A striking feature of the forest on Mabu during the expedition was the near-absence of figs on large stranglers, in contrast to the situation for example in Malawi when October is normally a productive month and large hornbills are breeding (Dowsett-Lemaire & Dowsett 2006). Of the more than 30 strangler figs examined, only one *Ficus bubu* was in fruit, one *F. scassellatii* was in unripe fruit and another had ripe figs. Not a single *F. thonningii* nor *F. sansibarica* was fruiting. The ripe figs of *F. scassellatii* were taken by Silvery-cheeked Hornbills and Green

Barbets, but observations were of short duration.

Of other large trees, *Olea capensis* were generally flowering except for a few trees at the forest edge at 1600 m that were out of phase and fruiting (with attendant Rameron Pigeons). *Cryptocarya* were also in flower, and *Polyscias* were near the end of the fruiting season (Rameron Pigeons were seen eating them). *Aphloia* were in young, fully formed fruit (already consumed by Green Barbet and Stripe-cheeked Greenbul). Lower down at 900 m, several *Xylopia aethiopica* were in ripe fruit, the arils being eaten occasionally by Green Barbet, White-eared Barbet, Golden-rumped Tinkerbird and Little Greenbul. One pair of Green Barbets was breeding there in a territory including many fruiting *Xylopia*, and the local *Syzygium cordatum* (some flowering) will provide an abundance of fruits in the middle of the rainy season. At 1600 m, a tall *Syzygium guineense* had just finished flowering. The fruiting of *Pittosporum* (common at 1600 m) was finished, with some old capsules still visible on the trees. One big *Ochna holstii* seen at 1600 m had unripe fruit.

Some Apocynaceae climbers were fruiting (especially *Landolphia kirkii*, a mammal-eaten fruit), and *Tabernaemontana stapfiana* were also bearing full-grown fruits in several places. The liana *Schefflera goetzenii* had unripe fruit (as on Namuli at this time of year) while *Urera trinervis* had ripe fruit. Stripe-cheeked Greenbuls were also seen taking the ripe, orange berries of the climber *Rutidea orientalis*. Several *Garcinia kingaensis* were flowering and forming young fruit (this species does not flower every year). There were many old fruits of *Myrianthus holstii* on the forest floor, and some "flowers" were seen on the trees (maturation is expected in the rains). Some *Drypetes gerrardii* had fully-formed fruits, not yet ripe. The plumed seeds of *Funtumia africana* were flying around in many places in the forest and open pods were seen on trees. Of the smaller understorey species, fruiting is usually spread out, with very few ripe fruits at any time – this was true of species of *Tricalysia* and *Coffea*, and also *Synsepalum muelleri* and *Maytenus acuminata*. Others were generally flowering or with flower-buds (*Canthium* sp., *Carissa bispinosa*, *Chassalia parvifolia*, *Erythroxylum emarginatum*, *Lasianthus kilimandscharicus*, *Lasiodiscus usambarensis*, *Pavetta gurueensis*, *Rinorea* spp., *Tabernaemontana ventricosa*), suggesting that the rains will be a productive time. Their main dispersers appear to be greenbuls of the genus *Andropadus*.

Table 5. Summary of forest plot data, Mt Mabu.

Species	Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		TOTAL	
	no.	BA	no.	BA	no.	BA	no.	BA	no.	BA	no.	BA	no.	BA	no.	BA	no.	BA	stems	BA
Acacia pentagona	1	0.0080																	1	0.0080
Aidia micrantha			4	0.0300															4	0.0300
Blighia unijugata	2	0.0087							3	0.0548									5	0.0635
Bridelia micrantha									1	0.0661									1	0.0661
Chrysophyllum gorungosanum	1	1.9609	1	0.8993	2	1.6178	1	0.2291			1	0.4779	1	0.2291	1	0.0062			8	5.4204
Cola greenwayi	3	0.0054					10	0.0767			2	0.0048							15	0.0868
Craibia brevicaudata							1	0.0805											1	0.0805
Dalbergia boehmii																	1	0.0090	1	0.0090
Diospyros abyssinica							1	0.0022			1	0.0057			1	0.0064			3	0.0142
Dovyalis macrocalyx							1	0.0275											1	0.0275
Drypetes gerrardii	1	0.2972	4	0.0486	7	0.8678	5	0.3065	7	0.4990	5	0.0770	7	0.3130	12	0.2570			48	2.6661
Drypetes natalensis	2	0.0058	2	0.0104	1	0.0106			7	0.0606	1	0.0026	1	0.0064	2	0.0083			16	0.1046
Englerophytum magalismontanum							3	0.0937	1	0.0133			1	0.0020					5	0.1090
Erythrococca polyandra									1	0.0045									1	0.0045
Funtumia africana	1	0.0739	1	0.0087	6	0.0741	1	0.0025	5	0.0700	10	1.0602	11	0.0651	2	0.0099			37	1.3644
Garcinia kingaensis	1	0.0401	2	0.0581	1	0.0043													4	0.1025
Haplocoelum foliolosum			1	0.0020															1	0.0020
Heinsenia diervilleoides			4	0.0380			1	0.0021					1	0.0269					6	0.0670
Ixora scheffleri													1	0.0050					1	0.0050
Keetia gueinzii									1	0.0021									1	0.0021
Lecaniodiscus fraxinifolius							1	0.0025											1	0.0025
Macaranga capensis													2	0.3878					2	0.3878
Maranthes goetzeniana	1	0.3167	2	0.0085	2	0.5302	1	1.3072			2	0.1499	1	0.4657	1	0.8172			10	3.5955
Millettia lasiantha					1	0.0135	3	0.0364			1	0.0021							5	0.0520
Myrianthus holstii					1	0.0026	1	0.0472	1	0.0145	1	0.0079			3	0.0176			7	0.0898
Newtonia buchananii									12	4.6231					1	2.6594			13	7.2825
Oncinotis sp.			1	0.0050											2	0.0117			3	0.0168
Oxyanthus speciosus	1	0.0054							1	0.0025			2	0.0105	1	0.0036			5	0.0220
Parinari excelsa																	8	0.3444	8	0.3444
Polysphaeria lanceolata	1	0.0072	1	0.0079															2	0.0151
Rauvolfia caffra													1	0.0050					1	0.0050
Rawsonia lucida	1	0.0050	1	0.0028			6	0.2282			1	0.0041			1	0.0021			10	0.2423
Rubiaceae spp. (uncertain)	1	0.0211	1	0.0284			1	0.0175	4	0.1193	1	0.0064	1	0.0133	1	0.0260			10	0.2320
Rytigynia uhligii											2	0.0507							2	0.0507

Strombosia scheffleri	2	0.2651	6	4.2483	12	0.7678					3	0.0982	5	0.7412	4	0.3779			32	6.4985
Synsepalum cf. brevipes	1	0.0106																	1	0.0106
Syzygium cordatum																	11	1.4618	11	1.4618
Tabernaemontana elegans			1	0.0028					3	0.0128					1	0.0661			5	0.0817
Trilepisium madagascariense									1	0.0106					1	0.0041			2	0.0146
Vitex doniana																	2	0.2631	2	0.2631
Xylopia aethiopica									1	0.0141									1	0.0141
unknown			1	0.0804			2	0.6923	1	0.1542	1	0.0255			3	0.1475			8	1.0999
TOTALS	**20**	**3.0312**	**33**	**5.4793**	**33**	**3.8886**	**39**	**3.1524**	**50**	**5.7215**	**32**	**1.9728**	**35**	**2.2710**	**37**	**4.4211**	**22**	**2.0782**	**301**	**32.0162**
mean BA/ha (m^2) equivalent		75.780		136.983		97.215		78.810		143.038		49.320		56.775		110.53		51.955		88.934

no. = number of individuals greater than 5 cm dbh; BA = basal area (m^2)

Coordinates of forest plots (central point):

Plot 1 – S16 17 10.3, E36 24 01.2, 981 m

Plot 2 – S16 16 56.9, E36 23 41.9, 111 m

Plot 3 – S16 17 00.3, E36 23 47.2, 1097 m

Plot 4 – S16 17 02.8, E36 23 33.2, 1232 m

Plot 5 – S16 17 10.1, E36 23 44.8, 1043 m

Plot 6 – S16 17 14.9, E36 23 55.0, 996 m

Plot 7 – S16 17 13.3, E36 23 58.8, 998 m

Plot 8 – S16 17 13.9, E36 23 39.7, 1084 m

Plot 9 – S16 17 19.6, E36 24 18.6, 956 m

5. PLANTS

5.1 Previous Studies

As far as we are aware, no previous biological collecting or survey work (botanical or zoological) had been carried out on the Mabu massif prior to our first reconnaissance visit in December 2005, nor are any descriptions of the area available. However, specimens cited in Flora Zambesiaca indicate that the botanists Barbosa and Carvalho collected in the Tacuane area in May 1949, including along the road from Tacuane to Limbuè, and there are also numerous collections made from 1943 to 1949 by Helen Faulkner from Namagoa Estates (16°47' S, 36°58' E, alt. 150 m) in Lugela District, 70 km to the south-east.

Moist forests in Zimbabwe and Malawi have been much better studied than those in Mozambique (e.g. Dowsett-Lemaire 1989a, Müller 1999, 2006, White *et al.* 2001), and comparisons can be made to these, particularly to the composition of forests occurring at medium altitude (medium altitude and sub-montane according to Müller 1999). However, a full comparison across these countries has not yet been done.

5.2 Plant Collections

During the Darwin expedition plant specimens were collected from forest, woodland, shrubland, rocky outcrops and from the overgrown tea estates across the south-eastern part of the mountain. As on previous project expeditions, there was no particular collecting strategy other than to gather as comprehensive a collection as possible of fertile identifiable material from the full range of accessible habitats. However, particular attention was paid to the main forest species. Complete sets were deposited at the National Herbarium in Maputo (LMA) and at Kew, while the third and fourth incomplete sets were deposited at the herbarium of the Universidade Eduardo Mondlane (LMU) and the National Herbarium in Malawi (MAL).

There were over 350 numbered collections with notes, with around another 300 voucher specimens from survey plots. Nearly all could be identified, and these form the basis of the checklist of species found above 800 m given in Annex 3.

The total number of plant taxa recorded from above 800 m was 249, comprising 9 Pteridophytes, 1 Gymnosperm, 35 monocotyledons and 204 dicotyledons, covering 90 families. The largest families in terms of taxa were Rubiaceae (24), Euphorbiaceae (13), Leguminosae: Papilionoideae (12), Acanthaceae (12) and Apocynaceae (10). Not unexpectedly, the forest understorey families Rubiaceae (mostly in montane forest), Acanthaceae and Euphorbiaceae were particularly common. The papilionoids, however, were more common in the surrounding woodland. However, the plant collections were quite limited, both in extent and intensity. It is probable that the full species list from the Mt Mabu area above 800 m altitude will exceed 350 taxa.

There was much similarity with the flora on Mt Namuli (Timberlake *et al.* 2009), with 118 (48%) of the species given here in Annex 3 also being found there. However, the checklist for Namuli only covers those species above 1300 m (most of the moist forest on Mt Namuli is montane and above 1600 m), whereas most of the forest on Mabu is at medium altitude (1000–1400 m). Medium altitude forest is known to be more species-rich than montane forest (T. Müller, pers. comm.).

5.3 Species of Particular Interest

The species of particular interest comprise those that are new, endemic, threatened or of particular conservation concern, and those that are new records or significant range extensions. There were 18 species of particular interest recorded from Mt Mabu during the expedition. These are shown in Table 6.

Table 6. Plant species of interest recorded from Mt Mabu.

Family	**Species**	**notes**
Amaryllidaceae	Cryptostephanus vansonii	previously a E Highlands/Moz border endemic
Orchidaceae	Bulbophyllum ballii	1st record for Moz; previously a Zimbabwe endemic
Orchidaceae	Bulbophyllum sandersonii	1st record for Moz
Orchidaceae	Polystachya malilaensis	1st record for Moz
Orchidaceae	Polystachya songaniensis	previously thought endemic to Mts Mulanje & Zomba; 1st record Moz
Poaceae	Oreobambos buchwaldii	1st record for Moz
Xanthorrhoeaceae	Dianella ensifolia	in FZ area previously only known from Chimanimani Mts
Acanthaceae	Mimulopsis arborescens	1st record for FZ area; signficant range extension from S Tanzania
Acanthaceae	Justicia asystasioides	significant range extension from N Malawi
Acanthaceae	Sclerochiton hirstus	only 2nd collection, previously thought to be a Namuli endemic
Asteraceae	Bothriocline glomerata	2nd FZ record (+ Namuli)
Euphorbiaceae	Crotonogynopsis usambarica	new genus for FZ area (previously Tanzania)
Loranthaceae	Helixanthera schizocalyx	new species; Mabu endemic
Molluginaceae	Corrigiola drymerioides	2nd record for Moz (Namuli)
Rubiaceae	Didymosalpinx norae	2nd record for Moz (Garuso)
Rubiaceae	Rytigynia sp.	not matched at K
Rutaceae	Vepris sp.nov. near V. bachmannii	possible new sp.
Viscaceae	Viscum cylindricum	1st record for Moz (previously Mal + Tanz)

Fig. 21 a,b. *Cryptostephanus vansonii* on upper slopes of Mt Mabu (JT).

Fig. 22. *Polystachya songensis* orchid on Mabu summit (TT).

New Species and Records

Of these 18 listed species, two have just been described (*Helixanthera schizocalyx*, Harris *et al.* 2011) or are thought to be new (*Vepris* sp. nov.), while five represent significant range extensions (*Cryptostephanus vansonii* (Figure 21) and *Dianella ensifolia* from the Chimanimani Mountains 600 km to the south; *Mimulopsis arborescens*, *Justicia asystasioides* and *Crotonogynopsis usambarica* from N Malawi or S Tanzania 700 km to the north). There are twelve species that are new records for Mozambique, of which four are known from Mt Mulanje in Malawi (Strugnell 2006), so their occurrence in a similar habitat nearby is not surprising.

Although its presence is not surprising, and probably more a reflection of under-recording in Mozambique rather than a particularly signficant range extension, it is interesting to note that this is the first record of the large common forest bamboo, *Oreobambos buchwaldii*, for Mozambique.

Didymosalpinx norae was previously only known from Chirinda Forest in SE Zimbabwe (Timberlake & Shaw 1994) and from Garuso Forest near Chimoio in central Mozambique, as well as in a few lowland forests in Kenya and Tanzania. It discovery almost 400 km north-east from its previous known southern African populations is quite unusual for a showy flowering shrub.

A question often raised is whether the Mulanje Cedar, *Widdringtonia whytei*, is found on similar mountains in Mozambique; to date it has only been found in Malawi. There was no sign of either *W. whytei* or, surprisingly, the more widespread *W. nodiflora* on Mabu, or on any other Mozambican mountains that have been visited during the Darwin project, although the massif may be too low and warm for it. However, it has been recorded from Mt Gorongosa in the centre of the country at around 1500 m (Müller *et al.* 2008).

It was interesting to note the abundance of *Maranthes goetzeniana*, a large forest tree that to date does not appear to have been recorded from any forest in Malawi (White *et al.* 2001). It was also not found on Mt Namuli (Timberlake *et al.* 2009), although it is common in mid-altitude forests in central Mozambique and adjacent parts of Zimbabwe.

Threatened and Endemic species

Apart from the newly-described mistletoe and possible new *Vepris*, it appears that there are no other endemic plant species on Mt Mabu, nor any taxa that are known to be particularly threatened across their range. This is in marked contrast to the situation on Mt Namuli where 16 endemic plant taxa, including five new species, were recorded (Timberlake *et al.* 2009) and, in addition, 26 new Mozambique records.

From the Sabonet Red Data List (Golding 2002, Izidine & Bandeira 2002, Timberlake *et al.* 2006) there are 14 species on the Mabu checklist that are said to be endemic to the Flora Zambesiaca area, Mozambique or adjacent countries, or were on one or more country's Red Lists (Table 7). However, a number of these have since been shown to be not as restricted in distribution as was originally believed or were cited in error.

What is apparent is that, compared to the zoological findings, the flora of Mabu has few species of particular interest; most species found here are moderately widespread in the scattered patches of most forest found across Eastern and Southern Africa. What is of much greater botanical interest, however, is the extent and good condition of the moist forest at an altitude where, elsewhere, so much of it has been cleared. For example, the total extent of moist forest on Mt Mabu is around 7880 ha, of which 5270 ha lies between 1000 and 1400 m, compared to 1300 ha of similar forest on Mt Chiperone (Timberlake *et al.* 2007), 135 ha on

Mt Namuli (Timberlake *et al.* 2009) and an unknown extent (perhaps 1000–2000 ha, figure not given in Müller *et al.* 2008) on Mt Gorongosa.

Further survey work should focus on the medium altitude forest areas, particularly gullies and streams within the forest and on the gully or riverine forests at lower altitudes. The drier side of the mountain has not yet been investigated biologically, and should contain some different habitats and species from the moister eastern side.

Table 7. Species found on Mt Mabu that are mentioned on the Sabonet Red Data lists (Izidine & Bandeira 2002, Golding 2002) as threatened or endemic.

Family	**Species**	**RD or endemic status**	**Notes**
Aloaceae	Aloe arborescens	VU in Mw	common elsewhere
Amaryllidaceae	Cryptostephanus vansonii	FZ endemic	
Orchidaceae	Bulbophyllum ballii	Zw endemic; VU in Zw	now found in Moz
Orchidaceae	Polystachya songaniensis	Mw endemic, LR	now found in Moz
Acanthaceae	Brachystephanus africanus	CR in Zw	more common elsewhere
Acanthaceae	Sclerochiton hirsutus	Moz endemic, DD	
Asteraceae	Senecio peltophorus	Mw endemic; VU	now found in Moz
Moraceae	Ficus bubu	CR in Zw	more common elsewhere
Moraceae	Ficus sansibarica	VU in Zw	more common elsewhere
Moraceae	Ficus vallis-choudae	EN in Zw	more common elsewhere
Rubiaceae	Coffea mufindiensis subsp. australis	FZ montane endemic	common
Rubiaceae	Tricalysia acocantheroides	VU in Zw	
Rutaceae	Zanthoxylum gilletii	VU in Zw	more common elsewhere
Sapindaceae	Allophylus chaunostachys	VU in Zw	

6. BIRDS

6.1 Previous Studies

Prior to the survey carried out in October 2008, the birds of Mabu were known only through a brief visit by Claire Spottiswoode and Eric Herrmann on 10–14 December 2005 (Spottiswoode *et al.* 2008), during which some 50 bird species were observed in the low-altitude tea forest as well as in the main forest block up to 1220 m. There are no other bird records known from the area. Jack Vincent in his trip to the nearby Mt Namuli (Vincent 1933b, 1933–1936) did not pass close to Mabu.

6.2 Bird Survey

During the present survey, from 10–30 October 2008, some 120 bird species were recorded, bringing the total bird list to 126 species (Annex 4). Four nights were spent at 550 m altitude by the old tea estate manager's house (10–12 & 29 October) when riparian forest, mixed tea forest and other habitats in the vicinity were explored, and 16 nights in the forest, mainly around 1000 m (main forest camp), with four nights also at higher levels (near the summit at 1400 m and north-west of the main camp at 1300 m).

In addition, some mist-netting was carried out over two days in order to assess state of moult and breeding condition (see Annex 5). All birds were released after being marked with rings from the East African scheme (Kenya National Museum).

The sections below discuss the biogeographical and conservation significance of the forest as related to birds (see also Dowsett-Lemaire 2010 for a comparison of Mts Mabu and Namuli). Nomenclature follows Dowsett-Lemaire & Dowsett (2006). A more comprehensive account of Mabu's birds is given in Dowsett-Lemaire & Dowsett (2009).

6.3 Biogeographical Significance

The known distributions of Afromontane and selected Eastern bird species on the five main montane massifs of the northern Mozambique/southern Malawi region are shown in Table 8. These are, from north to south, Namuli, Mulanje, Thyolo, Mabu and Chiperone. Records from Thyolo in southern Malawi are largely historical, as the forest was almost totally destroyed in the early 2000s. Records from Chiperone are based on Benson (1950) and Spottiswoode *et al.* (2008). The mention of Cabanis's Greenbul (race *placidus*) comes from a specimen duly collected by J. Makawa (R. Dean & R. Prys-Jones, pers. comm. 2009) but missed from the 1950 publication. Chorological status follows Dowsett-Lemaire & Dowsett (2006).

The biggest and tallest massif, Mulanje, has the highest number of Afromontane species, 31 (including the Spotted Ground Thrush), with Namuli coming a close second (27). A few non-forest species are not recorded (nor expected) to occur on Mabu, such as the Red-tailed Flufftail *Sarothrura affinis*, Blue Swallow *Hirundo atrocaerulea* and Cinnamon Bracken Warbler *Bradypterus cinnamomeus*. These absences can be explained by the reduced size of grassland or shrubland habitats. Although the Namuli massif has more extensive open habitats, these same birds are also missing there (the flufftail almost certainly so, Dowsett-Lemaire 2008) – the dominant type of grassland on Namuli gets water-logged and there are apparently no suitable breeding banks for Blue Swallow, while the montane shrubland is floristically impoverished and of limited extent for a species such as the Bracken Warbler.

The total number of Afromontane birds recorded on Mabu is 18 species. A few high-altitude montane forest birds seem to be absent (e.g. Olive-flanked Robin *Cossypha anomala*, White-tailed Crested Flycatcher *Elminia albonotata*, Eastern Double-collared Sunbird *Nectarinia mediocris*), all of which are recorded from the higher-altitude forests of Mulanje, Namuli and

Table 8. Afromontane (near-)endemic and selected Eastern endemic bird species present on Namuli, Mulanje, Thyolo, Mabu and Chiperone Mountains. Species are all found in forest except those marked "NF" (not forest) where the habitat consists of grassland, rocks, montane shrubland or forest edges.

Afromontane species:	**Namuli**	**Mulanje**	**Thyolo**	**Mabu**	**Chiperone**
Red-tailed Flufftail (NF)	?	X	-	-	-
Rameron Pigeon	X	X	X	X	X
Cinnamon Dove	X	X	X	X	X
Cape Eagle Owl (NF)	X	X	-	-	-
Scarce Swift	X	X	X	-	-
Bar-tailed Trogon	X	X	X	X	X
Moustached Green Tinkerbird	-	X	-	-	?
Blue Swallow (NF)	-	X	-	-	-
Grey Cuckoo-shrike	-	-	X	X	X
Eastern Mountain Greenbul	X	X	-	-	-
Stripe-cheeked Greenbul	X	X	X	X	X
Cabanis's Greenbul	X	X	X	X	X
Olive Thrush	X	X	X	-	X
Orange Thrush	X	X	X	-	X
Cholo Alethe	X	X	X	X	X
Starred Robin	X	X	X	X	X
Swynnerton's Robin	-	-	-	X	-
Olive-flanked Robin	X	X	-	-	X
Cape Robin (NF)	X	X	-	X	-
Cinnamon Bracken Warbler (NF)	-	X	-	-	-
Evergreen Forest Warbler	X	X	X	-	X
Yellow-throated Warbler	X	X	X	X	X
Wailing Cisticola (NF)	X	X	-	X	-
Bar-throated Apalis	-	X	-	-	-
Namuli Apalis	X	-	-	X	-
Cape (Malawi) Batis	X	X	X	X	X
White-tailed Crested Flycatcher	X	X	X	-	X
Dapple-throat	X	-	-	X	-
Eastern Double-collared Sunbird	X	X	-	-	X
Olive Bush Shrike	-	X	-	-	-
Bertram's Weaver (NF)	X	X	X	X	X
Red-faced Crimsonwing	X	X	X	-	X
Swee Waxbill (NF)	X	X	X	X	X
African Citril (NF)	X	X	X	-	X
Sub-Afromontane species:					
Spotted Ground Thrush	X	X	X	X	-
Selected Eastern Species:					
S. Banded Snake Eagle	-	-	-	X	-
White-eared Barbet	X	X	X	X	X
Green Barbet	X	-	X	X	-
Eastern Green Tinkerbird	X	-	-	-	?
Gunning's Akalat	-	-	-	X	-
White-winged Apalis	X	X	X	-	X
Green-headed Oriole	-	-	X	X	X

Chiperone. The absence of the Evergreen Forest Warbler *Bradypterus lopezi* is more surprising as it is common in mid-altitude forest throughout SE Malawi and on Chiperone where it reaches its southern limit of range (Dowsett-Lemaire 1989b), but elsewhere in Malawi it can be rare in this forest type (e.g. Ntchisi Mountain). Even more surprising is the apparent absence of Orange Thrush *Zoothera gurneyi* as this species is also common in mid-altitude forests in the region. It is unlikely to have been overlooked as it is very vocal from the months of at least September, even in dry weather (and it is unknown to the local hunters, see species account of *Zoothera guttata*). It is possible that further exploration of the high-altitude sections of Mabu forest (the largest area of which was not visited) will reveal the presence of some additional discreet Afromontane species such as Red-faced Crimsonwing *Cryptospiza reichenovii*. The intra-African migrant Scarce Swift *Schoutedenapus myoptilus* might have been missed as this noisy bird normally arrives by October, but could have been delayed by drought.

Many of the Afromontane birds listed above reach their overall southern limits of range within this region: seven (Bar-tailed Trogon *Apaloderma vittatum*, Cabanis's Greenbul, Olive-flanked Robin, Evergreen Forest Warbler, Eastern Double-collared Sunbird, Bertram's Weaver and African Citril *Serinus citrinelloides*) reach the most southerly massif of Chiperone. Mulanje represents the southern limit for Moustached Green Tinkerbird, Eastern Mountain Greenbul and Cinnamon Bracken Warbler, while Dapple-throat, which skips Malawi altogether, reaches Mabu, an extension from Namuli.

A small cluster of species (Afromontane or Eastern or otherwise) are shared between Thyolo, Mabu and Chiperone: Bronze-naped Pigeon, Grey Cuckoo-shrike and Green-headed Oriole. They all reappear on Mt Gorongosa, some 300–350 km to the south-west (Oatley & Tinley 1989). Mt Chiperone remains under-explored, especially the higher levels not reached by Spottiswoode *et al.* (2008). In addition to identifying the green tinkerbird, a form of Bar-throated Apalis (the yellow-bellied race of Mulanje or Namuli Apalis) should be sought in the montane forest.

The presence of Gunning's Akalat on Mabu suggests that the local microclimate is fairly warm, also shown by the distribution of some lowland forest species there – White-throated Nicator, Red-capped Robin and Blue-mantled Flycatcher all reach an altitude of 1400 m, whereas on the wet southern slopes of Mulanje they do not ascend above 800–950 m. On Namuli the Nicator does not ascend above 1160 m (J. Graham, pers. comm.), the Red-capped Robin reaches 1200 m and the flycatcher has not been recorded (if it occurs, this would be below 1150 m). Similarly the warm microclimate of Mabu could explain the scarcity of montane species such as Namuli Apalis and Dapple-throat, and the absence of high-montane species such as Olive-flanked Robin (very common on the large, colder massifs of Mulanje and Namuli above 1000 and 1550 m respectively).

6.4 Bird Species of Conservation Importance

The forests on Mt Mabu are especially important for the following Red Listed species (BirdLife International 2008) and the *belcheri* population of Green Barbet:

Southern Banded Snake Eagle *Circaetus fasciolatus*. **Near Threatened.** Several territorial pairs inhabit lower levels of the forest, including the foothills. It is an Eastern endemic, found mainly in coastal forest and unrecorded from adjacent Malawi, hence its discovery at Mabu represents a small range extension.

Green Barbet *Stactolaema olivacea belcheri*. An Eastern endemic with a very patchy distribution on the eastern side of Africa from coastal Kenya to Natal. This well-marked

race was until recently thought to be confined to the forests on Thyolo and Mt Namuli. Forests on Thyolo Mountain have been eliminated by recent deforestation (Dowsett-Lemaire & Dowsett 2006) and the barbet numbers on Namuli are rather small, at most 30–40 pairs (Dowsett-Lemaire 2008). First discovered on Mabu by C. Spottiswoode in 2005, this barbet occurs over the full altitudinal range of forest, and locally down to 750 m. Thus Mabu harbours the most important population to date, of the order of several hundred pairs (probably over 500 pairs; individual territories often cover about 10 ha).

Spotted Ground Thrush *Zoothera guttata*. **Endangered**. A rare thrush of mid-altitude forest in tropical Africa (i.e. a sub-Afromontane endemic), common only in the temperate forests of eastern South Africa (Chittenden in Hockey *et al.* 2005). It is known to have movements down to the coast in the off-season (although the populations in S Malawi appear to be resident). Until recently in Mozambique it was known only from a couple of winter records on the coast (Parker 2005), but was discovered in the breeding season on Namuli (Dowsett-Lemaire 2008). Its numbers on Mabu are probably very low, but the near-absence of song in October means that proper evaluation of densities will have to await further study.

Cholo Alethe *Alethe choloensis*. **Endangered**. Confined to mid-altitude and lower Afromontane forests in SE Malawi and adjacent N Mozambique. Populations in Malawi have decreased due to deforestation (especially bad on Thyolo Mountain, the lower slopes of Mulanje and at Lisau and Soche); they have also decreased on Namuli through the near-eradication of mid-altitude forest. Figures proposed for Namuli by Ryan *et al.* (1999) are far too high as the bird is rare in the cooler forest of Manho, the largest block of forest on Namuli (Dowsett-Lemaire 2008). The species occurs over a wide altitudinal range on Mabu (950–1650 m) but is rather uncommon below 1200 m. Vocal activity in most of October was low owing to the drought and population estimates are difficult to propose, although the order of magnitude should be around a 1000–1500 pairs. It is possible there are more Alethes on Mabu than on the whole of Mulanje (where the area of suitable forest covers c.5000 ha). In any case Mabu can be considered as extremely important for this species.

Swynnerton's Robin *Swynnertonia swynnertoni*. **Vulnerable**. This Afromontane endemic was known only from the forests of eastern Zimbabwe and adjacent Mozambique (including Gorongosa) and the central highlands of Tanzania (mainly Udzungwa, with few in the East Usambaras). Its discovery on Mabu partly fills the gap between the Zimbabwe/S Mozambique and Tanzanian populations as Mabu is about 350 km NE of Gorongosa. On Mabu it is confined to the higher-altitude forest above 1340–1400 m and is not uniformly distributed as it favours dense understorey. The area of forest above the contour line of 1400 m is about 900 ha, so the total population may be of the order of 100–200 pairs.

Gunning's Akalat *Sheppardia gunningi*. **Near Threatened**. An Eastern endemic with a patchy distribution from coastal Kenya to coastal Mozambique, and an inland population on the northern lakeshore of Lake Malawi and the eastern scarp of the Viphya Plateau. First discovered on Mabu by C. Spottiswoode in 2005, it is now seen to occur over a wide altitudinal range from 400–1350 m. It is surprising that this species has adapted to pure tea understorey under forest canopy (as has another understorey species, the Blue-mantled Flycatcher *Trochocercus cyanomelas*), and a substantial part of the population will be destroyed if the tea farms are reopened. Large numbers will, however, survive in the natural forest at low and middle levels if it receives adequate protection. The patchy habitat makes density estimates difficult, but there are probably several hundred pairs. In May 2009 L. Fishpool discovered the species on Mt Inago in forest patches at 1050–1450 m (Fishpool & Bayliss 2010). Inago (peak 1961 m) is 45 km to the north-east of Namuli

and 180 km NE of Mabu. The fairly richly coloured underparts and measurements of the Mabu birds (wing-lengths 71.7 mm, n=4, Appendix 5, compared to 71.3 mm, range 67.5–74.5 mm, n=9, from Malawi, R.J. Dowsett, pers. comm.) suggest that these birds are more closely related to the race *bensoni* of the northern Malawi lakeshore than to coastal races, despite the fact that the nearest population to Mabu is situated on the Mozambique coast at c.18°S.

Namuli Apalis *Apalis* (*thoracica*) *lynesi*. **Near Threatened**. Until now this form of Bar-throated Apalis was considered endemic to the forests of Mt Namuli, being replaced in SE Malawi by the yellow-bellied form *flavigularis*. Unlike on Namuli where it is very common, it is distinctly rare on Mabu, found only above 1400 m. Two of the three males heard or seen were unmated, which suggests that the population is not thriving. Possibly a warm microclimate combined with a very tall forest canopy are not favourable for this montane species, which prefers short-canopy forest and rich shrubland. The population is certainly small (a few dozen pairs, up to 100?). But the occurrence of this taxon on Mabu means that other high-altitude forests in this part of Mozambique are likely to harbour it, including a couple of high peaks next to Namuli and the southern section of the Namuli plateau (south of the Rio Malema dambo, with many forest patches around 1500 m), and possibly even Mt Chiperone, the upper parts of which remain largely unexplored. It was not, however, discovered on Mt Inago by L. Fishpool in 2009, where the altitude of the main forested area is rather low (below 1500 m).

Dapple-throat *Modulatrix orostruthus*. **Vulnerable**. This Afromontane endemic was thought to reach its southern limit of distribution from the highlands of central Tanzania on Mt Namuli, but its presence on Mabu extends its range by some 160 km to the south-west. Although quite common on Namuli, on Mabu it is rare and highly localized and limited to the Afromontane forest above 1400 m. The species normally favours understorey with a dense layer of saplings under closed canopy; the disturbed canopy in parts of the forest, caused partly by temporary habitations during the civil war, may in part explain its rarity. Only three territorial birds were located (as with the Namuli Apalis), one of which did not even react to tape playback. One bird (paired) followed for 3 hours covered an area of at least 5–6 ha. Overall numbers must be low, of a few dozen pairs or up to 100.

6.5 Bird Breeding Records

October is normally an important month for laying in forest birds in SE Africa (Dowsett & Dowsett-Lemaire 1984, Dowsett-Lemaire & Dowsett 2006), but that does not appear to be the case on Mt Mabu, at least in 2008. Clearly breeding had started in some species, but some pairs were perhaps delayed because of the prolonged drought. Species foraging on the ground such as alethes and akalats normally breed as soon as the main rains start and driver ant foraging activity increases; the few mist-netted in mid-October (Annex 4) were still inactive.

Cinnamon Dove: one bird was already sitting on completed nest, despite absence of eggs (27 Oct), thus egg-laying probably end Oct.
Green Barbet: one pair incubating (until at least 21 Oct), then feeding (by 28 Oct) = egg-laying in Oct.
Starred Robin: judging by the behaviour of pairs or males, breeding had just started in several pairs (not yet feeding, incubation stage) = egg-laying in Oct in several cases.
Black-headed Apalis: pair feeding fledgling(s) 26 Oct (= laying Sept).
Mozambique Batis: male feeding incubating female, 30 Oct (500 m) = laying Oct.
Olive Sunbird: one nest-building in the canopy 21 Oct [L. Fishpool]
Southern Puffback: nest-building 30 Oct (= laying Nov).

Mist-netted Green Twinspots had completed moult (one was just finishing), which suggests breeding at the end of the rains (normal in a seed-eater). Outside forest (transition woodland), a Chestnut-bellied Kingfisher was incubating 29 Oct (= laying Oct).

Fig. 23. Olive Sunbird in Mt Mabu forest (JB).

7. OTHER VERTEBRATES & INVERTEBRATES

7.1 Previous Studies

Prior to the survey carried out in October 2008 there had been limited recording of mammals and herps, apart from some opportunistic observations by Julian Bayliss on reconnaissance trips (late 2005/early 2006, mid 2008), although the butterflies were looked at in greater detail on these trips. During the October 2008 expedition, detailed studies were carried out on the avifauna (see Section 6) to complement earlier work in 2005 (Spottiswoode *et al.* 2008) and systematic survey work was done on the butterflies of the forest and summit areas as well as detailed collecting of reptiles and bats. Collecting was more opportunistic for amphibians, other small mammals, freshwater crabs and molluscs. All findings are given below by group.

7.2 Larger Mammals

The main source of information on larger mammals was interviews by R.J. Dowsett in October 2008 with a local hunter, Mr Ofelio Kavaliyawo using an illustrated field guide (R.J. Dowsett in Dowsett-Lemaire & Dowsett 2009). The hunter appeared knowledgeable and had lived in the area for a number of years. He regularly set traps in the area surrounding the main forest camp and was employed as a guide in late 2005 and all subsequent visits. In addition any sightings or aural records were recorded. Full details are given in Annex 5.

The Blue Monkey *Cercopithecus albogularis* is common within the forest but is hunted by the local community using bow and arrows, while Grant's Bush Baby *Galagoides* (*zanzibaricus*) *granti* was heard calling through the forest at night, especially around the main forest camp. Forest antelopes are under severe threat from bush meat hunting, primarily using gin-traps. Species such as Blue Duiker *Cephalophus monticola* and Bushbuck *Tragelaphus scriptus* are particularly hunted, as well as Klipspringer *Oreotragus oreotragus* and species such as Hyraxes (*Procavia capensis* and *Heterohyrax brucei*). According to local hunters, Leopard *Panthera pardus* are occasionally encountered. Both Buffalo *Syncerus caffer* and Elephant *Loxodonta africana* were historically common, although elephant have not been seen in recent years and the last sighting of buffalo was of a large herd passing through the tea estate in 2002.

7.3 Bats

As far as we are aware, there are no previous bat records from Mt Mabu or the immediate area. The nearest well-sampled and comparable localities in terms of habitat and environment are the montane areas of southern Malawi (Happold & Happold 1987, 1997) and Mt Namuli (see Timberlake *et al.* 2008, Curran & Kopp 2009). Although bats were opportunistically collected earlier by J. Bayliss, a more systematic survey was undertaken by Michael Curran and Mirjam Kopp in October 2008 (Curran & Kopp 2009). There have been some additional collections since (J. Bayliss), and the results presented here reflect all these findings. Records are backed up by voucher specimens deposited in three collections in the Durban Natural Science Museum (DNSM), the Museum of Natural History Geneva (MNHG) and the Natural History Museum Maputo (NHMM). Nomenclature follows Monadjem *et al.* (2010b).

Methods

Bats were sampled at four sites (Table 9) using mist nets, harp traps and acoustic monitoring. At each sampling site two to four ground nets (6 × 3 m and 9 × 3 m) and a canopy fixture were employed, the latter consisting of four 9 m nets (monofilament nylon with a 70/2 denier) hoisted to 16 m at site 3 and two 6 m nets held at 7.5 m height at site 4. Ground and canopy nets were opened from sunset until midnight or later, depending on the level of bat activity. Harp traps (2-tier, 1.5 × 1.5 m) were deployed from sunset to sunrise (18:00–05:00). Acoustic

monitoring was carried out at throughout the night consisting of one peak time (c.18:00) transect of 100 m lasting 10–15 minutes followed by two additional transects between 20:00 and 22:00. Bat calls were recorded from a D240 detector recording a sampling frequency of 44.1 kHz. Hand-held reference calls (Rhinolophidae and Hipposideridae) and hand-released calls (all other families) were taken from each species.

Table 9. Location of bat sampling sites and sampling effort.

Sampling site	alt. (m)	long. (S)	lat. (E)	no.nights
1. Base camp	550	16.3058	36.4242	2
2. Main forest camp	980	16.2864	36.4030	4
3. River near main camp	1000	16.2848	36.3980	5
4. Forest satellite camp	1300	16.2775	36.3803	2

Diversity and assemblage structure

Twelve species of bats across 38 individuals were recorded over the October 2008 sampling period (Annex 7). The mid-altitude forest assemblage superficially resembles that of the nearby montane forests of Mt Mulanje (Curran & Kopp, unpublished data) in containing a large proportion of species from the guild of 'dense-clutter feeders' (Kalko 1998), including a dominance of species from the families Rhinolophidae and Hipposideridae. Also of note is the presence of one member of the genus *Kerivoula* (woolly bats), a group which is generally viewed as being forest specialists. The identity of this particular *Kerivoula* species is uncertain at this stage, although based on external and cranial measurements it is clearly distinct from the two recognized Southern African species, *K. argentata* and *K. lanosa*. It represents an important record for Mozambique, either acting as the most southerly range extension for an existing species or possibly a new species in its own right, and indicating that montane forests are forming important stepping-stones for forest-restricted bat species. A new species of horseshoe bat, *Rhinolophus mabuensis* (Taylor *et al.* 2012, previously lumped with *R. hildebrantii*), was collected from Mabu and also later from neighbouring Mt Inago (Bayliss *et al.* 2010, Monadjem *et al.* 2010a).

In terms of abundance and dominance, activity levels (as measured in mist net captures) were unexpectedly low over the 13 nights of sampling in comparison to similar altitudes and habitats on Mts Mulanje and Namuli. This low abundance was confirmed by acoustic data from echolocation transects. It could be due to seasonal aspects such as low levels of insect activity, or a low proportion of fruiting trees in the case of fruit bats. A species accumulation curve of the current data shows incomplete sampling suggesting that the low abundance is not indicative of low species richness or diversity and that many more species have yet to be discovered.

7.4 Other Small Mammals

Opportunistic small mammal recording was mostly undertaken by Julian Bayliss and Lucas Sabão. Bucket pitfall traps were positioned in different habitat types ranging from moist forest to the forest edge. A total of 17 specimens, consisting of 4 species of rodents and 3 species of shrew, were collected from 1000 to 1300 m in October 2008 and June 2009 (Annex 7). Specimens were sent to Peter Taylor at the Durban Natural Science Museum; nomenclature follows Musser & Carleton (2005).

Specimens were prepared as skins and skulls in the collection of the Durban Natural Science Museum. Identification was based on keys in Skinner & Chimimba (2005) and the online key

of the Mammals of Tanzania (Field Museum of Natural History: http://www.fmnh.org/tanzania/).

All four rodents are tropical forest specialists and are affiliated with montane or coastal forests of central (Malawi) and eastern Africa (Kenya, Uganda, Tanzania, DRC). The populations sampled (except for *Grammomys dolichurus*) are the most southerly known. The dominant rodent was the soft-furred mouse *Praomys delectorum*, a montane forest specialist. Although in the IUCN 2010 Red Data List *Beamys major* (Figure 24) has been included in the widespread *B. hindei*, and *Lophuromys aquilus* in the widespread *L. flavopunctatus*, leading to them being placed in the category of Least Concern, it is highly probably that the southern populations are distinct species (Musser & Carleton 2005) meaning that they may qualify for Data Deficient or Threatened status. To the best of our knowledge *B. major* has not been recorded previously for Mozambique, although it was suspected to occur by Smithers & Tello (1976).

The shrew fauna of Mt Mabu is affiliated with tropical forests and woodlands as both *Crocidura luna* and *C. olivieri* found on Mt Mabu reach their southern extent in Africa in the montane forests of the Eastern Highlands of Zimbabwe. Both species are widespread in tropical Africa and are listed as Least Concern in the 2010 IUCN Red List.

Similar studies conducted in nearby montane forests (Mts Chiperone, Namuli and Mulanje) suggest that the small mammal fauna of Mt Mabu has been under-sampled at this stage. Comparison with Durban Museum collections from additional montane forest habitats between 2006 and 2009 in northern Mozambique (Mts Chiperone, Namuli and Inago) indicate that six additional species of rodents should also be found on Mabu: *Acomys spinossisimus*, *Aethomys namaquensis*, *Dendromus melanotis*, *Dasymys incomtus*, *Mus minutoides* and *Otomys angoniensis*. Whilst *P. delectorum*, the dominant rodent on Mt Mabu, was also found on Chiperone and Namuli, the other Mabu forest-specialists (*G. dolichurus*, *B. major* and *L. aquilus*) were not, although this may be due to under-sampling. Amongst the shrews, *C. silacea* and *C. luna* were also found on Mt Namuli but an additional species (*C. mariquensis*) collected on Namuli can be expected to occur on Mabu.

As with the bats, the terrestrial small mammal fauna occurring in these isolated relic montane forests of northern Mozambique form an important southern refuge biogeographically linked to tropical montane and coastal forests of central and east Africa.

Fig. 24. Lesser Pouched rat (*Beamys major*) caught in medium altitude forest, Mt Mabu (JB).

7.5 Herpetofauna

The herpetofauna were opportunistically sampled by Julian Bayliss between 2005 and 2008, resulting in the discovery of several new species, and more systematically by Bill Branch and Werner Conradie in May 2009 (Branch 2011). To date, 7 amphibian species and 15 reptile

species (9 lizards, 6 snakes) have been recorded (Annex 8). The relatively low species count is a result of low sampling effort with surveys occurring during periods of reduced activity. Much greater herpetofaunal diversity can be expected with further study.

Three new species of reptile have been discovered including a forest viper (*Atheris mabuensis*, Figure 25) in 2006 (Branch & Bayliss 2009), the southernmost record of the genus; a chameleon, *Nadzikambia baylissi*, discovered in 2008 and belonging to a genus previously thought to be endemic to Mt Mulanje (Branch & Tolley 2010); and also in 2006 a pygmy chameleon (*Rhampholeon* sp., Figure 26) that awaits description (Branch *et al.* in prep.). In addition to these new species, the taxonomic status of some of the other species is being investigated, including the status of a rare burrowing skink (*Melanoseps* sp.), again at its southernmost limit, an unusual large-scaled green snake (*Philothamnus* cf. *carinatus*), and two cryptic leaf-litter frogs (*Arthroleptis* sp.). Also of note is an unusual olive night snake (*Dipsadoboa*) that managed to escape after capture and which may prove to be new.

A number of species are shared with Mt Mulanje in southern Malawi, including the frogs *Leptopelis flavomaculatus* and *Hyperolius puncticulatus*, the chameleon *Triceros melleri*, and the snakes *Natricteres sylvatica* and *Naja melanoleuca*. Closely-related chameleons occur on both mountains with *Nadzikambia mlanjensis* and *Rhampholeon playceps* on Mt Mulanje and the sister taxa *N. baylissi* and *R.* sp. nov. on Mt Mabu. No forest viper (*Atheris*) has been recorded from Mt Mulanje, whilst *A. mabuensis* is now known from both Mabu and Namuli. Numerous Mt Mulanje endemics, such as the lizards *Trachylepis mlanjensis*, *Proscelotes mlanjensis*, *Platysaurus michelli*, *Lygodactylus rex* and *L. bonsi*, and the frogs *Arthroleptis francei*, *Amietia johnstoni*, *Ptychadena broadleyi*, *Strongylopus fuelleborni* and *Notophryne broadleyi*, have yet to be found on Mabu, although some are known to occur on Mt Namuli (e.g. *Lygodactylus rex* and *Strongylopus fuelleborni*).

Fig. 25. Two *Atheris mabuensis* on forest floor (JB).

The Gaboon Viper (*Bitis gabonica*) was collected from a relatively low altitude in the overgrown tea forest but is suspected to also occur in the main forest area. It was previously recorded from Mt Chiperone as part of an earlier survey (Timberlake *et al.* 2007), the first record since 1950 for this region of Mozambique. The Gaboon Viper is not known from

southern Malawi, but has been recorded from the Mzuzu–Nkhata Bay area in the north (Broadley pers. comm.).

The results generally indicate that many of the species are at their southernmost range with affinities to groups from the north and west.

Fig. 26. Pygmy chameleon, sp. nov. (JB).

7.6 Lepidoptera

The butterflies of Mt Mabu have been studied on a number of occasions, notably December 2005, January 2006, June 2008, September 2008, October 2008 and November 2010. Specimens were collected by J. Bayliss, C. Congdon, S. Collins, M. Hassan, I. Bampton, R.J. Dowsett and S. Georgiadis from a range of habitats including the abandoned tea estate, woodlands at the base of the peak and at the forest edge, throughout the moist forest, and the rocky summits. As a result of these visits the number of species identified from Mabu is currently 203 (see Annex 8). It is believed that there are more species to be recorded with an estimated total of around 250 species, bringing the total in line with lists from neighbouring mountains such as Mt Mulanje 70 km away.

Of the 203 species recorded four are regarded as new species (*Baliochila* sp. nov., *Cymothoe* sp. nov., *Epamera* sp. nov. and *Leptomyrina* (*Gonatomyrina*) sp. nov.), three are new subspecies (*Papilio pelodurus* subsp. nov., *Baliochila woodi* subsp. nov. and *Neocoenyra bioculata* subsp. nov.) and in addition, according to Congdon, Collins & Bayliss (2010), 35 are new records for Mozambique (two were previously found on Mt Namuli).

Species of interest

Cymothoe sp. nov. – The new species of montane *Cymothoe*, a member of the *Cymothoe aurivillius* group, was first collected by J. Bayliss on Mt Namuli in November 2007, Mt Mabu in September 2008 and Mt Inago in 2009 (Bayliss 2008, Congdon & Bampton 2009, Congdon *et al.* 2010, Figure 28). Males were commonly found but females proved elusive. Eggs were noted on *Rawsonia lucida* (Flacourtiaceae), and larvae from all three mountains were successfully raised to the adult stage. Males from Mabu are paler yellow than those from Mts Inago and Namuli, and the yellow areas of the Namuli males are heavily dusted with black. Nevertheless it appears that they are all races of the same species. Montane *Cymothoe* characteristically reside in forest clearings; they are relatively sedentary and generally do not move between forest patches if separated by a significant distance.

According to DNA analysis (Van Velsen & S. Collins, pers comm.), this species lies far apart from all other East African montane species, probably diverging in the Miocene some 3.8 million years ago. There is also some variation between samples from each mountain population.

Epamera sp. nov. – A new species of *Epamera* was collected on the summit of Mabu in October 2010 by J. Bayliss and M. Hassan, having been previously found on Mt Namuli by C. Congdon in 2009. Unfortunately all specimens caught were female and the male is yet to be discovered. Females were observed to lay on *Actinanthella menyharthii* (Loranthaceae).

There is a group of related species in *Iolaus* (*Epamera*), which includes *I. silanus*, *I. nolaensis* and *I. helenae*. Other members of this group have been found on the Upper Sangha River, Congo Republic, on the Usambara, Nguru and Udzungwa mountains in Tanzania, and on the Mafinga Mountains in N Malawi and neighbouring Zambia, as well as in coastal Tanzania. The discovery of the new species extends the range of the group southwards.

Baliochila sp. nov. – Two specimens of a new species of *Baliochila* were caught on Mabu in early June 2009 by C. Congdon, S. Collins and M. Hassan (Figure 29). The upperside resembles that of *B. woodi* from Mt Mulanje, while the underside is closer to that of the Tanzanian species. It is unusual to find two species in the same group in the same forest, but the new species was found at lower elevations in riverine forest compared to the new subspecies of *B. woodi*. The habits of the two are also different – *B. woodi* males perch around open spaces on ridges in the forest and are relatively easily netted, while those of the new species circle high under the canopy. It is probable that the *B. woodi* from Mabu represents a new subspecies.

Leptomyrina sp. nov. – *Leptomyrina* (*Gonatomyrina*) *handmani* was described from S Malawi and there are records from N and NW Zambia, but these may refer to another species. The new species of *Leptomyrina* from Mabu, which was first caught on the summit of Mt Mabu in October 2008 by J. Bayliss and which is also found on Mts Namuli and Inago, is darker and with more rounded wings; the hindwing lacks the tornal attenuation of *L. handmani*.

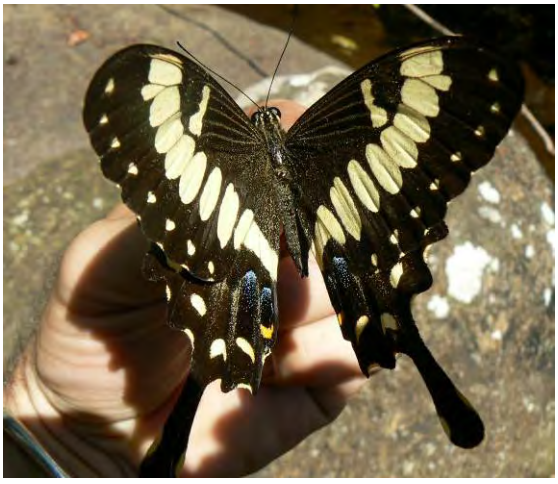

Fig. 27. *Papilio ophidicephalus* (JB)

Fig. 28. *Cymothoe* sp. nov. (JB)

Fig. 29. *Baliochila* sp. nov. (JB)

7.7 Molluscs

Leaf-litter molluscs were opportunistically collected from woodland and moist forest habitats by Julian Bayliss & Malaika Sacranie, with a total of 6 species being identified by A.C. van Bruggen (Netherlands). Not surprisingly, most species found on this rapid survey belonged to the genus *Gonaxis* – the two commonest being *G. vengoensis*, known from central Mozambique, and *G. elongatus* with a range from central Mozambique and adjoining parts of Zimbabwe to S Malawi. The total number of terrestrial snail species expected would be around 40–50 (van Bruggen, pers. comm. 2012).

Table 10. List of molluscs collected on Mt Mabu, 2005–2009.

Family / species
Pomatiasidae
Tropidophora insularis (Pfeiffer, 1852) var. *nyasana* (Smith, 1899)
Streptaxidae
Gonaxis vengoensis Connolly, 1922
Gonaxis elongatus (Fulton, 1899)
Gonaxis sp.
Subulinidae
Pseudoglessula (*Kempioconcha*) *liederi* (Von Martens, 1895)
Urocyclidae
Carinazingis regalis Van Bruggen & De Winter, 1990
Helicarionidae
Sitala jenynsi (Pfeiffer, 1845)

Species of interest

Apart from a single shell from Lengwe National Park in Malawi, *Pseudoglessula (Kempioconcha) liederi* is otherwise known only from its type locality in coastal SE Tanzania (SW Lindi). The Mt Mabu record bridges the range gap. *Carinazingis regalis* is a relatively new genus and species first collected and described from Mt Mulanje. It is a very peculiar snail with a coronet between the tentacles on the head, first described from the Mt Mulanje complex at 1000–2000 m. Congeneric specimens were reported from Ntchisi Mt, and shells probably belonging to this species are recorded from the Zomba and Nyika Plateaux in Malawi. *Tropidophora insularis* var. *nyasana*, with a large turbinate shell and spiral structure, was collected from woodland below 1000 m. *Tropidophora* species, widely distributed in southern and East Africa from the coast westward, although not really reaching Central Africa, are difficult to identify properly because of variation in the shell characters. They are tree dwellers usually found on tree stems in the forest. *Sitala jenynsi* is a widely distributed woodland species in coastal East Africa as far north as Kenya, reaching its southern limits in E Zimbabwe/C Mozambique.

7.8 Freshwater Crustacea

Six specimens of freshwater crabs from two of the rocky mountain streams near to the main forest campsite were opportunistically collected in October 2008. These were identified as *Potamonautes choloensis* (S. Daniels, pers. comm.), a species listed as Vulnerable on the 2010 IUCN Red List. This is a range extension and the first record from Mozambique.

As part of a broader study on Eastern and Southern African freshwater crabs, two new species were also described from Mt Namuli and Mt Mulanje (Daniels & Bayliss 2012), but not from Mt Mabu.

7.9 Biogeography

Within most taxonomic groups that have been even partially surveyed, there is evidence of a significant biogeographical link with mountains to the north (in Tanzania) and west (Malawi), such as the Eastern Arc Mountains and Moreau's Tanganyika–Nyasa Montane Chain. However, there is more of an influence from the latter, coupled with significant elements from the mountains in northern Malawi and southern Tanzania. Biogegraphical aspects will be expanded upon in a forthcoming paper (Bayliss *et al.*, in prep.).

In addition, the number of endemic species from Mabu and surrounding mountains suggest a long period of isolation and ancient linkages with the north.

8. CONSERVATION

The main conservation attributes of the Mt Mabu area are (a) the large extent and intact nature of the medium-altitude moist forest found here, and (b) the new species of vertebrates and invertebrates discovered. It is these attributes, along with the fact that it was previously almost unknown, that have given rise to much of the public interest in the area and make it unique in the Mozambique and regional context. And it is these attributes that should be the main objectives of conservation action.

In this section we outline the main conservation issues and threats to Mabu's biodiversity and suggest some possible approaches and actions. Mabu's ornithological significance is also discussed by Dowsett-Lemaire (2010).

8.1 Conservation Threats

Although there are no significant immediate threats to the forest of Mt Mabu, a number of medium-term threats to its biodiversity and ecological integrity have been identified. These include, in order of assumed priority: (a) expansion of agriculture into lower parts of medium altitude forest if local populations or demand increases; (b) frequent fires are "hardening" the forest boundary and may, over a period of time, inhibit forest regeneration at the margins, resulting in a gradual diminution of the forest extent at the expense of moist woodland; (c) there is a slight danger of logging for timber, particularly in the surrounding moist woodland and in lower part of forest; and (d) the unsustainable level of bushmeat hunting in the forest by the local population. These are expanded upon below.

a) Clearance for agriculture

Inside the forest a few smaller patches cleared for subsistence agriculture were found on the eastern slopes, for example one near the forest fly camp (16°17'07"S, 36°23'13"S, 1325 m) where a small field of around 0.3 ha had been cleared perhaps 20–25 years ago. This patch was now overgrown with secondary vegetation including *Rubus pinnatus* and many lianas. According to a local hunter, Ofelio Kavaliyawo, it was the locality where a few families took refuge during the civil war in the 1980s, living in lean-to shelters by a stream. Similar areas where there had been small fields in forest clearings were seen elsewhere. However, the ecological footprint appears rather small, in some respects similar to that of larger tree-fall sites.

On the 1965/69 aerial photos there appears to have been some minor clearance at the lower forest margins on the southern and north-eastern slopes, suggesting previous clearance for small fields. But it could be that these areas were actually in woodland, not forest. Similar patches were not seen on recent satellite imagery, but with the resolution available it is not possible to confirm this.

Also on the 1965 aerial photos two commercial tea estates be clearly be seen on the lower southern and south-eastern slopes, including the development of a network of tracks, and what looks like rural or agricultural development off part of the north-eastern slope. No evidence was seen that these tea plantations had been planted on what was forest, except perhaps across strips of what was riverine forest, although such evidence may not be apparent given that the plantations were put in perhaps 50 years ago. However, it is unlikely, due to altitude and limited moisture in the dry season, that there was much forest at these lower altitudes anyway, except strips of what here has been called lowland riparian forest, confined to bands along drainage lines with additional moisture.

Today what is seen on Mt Mabu is subsistence agriculture coming up to the forest margin, particularly on the south-eastern side where there appears to be more local population than elsewhere. Fire (see below) is hardening these boundaries. However, there was no evidence seen of encroachment of agricultural clearance into the forest itself – clearance and cultivation comes up to forest boundary but appears to be in what was moist woodland or forest fringing vegetation. The woodland trees are felled and the dry, cleared vegetation is burnt in the dry season, the fire going uphill to the moist forest margin where it stops (Figure 12). Evidence was seen in the form of old field furrows that fallow areas were reused some years later, but it is not known what the fallow period is.

However, with an increasing population and with the increasing demands of a cash economy, it is very possible that agricultural land will become scarce and land use pressures build up. This may well result in the forest margins being pushed back further and more forest being cleared. But on the mid-slopes of the mountain itself there were very few areas that would be level enough or sufficiently non-rugged to allow for small fields or settlements. Any agriculture or production would be very marginal.

b) Fire

Wildfires seemed to be very frequent during the 2008 dry season, with smoke being seen all around. At times, smoke and ash could be seen in the canopy right inside the forest. It was not the forest vegetation that was burning, and very little evidence was seen of such an occurrence, but the surrounding woodland and grassland (Figure 30).

The fires are set to clear fallow agricultural fields or areas that have recently been cleared, and presumably fire has been used in such away for perhaps hundreds of years. What appears to be happening now, though, is that fire is increasingly frequent in any given locality, not just occasional and fierce. Wildfires come right up to the forest boundary, which they seem to "harden" in the sense that regeneration of forest species is greatly inhibited. However, there was no evidence seen to suggest that moist forest could or had extended much lower down the slopes from its present position, at least on the south-eastern side. The forest boundary is likely to be mostly determined by altitude/microclimate and dry season moisture availability, both in the soil and atmosphere in terms of low cloud, dew, etc.

Fig. 30. Woodland clearance for agriculture and fire (JB).

c) Logging

An important feature of the forests on Mt Mabu is that there was no evidence of logging or tree cutting seen. Although not 'pristine', the forest is remarkably intact and undisturbed. In many forests in Mozambique, for example those on Mt Namuli (Timberlake *et al.* 2009) or the coastal forests of Cabo Delgado Province (Timberlake *et al.* 2011), selective logging has had a significant impact on forest extent, structure and composition. This is not the case, as far as we could determine, on Mabu.

There still remains a minor danger of commercial logging, but most trees found in the forest are not of desired species and in addition extraction would be difficult and expensive in such terrain. However, significant levels of illegal logging have been reported from parts of Zambézia Province closer to the coast (Mackenzie 2006, Mackenzie & Ribeiro 2009), so the organisation and logistics for extraction are available.

Many trees of *Pterocarpus angolensis* were seen on a ridge felled and burnt in the process of clearing for fields, but interestingly there was no attempt to use the wood.

d) Hunting

According to a local hunter, mammal populations are now relatively low (see Section 7.2), although Blue Monkeys are still relatively common. It is only the largest mammal species that appear to have been extirpated. There are no or very few predators present. These losses are probably due to bushmeat hunting. Game birds such as Francolin and Guinea Fowl are still actively hunted, along with a number of small antelope.

The forest is used by local hunters from the villages below, particularly the area around the summit. One trapped and dying klipspringer was seen here. The hunting method of choice appears to be gin-traps, a kind of spring trap (Figures 31, 33). Of the gin-traps seen, many were relatively small, designed for duikers or klipspringer, but could easily damage a human foot or leg. One very large and active trap was seen in 2006 (Figure 34) which appears designed to trap much larger animals. Also noted was a technique where a low drift fence of scrub is laid across a marked path, with a single 'gateway' through it. In the soil under this gateway a gin trap is set, attached to a strong nearby bush to stop any captured animal running away. Another technique designed, peresumably for elephant shrews and similar-sized rodents, is the construction of a low fence of small stakes. In a gap a small sprung snare is made using bark cord, which is triggered by the animal passing through (Figure 32).

Fig. 31. Sun squirrel caught in gin trap, Mt Mabu (JB).

Fig. 32. Small mammal trap and fence, Mt Mabu (JB).

Fig. 33 a,b. Small but powerful gin trap, Mabu summit (JT).

Fig. 34. Large gin trap with Hassam Patel, Mabu forest (JB).

Only a few villagers are hunters, a skilled ocupation that seems to run in families. Hunting trips can take place over a number of days in the forest while visiting set traps. Each hunter is aware of where the traps are, and who they belong to.

The reduced number of desired animals, such as antelope, is acknowledged by the hunters. The present level of extraction is thought by us to be unsustainable, although could be maintained at a lower level.

8.2 Protection and Conservation

At present Mt Mabu is under no form of official protection, but as there are few immediate threats this is not a major problem. However, there are a number of medium-term threats and it will be necessary in due course to gazette the area as some sort of Reserve. Moves towards this are apparently being made at Provincial level (October 2012).

It is not yet clear which would be the most appropriate form of protection under the new national Protected Area legislation. This legislation is now in the process of being finalised and appropriate structures developed for its implementation. A possible status for an area of the biodiversity significance and size of Mabu might be that of a Forest Reserve (under the National Directorate of Lands and Forests, NDLF, of the Ministry of Agriculture) or Reserva Especial (under the National Directorate for Conservation Areas, DNAC, of the Ministry of Tourism). An alternative would be some sort of Community Reserve that is 'owned' and managed by the local community.

In 2011, the international conservation NGO, Fauna and Flora International (FFI), agreed to initiate and fund a community-based conservation project in the Mabu area. At the time of writing, this project is still being developed, although local NGO partners have been identified.

We do not wish to speculate here as to what are the most appropriate conservation actions. However, various suggestions for conservation action include: (a) limited ecotourism based and run by local communities, with trained local guides taking visitors through the forest to the peaks and able to explain something of the history and natural history of the area; (b) improvement and intensification of local agriculture to reduce the need to repeatedly clear new areas; (c) controlled, sustainable use of forest for some products (e.g. medicinal plants, some bush meat) is possible, but this would have to be limited in extent and carefully monitored to stop damage. A great attribute of the Mabu forests is their "pristine" nature – not untouched or truly pristine, but fully intact and relatively undisturbed, self-regenerating without compromise. This needs to be retained.

Fig. 35. Villagers at Mt Mabu forest camp (JB).

9. MAIN FINDINGS

1. The moist forest present on Mt Mabu is around 7880 ha in extent, 5270 ha of which is thought to be at medium-altitude (1000–1400 m). Forests at this altitude are increasingly scarce across the region as many similar areas have been cleared for agriculture. The Mabu forests are possibly the largest extent in southern Africa. In addition, the forests seen here have been little disturbed and are in very good condition.

2. Although not pristine, the forest is intact and in very good ecological condition. No evidence of tree cutting was seen.

3. Plant species composition is typical of medium altitude forest and inselbergs, although twelve new records for Mozambique and one (possibly two) new species were discovered. The species richness found (249 taxa) above 800 m altitude is normal for such areas.

4. The finds of vertebrates were particularly exciting. Out of 15 reptile species recorded, three are new to science, including a forest viper and a chameleon, with a further three possibly new. A total of 126 bird species were recorded, including Southern Banded Snake Eagle, Green Barbet (*belcheri* race), Spotted Ground Thrush, Cholo Alethe, Swynnerton's Robin, Gunning's Akalat, Namuli Apalis and Dapple-throat. Several of these records represent significant extensions of known range.

5. Large mammal populations are rather low, in part owing to bushmeat hunting. Although only a few species of small mammal were recorded, these include three new Mozambique records and one (possibly two) new species of bat.

6. A particularly high number of butterflies (203) were recorded, including 7 species or subspecies new to science plus 35 other new Mozambique records.

7. In conclusion, although the immediate threats to the forests on Mt Mabu are not as great as those on many other forests in Mozambique, with increasing land pressures they are likely to become much more significant. Two important threats are the high and unsustainable hunting for bushmeat, and the recent increase in fire incidence along the forest margins. Some sort of protected status will possibly be needed, along with a locally-based conservation project.

10. RECOMMENDATIONS

Research

1. Further documentation of the biodiversity of Mt Mabu is required, especially that of the medium-altitude moist forest areas. The number of new species and records of vertebrates and invertebrates is high, and many more are likely to be found. These appear to be primarily located in forests at medium altitude, a habitat that in many other localities across the region has been cleared.

2. There should be a more detailed plant survey by habitat and altitude. Plant collecting to date has not been sufficiently comprehensive or systematic. Few new species of plant are likely to be found, but the number of new plant records is likely to increase once the northern and western sides of the mountain are explored.

3. There is a need for better documentation of the extent of forest around the whole massif, and better typification of the range of forest habitats. In addition, investigation is required into what factors might be determining forest extent.

4. An important next stage of investigation should be a comparative study of the various inselbergs across this part of northern Mozambique and southern Malawi. This would focus on determining similarities and differences between the various massifs in this region, and with those further afield in southern Tanzania and eastern Zimbabwe, especially the distribution ranges of endemics. It may be appropriate to define and describe an south-central African inselberg ecoregion.

Management

5. It is not yet clear which would be the most appropriate form of protection under the new national Protected Area legislation, possibly that of Forest Reserve (under the National Directorate of Lands and Forests, NDLF, of the Ministry of Agriculture) or Reserva Especial (under the National Directorate for Conservation Areas, DNAC, of the Ministry of Tourism). An alternative would be some sort of Community Reserve that is 'owned' and managed by the local community. Although not urgent, any longer-term future of the Mt Mabu forests will involve some sort of protected status.

7. The development of low-impact tourism, based and run by local communities around the mountain, perhaps through a development NGO, is considered the most appropriate land use for the massif. Some regulation of external visitors may become necessary to ensure that benefit goes to these communities as well as to operators or other external partners, but without destroying the visitor's sense of adventure and excitement.

8. A local guide programme should be developed, including training and licensing of a few local guides who would accompany each visitor group. These guides should be versed in local history and have a good knowledge of the forest, the plants and animals found there, and an ability to communicate this for ecotourism.

9. Current levels of hunting and bush meat extraction need to be reduced so that antelope populations, and that of other medium-size animals, can increase. The present level is thought to be so high that populations of some species may become locally extinct.

10. There is a need for public education across the area aimed at reducing the incidence of uncontrolled wildfires. At present there is a lot of unnecessary burning in order to clear agricultural fields, with much collateral damage to forest and woodland biodiversity.

11. Any ecotourism programme needs to have a base accessible by road, perhaps on the old Madal tea estate. This should feature in any local infrastructure planning. Appropriate "base" accommodation will also be required for ecotourism, the development of which offers an opportunity to local enterprise.

12. The owners of the old tea estate on the south-eastern slopes, previously Grupo Madal, should be fully involved in the protection and development of Mabu forest, including ecotourism. There is some infrastructure there which could be rehabilitated, and there were also plans to re-open or replace the plantations. As well as the local population, the estate has long-established rights in the area.

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ANNEX 1. Participants on main Mt Mabu expedition, October 2008.

Ivan **Bampton**, Research Associate, African Butterfly Research Institute, Nairobi, Kenya [deceased].

Aurélio Constantino **Banze**, botanist, National Herbarium, IIAM, Maputo, Mozambique.

Julian **Bayliss**, Darwin Project Regional Coordinator, Mt Mulanje Conservation Trust, Mulanje, Malawi.

Carl **Bruessow**, Executive Director, Mt Mulanje Conservation Trust, Mulanje, Malawi.

Colin **Congdon**, Research Associate, African Butterfly Research Institute, Nairobi, Kenya.

Michael **Curran**, postgraduate student, Zoology Dept., University of Basel, Switzerland.

Robert J. **Dowsett**, zoologist, Sumène, France.

Françoise **Dowsett-Lemaire**, ornithologist & ecologist, Sumène, France.

Lincoln **Fishpool**, BirdLife International, Cambridge, UK.

Jorge R. **Francisco**, GIS Unit, Land & Water Department, IIAM, Maputo, Mozambique.

Timothy **Harris**, botanist, Herbarium, RBG Kew, London, UK.

Martin **Hassan**, butterfly collector, Mbeya, Tanzania.

Feliciano Baptista **João**, silviculturalist, Madonge Forest Research Station, IIAM, Sussundenga, Mozambique.

Mirjam **Kopp**, postgraduate student, Zoology Dept., University of Basel, Switzerland.

Alinafe Carolyne **Litta**, Assistant Forestry Research Officer, Research Institute of Malawi, Zomba, Malawi.

José Carlos **Monteiro**, forester, Madonge Forest Research Station, IIAM, Chimoio, Mozambique.

Steven **Mphamba**, forester, Forestry Research Institute of Malawi, Zomba, Malawi.

Hermenegildo Alfredo **Matimele**, botanist, IIAM, Maputo, Mozambique.

Hassam **Patel**, botanist, Mulanje Mountain Conservation Trust, Mulanje, Malawi.

Lucas **Sabão**, taxidermy technician, Museu de História Natural, Universidade Eduardo Mondlane, Maputo, Mozambique.

Camila **de Sousa**, forester, Forestry Research Section, IIAM, Marracuene, Mozambique.

Jonathan **Timberlake**, Project Coordinator, botanist & ecologist, Herbarium, RBG Kew, London, UK.

Thomas **Timberlake**, student, Eastbourne, UK.

ANNEX 2. Media Coverage of Mt Mabu.

There was a phenomenal level of international media attention on the discovery and biodiversity of Mt Mabu between December 2008 and March 2009, with some follow-up articles or interviews right through until mid-2012.

Following an interview by Juliette Jowit, Environmental Editor of The Observer newspaper, with Jonathan Timberlake in December 2008, a 3/4-page article appeared on 21 December along with links to a photo gallery of a selection of photos taken on the trip. Immediately following this a number of UK-based newspapers ran articles and requested interviews, ranging from The Daily Telegraph to SkyNews and French RFI radio. Over the course of the following three months other significant articles or interviews included The Sunday Express, CNN television, The Times, Publico (Portugal), BBC World Service, BBC Wales and the News of Hellenic Nobel Collection. The more significant or original ones are listed below.

The Kew Press Office put together a compilation of these articles and links in May 2009 (Mount Mabu media coverage report, Kew Press Office 2009, 34 pp.) covering 105 items from at least 36 countries and many languages across print, broadcast and online media (including blogs), but it is likely there were many more generated than this. As would be expected, there was also significant media attention in Mozambique, which raised much national interest, both in Mabu and in the country's rich biodiversity. This interest was particularly exemplified in the final project workshop held in Maputo in June 2009, attended by three Government Ministers, and will hopefully lead to required conservation action.

Main published articles

Birds and butterflies among host of species discovered in African Eden (Juliette Jowit). The Observer, 21 December 2008.

Paradise found (with the help of Google Earth) (Louise Gray). The Daily Telegraph, 22 December 2008.

Parte de Moçambique ignorada pela "Google Earth". Noticias (Maputo), 29 December 2008.

Google Earth helps Kew put ‘lost forest’ of Mount Mabu on the conservation map (RBG Kew website), January 2009.

How Google found the land that time forgot (Stuart Winter). Sunday Express, January 11 2009.

Unspoilt Eden - a rare find (Leon Marshall). The Sunday Independent, 1 February 2009.

Darwin project discovers virgin rainforest in Mozambique (P. Smith & J. Bayliss). Darwin News, issue 14, April 2009: 3-4.

Mozambique's biological treasures: Expeditions discover new areas for conservation (J. Timberlake). News of the Hellenic Nobel Collection, issue 26, April 2009.

Um novo mundo nas montanhas da Zambézia (Fernando Peixeiro). Prestígio (Maputo), issue 29, August 2009: 42-43.

Treasure Mountain (Bill Branch). Africa Geographic, March 2011: 30-33.

Mabu: The secret ‘Google forest’ of Mozambique. FFI Update no. 18, May 2011: 1.

Selection of media articles and interviews by country and date.

Country / medium	**URL if known** (accessed April 2012)
UK	
The Observer, 21/12/08	http://www.guardian.co.uk/environment/2008/dec/21/mount-mabu-mozambique-jonathan-timberlake
The Guardian, 21/12/08	Online photo gallery, http://www.guardian.co.uk/environment/gallery/2008/dec/21/new-species-wildlife-mozambique?picture=340939201
Daily Telegraph, 22/12/08	http://www.telegraph.co.uk/earth/earthnews/3884623/Scientists-discover-new-forest-with-undiscovered-species-on-Google-Earth.html
SkyNews, 22/12/08	Online photo gallery
Daily Mail, 22/12/08	http://www.dailymail.co.uk/sciencetech/article-1100323/Lost-World-discovered-thanks-Google-Earth.html
RBG Kew, 22/12/08	Press release, The lost forest of Mount Mabu
RBG Kew website, Jan 09	http://www.kew.org/science/news/mount-mabu-mozambique.html Google Earth helps Kew put 'lost forest' of Mount Mabu on the conservation map
Sunday Express, 11/01/09	http://www.express.co.uk/posts/view/79343/How-Google-found-the-land-that-time-forgot-/
Daily Post (Wales), 19/01/09	http://www.dailypost.co.uk/news/north-wales-news/2009/01/19/jungle-finds-by-scientist-inspired-by-google-earth-55578-22721815/
Wales Online, 19/01/09	http://www.walesonline.co.uk/news/wales-news/2009/01/19/how-google-pointed-julian-to-the-lost-world-of-mabu-91466-22722298/
BBC Wales Online, 19/01/09	http://news.bbc.co.uk/1/hi/wales/7837049.stm
BBC World Service, World Tonight (radio), 27/01/09	Interview with Jonathan Timberlake in Kew Herbarium
BBC Online (news website), 27/01/09	http://news.bbc.co.uk/1/hi/in_depth/7860561.stm Audio slide show
Birdlife International Website, 26/01/09	http://www.birdlife.org/news/news/2009/01/mount_mabu.html
The Times, 14/02/09	
Guardian Weekly, 20/02/09	http://www.guardian.co.uk/world/2008/feb/20/mozambique-conservation Interview with Julian Bayliss
Evening Standard, 03/03/09	http://www.thisislondon.co.uk/standard/article-23656839-details/Google+map+leads+Kew+scientists+to+hundreds+of+new+species/article.do
The One Show, BBC 1 (TV), 20/03/09	Interview with Jonathan Timberlake in RBG Kew Palm House
BBC website, 11/06/09	http://news.bbc.co.uk/1/hi/sci/tech/8094444.stm Undiscovered rainforest 'Googled'
BBC website, 11/06/09	http://news.bbc.co.uk/1/hi/sci/tech/8094862.stm Exploring the Google Forest
BBC website, 11/06/09	http://news.bbc.co.uk/1/hi/sci/tech/8094142.stm Hunting butterflies on Mt Mabu
BirdLife International website, 18/06/09	http://www.birdlife.org/news/news/2009/06/mount_mabu.html Exploring the 'Google forest'
The Guardian, 27/06/09	http://www.guardian.co.uk/environment/audio/2009/jun/27/mount-mabu-mozambique-new-species Mount Mabu new species: 'It's been a very successful week'
Mail & Guardian, 28/06/09	http://www.mg.co.za/article/2009-06-28-mozambique-agrees-to-protect-lost-rainforest-of-mount-mabu Mozambique agrees to protect lost rainforest of Mount Mabu
International Year of Forests, YouTube, 2011	http://www.youtube.com/watch?v=4ymIs3Mxj24&feature=plcp
RBG Kew website, 05/10/11	http://www.kew.org/news/mount-mabu.htm How Google helped Kew to put Mount Mabu on the conservation map + video at http://www.youtube.com/watch?v=4ymIs3Mxj24&feature=plcp
The Observer, 22/01/12	http://www.guardian.co.uk/science/2012/jan/22/mozambique-chameleon-new-to-nature New to Nature No 64: *Nadzikambia baylissi*
Australia	
Western Australia	http://www.watoday.com.au/world/paradise-found-on-google-20081226-75bj.html
The Age, 26/12/08	http://www.theage.com.au/world/paradise-found-on-google-20081225-753x.html

Sydney Morning Herald, 04/01/09	http://www.smh.com.au/news/opinion/nature-bites-back/2009/01/03/1230681806843.html
Belgium	
ZD.net, 23/12/08	http://www.zdnet.be/news.cfm?id=96398
Brazil	
BBC Brasil, 23/12/08	http://www.bbc.co.uk/portuguese/reporterbbc/story/2008/12/081223_galeriamontemabu_np.shtml
Canada	
Global Post, 20/04/09	http://www.globalpost.com/dispatch/africa/090419/the-hunt-the-black-charaxis The hunt for the Black Charaxis
Global Post, 06/07/09	http://www.globalpost.com/dispatch/africa/090624/expedition-discovers-new-pygmy-chameleon Expedition discovers new chameleon
China	
163 News, 02/03/09	http://discover.news.163.com/09/0203/10/517L7B2E000125LI.html
France	
Futura Sciences, 30/12/08	http://www.futura-sciences.com/fr/news/t/zoologie/d/un-monde-perdu-decouvert-sur-google-earth_17785/
Le Monde, 06/01/09	
Liberation, 07/01/09	http://www.ecrans.fr/Un-monde-perdu-decouvert-grace-a,6062.html
RFI Radio, 07/01/09	http://www.rfi.fr/actufr/articles/109/article_77498.asp
Figaro Magazine	
Germany	
Berliner Zeitung, 23/12/08	http://www.bz-berlin.de/BZ/boulevard/2008/12/24/mit-google-earth/entdecken-forscher-ein-vergessenes-paradies.html
Der Spiegel, 03/01/09	
Greece	
To Vima (The Tribune), 23/12/08	http://www.tovima.gr/default.asp?pid=2&ct=33&artId=248026
Origo, 06/02/09	http://www.origo.hu/tudomany/elovilag/20090204-mount-mabu-rejtett-oazisba-vezette-a-kutatokat-a-google-fold.html
India	
The Hindu, 23/12/08	
Italy	
La Republica, 22/12/08	http://www.repubblica.it/2008/12/sezioni/scienze/mozambico-inesplorato/mozambico-inesplorato/mozambico-inesplorato.html?rss
Madagascar	
Mongabay.com, 22/12/08	http://news.mongabay.com/2008/1222-google_earth.html
Mozambique	
O Pais	
Carlos Serra blog, Dec 08	http://oficinadesociologia.blogspot.co.uk/2008/12/monte-mabu-descoberta-que-no.html
TMC.net, 24/12/08	http://www.tmcnet.com/usubmit/2008/12/23/3876275.htm
Notícias, 29/12/08	
Netherlands	
NOS, 30/12/08	http://www.nos.nl/jeugdjournaal/artikelen/2009/1/30/googleontdektbos.html
Norway	
NRK Oslo, 28/01/09	http://www.afrol.com/articles/32263
Portugal	
Publico, 23/12/08	http://ultimahora.publico.clix.pt/noticia.aspx?id=1354048&idCanal=13
South Africa	
South Africa Direct, 10/02/09	http://www.southernafricadirect.com/news/entries/2009-04-01/mozambiques-unmapped-mount-mabu-explored.html
Carte Blanche, 24/01/10	http://beta.mnet.co.za/carteblanche/Article.aspx?Id=3821 TV programme
Spain	
La Segunda, 23/12/08	http://www.lasegunda.com/ediciononline/espectaculos/detalle/index.asp?idnoticia=455113
ABC Spain, 23/12/08	http://www.abc.es/20081223/nacional-sociedad/descubren-gracias-google-earth-200812232127.html

Redes (magazine), June 2012	
Russia	
Vokrugsveta, 22/12/08	http://www.vokrugsveta.ru/news/5570/
Sweden	
Dagans Heyeten, 22/12/08	
USA	
CNN Atlanta, 07/02/09	Jonathan Timberlake talks to CNN's Ralitsa Vassileva
Environmental Graffiti, 18/02/09	http://www.environmentalgraffiti.com/featured/google-earth-uncovers-lost-forest-mount-mabu/7747
National Geographic website, 20/02/09	http://news.nationalgeographic.com/news/2009/02/photogalleries/lost-forest-found-rare-animals/index.html
Link TV, 2010	http://www.linktv.org/video/6432/discovering-mount-mabu TV clip
Google Earth website, 2011	http://oneworldmanystories.com/mount_mabu.html Armchair archaeology: Welcome to the lost forest of Mt. Mabu

ANNEX 3. Plant checklist for Mt Mabu above 800 m.

Life-form (l/f): T - tree, S - shrub, cl - climber/liana, ep - epiphyte, h - herb, g - grass/sedge
Habitat (H): W - woodland, F- medium-altitude forest, mF - montane forest, R - rocky outcrop
Records (r): 1 -specimen, 2 - sight record only

Family	Determination	l/f	hab.	r
PTERIDOPHYTES				
Aspleniaceae	Asplenium dregeanum *Kunze*	h	F	1
Aspleniaceae	Asplenium erectum *Willd.*	h	mF	1
Aspleniaceae	Asplenium holstii *Hieron*	h	F	1
Cyatheaceae	Cyathea dregei *Kunze*	S	F	1
Dennstaedtiaceae	Blotiella natalensis *(Hook.) Tryon*	h	F	1
Lomariopsidaceae	Lomariopsis warneckei *(Hieron.) Alston*	cl	F	1
Marattiaceae	Marattia fraxinea *Sm.* var. salicifolia *(Schrad.) C.Chr.*	h	F	1
Polypodiaceae	Pleopeltis macrocarpa *(Willd.) Kaulf.*	h	F	1
Pteridiaceae	Pteridium aquilinum *(L.) Kuhn* subsp. aquilinum	h	W	2
GYMNOSPERMS				
Podocarpaceae	Podocarpus latifolius *(Thunb.) Mirb.*	T	mF	1
MONOCOTYLEDONS				
Aloaceae	Aloe arborescens *Mill.*	S	R	1
Aloaceae	Aloe sp.	h	R	2
Amaryllidaceae	Cryptostephanus vansonii *I.Verd.*	h	F	1
Araceae	Culcasia falcifolia *Engl.*	cl	F	2
Arecaceae	Phoenix reclinata *Jacq.*	T	F,W	2
Asparagaceae	Asparagus setaceus *(Kunth) Jessop*	cl	F	1
Behniaceae	Behnia reticulata *(Thunb.) Didr.*	cl	mF	1
Commelinaceae	Aneilema aequinoctiale *(P.Beauv.) Loudon*	h	F	1
Commelinaceae	Commelina diffusa *Burm.f.*	h	F	1
Commelinaceae	Pollia condensata *C.B.Clarke*	h	F	1
Cyperaceae	Coleochloa setifera *(Ridl.) Gilly*	g	R	1
Cyperaceae	Cyperus fischerianus *Schimp.*	g	R	1
Cyperaceae	Cyperus cf. albostriatus *Schrad.*	g	R	1
Dracaenaceae	Dracaena fragrans *Ker Gawl.*	h	F	1
Dracaenaceae	Dracaena laxissima *Engl.*	cl	F	1
Hyacinthaceae	Drimia calcarata *(Baker) Stedje*	h	R	1
Hypoxidaceae	Hypoxis angustifolia *Lam.*	h	R	1
Orchidaceae	Angraecopsis parviflora *(Thours) Schltr.*	ep	mF	1
Orchidaceae	Bulbophyllum ballii *P.J.Cribb*	ep	mF	1
Orchidaceae	Bulbophyllum sandersonii *(Hook.f.) Rchb.f.*	ep	F	1
Orchidaceae	Liparis caespitosa *(Lam.) Lind.*	ep	F	1
Orchidaceae	Polystachya fusiformis *(Thouars) Lindl.*	ep		1
Orchidaceae	Polystachya malilaensis *Schltr.*	ep	W	1
Orchidaceae	Polystachya songaniensis *G.Will.*	ep	R	1
Orchidaceae	Polystachya transvaalensis *Schltr.*	ep	mF	1
Poaceae	Danthoniopsis sp. (possibly)	g	R	2
Poaceae	Helictotrichon elongatum *(A.Rich.) C.E.Hubb.*	g	R	1
Poaceae	Leptaspis cochleata *Thw.*	g	F	1
Poaceae	Oreobambos buchwaldii *K.Schum.*	S	F	1
Poaceae	Oxytenanthera abyssinica *(A.Rich.) Munro*	S	W	2

Poaceae	Panicum brevifolium *L.*	g	F	1
Smilacaceae	Smilax anceps *Willd.*	cl	F	2
Xanthorrhoeaceae	Dianella ensifolia *(L.) DC.*	h	W	1
Zingiberaceae	Aframomum albiflorum *Lock*	h	W	1
Zingiberaceae	Aframomum angustifolium *(Sonn.) K.Schum.*	h		1
DICOTYLEDONS				
Acanthaceae	Acanthus ueleensis *De Wild.*	h	F	1
Acanthaceae	Asystasia malawiana *Brummitt & Chisumpa*	h	F	1
Acanthaceae	Brachystephanus africanus *S.Moore*	h	F	1
Acanthaceae	Brillantaisia cicatricosa *Lindau*	h	F	1
Acanthaceae	Dicliptera heterostegia *Nees*	h	F	1
Acanthaceae	Hypoestes aristata *(Vahl.) Roem.& Schult.*	h	F	1
Acanthaceae	Justicia asystasioides *(Lindau) M.E.Steiner*	S	F	1
Acanthaceae	Mimulopsis arborescens *C.B.Clarke*	h	F	1
Acanthaceae	Mimulopsis solmsii *Schweinf.*	T	F	2
Acanthaceae	Phaulopsis imbricata *(Forssk.) Sweet* subsp. imbricata	h	F	1
Acanthaceae	Pseuderanthemum subviscosum *(C.B.Clarke) Stapf*	h	F	1
Acanthaceae	Sclerochiton hirsutus *Desc.*	S	F	1
Amaranthaceae	Achyranthes aspera *L.* var. pubescens *(Moq.) Townsend*	h	F	1
Annonaceae	Annona senegalensis *Pers.*	S	W	1
Annonaceae	Xylopia aethiopica *(Dunal) A.Rich.*	T	F,W	1
Apocynaceae	Carissa bispinosa *(L.) Brenan*	S	mF	1
Apocynaceae	Carvalhoa campanulata *K.Schum.*	S	W,F	1
Apocynaceae	Dictyophleba lucida *(K.Schum.) Pierre*	cl	F	1
Apocynaceae	Funtumia africana *(Benth.) Stapf*	T	F	1
Apocynaceae	Landolphia kirkii *Hook.f.*	cl	F	1
Apocynaceae	Oncinotis tenuiloba *Stapf*	cl	F	1
Apocynaceae	Rauvolfia caffra *Sond.*	T	F	1
Apocynaceae	Saba comorensis *(Bojer) Pichon*	cl	F	2
Apocynaceae	Tabernaemontana stapfiana *Britten*	T	F	1
Apocynaceae	Tabernaemontana ventricosa *A.DC.*	T	F	1
Araliaceae	Cussonia arborea *A.Rich.*	T	W	2
Araliaceae	Cussonia spicata *Thunb.*	T	mF	1
Araliaceae	Polyscias fulva *(Hiern) Harms*	T	F,mF	2
Araliaceae	Schefflera goetzenii *Harms*	cl	mF	1
Asclepiadaceae	Secamone alpini *Schult.*	cl	R	1
Asclepiadaceae	Tylophora sp.	h	mF	1
Asteraceae	Adenostemma mauritianum *DC.*	h	F	1
Asteraceae	Anisopappus chinensis *(L.) Hook.& Arn.* subsp. buchwaldii *(O.Hoffm.) S.Ortiz, Paiva*	h	R	1
Asteraceae	Bothriocline glomerata *(O.Hoffm.& Muschl.) C.Jeffrey*	h	F	1
Asteraceae	Aspilia kotschyi *(Hochst.) Oliv.* var. kotschyi	h	mF	1
Asteraceae	Helichrysum forskahlii *(J.F.Gmel.) Hilliard & B.L.Burtt*	h	R	1
Asteraceae	Mikania chenopodifolia *Willd.*	h	F	1
Asteraceae	Senecio peltophorus *Brenan*	h	R	1
Balsaminaceae	Impatiens wallerana *Hook.f.*	h	F	1
Balsaminaceae	Impatiens zombensis *Baker*	h	F	1
Cactaceae	Rhipsalis baccifera *(J.Mill.) Stearn* subsp. mauritiana *(DC.) Barthlott*	ep	F	2
Campanulaceae	Lobelia trullifolia *Hemsl.* subsp. trullifolia	h	W,R	1
Cecropiaceae	Myrianthus holstii *Engl.*	T	F	1

Celastraceae	Maytenus acuminata *(L.f.) Loes.*	S	F	1
Celastraceae	Maytenus undata *(Thunb.) Blakelock*	T	F,mF	1
Celastraceae	Mystroxylon aethiopicum *(Thunb.) Loes.* (= Cassine aethiopica)	T	mF	2
Chrysobalanaceae	Maranthes goetzeniana *(Engl.) Prance*	T	F	1
Chrysobalanaceae	Parinari excelsa *Sabine*	T	F,W	1
Clusiaceae	Garcinia kingaensis *Engl.*	T	F	1
Clusiaceae	Garcinia smeathmannii *(Planch & Triana) Oliv.*	T	F	1
Clusiaceae	Harungana madagascariensis *Poir.*	S	W/F	2
Clusiaceae	Psorospermum febrifugum *Spach*	T	W	2
Combretaceae	Combretum paniculatum *Vent.*	cl	F	2
Combretaceae	Pteleopsis myrtifolia *(M.A.Lawson) Engl.& Diels*	T	W,F	2
Connaraceae	Agelaea pentagyna *(Lam.) Baill.*	cl	F	2
Convolvulaceae	Ipomoea involucrata *P.Beauv.*	h	R	1
Convolvulaceae	Ipomoea wightii *Choisy*	h	F	1
Crassulaceae	Crassula globularioides *Britten*	h	R	1
Cucurbitaceae	Coccinia barteri *(Hook.f.) Keay*	cl	F	1
Ebenaceae	Diospyros abyssinica *(Hiern) F.White* subsp. abyssinica	T	F,mF	1
Ebenaceae	Diospyros whyteana *(Hiern) F.White*	T	mF	1
Erythroxylaceae	Erythroxylum emarginatum *Thonn.*	T	F,W	1
Euphorbiaceae	Alchornea hirtella *Benth.* forma glabrata *(Müll.Arg.) Pax & K.Hoffm.*	S	F	1
Euphorbiaceae	Antidesma vogelianum *Müll.Arg.*	S	F	1
Euphorbiaceae	Bridelia micrantha *(Hochst.) Baill.*	T	F,W	1
Euphorbiaceae	Croton sylvaticus *C.Krauss*	T	mF	1
Euphorbiaceae	Crotonogynopsis usambarica *Pax*	S	F	1
Euphorbiaceae	Drypetes gerrardii *Hutch.* var. gerrardii	T	F	1
Euphorbiaceae	Drypetes gerrardii *Hutch.* var. grandifolia *Radcl.-Sm.*	T	F	1
Euphorbiaceae	Drypetes natalensis *(Harv.) Hutch.*	T	F	1
Euphorbiaceae	Erythrococca polyandra *(Pax & K.Hoffm.) Prain*	S	F	1
Euphorbiaceae	Macaranga capensis *(Baill.) Sim*	T	W,F	1
Euphorbiaceae	Macaranga mellifera *Prain*	T	mF	1
Euphorbiaceae	Phyllanthus nummulariifolius *Poir.* var. nummulariifolius	S	F,R	1
Euphorbiaceae	Shirakiopsis elliptica *(Hochst.) Esser* (= Sapium ellipticum)	T	F	1
Flacourtiaceae	Aphloia theiformis *(Vahl) Benn.*	T	mF	1
Flacourtiaceae	Calancoba welwitschii *(Oliv.) Gilg*	T	F	1
Flacourtiaceae	Dovyalis macrocalyx *(Oliv.) Warb.*	T	F,mF	1
Flacourtiaceae	Rawsonia lucida *Harv.& Sond.*	T	F	1
Gesneriaceae	Streptocarpus goetzei *Engl.*	h	F	1
Icacinaceae	Apodytes dimidiata *Arn.*	T	mF	1
Icacinaceae	Pyrenacantha kirkii *Baill.*	cl	F	1
Lamiaceae	Achyrospermum carvalhi *Gürke*	S	F	1
Lamiaceae	Aeollanthus buchnerianus *Briq.*	h	R	1
Lamiaceae	Plectranthus melleri *Baker*	h	mF	1
Lamiaceae	Plectranthus sanguineus *Britten*	h	R	1
Lamiaceae	Plectranthus stenosiphon *Baker*	h	?	1
Lamiaceae	Tetradenia riparia *(Hochst.) Codd*	S	R	2
Lamiaceae	Vitex buchananii *Gürke*	T	F	1
Lamiaceae	Vitex doniana *Sweet*	T	W	1
Lauraceae	Cryptocarya liebertiana *Engl.*	T	F,mF	1
Leg: Caesalpinioideae	Cassia angolensis *Hiern*	T	F	1
Leg: Caesalpinioideae	Erythrophleum suaveolens *(Guill.& Perr.) Brenan*	T	F	2

Leg: Mimosoideae	Acacia pentagona *(Schumach.) Hook f.*	cl	F	1
Leg: Mimosoideae	Albizia adianthifolia *(Schumach.) W.F.Wight*	T	F	1
Leg: Mimosoideae	Albizia gummifera *(J.F.Gmel.) C.A.Sm.*	T	F	1
Leg: Mimosoideae	Newtonia buchananii *(Baker) G.C.C.Gilbert & Boutique*	T	F	2
Leg: Papilionoideae	Aeschynomene nodulosa *(Baker) Baker* var. nodulosa	S	W,R	1
Leg: Papilionoideae	Craibia brevicaudata *(Valke) Dunn* subsp. baptistarum *(Buttner) J.B.Gillett*	T	F	1
Leg: Papilionoideae	Dalbergia boehmii *Taub.*	T	W	1
Leg: Papilionoideae	Dalbergia lactea *Vatke*	cl	F	2
Leg: Papilionoideae	Eriosema parviflorum *E.Mey.*	h	W	1
Leg: Papilionoideae	Erythrina livingstoniana *Baker*	T		1
Leg: Papilionoideae	Indigofera lyallii *Baker* subsp. nyassica *J.B.Gillett*	S	F	1
Leg: Papilionoideae	Kotschya recurvifolia *(Taub.) F.White*	S	R	1
Leg: Papilionoideae	Millettia lasiantha *Dunn*	cl	F	1
Leg: Papilionoideae	Mundulea sericea *(Willd.) A.Chev.*	S	F	1
Leg: Papilionoideae	Pericopsis angolensis *(Baker) Meeuwen*	T	W	2
Leg: Papilionoideae	Pterocarpus angolensis *DC.*	T	W	2
Loganiaceae	Anthocleista grandiflora *Gilg*	T	F	2
Loganiaceae	Mostuea brunonis *Didr.* var. brunonis	S	F	1
Loganiaceae	Nuxia congesta *Fresen.*	T	mF	2
Loganiaceae	Strychnos cf. mitis *S.Moore*	T	F	1
Loranthaceae	Agelanthus zizyphifolius *(Engl.) Polhill & Wiens* subsp. vittalius *(Engl.) Polhill & Wiens*	ep	mF	1
Loranthaceae	Erianthemum dregei *(Eckl.& Zeyh.) Tiegh.*	ep	mF	1
Loranthaceae	Helixanthera schizocalyx *T.Harris, I.Darbysh. & Polhill*	ep	mF	1
Melastomataceae	Dissotis sp.	S	R	2
Melastomataceae	Memecylon sansibaricum *Taub.*	T	F	1
Melastomataceae	Memecylon sp. – unmatched @ K	S	F	1
Meliaceae	Khaya anthotheca *(Welw.) C.DC.*	T	F	1
Melianthaceae	Bersama abyssinica *Fresen.*	T	F	2
Molluginaceae	Corrigiola drymerioides *Baker f.*	h	R	1
Monimiaceae	Xymalos monospora *(Harv.) Warb.*	T	mF	1
Moraceae	Ficus sansibarica *Warb.*	T	F	2
Moraceae	Ficus scassellatii *Pamp.*	T	mF	2
Moraceae	Ficus thonningii sensu White	T	F	2
Moraceae	Trilepisium madagascariense *DC.*	T	F	1
Myrothamnaceae	Myrothamnus flabellifolius *Welw.*	S	R	1
Myrsinaceae	Maesa lanceolata *Forssk.*	T	mF	2
Myrsinaceae	Myrsine africana *L.*	S	R	1
Myrsinaceae	Rapanea melanophloeos *(L.) Mez*	T	mF	1
Myrtaceae	Eugenia capensis *(Eckl.& Zeyh.) Sond.* subsp. gracilipes *F.White*	T	F	1
Myrtaceae	Eugenia capensis *(Eckl.& Zeyh.) Sond.* subsp. nyassensis *(Engl.) F.White*	T	mF	1
Myrtaceae	Syzygium cordatum *Krauss*	T	W,F	1
Myrtaceae	Syzygium guineense *(Willd.) DC.* subsp. afromontanum *F.White*	T	mF	2
Ochnaceae	Ochna holstii *Engl.*	T	mF	2
Olacaceae	Strombosia scheffleri *Engl.*	T	F	1
Oleaceae	Chionanthus foveolatus *(E.Mey.) Stearn*	T	F	1
Oleaceae	Jasminum brachyscyphum *Baker*	cl	mF	1
Oleaceae	Olea capensis *L.*	T	mF	1
Piperaceae	Piper capense *L.f.* var. capense	h	F	1
Pittosporaceae	Pittosporum viridiflorum *Sims*	T	mF	1

Polygalaceae	Securidaca longipedunculata *Fresen.*	T	W	1
Proteaceae	Faurea racemosa *Farmar*	T	mF	1
Proteaceae	Protea cf. caffra *Meisn.*	S	W	1
Rhamnaceae	Lasiodiscus usambarensis *Engl.*	T	F	1
Rhizophoraceae	Cassipourea malosana *(Baker) Alston*	T	mF	2
Rosaceae	Prunus africana *(Hook.f.) Kalkman*	T	mF	2
Rosaceae	Rubus pinnatus *Willd.*	S	F	1
Rubiaceae	Aidia micrantha *(K.Schum.) F.White* var. msonju *(K.Krause) Petit*	T	F	1
Rubiaceae	Canthium sp.	T	F	1
Rubiaceae	Chassalia parvifolia *K.Schum.*	S	F	1
Rubiaceae	Coffea mufindiensis *Bridson* subsp. australis *Bridson*	S	F	1
Rubiaceae	Craterispermum schweinfurthii *Hiern* (= C. laurinum)	S	F	1
Rubiaceae	Didymosalpinx norae *(Swynn.) Keay*	S	?	1
Rubiaceae	Heinsenia diervilleoides *K.Schum.* subsp. diervilleoides	T	F	1
Rubiaceae	Ixora scheffleri *K.Schum.& K.Krause*	S	mF	1
Rubiaceae	Keetia gueinzii *(Sond.) Bridson* (= Canthium gueinzii)	cl	mF	1
Rubiaceae	Lasianthus kilimandscharicus *K.Schum.*	S	mF	1
Rubiaceae	Oxyanthus goetzei *K.Schum.*	S	F	1
Rubiaceae	Oxyanthus speciosus *DC.* subsp. stenocarpus *(K.Schum.) Bridson*	T	F	1
Rubiaceae	Pauridiantha symplocoides *(S.Moore) Bremek.*	S	mF	1
Rubiaceae	Pavetta gurueënsis *Bridson*	S	mF	1
Rubiaceae	Pavetta sp.	h	F	1
Rubiaceae	Polysphaeria lanceolata *Hiern*	S	F,mF	1
Rubiaceae	Psychotria ealaensis *De Wild.*	cl	mF	1
Rubiaceae	Psychotria zombamontana *(Kuntze) Petit*	S	mF	1
Rubiaceae	Rothmannia manganjae *(Hiern) Keay*	T	W/F	1
Rubiaceae	Rutidea orientalis *Bridson*	cl	mF	1
Rubiaceae	Rytigynia sp.	T	F	1
Rubiaceae	Rytigynia uhligii *(K.Schum.& K.Krause) Verdc.*	S	mF	1
Rubiaceae	Tricalysia acocantheroides *K.Schum*	S	mF	1
Rubiaceae	Tricalysia pallens *Hiern*	T	F	1
Rutaceae	Toddalia asiatica *(L.) Lam.*	cl	mF	2
Rutaceae	Vepris cf. amaniensis *(Engl.) Mziray*	S	mF	1
Rutaceae	Vepris nobilis *(Delile) Mziray*	T	F,mF	1
Rutaceae	Vepris sp. nov. near V. bachmannii	T	F	1
Rutaceae	Zanthoxylum gilletii *(De Wild.) P.G.Waterman*	T	F	1
Sapindaceae	Allophylus chaunostachys *Gilg*	S	F	1
Sapindaceae	Aporrhiza paniculata *Radkl.* (= A. nitida)	T	F	1
Sapindaceae	Blighia unijugata *Baker*	T	F	1
Sapindaceae	Haplocoelum foliolosum *(Hiern) Bullock*	T	F	1
Sapotaceae	Chrysophyllum gorungosanum *Engl.*	T	F	2
Sapotaceae	Englerophytum magalismontanum *(Sond.) T.D.Penn.*	T	F,mF	1
Sapotaceae	Synsepalum brevipes *(Baker f.) T.D.Penn.*	T	F	1
Sapotaceae	Synsepalum cerasiferum *(Welw.) T.D.Penn.*	S	F/W	1
Sapotaceae	Synsepalum muelleri *(Kupicha) T.D.Penn.*	T	F	1
Scrophulariaceae	Halleria lucida *L.*	S	R	1
Solanaceae	Solanum richardii *Dunal* var. richardii	h	R	1
Sterculiaceae	Cola greenwayi *Brenan*	T	F	1
Thymelaeaceae	Peddiea fischeri *Engl.*	T	F	1
Ulmaceae	Celtis gomphophylla *Baker*	T	F	2

Ulmaceae	Trema orientalis *(L.) Blume*	T	W,F	1
Urticaceae	Laportea mooreana *(Hiern) Chew*	h	F	1
Urticaceae	Procris crenata *C.B.Rob.*	cl	F	1
Urticaceae	Urera trinervis *(Hochst.) Friis & Immelman*	cl	F	2
Verbenaceae	Cleodendrum cephalanthum *Oliv.* subsp. swynnertonii *(S.Moore) Verdc.*	S	mF	1
Violaceae	Rinorea angustifolia *(Thouars) Baill.*	S	F,mF	1
Violaceae	Rinorea ferruginea *Engl.*	T	F	1
Viscaceae	Viscum cylindricum *Polhill & Wiens*	ep	mF	1
Viscaceae	Viscum triflorum *DC.*	ep	mF	1
Vitaceae	Cissus cornifolia *(Baker) Planch.*	cl	F	1
Vitaceae	Cissus petiolata *Hook.f.*	cl		1
Vitaceae	Cyphostemma adenocaule *(A.Rich.) Desc.*	cl	F	1

ANNEX 4. Annotated list of bird species on Mt Mabu recorded above 400 m.

All bird species noted above 400 m altitude on and around Mt Mabu are listed, with common names in **bold** (from Dowsett-Lemaire & Dowsett 2009). Species in square brackets were not directly seen. Chorological status (Afromontane, Eastern, Zambezian, Palaearctic migrant) is given after the species name; if threatened the level of threat (BirdLife International 2008) appears in **bold**. Nomenclature follows Birds of Malawi (Dowsett-Lemaire & Dowsett 2006).

Tea house (estate manager's house)	540 m	..... 16°18'22"S, 36°25'28"E
Main forest camp	980 m	..... 16°17'10"S, 36°24'01"E
Summit satellite camp	1400 m	..... 16°17'31"S, 36°23'34"E
Forest satellite camp	1300 m	..... 16°17'05"S, 36°23'09"E
Peak of Mt Mabu	1710 m	..... 16°17'56"S, 36°23'44"E

African Cuckoo Hawk *Aviceda cuculoides*. Two birds counter-singing in flight near tea house, 550 m, 11 Oct. Song imitated by Red-capped Robin at forest edge at 980 m.

Honey Buzzard *Pernis apivorus*. Palaearctic migrant. One seen 19 Oct at 950 m, just outside main forest camp. Also noted by C. Spottiswoode (pers. comm.) in Dec 2005, so likely to winter.

Palm-nut Vulture *Gypohierax angolensis*. One drifting over forest near peak, 23 Oct. Normally associated with *Raphia* palms (not found on Mabu but may exist in riparian nearby).

Brown Snake Eagle *Circaetus cinereus*. Several observations of singles or pairs in or over transition woodland and small forest patches between 400–900 m.

Southern Banded Snake Eagle *Circaetus fasciolatus*. Eastern endemic, **Near Threatened.** Heard and seen on most days from 400–1500 m (at forest edges below peak), mostly below 1000 m. In forest and transition woodland. Often sings perched early morning (calling from 04.30 at day-break) and in display flight in warm hours of day.

Gymnogene *Polyboroides typus*. Widespread in forest, at edges and in transition woodland, from the foothills to at least 1500 m.

African Goshawk *Accipiter tachiro*. Common and widespread in forest at all elevations.

Lizard Buzzard *Kaupifalco monogrammicus*. One heard between tea house and forest camp. Song imitated by some Red-capped Robins at forest edge.

Common Buzzard *Buteo buteo*. Palaearctic migrant. Two over wooded hill above tea house, interacting and calling, 30 Oct. Also noted by C. Spottiswoode in Dec, and likely to winter.

Augur Buzzard *Buteo augur*. One seen by L. Fishpool on way between tea house and forest camp, 17 Oct.

Eagle *Aquila* sp. Two singles, almost certainly Lesser Spotted Eagle *A. pomarina* (Palaearctic migrant), seen from peak on 23 Oct and moving south.

Ayres's Hawk Eagle *Hieraaetus ayresii*. One seen on 3 occasions over forest and transition woodland from 500–1000 m, including one circling over bush fire on 29 Oct just below tea house.

Crowned Eagle *Stephanoaetus coronatus*. One pair or individual noticed almost daily in area of forest around main forest camp and satellite camps. Often sang from 09.00 (i.e. only 4½ hours after dawn), quite early for this species; also singing midday and in afternoon. Song frequently imitated by Red-capped Robin.

Peregrine Falcon *Falco peregrinus*. One seen around peak on 23 Oct, and by others on other dates.

Hildebrandt's Francolin *Francolinus hildebrandti*. Occasionally heard at dusk or at night in secondary forest or thickets near the tea house, edge of main forest camp, and near the peak (heard from summit satellite camp), over an altitudinal range from 500–1650 m.

Red-necked Francolin *Francolinus afer*. In secondary growth around the tea house.

[**Crested Guineafowl** *Guttera pucherani*. Well known to local hunter from forest patches at low altitude and lower levels of main forest (up to c.1000 m). Hunted and decreasing, said to be very uncommon. No feathers seen in main forest, where altitude may be too high.]

Rameron Pigeon *Columba arquatrix*. Afromontane near-endemic. A few pairs in forest from 1350–1400 m to upper edges (1600–1650 m). Singing and displaying. Seen feeding in crowns of *Polyscias* and *Olea capensis* (few trees fruiting at upper edge). As most *Olea* were flowering, this pigeon is likely to be more numerous in Olive years (e.g. 2009, 2011).

Bronze-naped Pigeon *Columba delegorguei*. Widespread, in small numbers, in canopy of forest from 980–1420 m. Vocal activity seemed to be decreasing from mid-Oct.

Cinnamon Dove *Aplopelia larvata*. Afromontane near-endemic. Quite common in forest understorey above 1350–1400 m. Vocally active; one bird flushed from nest built at height of 2 m, still empty, 27 Oct.

Blue-spotted Wood Dove *Turtur afer*. Few in forest patches or transition woodland, from 400–900 m.

Tambourine Dove *Turtur tympanistria*. Very common in forest patches and main forest, from 400–1300 m.

[**Brown-necked Parrot** *Poicephalus robustus*. Well known to hunter from lower altitudes, said to move into the main forest seasonally. From fieldwork in Malawi, would be expected to come into the main forest when *Parinari* are fruiting to extract seeds.]

Livingstone's Turaco *Tauraco livingstonii*. Very common in forest throughout, from 400–1650 m.

Red-chested Cuckoo *Cuculus solitarius*. One heard at night near tea house, 30 Oct. Should be common in area given the number of robin species to parasitize, but calling was evidently delayed by prevailing drought.

Emerald Cuckoo *Chrysococcyx cupreus*. One heard in forest at 600 m above tea house, 30 Oct. A rains migrant that was perhaps just starting to call and could be more common.

Klaas's Cuckoo *Chrysococcyx klaas*. Widespread in forest patches or transition woodland low down (often in riparian situations) and along edges of main forest from 400–1000 m.

Green Coucal *Ceuthmochares aereus*. One heard briefly in secondary *Macaranga* forest and thickets near tea house, 530 m, 11 Oct.

Burchell's Coucal *Centropus superciliosus*. Common at forest edges and in secondary growth, from at least 400–1100 m.

Barn Owl *Tyto alba*. One heard at night around tea house, 11 Oct.

Spotted Eagle Owl *Bubo africanus*. Heard around wooded rocky hill above tea house, 29-30 Oct.

Wood Owl *Strix woodfordii*. Very common throughout forest (including secondary or mixed tea forest) at all elevations.

African Palm Swift *Cypsiurus parvus*. A few over transition woodland at 800 m, and tea house, 29 Oct.

Alpine Swift *Apus melba*. Intra-African migrant; several hunting around peak, 23 Oct.

Mottled Swift *Apus aequatorialis*. Several around peak, 23 Oct. Also seen lower down with other swifts and martins, 29 Oct. Could be breeding locally in rock cracks.

Eurasian Swift *Apus apus.* Palaearctic migrant. A dozen or so seen moving through with other swifts and martins on 29 Oct at 800 m. Not calling, but almost certainly this species, as the resident African Black Swift *A. barbatus* (with which it can be easily confused when not calling) was not noted in three weeks.

African White-rumped Swift *Apus caffer*. A few in association with Lesser Striped Swallow, around and below the tea house.

Narina's Trogon *Apaloderma narina*. A few in riparian forest low down, and many in the main forest block up to 1400–1430 m. Vocally very active, despite the drought.

Bar-tailed Trogon *Apaloderma vittatum*. Afromontane endemic. Fairly common in forest above 1400 m on summit path and above 1350 m in forest around the forest satellite camp (one even around 1320 m), thus overlaps with Narina's from 1320–1430 m.

Pygmy Kingfisher *Ceyx pictus*. Few present in thickets low down, and at forest edges up to 1000 m.

Chestnut-bellied Kingfisher *Halcyon leucocephala*. One flushed from nest in road bank, in transition woodland, c.400 m, 29 Oct.

Little Bee-eater *Merops pusillus*. One pair in secondary grassland in old field near tea house.

Madagascar Bee-eater *Merops superciliosus.* Intra-African migrant, with a flock on passage on 29 Oct near tea house. Calls imitated to perfection by Red-capped Robin at 980 m.

Eurasian Bee-eater *Merops apiaster*. Palaearctic migrant. Some large groups on passage, noted irregularly from 11-28 Oct, any altitude.

Broad-billed Roller *Eurystomus glaucurus*. One bird in riparian transition woodland near the tea house seemed to hold a territory, 11-12 Oct.

Crowned Hornbill *Tockus alboterminatus*. Uncommon, with the odd one noted in transition woodland and at forest edges from 600–950 m.

Silvery-cheeked Hornbill *Bycanistes brevis*. Common in the main forest at all elevations; a few pairs lower down to 500 m. Some singles or pairs or trios crossing vast expanses to go to feed in certain areas. Much movement noted near main forest camp to feed in a fruiting *Shirakiopsis* (*Sapium*) *ellipticum*. Appeared not to be breeding in Oct (unlike on Misuku Hills, Malawi), probably due to lack of fruiting figs at this season.

White-eared Barbet *Stactolaema leucotis*. Eastern endemic. Uncommon. Heard a few times at forest edge near main forest camp (c.1000 m), seen once below in a fruiting *Xylopia aethiopica* and lower down in burnt woodland near a stream (c.400 m).

Green Barbet *Stactolaema olivacea*. Eastern endemic. Common in the main forest at all elevations, also a few pairs lower down in riparian forest patches (down to 750 m). A pair examined at close range around a nest appeared to belong to the race *belcheri* of Thyolo and Namuli (dark blackish head, dark olive breast contrasting with olive belly; pale brown patch behind eye not conspicuous). The nest hole was situated at a height of 6 m in a dead trunk of *Syzygium cordatum*, and the territory consisted of a few hectares of dry forest with many *Xylopia aethiopica*, *Syzygium cordatum* and mixed forest along a dry stream (900 m). Incubation behaviour was watched from 16–21 Oct and feeding on 28 Oct. At least 3 young had hatched as up to 3 faecal sacs were carried out simultaneously by the adult (held neatly in bill). Both adults brooded and fed the young, with regular change-overs every 15 minutes when feeding; each sex sings in this species, for example on every one of 8 change-overs seen on 28 Oct, the adult who had just left the nest gave a few notes of song. Most food brought was taken from a rotten branch of *Syzygium* just above the nest and apparently consisted of small beetle larvae; food was brought 17 times in two hours, often several times in quick succession by the same adult when collected immediately above the nest. Brooding of eggs was not continuous but the attending adult never went far from the nest, usually sitting 1–2 m away, thus the nest was always under watch except when the bird was seriously disturbed by noisy passers-by (nest was metres away from the main path). A Lesser Honeyguide (the most likely nest parasite) was seen perched close to the nest on 18 Oct, when the adult was inside. But the presence of several faecal sacs proves that the honeyguide failed to lay in this nest.

Golden-rumped Tinkerbird *Pogoniulus bilineatus*. Very common throughout forest and transition woodland, at all elevations. On 29 Oct playback of song of Eastern Green Tinkerbird *P. simplex* was tried at 900 m altitude and provoked a strong vocal reaction by the local Golden-rumped. This may be the result of superficial resemblance between the staccato song of *P. simplex* and the rolled call of *P. bilineatus*, or it might mean that *P. simplex* exists somewhere in the area (but in that case would be rare).

Scaly-throated Honeyguide *Indicator variegatus*. One seen and calling (the distinctive whistles reminiscent of those of Scimitarbill *Phoeniculus cyanomelas*) in tall *Eucalyptus* plantations over secondary scrub, and one singing in a patch of forest below the tea house, 450–530 m. Several heard (whistles) in the main forest, from 1000–1400 m.

Lesser Honeyguide *Indicator minor*. Two singing in riparian forest and at edge of main forest, 800 and 950 m. Seen near the Green Barbet nest.

Eastern Least (Pallid) **Honeyguide** *Indicator meliphilus*. Two singing in forest patches below the tea house (450 m), one in an emergent *Newtonia* and the other in *Albizia adianthifolia* and *Newtonia*, c.500 m apart. Also one singing in the main forest, at c.1000 m.

Golden-tailed Woodpecker *Campethera abingoni*. Uncommon but probably widespread; called very little and some perhaps overlooked. Noted in main forest at 1050 m and also just below the upper edge of forest near peak, 1570 m.

Cardinal Woodpecker *Dendropicos fuscescens*. Three records in transition woodland, *Syzygium cordatum* forest and riparian lower down, 400–900 m.

African Broadbill *Smithornis capensis*. A few heard at dawn and dusk in mixed tea forest at 550 m, and a few in main forest around 1000 m. Not heard from the satellite camps (1300–1400 m).

Black Saw-wing *Psalidoprocne pristoptera*. A few at low levels, and at forest edges up to at least 1100 m.

Lesser Striped Swallow *Hirundo abyssinica*. A few pairs below the tea house.

Eurasian (Barn) **Swallow** *Hirundo rustica*. Palaearctic migrant. Small groups of migrants, from 23 Oct. onwards up to peak area.

Eurasian House Martin *Delichon urbicum*. Palaearctic migrant. Passage of dozens noted by T. Timberlake around peak on 28 Oct. Some moving through with swifts on 29 Oct (800 m).

Long-tailed Wagtail *Motacilla clara*. A pair noted by M. Curran and M. Kopp on a rocky stream just below main forest camp, c.900 m.

Striped Pipit *Anthus lineiventris*. Two birds singing in rocky woodland just below peak, 1650–1680 m.

Grey Cuckoo-shrike *Coracina caesia*. Afromontane near-endemic. A few pairs in canopy of main forest from 1000–1400 m.

Stripe-cheeked Greenbul *Andropadus milanjensis*. Afromontane endemic. Widespread in main forest in canopy, subcanopy and edge of clearings. Few below 1100 m (from 1030 m), becoming more common above 1200–1300 m, very common 1400–1650 m.

Little Greenbul *Andropadus virens*. Common understorey species throughout, 400–1650 m.

Yellow-bellied Bulbul *Chlorocichla flaviventris*. Recorded by C. Spottiswoode (pers. comm.) from forest below tea house at 450 m.

Grey-olive Bulbul *Phyllastrephus cerviniventris*. Eastern near-endemic. Widespread in riparian forest at low levels, from 450–950 m.

Cabanis's Bulbul *Phyllastrephus cabanisi* (race *placidus*). Afromontane near-endemic. Understorey species widespread in main forest from 980–1450 m; probably throughout. Favours dense low growth near streams or on slopes, less often on ridges.

Yellow-streaked Bulbul *Phyllastrephus flavostriatus*. Common mid-storey species, gleaning on bark, throughout from 800–1650 m.

Black-eyed Bulbul *Pycnonotus barbatus*. Widespread in transition woodland and along edges of forest, at all levels (including just below the peak).

White-throated Nicator *Nicator gularis*. Eastern near-endemic. Mid-storey species favouring small forest clearings with tangles of lianas; common from 400–1400 m (much higher than in S Malawi).

Kurrichane Thrush *Turdus libonyana.* Zambezian near-endemic. One heard in transition woodland between tea house and forest camp.

Spotted Ground Thrush *Zoothera guttata*. Sub-Afromontane endemic, **Endangered**. In October the silence of ground thrushes was striking as normally Orange Thrush *Z. gurneyi* is very common and noisy in mid-altitude forest, occurring throughout adjacent forests in Malawi and N Mozambique. Tapes of *Z. gurneyi* and *Z. guttata* from Natal and of *Z. guttata* from Thyolo were played a few times in the forest and elicited no response (normally Orange Thrush reacts vigorously to all songs of *Zoothera* spp., whereas *Z. guttata* does not). First rains fell on afternoon of 21 Oct, then all night on 26/27 Oct after which one *Zoothera* sp. was heard giving a few songs at dawn, at 1300 m (next to satellite forest camp). It did not react to playback of *Z. gurneyi* nor *Z. guttata* [on Namuli the local *Z. guttata* never reacted to song playback of its own species from Thyolo]. Another *Zoothera* song was heard at dusk just above main camp (1000 m) on 28 Oct. A local hunter interviewed identified Spotted Ground Thrush on the plate of Chittenden (in Hockey *et al.* 2005) without any hesitation and also indicated that Orange Thrush was completely unknown to him (which would seem to imply its absence). *Z. guttata* can produce a short song but frequently also a 'long song', not separable from that of *Z. gurneyi*, thus visual confirmation was necessary. The hunter was sufficiently familiar with thrush species that he also recognized the Alethe as being very common.

Cholo Alethe *Alethe choloensis*. Afromontane endemic, **Endangered**. Encountered throughout the main forest from 950–1650 m. Common above 1200 m, not evenly distributed below this. A substantial population must exist on Mabu, of order of at least a thousand pairs (2 pairs/10 ha in optimal habitat). This population has a most distinctive contact call, a whistle rising in pitch, whereas all other populations of this species (Namuli and Malawi) produce a downward whistle. It was frequently heard at dawn near the main camp.

Starred Robin *Pogonocichla stellata*. Afromontane endemic. Common at higher levels, from 1350 m to upper edges.

Swynnerton's Robin *Swynnertonia swynnertoni*. Afromontane endemic, **Vulnerable**. Much like Starred Robin it occupies higher levels of the main forest, from 1340–1400 m to upper limits. Unlike Starred Robin it is not uniformly distributed as it favours dense undergrowth with high density of saplings, or rank growth near streams. Several pairs were encountered along the path from summit satellite camp to upper edges near peak. Some pairs were alarm-calling persistently, suggesting breeding had started.

Gunning's Akalat *Sheppardia gunningi*. Eastern endemic, **Near Threatened**. Locally common in pure tea forest (under indigenous canopy), dense understorey and thickets in secondary forest, riparian forest (400–900 m) and in main forest block up to 1350 m, where it favours gullies and slopes just above a stream. In Malawi Gunning's Akalat and Starred Robin are allopatric when breeding, the latter replacing the former at higher altitudes; this also seems to be the case on Mabu. Territories can be quite small (0.5–1 ha) but suitable habitat is patchy, hence overall estimates are difficult to make. One bird tested with tape playback in the tea forest reacted twice to the song dialect from the Malawi Lakeshore (coming within 5–6 m of the recorder), but did not

apparently react to the song dialect from coastal Kenya.

Cape Robin *Cossypha caffra*. Afromontane near-endemic. Common in *Aeschynomene* and other shrubland around the peak; also along upper edges of forest (from 1500 m); heard at 1400 m in forest clearing above satellite forest camp.

Red-capped Robin *Cossypha natalensis*. Widespread in understorey of forest from 400–1400 m. Highly imitative song, including lengthy imitations of Eurasian and Madagascar Bee-eater and other species.

Eastern Bearded Scrub Robin *Erythropygia quadrivirgata*. Eastern near-endemic. Widespread in riparian forest and thickets at low levels (from 400–700 m).

White-browed Scrub Robin *Erythropygia leucophrys*. One or two heard in transition woodland at 850–900 m.

Red-faced Crombec *Sylvietta whytii*. A few encountered in *Syzygium* woodland up to 900 m, also more surprisingly in riparian forest low down (one seen feeding in a *Newtonia* at 450 m) and in thickets in secondary *Macaranga* forest or even under Eucalyptus.

Yellow-throated Warbler *Phylloscopus ruficapilla*. Afromontane endemic. Present in canopy and subcanopy of main forest block from 1050 m; more common above 1200 m.

Garden Warbler *Sylvia borin*. Palaearctic migrant. One feeding on flowers of a *Grevillea* in thickets below the tea house, 30 Oct.

Wailing Cisticola *Cisticola lais*. Afromontane endemic. Several pairs in rocky grassland all around the peak, 1550–1650 m.

Red-faced Cisticola *Cisticola erythrops*. A few pairs in rank moist secondary growth in cultivated gullies near the tea house and on way to forest from 400–700 m.

Tawny-flanked Prinia *Prinia subflava*. A few in grassland (mostly of secondary origin) at low levels.

Red-winged Warbler *Heliolais erythropterus*. One encountered in secondary grassland and shrubs at c.400 m.

Yellow-breasted Apalis *Apalis flavida*. Probably widespread in riparian forest and thickets at low elevations, but hardly calling in early Oct. More heard on 29-30 Oct (400–600 m).

Namuli Apalis *Apalis* (*thoracica*) *lynesi*. Afromontane endemic, **Near Threatened**. Present in small numbers only above 1380–1400 m; only one heard singing in a 2-day visit near path to summit, c.1550 m on 23 Oct. This bird was singing male version of the duet only and appeared unmated; playback of a Namuli tape (and Nyika tape of Bar-throated Apalis) did not seem to interest him, and the bird was heard calling further away after playback. Tape playback along the upper edges of the forest (at 1600 m) on 24 Oct elicited no response. Similarly, very few birds were located on 26-27 Oct in the area of forest around 1380–1400 m above the forest satellite camp. One male followed for more than an hour on both days and circulated over several hectares of forest with many gaps and clearings, feeding at edges but also in the shaded interior 1–3 m above the ground. This bird was definitely unmated and showed little or no interest in tape playback. Another male was heard just beyond this territory and was answered by a female trill once. Thus of three males only one seemed to have a female. This unbalanced sex ratio suggests that conditions are probably suboptimal for the species. Forms of Bar-throated Apalis are usually very common in montane forest, but locally in N Malawi (as in the Misuku Hills) the species can be uncommon, especially at medium altitudes (Dowsett-Lemaire 1989b).

B**lack-headed Apalis** *Apalis melanocephala*. Eastern endemic. Very common in main forest at all elevations; few present in riparian forest down to 850 m.

Bleating Bush Warbler *Camaroptera brachyura*. Common understorey species in transition woodland, thickets, riparian forest, and in main forest block to 1300 m, where it is partial to moist gullies.

Spotted Flycatcher *Muscicapa striata*. Palaearctic migrant recorded by C. Spottiswoode on 11 Dec 2005 in woodland.

Ashy Flycatcher *Muscicapa caerulescens*. Common in riparian forest low down, transition woodland and edges of main forest up to 1000 m, singing in canopy.

Lead-coloured Flycatcher *Myioparus plumbeus*. Widespread in transition woodland, lowland forest and main forest block up to 1300 m, where partial to gullies with large clearings.

Cape Batis *Batis capensis*. Afromontane near-endemic. Uncommon above 1400 m (summit area) or 1340 m (forest satellite camp); pairs rather scattered. Density well below that observed in Malawi, normally about 1 pair/ha.

Mozambique Batis *Batis soror*. Widespread in transition woodland, edges of riparian forest, even Eucalyptus plantations with secondary growth near the tea house, from 400–950 m. Penetrates

feebly into the main forest block along gullies with very big clearings; heard up to 1100 m.

Blue-mantled Flycatcher *Trochocercus cyanomelas*. Eastern near-endemic. Common in mixed tea forest around the tea house, also in secondary forest with thickets, and in main forest block up to 1300 m or higher (two located up to 1400 m above forest satellite camp).

African Paradise Flycatcher *Terpsiphone viridis*. Uncommon, with few pairs in main forest from 1000–1400 m.

Dapple-throat *Modulatrix orostruthus*. Afromontane endemic, **Vulnerable**. Uncommon species of the ground stratum, discovered only above 1380 m and with a patchy distribution. One heard and tape recorded near path to summit at c.1500 m seemed strongly territorial, while another sang briefly near our camp (1400 m), presumably a wanderer. Only two territorial owners found above the forest satellite camp, one just below 1400 m, the other around 1400 m. One bird was followed for more than 3 hours on 26-27 Oct and circulated over at least 5–6 ha; it seemed to be mated (second bird seen briefly). Species is normally partial to understorey with a high density of saplings under closed canopy. Why it should be so rare near the summit is not clear, but above the forest satellite camp the canopy is disturbed in many places with old signs of human habitation. Other sections of high-altitude forest need to be visited in order to evaluate total numbers.

Rufous-bellied Tit *Parus rufiventris*. Zambezian endemic. One in *Syzygium cordatum* woodland, 900 m.

Violet-backed Sunbird *Anthreptes longuemarei*. A female in *Syzygium cordatum* woodland, 900 m.

Collared Sunbird *Anthreptes collaris*. Common in secondary thickets, riparian forest and mixed tea forest at low elevations from 400–700 m. Its absence from riparian forest higher up is not understood.

Olive Sunbird *Nectarinia olivacea*. Very common, the most numerous bird on Mabu, in forest and thickets, from 400–1650 m.

Black Sunbird *Nectarinia amethystina*. A few in *Pterocarpus* transition woodland, feeding on flowers, 500–600 m.

Yellow-bellied Sunbird *Nectarinia venusta*. A few in transition woodland and gullies with scrub, 800–950 m; one also in *Aeschynomene* shrubland below the peak at 1620 m.

Yellow White-eye *Zosterops senegalensis*. Widespread in forest at all elevations; also in secondary thickets and transition woodland.

Green-headed Oriole *Oriolus chlorocephalus*. Eastern endemic. Fairly common in canopy and subcanopy of main forest from 980–1300 m; once at 1400 m above forest satellite camp. One bird singing in riparian *Newtonia–Albizia* forest below tea house on 11 Oct (450 m) and had moved lower down on the next day (c.400 m).

Southern Puffback *Dryoscopus cubla*. Widespread in transition woodland and forest canopy from low down to at least 1400 m.

Brown-headed Tchagra *Tchagra australis*. Present in secondary growth and thickets, also in transition woodland from 400–1000 m.

Tropical Boubou *Laniarius aethiopicus*. Present in secondary growth, thickets, forest edges, from 400–1500 m, below peak.

Black-fronted Bush Shrike *Malaconotus multicolor*. Common canopy species in main forest from 980–1650 m.

Square-tailed Drongo *Dicrurus ludwigii*. Common in any forest type from 400 m, even neglected Eucalyptus plantations with some forest trees, and in main forest block up to at least 1400 m.

White-necked Raven *Corvus albicollis*. Regularly seen near rocky peak, occasionally in woodland lower down.

African Red-winged Starling *Onychognathus morio*. Very few in wooded gullies on southern side of peak; one seen mobbing a Gymnogene there on 29 Oct. Calls imitated by Red-capped Robin at forest edge at 980 m.

Bertram's Weaver *Ploceus bertrandi*. Afromontane endemic. C. Spottiswoode and E. Herrmann located one pair at the forest/woodland ecotone at 920 m, 11 Dec 2005 [C. Spottiswoode, pers. comm.].

Spectacled Weaver *Ploceus ocularis*. A couple seen in secondary growth near stream by tea house on 11 Oct.

Dark-backed Weaver *Ploceus bicolor*. Common in any forest type at all elevations, also neglected Eucalyptus or *Grevillea* plantations where it feeds on nectar.

Thick-billed Weaver *Amblyospiza albifrons*. A single bird in secondary growth near the tea house, 500–600 m, on 14 Dec 2005 [C. Spottiswoode, pers. comm.]. A bird of swamps that may visit

thickets in the off-season.

Green Twinspot *Mandingoa nitidula*. Very common in forest and secondary growth from 400–1550 m; scarce in most parts of its range, this twinspot is exceptionally numerous at Mabu with hundreds seen in a day around the tea house, including many pairs and families coming to drink in a small stream. Outside or on edge of forest it seemed to feed mainly on a small-seeded *Panicum*. Inside forest it was found more at high levels or in clearings feeding on inflorescences and small seeds of creepers, etc.

Blue-billed Firefinch *Lagonosticta rubricata*. A few in secondary growth near the tea house.

Swee Waxbill *Estrilda melanotis*. Afromontane near-endemic. A pair flying past the peak, 23 Oct. Normally in scrub among rocks.

Common Waxbill *Estrilda astrild*. Fairly common in secondary growth in moist gullies from 400–600 m.

Bronze Mannikin *Spermestes cucullata*. Several small groups seen in secondary grassland at low levels, 400–600 m.

Red-backed Mannikin *Spermestes bicolor*. Very common in neglected plantations and secondary growth at low levels; also at forest edges and in transition woodland higher up to at least 1000 m.

Yellow-eyed Canary *Serinus mozambicus*. A few in neglected plantations and secondary growth near the tea house.

ANNEX 5. Details of birds ringed near main forest camp on Mt Mabu, 16–17 Oct 2008, including mensural data (R.J. Dowsett).

Some mist-netting was carried out over two days in order to assess state of moult and breeding condition. All birds were released, marked with rings from the East African scheme (Kenya National Museum).

Ring no.	Species	Age	Sex	Date	Wing (mm)	Wt (g)
A.64132	Andropadus virens	ad		16/10/2008	82	26.1
A.64133	Andropadus virens	ad	M	16/10/2008	80	22.1
A.64134	Andropadus virens	ad		16/10/2008	82.5	27.7
A.64135	Andropadus virens	ad	M	16/10/2008	87	26.5
A.64136	Andropadus virens	ad	M	16/10/2008	82	28.1
A.64137	Andropadus virens	ad	M	16/10/2008	86.5	31.5
A.64138	Andropadus virens	ad	M	16/10/2008	90	27.5
A.64139	Cossypha natalensis	ad		16/10/2008	88	31.3
A.64140	Alethe choloensis	ad	M?	17/10/2008	99	43.1
A.64141	Andropadus virens	ad		17/10/2008	88	25.8
A.64142	Alethe choloensis	1Y	M?	17/10/2008	104	40.8
A.64143	Andropadus virens	ad		17/10/2008	84	23.1
A.64144	Andropadus virens	ad		17/10/2008	84	23.8
T.9484	Mandingoa nitidula	ad	F	16/10/2008	53	9.9
T.9485	Mandingoa nitidula	ad	M	16/10/2008	52	8.4
T.9486	Mandingoa nitidula	ad	F	16/10/2008	53	8.8
T.9487	Mandingoa nitidula	ad	F	16/10/2008	51	9.5
T.9488	Mandingoa nitidula	ad	M	16/10/2008	53	9.1
T.9489	Mandingoa nitidula	ad	M	17/10/2008	53	9
T.9490	Mandingoa nitidula	ad	F	17/10/2008	50.5	9.3
T.9491	Mandingoa nitidula	ad	F	17/10/2008	52	10.4
X.82333	Nectarinia olivacea	ad	M	16/10/2008	58	9
X.82334	Nectarinia olivacea	ad	M	16/10/2008	59	10.7
X.82335	Ceyx pictus	ad		16/10/2008	56	13.9
X.82336	Nectarinia olivacea	ad	M	16/10/2008	58.5	11
X.82337	Nectarinia olivacea	ad	M	16/10/2008	64	11.1
X.82338	Sheppardia gunningi	ad	M	16/10/2008	74	19.1
X.82339	Sheppardia gunningi	ad	F	16/10/2008	69	16.8
X.82340	Nectarinia olivacea	ad	M	16/10/2008	65.5	11.2
X.82341	Nectarinia olivacea	ad	M	16/10/2008	66	10.6
X.82342	Ceyx pictus	ad		16/10/2008	56.5	13.5
X.82343	Nectarinia olivacea	ad	M	16/10/2008	57.5	9.7
X.82344	Nectarinia olivacea	ad	F	16/10/2008	59	12.8
X.82345	Nectarinia olivacea	ad	M	16/10/2008	66.5	11.9
X.82346	Sheppardia gunningi	ad	M	16/10/2008	76	18.3
X.82347	Sheppardia gunningi	ad	F	17/10/2008	68	16.5
X.82348	Nectarinia olivacea	ad	M	17/10/2008	66	11.7
X.82349	Nectarinia olivacea	ad	F	17/10/2008	56.5	9.6

Species	n	wing (mm)	mean	wt (g)	mean
Pygmy Kingfisher, *Ceyx pictus*	2	56–56.5	56.2	13.5–13.9	13.7
Little Greenbul, *Andropadus virens*	10	80–90	83.6	22.1–31.5	26.9
Gunning's Akalat, *Sheppardia gunningi*	4	68–76	71.7	16.5–19.1	17.6
Red-capped Robin, *Cossypha natalensis*	1	88		31.3	
Cholo Alethe, *Alethe choloensis*	2	99–104	101.5	40.8–43.1	41.9
Olive Sunbird, *Nectarinia olivacea*	11	56.5–66.5	61.1	9.0–12.8	10.8
Green Twinspot, *Mandingoa nitidula*	8	50.5–53	51.2	8.4–10.4	9.3

ANNEX 6. List of larger mammal species recorded from the Mabu massif (compiled by R.J. Dowsett, Oct. 2008).

List based on field observation and interviews with a local hunter (Ofelio Kavaliyawo) who has known the mountain well for many years.

Bush Baby *Otolemur crassicaudatus*. Several heard in tea forest and secondary bush near the tea house, not in the main forest.

Grant's Bush Baby *Galagoides* (*zanzibaricus*) *granti*. Heard calling throughout the forest at all altitudes, including tea forest with indigenous canopy (watched there from near ground to the canopy). Noisy at dusk and dawn.

Yellow Baboon *Papio cynocephalus*. Some on the edge of forest and in transition woodland at all levels.

Vervet Monkey *Cercopithecus pygerythrus*. A few in riparian forest and transition woodland below the main forest.

Blue Monkey *Cercopithecus albogularis*. Groups encountered at all levels, from at least 400–1600 m. Common and fairly approachable.

Leopard *Panthera pardus*. We saw no signs, and it must now be rare, but the hunter (Ofelio Kavaliyawo) saw one by day as recently as 2005, and another was caught in a gin-trap and killed in 2001. This last one was eaten, but the skin and other remains thrown away. It is not known to attack livestock locally.

[Lion *Panthera leo*. Not known in the area in recent memory.]

[African Elephant *Loxodonta africana*. Not known in the area in recent memory.]

Cape Rock Hyrax *Procavia capensis*. Several heard by day and night from above the tea house as well as near the peak. Trapped by hunters.

Yellow-spotted Hyrax *Heterohyrax brucei*. Known to the hunter, and occasionally trapped.

Bushpig *Potamochoerus porcus*. Its characteristic smell noticed in a few places (including a marshy stream at 1400 m), and said to be common by the local hunter. Occasionally caught in gin-traps, and eaten.

[Red Forest Duiker *Cephalophus natalensis*. From its noisy flight and alarm call, a duiker flushed in forest at about 1000 m is believed to be this species (known from forests in Malawi). However it was unknown to the local hunter. Its presence on Mabu needs confirmation.]

Blue Duiker *Cephalophus monticola*. A few animals flushed, and dung seen. Not as common as in some Malawi forests, and caught occasionally in gin-traps.

Klipspringer *Oreotragus oreotragus*. One caught in a gin-trap near the peak in Oct. 2008, and numbers must be decreasing through hunting.

African Buffalo *Syncerus caffer*. Not resident in the area, but the local hunter saw a large group pass through the tea estate from the north in 2002.

Bushbuck *Tragelaphus scriptus*. Must be rare as we never heard it, but known to the hunters from forest edges at all levels.

Sun Squirrel *Heliosciurus mutabilis*. Very common throughout the forest and secondary habitats near the tea house. Two colour morphs occur, one pale chestnut and the other dark grey-brown with a black tail; both have a ringed tail.

[Red Squirrel *Paraxerus palliatus*. We did not find this species, which might be expected to occur.]

Red Rock Hare *Pronolagus rupestris*. Known to the hunters from rocky areas; large piles of fawn-coloured dung seen on rocks could belong to this species or the small Yellow-spotted Hyrax.

Four-toed Elephant-shrew *Petrodromus tetradactylus*. Active by night (heard moving and whistling near tents at main forest camp). Known to the local hunter, who recognizes two species of elephant-shrew.

Chequered Elephant-shrew *Rhynchocyon cirnei*. Active by day, and occasionally flushed in the main forest.

ANNEX 7. List of small mammal species collected or recorded from the Mabu massif (S = sight record only). Nomenclature follows Musser & Carleton (2005), and Mondjem *et al.* (2001) for bats.

Family	Species	Habitat	Altitude	Status
Chiroptera				
Pteropodidae	*Epomophorus wahlbergi*	moist forest	1300	
	Rousettus aegyptiacus	tea plantation	550	
Rhinolophidae	*Rhinolophus blasii*	river in moist forest	1000	
	Rhinolophus clivosus	moist forest	± 1000	
	Rhinolophus landeri	river in moist forest	1000	
	Rhinolophus mabuensis (= "*R.hildebrandtii*")	tea plantation, moist forest	550-1000	
Hipposideridae	*Hipposideros ruber*	moist forest	± 1000	
Miniopterinae	*Miniopterus* cf. *fraterculus*	moist forest	980-1300	
	Miniopterus cf. *inflatus/natalensis*	moist forest	980	
Vespertilionidae	*Kerivoula* cf. *phalaena* **	moist forest	980	
	Myotis tricolor	moist forest	1300	
	Laephotis botswanae *	tea plantation	550	
Insectivora				
Soricidae	*Crocidura silacea*	moist forest	1000	
	Crocidura luna	moist forest	1000	
	Crocidura olivieri	moist forest	1000	
Macroscelidae	*Petrodromus tetradactylus* Four-toed Elephant Shrew	moist forest		S
	Rhynchocyon cirnei Chequered Elephant Shrew	moist forest		S
Lagomorpha	*Pronolagus rupestris* Red Rock Hare	rocky areas	1600	S
Rodentia				
Sciuridae	*Heliosciurus mutabilis* Sun Squirrel	moist forest & secondary		S
Muridae	*Grammomys dolichurus* Narrow-footed Woodland Mouse	moist forest	1000	
	Lophuromys aquilus Brush-furred Mouse	moist forest	1000	
	Mus triton	moist forest		S
	Praomys delectorum Soft-furred Rat	moist forest	1000	
Cricetomyinae	*Beamys major* * Lesser Pouched Rat	moist forest	1000	
Hyracoidea				
Procavidae	*Procavia capensis* Cape Rock Hyrax	rocky areas & tea plantation		S
	Heterohyrax brucei Yellow-spotted Hyrax	rocky areas	1000	S

* = new Mozambique record; ** = new southern African record

ANNEX 8. List of reptile and amphibian species collected or recorded from the Mabu massif.

Habitats: F = forest; FE = forest edge; W = transition woodland; G = grassland and scrub; R = granitic dome; H = commensal (tea house).
Altitudinal limits: L = 400–1000 m; M = 1000–1400 m; H = above 1400 m.
Status: C = common (recorded daily in relevant habitat); F = fairly frequent; U = few records; R = rare or vagrant.

Family	Species	Habitat	Altitude	Status
REPTILES - LIZARDS				
Scincidae	Variable Skink *Trachylepis varia*	shambas and old tea estate house, SW foothills	L	C
	Rainbow Skink *Trachylepis margarite*	shambas and old tea estate house, SW foothills	L	F
	Speckled Writhing Skink *Moluchus afrum*	shambas and old tea estate house, SW foothills	L	U
	Black Burrowing Skink *Melanoseps afer* (juv., unconfirmed)	mid-altitude forest and upper slopes	M	U
Agamaidae	Mozambique Agama *Agama mossambica*	shambas and old tea estate house, SW foothills	L	C
Chamaeleonidae	Sword-snouted Chameleon *Triceros melleri*	low and mid-altitude forest fringe	L	U
	Bayliss' Chameleon *Nadzikambia baylissi*	mid-altitude forest and upper slopes	M	U
	Mt Mabu Leaf Chameleon *Rhampholeon* sp. nov.	mid-altitude forest and upper slopes	M	C
Gekkonidae	Flat-headed Tropical House Gecko *Hemidactylus platycephalus*	shambas and old tea estate house, SW foothills	L	C
REPTILES - SNAKES				
Natricidae	Forest Marsh Snake *Natriciteres sylvaticus*	low and mid-altitude forest	LM	?
Colubridae	Black Bush Snake *Philothamnus* cf. *carinatus*	forest floor	M	U
	Tree Snake *Dipsadoboa* sp. – posssible new sp.	low shrub layer	M	U
Elapidae	Forest cobra *Naja melaoleuca*	forest floor	LM	?
Viperidae	Gaboon Viper *Bitis gabonica*	in overgrown tea plantation	L	?
	Mt Mabu Forest Viper *Atheris mabuensis*	mid-altitude forest and upper slopes	M	U
AMPHIBIANS				
Arthroleptidae	Lujeri Squeaker *Arthrolepis* 'Luyeri' - new species Mt Mulanje	shambas and old tea estate house, SW foothills	LM	F
	Squeaker *Arthrolepis* sp. (large) – possible new sp.	shambas and old tea estate house, SW foothills	LM	C
	Dwarf Squeaker *Arthroleptis xenodactyloides*	shambas and old tea estate house, SW foothills	LM	C
	Yellow-spotted Tree Frog *Leptopelis flavimaculata*	mid-altitude forest and upper slopes	M	U
Hyperoliidae	Leaf-folding Frog *Afrixalus* sp.	mid-altitude forest and upper slopes	M	?
	Golden-spotted Reed Frog *Hyperolius substriatus*	mid-altitude forest and upper slopes	M	F
Bufonidae	Flat-backed Toad *Amietophrynus maculatus*	shambas and old tea estate house, SW foothills	LM	c

ANNEX 9. Butterfly species collected on Mt Mabu from 2006 to 2010 (Julian Bayliss, Colin Congdon, Ivan Bampton, Martin Hassan, Robert Dowsett, Steve Collins, Stephen Georgiadis). Identifications confirmed by Steve Collins (African Butterfly Research Institute, Nairobi, Kenya).

Species arrangement follows Carcasson's African Butterflies (Ackery *et al.* 1995) taking account of some recent changes; nomenclature follows Williams (2012). Species new to Mozambique (marked N) are those not listed as occurring in Mozambique according to Ackery *et al.* (1995), Cabral (2000), d'Abrera (1980), Alan Gardiner (unpublished records), Kielland (1990), Libert (1999, 2004), Pringle *et al.* (1994) and Williams (2012).

Habitat: f = forest; w = woodland; o = open habitats; r = rocky outcrop; s = wetland; u = ubiquitous.

Species	**new to Moz**	**Habitat**
HESPERIIDAE		
Coeliadinae		
Coeliades forestan (Stoll, 1782)		u
Pyrginae		
Celaenorrhinus galenus (Fabricius, 1793)		f
Celaenorrhinus handmani Collins & Congdon, 1998	N	f
Tagiades flesus (Fabricius, 1781)		u
Eagris sabadius (Gray, 1832)	N	f
Eretis melania Mabille, 1891		w
Sarangesa lucidella (Mabille, 1891)	N	w
Sarangesa thecla (Plötz, 1879)	N	f
Spialia depauperata (Strand, 1911)		w
Spialia dromus (Plötz, 1884)		f
Abantis zambesiaca (Westwood, 1874)		w
Hesperiinae		
Metisella orientalis (Aurivillius, 1925)		s
Kedestes marshalli Aurivillius, 1925	N	w
Kedestes wallengrenii (Trimen, 1883)		w,s
Teniorhinus harona (Westwood, 1881)		w
Pardaleodes incerta (Snellen, 1872)	N	f
Acada biseriata (Mabille, 1893)		w
Acleros mackenii (Trimen, 1868)		f
Semalea arela (Mabille, 1891)		f
Semalea pulvina (Plötz, 1879)		f
Andronymus caesar (Fabricius, 1793)		w
Artitropa erinnys (Trimen, 1862)		f,w
Artitropa reducta Aurivillius, 1925		f,w
Platylesches galesa (Hewitson, 1877)		f,w
Zenonia anax Evans, 1937	N	f
Zenonia zeno (Trimen, 1864)		f
Borbo detecta (Trimen, 1893)		w

Borbo fatuellus (Hopffer, 1855)		f,w
Gegenes niso (Linnaeus, 1764)		u
PAPILIONIDAE		
Papilioninae		
Papilio dardanus Brown, 1776		f,w
Papilio demodocus Esper, 1798		u
Papilio desmondi van Someren, 1939	N	f
Papilio echerioides Trimen, 1868		f
Papilio nireus Linnaeus, 1758		u
Papilio ophidicephalus Oberthür, 1878		f
Papilio pelodurus Butler, 1896 subsp. nov.	N	f
Papilio phorcas Cramer, 1775		f
Graphium angolanus (Goeze, 1779)		u
Graphium policenes (Cramer, 1775)		f
PIERIDAE		
Coliadinae		
Catopsilia florella (Fabricius, 1775)		u
Colias electo (Linnaeus, 1763)		o
Eurema (E.) brigitta (Stoll, 1780)		f,w
Eurema (E.) desjardinsii (Boisduval, 1833)		f,w
Eurema (E.) mandarinula (Holland, 1892)		f,w
Eurema (Terias) hapale (Mabille, 1887)		f,w
Eurema (T.) hecabe (Linnaeus, 1758)		f,w
Pierinae		
Nepheronia argia (Fabricius, 1775)		w
Belenois aurota (Fabricius, 1793)		o
Belenois creona (Cramer, 1775)		o
Appias sylvia (Fabricius, 1775)	N	f
Mylothris agathina (Cramer, 1779)		f,w
Mylothris rueppellii (Koch, 1865)		w
Mylothris sagala Grose-Smith, 1886		f
Mylothris yulei Butler, 1897		f
Leptosia alcesta (Stoll, 1780)		f
NYMPHALIDAE		
Acraeini		
Acraea acrita Hewitson, 1865		w
Acraea aganice Hewitson, 1852		f
Acraea asema Hewitson, 1877		w
Acraea egina (Cramer, 1775)		f
Acraea insignis Distant, 1880		f
Acraea natalica Boisduval, 1847		f,w

Acraea neobule Doubleday, 1848		w
Acraea nohara Boisduval, 1847		o
Acraea oncaea Hopffer, 1855		w
Acraea cabira Hopffer, 1855		f,w
Acraea encedon (Linnaeus, 1758)		w
Acraea goetzei Thurau, 1903	N	f
Acraea igola Trimen, 1889		f
Acraea johnstoni Godman, 1885		f
Acraea pentapolis Ward, 1871		f
Acraea perenna Doubleday, 1847	N	f
Acraea serena (Fabricius, 1775)		w
Acraea sotikensis Sharpe, 1892	N	f
Acraea vumbui (Stevenson, 1934)		f
Argynnini auct.		
Pardopsis punctatissima (Boisduval, 1833)		w
Lachnoptera ayresii Trimen, 1879		f
Phalanta phalantha (Drury, 1773)		u
Issoria smaragdifera (Butler, 1895)	N	s
Danainae		
Danaus chrysippus (Linnaeus, 1758)		u
Amauris niavius (Linnaeus, 1758)		f
Amauris albimaculata Butler, 1875		f
Amauris echeria (Stoll, 1790)		f
Amauris ochlea (Boisduval, 1847)		f
Satyrinae		
Gnophodes betsimena (Boisduval, 1833)		f,w
Melanitis leda (Linnaeus, 1767)		f,w
Aphysoneura pigmentaria Karsch, 1894		f
Bicyclus anynana (Butler, 1879)		f,w
Bicyclus campinus (Aurivillius, 1901)		f,w
Bicyclus safitza (Westwood, 1850)		f,w
Bicyclus simulacris Kielland, 1990	N	f
Heteropsis ubenica (Thurau, 1903)	N	o,w
Ypthimomorpha itonia (Hewitson, 1865)		s
Neocoenyra bioculata Carcasson, 1964 subsp. nov.	N	r
Nymphalinae		
Hypolimnas anthedon (Doubleday, 1845)		f,w
Hypolimnas misippus (Linnaeus, 1764)		w
Salamis parhassus (Drury, 1782)		f
Precis archesia (Cramer, 1779)		o,w
Precis octavia (Cramer, 1777)		f,w

Precis tugela Trimen, 1879		f
Junonia natalica (Felder & Felder, 1860)		w
Junonia oenone (Linnaeus, 1758)		u
Junonia terea (Drury, 1773)		f,w
Vanessa cardui (Linnaeus, 1758)		u
Antanartia schaeneia (Trimen, 1879)	N	f
Limenitidinae		
Byblia ilithyia (Drury, 1773)		u
Neptidopsis ophione (Cramer, 1777)		f
Eurytela dryope (Cramer, 1775)		f,w
Eurytela hiarbas (Drury, 1782)		f,w
Sevenia boisduvali (Wallengren, 1857)		f,w
Sevenia moranti (Trimen, 1881)		f
Cyrestis camillus (Drury, 1782)		f
Neptis alta Overlaet, 1955		w
Neptis laeta Overlaet, 1955		f,w
Neptis nina Staudinger, 1896	N	f
Neptis saclava Boisduval, 1833		f,w
Neptis swynnertoni Trimen, 1912		f
Neptis trigonophora Butler, 1878		f
Cymothoe sp. nov.	N	f
Pseudacraea boisduvali (Doubleday, 1845)		f,w
Pseudacraea deludens Neave, 1912	N	f
Pseudacraea eurytus (Linnaeus, 1758)		f
Pseudacraea lucretia (Cramer, 1775)		f,w
Euptera kinugnana (Grose-Smith, 1889)		f
Euryphura achlys (Hopffer, 1855)		f,w
Euryphura concordia (Hopffer, 1855)		w
Euphaedra neophron (Hopffer, 1855)		f
Bebearia orientis (Karsch, 1895)		f
Hamanumida daedalus (Fabricius, 1775)		o,f,w
Aterica galene (Brown, 1776)		f
Pseudargynnis hegemone (Godart, 1819)		s
Charaxinae		
Charaxes achaemenes C.& R.Felder, 1867		w
Charaxes acuminatus Thurau, 1903		f
Charaxes bohemani C.& R.Felder, 1859		w
Charaxes brutus (Cramer, 1779)		f,w
Charaxes candiope (Godart, 1824)		u
Charaxes castor (Cramer, 1775)		o,w
Charaxes cithaeron C.& R.Felder, 1859		f,w
Charaxes dilutus Rothschild, 1898	N	f
Charaxes druceanus Butler, 1869		f,w

Charaxes ethalion (Boisduval, 1847)		w
Charaxes fionae Henning, 1977		w
Charaxes guderiana (Dewitz, 1879)		w
Charaxes jasius (Linnaeus, 1767)		w
Charaxes macclounii Butler, 1895		f,w
Charaxes margaretae Rydon, 1980	N	f
Charaxes pollux (Cramer, 1775)		f
Charaxes protoclea Feisthamel, 1850		f,w
Charaxes varanes (Cramer, 1777)		u
Charaxes violetta Grose-Smith, 1885		f
Charaxes wakefieldi (Ward, 1871)		f,w
Charaxes xiphares (Stoll, 1781)	N	f
Libytheinae		
Libythea labdaca Westwood, 1851		f
LYCAENIDAE		
Lipteninae		
Alaena amazoula Boisduval, 1847		r
Alaena picata Sharpe, 1896	N	r
Pentila pauli Staudinger, 1888	N	f,w
Pentila tropicalis Boisduval, 1847		f
Ornipholidotos peucetia (Hewitson, 1866)		f,w
Teriomima puella Kirby, 1887		f,w
Teriomima williami Henning & Henning, 2004*	N	f
Baliochila neavei Stempffer & Bennett, 1953		?f
Baliochila woodi (Riley, 1943) subsp. nov.	N	f
Baliochila sp. nov.	N	f
Miletinae		
Spalgis lemolea Druce, 1890		f,w
Lachnocnema emperamus (Snellen, 1872)		w
Lachnocnema sp.		f
Lachnocnema sp.		f
Theclinae		
Myrina silenus (Fabricius, 1775)		f,w
Cigaritis mozambica (Bertoloni, 1850)		o
Cigaritis nyassae (Butler, 1884)		w
Axiocerses bamptoni Henning & Henning, 1996	N	f
Epamera sidus (Trimen, 1864)		f
Epamera sp. nov.	N	f
Argiolaus silarus Druce, 1885		f,w
Hypolycaena buxtoni Hewitson, 1874		f,w
Leptomyrina hirundo (Wallengren, 1857)		r

Leptomyrina (Gonatomyrina) sp. nov.	N	r
Pilodeudorix caerulea (Druce, 1890)		o,w
Pilodeudorix jacksoni (Talbot, 1935)	N	f,w
Virachola nr. *vansomereni* (Stempffer, 1951)	N	f
Capys disjunctus Trimen, 1895	N	o
Polyommatinae		
Anthene livida (Trimen, 1881)		r
Anthene crawshayi (Butler, 1899)	N	o,w
Anthene larydas (Cramer, 1780)		f,w
Cupidopsis cissus (Godart, [1824])		u
Pseudonacaduba sichela (Wallengren, 1857)		u
Uranothauma antinorii (Oberthür, 1883)		f
Uranothauma falkensteini (Dewitz, 1879)	N	f
Uranothauma nubifer (Trimen, 1895)		o,f
Cacyreus lingeus (Stoll, 1782)		u
Cacyreus fracta (Grünberg, 1911)		u
Cacyreus virilis Aurivillius, 1924		u
Leptotes brevidentatus (Tite, 1958)	N	w
Leptotes pirithous (Linnaeus, 1767)	N	u
Leptotes pulchra (Murray, 1874)		w
Tuxentius melaena (Trimen, 1887)		w
Zizeeria knysna (Trimen, 1862)		u
Actizera lucida (Trimen, 1883)		o
Azanus mirza (Plötz, 1880)		u
Euchrysops malathana (Boisduval, 1833)		o
Euchrysops osiris (Hopffer, 1855)		w
Thermoniphas micylus (Cramer, 1780)		f
Oboronia bueronica Karsch, 1895		f
Oboronia guessfeldtii (Dewitz, 1879)		f
TOTAL 203 taxa	39	

* Reinstatement in prep. (Collins *et al.*).