

THE MAFINGA MOUNTAINS, ZAMBIA:

Report of a reconnaissance trip, March 2018



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SUMMARY

A brief trip was made in May 2018 to the high-altitude grasslands (2000–2300 m) on the Zambian side of the Mafinga Mountains in NE Zambia. The major objective was to look at plants, although other taxonomic groups were also investigated. This report gives an outline of the area's physical features and previous work done there, especially on vegetation, as well as an account of our findings. It was done at the request of and with support from the Wildlife and Environmental Conservation Society of Zambia under a grant from the Critical Ecosystem Partnership Fund.

Over 200 plant collections were made representing over 100 species. Based on these collections, along with earlier, unconfirmed records from Fanshawe's 1973 vegetation study, a preliminary checklist of 430 taxa is given. Species of particular interest are highlighted, including four known endemic species and five near-endemics that are shared with the Nyika Plateau in Malawi. There were eight new Zambian records.

Based on earlier studies a bird checklist is presented, followed by a brief discussion on mammals and herps. More detailed accounts are given on Orthoptera and some other arthropod groups.

A discussion on the ecology and range of habitats is presented, with particular focus on the quartzite areas that are rather similar to those on the Chimanimani Mountains in Zimbabwe/ Mozambique. The role of fire is also discussed.

Five conservation recommendations are given ranging from reducing the incidence of wildfires and development of the ecotourism potential to the necessity for further basic biodiversity survey work.

ACKNOWLEDGEMENTS

We would like to thank the Mafinga District Agricultural Officer, Mr Elias Kunda, who accompanied us. Alan Gardiner and Colin Congdon provided information on butterflies, while Bob Dowsett provided comments on the bird section and additional references. Kaj Vollesen (RBG Kew) carried out most of the plant identifications, while Nicholas Wightman identified the orchids.

Photo credits: JT - Jonathan Timberlake; WN - William Van Niekirk; LM - Lari Merritt

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1. INTRODUCTION

The Mafinga Mountains (sometimes termed the Mafinga Hills) are a relatively small montane massif in north-eastern Zambia lying between 9°55' and 10°00' S and 33°15' and 33°25'E along the border with Malawi (White 1962, Fanshawe 1973). Its total extent above 1500 m is here estimated at around 120 km². Perhaps 30% of the massif above this altitude is in Malawi (although Fanshawe suggests only 10%), but the greater part lies in Zambia (Figure 1). Falling within the newly-created Mafinga District in Muchinga Province of Zambia (formerly in Northern Province), and in Chitipa District in Malawi, the nearest towns or larger settlements are Isoka in Zambia some 75 km away to the south west, while Chitipa is 26 km away to the north west in Malawi.

Montane habitats such as those found on the Mafingas are of limited extent in Zambia, being confined to a small part of the Nyika Plateau some 80 km to the south-east and to the Makutu mountains 50 km to the south. They are thus of particular interest from a biodiversity viewpoint. Although a significant amount of information exists on the birds found there (see section on birds and Leonard 2005), and an unpublished but detailed account on the plants and vegetation was written almost 50 years ago (Fanshawe 1973), much less is known on other groups of organisms or on the conservation significance and threats on the plateau.

Because of its importance as a watershed, and having being provisionally designated a priority Key Biodiversity Area (KBA) by the Critical Ecosystem Partnership Fund (CEPF 2012a, see also <https://www.cepf.net/our-work/biodiversity-hotspots/eastern-afromontane/>) under its Eastern Afromontane Hotspot initiative, the Wildlife and Environmental Conservation Society of Zambia (WECSZ) developed a Conservation Action Plan for the area involving riparian forest rehabilitation, species inventory, alternative livelihood promotion and other activities to help with conservation (WECSZ 2015). Particular focus is being given to ensuring the integrity of the upper Luangwa river catchment. In order to assist this project, and with the support of WECSZ, a small group of biologists and interested individuals planned a 5-day trip to the Zambian side of the Mafingas from 10 to 14 March 2018 in order to make a preliminary collection of plants, to add to the bird list, to look at arthropod groups (especially Orthoptera), and to assess the current habitat condition and any conservation issues. Team members were: Lari and Mike Merrett (Mutinondo Wilderness Area, Mpika, Zambia), Gift Mwandila (WECSZ), Elias Kunda (Muchinga Agricultural Officer, Chifungwe), Mpande Sichamba (Forest Research Division, Kitwe), Paul Smith (Botanic Gardens Conservation International, UK), Jonathan Timberlake (independent botanist, UK) and William Van Niekirk (Lusaka).

The starting point for this trip was the small town of Chifungwe (Thendele) from where we drove on what was often a very bad road to the small village of Maliko at 1530 m altitude. From there the team walked through miombo woodland on the steep southern slopes following the Insinza River up to the plateau at 2000 m. The full route taken, and subsequent trek across the plateau, is shown in red on the Google Earth image (Figure 2). The team camped close to a small patch of Afromontane forest at 10°00'10.0"S, 33°19'49.2", alt. 2213 m, which was used as a base for the following three field days.

This report gives an account of this fieldtrip and its findings, along with a discussion of earlier studies, particularly on plants and vegetation. Some preliminary conclusions are also given regarding the conservation status and importance of the Mafingas, and some recommendations to WECSZ and others on conservation actions that could be taken.

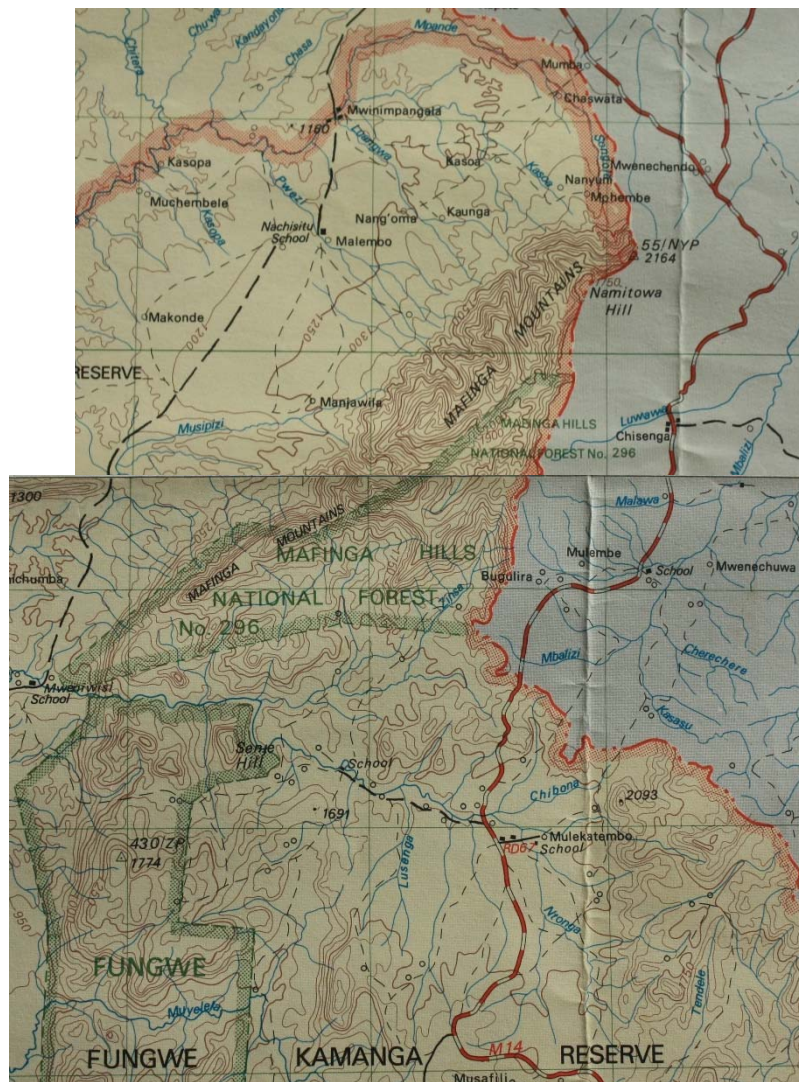


Figure 1. Map sheets of Zambia (1:250,000 scale) showing the Mafinga Mountains.

2. PHYSICAL FEATURES

Lying 25–30 km south-southwest of the Misuku Hills in northern Malawi, the Mafinga Mountains appear as a massif, albeit not as large as those of the Nyika and Mt Mulanje, and rise abruptly some 500–700 m above the surrounding plains of the Mid-Tertiary erosion surface. The metamorphosed rocks belong to the Mafinga System and are composed of quartzites, phyllites and feldspathic sandstones of sedimentary origin (https://en.wikipedia.org/wiki/Mafinga_Hills). Owing to the steep dips of the quartzite that forms the upper parts, the slopes here are very steep and frequently precipitous. About 32 km in length and running north-north-west and south-south-east, the relatively narrow plateau is dissected by deep ravines. Towards the south the massif splits into several parallel ridges, with transverse ridges at each end (White 1962). The international boundary between Malawi and Zambia follows the watershed on the eastern side, with drainage into the Upper Lufira River on the Malawi side and into the Luangwa River on the Zambian side.

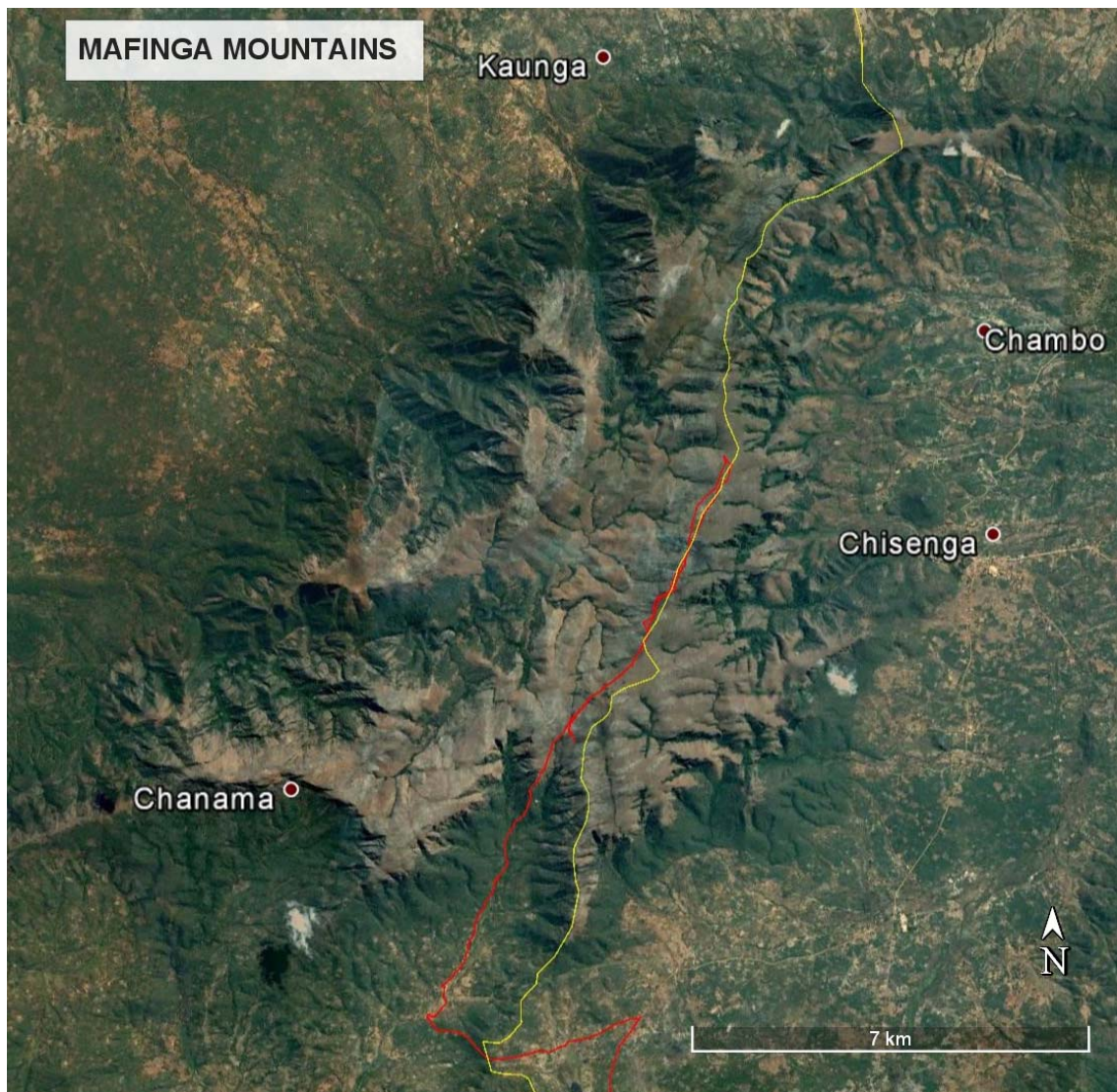


Figure 2. Google Earth image of the Mafinga Mountains showing the international border (yellow line) and tracks taken by the 2018 trip (red lines).

Above c.1500 m the plateau is around 120 km² in extent (calculated from Google Earth), while Dowsett-Lemaire (2006) suggests 42 km² in Malawi and Leonard (2005) gives 130 km² for Zambia. The CEPF description of the Mafingas Key Biodiversity Area (CEPF 2012a, KBA no. 144) shows the area as being 187.2 km² in extent, but the boundary appears to be rather simplistically defined, possibly incorporating just the Forest Reserves in Zambia and Malawi. For unknown reasons, the actual Eastern Afromontane Hotspot boundary (CEPF 2012b) differs significantly from that of the KBA, presumably in error.

The flat and undulating plateau is mostly at an altitude of 2100 to 2200 m, with peaks along the international border reaching 2330 m. The highest point indicated on published maps appears to be just over 7600 ft (2316 m) on the Zambia 1: 50,000 scale map series, or 7750 ft, (2362 m) on the 1: 250,000 series, but a GPS reading taken at what appears to be one of the highest points was 2330 m. Wikipedia (https://en.wikipedia.org/wiki/Mafinga_Hills) gives the highest point as Mafinga Central at 2339 m altitude.

No rainfall or other climatic data appear to be available for the Mafingas, although records for 11 years are noted by White (1962) from Chisenga in Malawi, not far from the eastern footslopes (altitude 1525 m). Here main annual rainfall, presumably recorded in the 1950s, was 972 mm with four months receiving more than 100 mm of rain, and only 11 mm (1.09%) falling

in the six months May–October. But, as he notes, the mountains are frequently enveloped in cloud at higher altitudes and rainfall is likely to be significantly higher than this. White suggests that rainfall is less than it is in the Misuku Hills, and the dry season more pronounced.

3. PLANTS AND VEGETATION

Past Studies and Vegetation

The main account on the vegetation and plants of the Mafinga Mountains is the comprehensive listing by Denys Fanshawe (Fanshawe 1973) as part of his series of district vegetation accounts of Zambia. This account only covers the larger Zambian portion, but it appears he visited both sides of the border. The detailed book on the evergreen forest flora of Malawi (White, Dowsett-Lemaire & Chapman (2001), although mentioning the Mafingas, contains no further detail, although they are mapped as an area with Afromontane forest. Likewise, White's earlier book (White 1962) on the forest flora of Zambia also mentions the mountains, but with no botanical detail. More significant are the publications by Jim Chapman & Frank White (1970) on the evergreen forests of Malawi, and the series of papers by Françoise Dowsett-Lemaire on forest vegetation in Malawi (Dowsett-Lemaire 1989). Both these contain detail on vegetation and plant species composition from the Malawi side that are probably equally valid for the Zambian side.

Regarding the vegetation of the Mafingas as a whole, it may be best to use Fanshawe's own words (Fanshawe 1973):

"The highest parts of the mountains are predominantly covered by montane grassland, smooth in a few places but rocky in most. Hill miombo woodland covers most slopes, sometimes up to the crests. Some ridges are almost completely bare or with a sparse cover of montane scrub. Where the valleys begin to flatten out riparian forest is bordered by a narrow fringe of secondary chipya, reduced almost to a very luxuriant scrub of shrubs and tall herbs. Montane forest can be vaguely differentiated into a moister submontane forest along the streams and a drier montane forest as a fringe. Some of the submontane and most of the montane forest is secondary, the latter varying from low forest to scrub.

The vegetation in general compares well with that of the much better preserved Makutu Mountain forests, but not so well to that of the Nyika plateau. The total woody flora – forest, woodland, scrub and grassland – is of the order of 400-450 species, of which 360 are so far known."

Chapman & White (1970) describe well the miombo woodland and riverine forests:

"Except in the gorges, *Brachystegia* woodland ascends to about 1830 m (6000 ft), consisting chiefly of *Brachystegia microphylla* [now *B. tamarindoides* subsp. *microphylla*] above and *Brachystegia taxifolia* and *Uapaca kirkiana* below. Above 1830 m the rocky slopes are occupied by an open shrubland with *Protea*, *Vellozia* [*Xerophyta*], *Aeschynomene nyikensis* and *Helichrysum densiflorum*.

Below the gorges, *Adina microcephala* [*Breonadia salicina*] is the most conspicuous streambank tree. With it may be found *Bridelia micrantha*, *Cyathea dregei*, *Ficus capensis* and *Syzygium cordatum*. At the entrance to the gorges the streambank forest becomes much more luxuriant and the species begin to change. *Ficalhoa laurifolia* is particularly abundant, associated with *Macaranga kilimandscharica* [*M. capensis*], *Parinari excelsa* and *Polyscias fulva*; *Cephaelis peduncularis* [*Psychotria peduncularis*] is common in the understorey. Further back in the depths of the gorges, where the streams come cascading down between rocks thickly covered with moss and ferns, and the fronds of *Marattia fraxinea* [*Ptisana fraxinea*] arch out over the water, the forest reaches its best

development. Here *Entandrophragma* and *Chrysophyllum* can be found with *Tabernaemontana johnstonii* [*T. stapfiana*] and *Myrianthus holstii* common in the understorey. Higher up, above the waterfalls, the forest becomes increasingly stunted though it persists in the ravines almost to the lip of the plateau. Here *Cassipourea congoensis* [*C. malosana*], *Olinia usambarensis* [*O. rochetiana*], *Podocarpus milanjanus* and *Rothmannia fischeri* are all common species."

The actual Afromontane forests are described in some detail by Dowsett-Lemaire (1989), although this refers primarily to the Malawi side:

"The forests have a somewhat broken canopy and no emergents. The dominant large trees (in the north) are *Albizia gummifera*, *Ficus capensis*, *Macaranga capensis*, *Parinari excelsa* and *Prunus africana*. At the bottom of Chisenga Gorge (1600 m), *Harungana madagascariensis* reaches the 25 m high canopy and *Syzygium guineense* subsp. *afromontanum* is dominant. *Macaranga kilimandscharica* [now also *M. capensis*] appears higher up (1700 m) and overlaps with *M. capensis*. At that altitude, *Canthium* sp. (10-12 m tall) is not uncommon in the understorey. The one Malawi record of *Teclea simplicifolia* [*Vepris simplicifolia*] comes from shrubby growth near the crest of the northern range, near 2000 m. The fern flora is rather poor, especially in epiphytes; but the epiphytic orchid *Aerangis carnea* occurs in numbers....."

In Fanshawe's account (Fanshawe 1973) he described the vegetation under seven 'national' categories, with lower altitude and upper altitude forests, riparian forest along watercourses, just one type of miombo woodland, and up on the plateau two montane vegetation types, grassland and scrub. Rather than describing these again based on our limited observations, Fanshawe's account, greatly simplified here, is given below. Nomenclature has been updated where certain and the main focus is on the principal trees and shrubs.

1. **Closed Forest**
 - A. Climatic
 1. Chipya scrub
 2. Submontane forest
 - (a) Secondary submontane forest
 3. Montane forest
 - (a) Secondary montane forest
 - B. Edaphic
 4. Riparian forest
2. **Open Forest**
 1. Hill miombo woodland
3. **Grasslands**
 1. Montane grassland
 2. Montane scrub

Secondary Chipya Scrub: A tangle of shrubs and tall herbs to 2-3 m with occasional emergent tree to 6 m on deep valley soils; probably only an extension of secondary montane forest with *Piliostigma thonningii* and *Azanza garckeana*. Characteristic is *Acacia abyssinica*, along with *Harungana madagascariensis* and the shrubs *Dissotis princeps*, *Bothriocline longipes*, *Platostoma rotundifolium*, *Heteromorpha arborescens*, *Leonotis equisetiformis*?, *Tecoma capensis* and *Baccharoides adoensis*. There are few climbers but *Clematis brachiata*, *Microglossa pyrifolia*, *Mikania natalensis* and *Tragia benthamii* are frequent.



Figures 3 & 4. Miombo woodland, middle slopes of Mafingas [JT]; *Uapaca robynsii* [JT].

Submontane Forest: A typical 3-storey evergreen forest with canopy dominants at c.24 m, especially *Parinari excelsa* and *Syzygium guineense* subsp. *afromontanum* along streamsides, and *Ficalhoa laurifolia*, *Macaranga capensis*, *Podocarpus milanjianus* and *Polyscias fulva*. Smaller trees include *Aphloia theiformis*, *Cassipourea malosana*, *Diospyros whyteana*, *Garcinia smeathmannii*, *G. volkensii*, *Olea capensis* and *Tricalysia pallens*. Common shrubs include *Chassalia cristata*, *Mellera nyassana*, *Mostuea brunonis*, *Peddiea fischeri* and *Psychotria succulenta*. Climbers are *Artabotrys stolzii*, *Landolphia buchananii*, *Opilia amentacea* and *Tiliacora funifera*. The ground layer is bare or with a sparse cover of *Acanthaceae* or *Oplismenus* grass. In this area the forest is mostly secondary, occurring in gaps, the main trees being *Bersama abyssinica*, *Neoboutonia melleri* and the climbing fern *Dicranopteris linearis*.

Montane Forest: Forming a drier fringe to the moister submontane forest, the evergreen canopy is c.15 m high, with dominants of *Aphloia theiformis*, *Faurea saligna*, *Nuxia floribunda* and *Rapanea melanophloeos*. The main shrub is *Psychotria djumaensis*, while climbers include *Landolphia buchananii*, *Smilax kraussiana* and *Tiliacora funifera*. On the fringes the vegetation is secondary, similar to chipya scrub found lower down, and trees are absent. Common shrubs include *Aeschynomene schliebenii*, *Dissotis princeps*, *Dodonaea viscosa*, *Harungana madagascariensis*, *Erica benguelensis*, *Protea madiensis*, *Pycnostachys sphaerocephala*, *Tecomaria capensis* and *Xerophyta equisetoides*. On the fire-induced ecotone stands of Bracken fern *Pteridium aquilinum* occur.

Riparian Forest: A comparatively low forest, 12 m high, on lower reaches of streams. Apart from *Cyathea* and *Osmunda* most common species are lowland. Common trees are *Breonadia salicina*, *Bridelia micrantha*, *Englerophytum magalismsontanum*, *Faurea saligna*, *Gardenia imperialis* and *Syzygium cordatum*. Shrubs include *Psychotria peduncularis*, *Craterispermum laurinum*, *Cyathea dregei*, *Dodonaea viscosa*, *Maesa lanceolata*, *Pycnostachys sphaerocephala* and *Raphia farinifera*. *Osmunda regalis* is the only common plant at shrub level, while *Dalbergia arbutifolia* is the only common climber.

Hill Miombo Woodland: A variable open woodland on the slopes occasionally right up to the crests. It becomes more open with a more restricted composition with altitude. At lower levels *Brachystegia bussei*, *B. longifolia*, *B. manga* and *Julbernardia paniculata* are dominant, frequently with *Anisophyllea boehmii*. At mid-levels *B. manga* and *B. bussei* disappear to be replaced by *Brachystegia spiciformis* and *Julbernardia globiflora*, while at the highest level *Brachystegia tamarindoides* appears. Near the crest the woodland becomes open with just *Monotes africanus*, *Uapaca robynsii* and *Protea petiolaris*. Smaller trees throughout include

Protea petiolaris, *P. rupestris*, *Syzygium guineense* subsp. *macrocarpum* and *Uapaca kirkii*, with the tree heather *Erica pallidiflora* and *Uapaca robynsii* on the upper slopes. Common shrubs include *Haumaniastrum rupestre*, *Xerophyta equisetoides* and *Vernonia bellinghamii*. Climbers are virtually absent.



Figure 5. View north over Mafingas grasslands [JT].

Montane Scrub and Grassland: The highest parts of the mountains support a suffrutex grassland, with grass cover directly related to the amount of outcropping rock and depth of soil. With outcropping rock, a relatively smooth tussock grass/suffrutex sward is seen, but as outcropping rock increases, rock crevice suffrutexes, shrubs and small trees become dominant. The grass/sedge sward contains small clumps of *Protea heckmanniana* while rocky sites are dominated by the shrubs *Aeschynomene rubrofarinacea*, *A. schliebenii*, *Dissotis lanata*, *Erica benguelensis*, *Protea madiensis*, *P. petiolaris* and locally *P. wentzeliana*, *Tephrosia interrupta* and *Xerophyta equisetoides*. Subshrubs in the scrub grassland include *Haumaniastrum rupestre*, *Aloe duckeri*, *Diplolophium zambesianum*, bracken *Pteridium aquilinum* and *Vernonia poskeana*.

Fanshawe also says that, from his viewpoint, the best-preserved forest is at Mulangale on the mid-western slopes. He is rather dismissive of other forest patches – "... Mulangale Forest is too small to make protection worthwhile even if protection could be enforced so far from civilization. There will always be fires in the montane grasslands and the forest has almost reached the stage when it is no longer worthwhile protecting. It is rapidly being degraded and encroached upon, oddly enough by miombo dominants, e.g. *Brachystegia spiciformis*, along its upper edge" – and also, surprisingly, of the 'frequently burnt' montane grasslands.

Our observations in 2018 supported this earlier work. Miombo woodland, with clear signs of disturbance and past cutting and regeneration in places, was seen going up to the lip of the plateau at around 2100 m (Figure 3). *Brachystegia tamarindoides* subsp. *microphylla* was most common, or even restricted to, outcrops of quartzite of fine-grained sandstone at above 1900 m, and the *Uapaca kirkiana* found lower down was replaced by *U. robynsii* at around 1800 m (Figure 4). There was a noticeable lack of epiphytes, which are often seen in such situations.

We did not pass through any patches of evergreen or riparian forest (other than very thin fringes flanking the Insinza stream) on our ascent.



Figures 6 & 7. Upland grassland (L) and shallow quartzite outcrops on ridge [JT].

Once on the plateau, we visited only few and very small Afromontane forest patches (Figure 5). These relatively small patches consist of larger trees (to 15 m high), mostly *Agarista salicifolia* with *Myrica serrata* on the margins. At the forest edge, a shrubby fringe is seen, often with bracken fern *Pteridium aquilinum*, small shrubs and woody herbs.

Our main focus was on the grassland vegetation (Figures 6 & 7), and any of the endemic or restricted-range species found there. A major finding in that regard, elaborated upon later in Section 5, was the difference in geomorphology and soils between the quartzite/fine-grained sandstone substrates and those on medium-textured sandstone or schists. The vegetation also differed in its structure and in the proportions of some species, but whether certain species are confined to just one substrate and not found on the other was not determined. It would be interesting to investigate further whether any of the known Mafinga endemics are confined to the more nutrient-impooverished quartzite soils, as is the case in the Chimanimani Mountains along the Zimbabwe-Mozambique border.

Plant Species

The total number of plant specimens collected in 2018 was 217 (numbers from Lari Merrett, Mpande Sichamba, Paul Smith, Jonathan Timberlake and two others), representing 109 different species. Unfortunately, many of them became mouldy after inadequate drying, hence some identifications are uncertain and many were too poor to accession into the Kew herbarium. Identifications were done by Kaj Vollesen at RBG Kew, Nicholas Wightman (Lusaka) looked at the orchids, and Elena Phiri (NDO) did some preliminary identifications. A complete set of specimens was deposited at the Forest Herbarium in Kitwe (NDO).

From these collections, sight records, and records cited in Fanshawe (1973) with updated nomenclature, a preliminary checklist was compiled (Annex 1). Unfortunately, nearly all Fanshawe's records do not cite a specimen so it has not been possible to get confirmation. The checklist contains a total of 430 confirmed taxa from 110 families, comprising 10 Pteridophytes, 2 gymnosperms, 379 dicotyledons and 39 monocotyledons. The main families are shown in Table 1.

With more complete plant collecting, including in the forests and miombo woodlands on the upper slopes and carried out at different times of year, we estimate a complete checklist would be expected to cover around 550 to 600 species.



Figure 8. Interesting species from the Mafinga grasslands [all JT]. Top L, *Protea kibarensis* subsp. *cuspidata*; top R, *Xerophyta equisetoides* or *X. nutans*; middle, *Dissotidendron lanatum* (endemic); bottom L, *Ochna* cf. *confusa*; middle, *Lapeirousia erythrantha*; bottom R, *Moraea schimperii*.



Figure 9. Further interesting species from the Mafinga Mountains [all LM]. Top L, *Helichrysum tillandsiifolium*; top R, *Eriosema lebrunii*; bottom, *Streptocarpus* sp. nov? from quartzite rock crevices at high altitude.

Table 1. The main six families in terms of species number recorded from the Mafinga Mountains.

Family	no. species
Rubiaceae	46
Leg.: Papilionoideae	45
Asteraceae	41
Lamiaceae	20
Leg.: Caesalpinioideae	17
Proteaceae	11

Plants listed by CEPF (2012a) as being priority species within the KBA are shown in Table 2, essentially because they were believed to be endemic. Endemic is here defined as a taxon that is only known from the Mafinga Mountains in either Zambia or Malawi, whilst near-endemic is a taxon that is also known to occur on the Nyika and/or Makutu hills. As can be seen, three of the 11 taxa (species or subspecies) listed were included in error as they are moderately widespread, being found also in southern Tanzania as well as on the Nyika (*Ocimum obovatum* subsp. *crystallinum* and *Rytigynia adenodonta*) or are not known to occur on the Mafingas at all (*Cyphostemma vollesenii*). It is not clear how these species got incorporated into the CEPF list. Another important taxon, *Protea heckmanniana* subsp. *heckmanniana*, known just from the Mafingas and the Nyika Plateau (see Chisumpa & Brummitt 2006: 81), should also be included.

All nine restricted-range taxa, endemic or near-endemic, occur in montane grassland above 2100 m altitude, and only two of these also occur in high-altitude miombo woodland. However, one, the shrub *Dissotidendron lanatum* (previously known as *Dissotis lanata*), seemed to us to occur primarily on rocky outcrops, not in woodland. Taxa from montane grassland can often be restricted to just one or two mountains, whilst miombo woodland species can be widespread over large areas, as are Afromontane forest species. In part this reflects the limited extent and great separation of montane grasslands across south-central Africa. The Nyika, for example, has 33 endemic species (1.7% of its flora) while Mt Mulanje has 71 (5.4%), and most of these are found in the grassland or montane scrub areas (Wursten, Timberlake & Darbyshire 2017).

Of the four Mafinga endemics and five near-endemics shown in Table 2, we found only three on the 2018 trip – *Cyphia mafingensis*, *Dissotidendron lanatum* (Figure 8c) and *Protea kibarensis* subsp. *cuspidata* (Figure 8a). Given the frequency of quartzite outcrops at high altitude, and the nutrient-deficient soils that result, it is possible there are more endemics to be found. A similar quartzite crag and grassland environment on the Chimanimani Mountains on the Zimbabwe–Mozambique border, for example, has 74 known endemic plant species (Wursten *et al.* 2017), although from a significantly larger area (530 km²).

One interesting find was of a species of prostrate herb *Streptocarpus* (LM 2397), growing in quartzite crevices under a *Podocarpus* tree at c.2300 m altitude (Figure 9d). This was unmatched in the Kew Herbarium and appears to be potentially new. Other collections of interest were of very range-restricted species (*Aframni longiradiatum*, *Spermacoce samfya*) or represent new records for Zambia (*Pimpinella mulanjiensis*, *Impatiens eryaleia*, *Crassula alba*, *Eriosema lebrunii* (figure 9b) *Kotschya uguenensis*, *Lotus goetzei*, *Cyphia mafingensis* and *Lippia baumii* var. *nyassensis*), although in nearly all cases the species is known from not far over the Malawi border on the Nyika Plateau. There would appear to be eight new records for Zambia, according to available records at Kew.

Although *Cyphia mafingensis* is a Mafinga endemic, it was previously only known from one specimen in the northern part of the range on the Malawi side; it is likely to be more common than the few records suggest. *Pimpinella mulanjiensis* was believed to be endemic to Mt Mulanje in southern Malawi, but was later found on Mt Namuli in northern Mozambique; this is now the most northerly record.

Spermacoce samfya appears to have a very strange distribution. This is only the second record, the first being from seasonally flooded grassland around Lake Bangweulu in northern Zambia, a quite different habitat and at a much lower altitude (1200 m rather than 2200 m). It is possible, of course, that these represent two different taxa, but with the existing material they are not convincingly separable. Within the Apiaceae family, *Aframni longiradiatum* also has a strange

distribution. It is otherwise only known from Kalambo Falls in far north-eastern Zambia and just over the border in Katanga in the D.R. Congo, again in a quite different habitat.

Table 2. Listed 'priority' plant species for the Mafinga KBA (from CEPF consultancy database).

Family	Species	Notes
Lamiaceae	<i>Ocimum obovatum</i> Benth. subsp. <i>crystallinum</i> (A.J.Paton) A.J.Paton	in error?: also Nyika & S Tanzania, <i>Brachystegia</i> woodland above 2000 m
Lobeliaceae	<i>Cyphia mafingensis</i> Thulin	Mafinga endemic, montane grassland at 2300 m
Melastomataceae	<i>Dissotidendron lanatum</i> (A. & R. Fern.) Ver.-Lib. & Kadereit (previously <i>Dissotis lanata</i> A. & R. Fern.)	Mafinga endemic, upper <i>Brachystegia</i> woodland. Also exposed quartzite outcrops
Orchidaceae	<i>Polystachya mafingensis</i> P.J.Cribb	Mafinga endemic, epiphyte in montane grassland/woodland above 2200 m
Orobanchaceae	<i>Buchnera crassifolia</i> Engl.	Mafinga near-endemic (also Nyika), montane grassland
Orobanchaceae	<i>Buchnera nitida</i> Skan	Mafinga near-endemic (also Nyika), montane grassland to 2400 m
Phyllanthaceae	<i>Phyllanthus mafingensis</i> Radcl.-Sm.	Mafinga endemic, montane grassland at 2300 m
Proteaceae	<i>Protea mafingensis</i> (Chisumpa & Brummitt) Beard	Mafinga near-endemic (also Nyika), montane grassland above 2000 m
Proteaceae	<i>Protea kibarensis</i> Hauman subsp. <i>cuspidata</i> (Beard) Chisumpa & Brummitt	Mafinga near-endemic (Zam + Mal, also Makutus), montane grassland above 2100 m
Rubiaceae	<i>Rytigynia adenodonta</i> (K.Schum.) Robyns var. <i>adenodonta</i>	in error: also Nyika & S Tanzania, montane forest above 2100 m
Vitaceae	<i>Cyphostemma vollesenii</i> Verdc.	in error: only known from Tanzania
Species to be added		
Proteaceae	<i>Protea heckmanniana</i> Engl. subsp. <i>heckmanniana</i>	Mafinga near-endemic (also Nyika), montane grassland above 2100 m

One interesting species is *Podocarpus elongatus* (Figure 10). This has previously been recorded from the Mafinga Mountains (*Chapman* 58 (K) and *Angus* 828 (K), both collected in 1952) and from the Chimanimani Mountains at a similar altitude (Timberlake *et al.* 2016: 48), but otherwise appears to be only recorded from the Cape Region of South Africa (Farjon 2010, Farjon & Filer 2013). In both the Mafingas and Chimanimanis the trees are stunted, but do not look out of place, growing in similar situations on exposed quartzite outcrops, and also (in Chimanimani) at lower altitudes (\pm 1000 m) on bare rocks at the edge of riverbeds. Although very similar morphologically, to the point where it is difficult to separate them (the leaves of *P. elongatus* are significantly shorter, despite its specific name!), this species is quite different in form and habitat from *Podocarpus milanjanus*, which is a fairly large montane forest tree. There appears to be confusion with the taxonomy, which may only get resolved with genetic

studies. Ecologically *P. elongatus* is a clearly separate entity from the forest *P. milanjanus*, although they do occur on the same mountains.



Figure 10. *Podocarpus elongatus*, tree and fruits, summit ridge of Mafingas [JT].

4. FAUNA

Birds

There have been two published studies of the avifauna of the Mafingas in Zambia (Dowsett & Stjernstedt 1973 and Leonard *et al.* 2001), while from the Malawi side a brief account is found in Dowsett-Lemaire (2006) with more detail available in Dowsett-Lemaire (1989). Additional information on the birds is given in Aspinwall (1976) and Dowsett, Berry & Foot (2003). These accounts resulted in the area – upland grassland and the surrounding miombo woodlands, totalling c.1300 ha – being designated as a Zambian Important Bird Area (no.39, Leonard 2005). The IBA was not mentioned in the initial book on African IBAs (Fishpool & Evans 2001) either under Zambia or Malawi but was added in later with the advent of increased knowledge. Recently, an ornithological study of the whole montane and woodland area was carried out by BirdWatch Zambia, funded by CEPF, resulting in a list of 207 species (Reynolds & Willems 2018).

Leonard mentions a total of 144 bird species recorded from the Zambian portion of the Mafingas, an area that includes miombo woodland, montane grassland, Afromontane and riparian forest. The species that help define the IBA are the restricted range species Sharpe's Akalat (very localised resident), Black-lored Cisticola (scarce resident) and Chestnut-headed Apalis (common resident). In addition, there are 38 biome-restricted species – 18 Afromontane endemics, 12 Afromontane near-endemics, 1 sub-Afromontane endemic, 1 Eastern near-endemic, 3 Zambebian endemics and 5 Zambebian near-endemics.

A preliminary checklist is given as Appendix 2 based solely on Dowsett & Stjernstedt (1973), the IBA account and our own observations. More species could be added from the bird atlases for Malawi and Zambia (Dowsett-Lemaire & Dowsett 2006 (updated by Dowsett-Lemaire 2006) and Dowsett *et al.* 2008, respectively) and the other studies mentioned earlier, but this is not done here.

Mammals

The mammal fauna is said to be not well known (Leonard 2005), although the area is included in publications by Ansell and others (Ansell & Ansell 1973, Ansell 1974, Ansell 1978, Ansell & Dowsett 1988).

The most comprehensive account of mammals in the Mafinga Mountains is that of Ansell & Ansell (1973). Recorded species (abbreviations in brackets indicate IUCN conservation assessments) include Chequered Elephant Shrew *Rhynchocyon cirnei* subsp. *reichardei* (LC), Common Duiker *Sylvicapra grimmia* (LC), Common Mole Rat *Cryptomys hottentotus* (LC), Red-legged Sun Squirrel *Heliosciurus rufobrachium* subsp. *mutabilis* (LC), Mozambique Thicket Rat *Grammomys cometes* (LC), Red Rock Rat *Aethomys chrysophilus* (LC), Delectable Soft-furred Mouse *Praomys delectorum* (LC), Yellow-spotted Brush-furred Rat *Lophuromys flavopunctatus* (LC), Grey-bellied Mouse *Mus triton* subsp. *murillus* and Giant Mastiff Bat *Otomops martiensseni* (NT). Species occurring in the Mafingas with limited distribution in Zambia include Welwitsch's bat *Myotis welwitschii* (LC), Smith's Red Rock Hare *Pronolagus rupestris* (LC), Lesser Pouched Rat *Beamys hindei* and the Nyika Bush-rat *Aethomys nyikae*.

In the past, occasional lion (*Panthera leo*) were reported to occur on the Mafingas, and Burchell's Zebra (*Equus burchelli*), Wild Pig (*Potamochoerus porcus*), Roan Antelope (*Hippotragus equinus*) and Bushbuck (*Tragelaphus scriptus*) were all recorded during earlier scientific expeditions (see Ansell & Ansell 1973 pp. 64-65).

On the present trip we surprisingly did not note any sign of rock rabbit, hyrax or small buck in the form of droppings, although a small troop of Yellow Baboons *Papio cynocephalus* were seen. It is possible that there never were any significant herds of larger herbivores present in the past, owing probably to the relatively small size of the grasslands and also to its poor forage quality compared to the far more extensive grasslands on the Nyika Plateau and the high frequency there of the palatable grass *Themeda triandra*, which we did not see at all up on the Mafinga plateau. Indeed, the grasslands mostly comprise sourveld grasses, which are not particularly good or able to support larger numbers of grazers. Given the lack of raptors seen by us, this may indicate that there are also few small mammals in the grasslands.

Reptiles & Amphibians

No records appear to exist on the herpetofauna of the Mafingas, although a checklist is available for the rather similar Nyika Plateau (Broadley 2013) and there is an earlier checklist for Zambia as a whole (Broadley 1971). Jeffery (1993) records that the Mafinga Hills are home to a near-endemic reptile, the Nyika Dwarf Chameleon (*Chamaeleo goetzei nyikae*), and also the Nyika Dwarf Toad (*Bufo loennbergi*).

On the present trip a small puff adder (*Bitis arietans*) was seen, and numerous frogs were heard calling including Nutt's river frog *Amietia nutti* (Boulenger, 1896) and the sharp-nosed grass-frog *Ptychadena oxyrhynchus* (Smith, 1849); there is a previous photographic record of a puddle frog, which may be *Phrynobatrachus mababiensis* FitzSimons, 1932. Descriptions of a second snake seen by a guide are consistent with a bush-snake, *Philothamnus* sp., of which several species are likely present in the area. Being very overcast, cold and wet, the period there was not the most suitable for seeing cold-blooded animals.

Lepidoptera

According to Leonard (2005) there is a possibly endemic butterfly *Iolais stewarti* on the Mafingas. However, this species is also recorded from the Nyika (Alan Gardiner, pers. comm. June 2018, Congdon n.d.). Populations of the restricted-range *Pilodeudorix zelomina* are found on both the Mafingas and the nearby Makutu mountains, while *Iolais pamela*, which breeds

on *Phragmanthera* and *Erianthemum* (Loranthaceae) and which Leonard says is very local, is actually quite widespread across north-eastern Zambia (Alan Gardiner, pers. comm.). There is a species of *Lepidochrysops* taken from the Mafingas by Ivan Bampton which may be undescribed, although similar specimens have been recorded near Mutinondo some 350 km to the southwest (Alan Gardiner, pers. comm.).

A full butterfly checklist is available for the Nyika Plateau nearby (Congdon n.d.), and many of these species can be expected to occur on the Mafingas.

Orthoptera

Although both Nyika and Mbala have been reasonably well surveyed previously, there do not appear to be existing records of Orthoptera from the Mafingas. A total of 19 species of the order were recorded from the various levels of the mountain on the present trip, of which three cannot be identified from material seen or collected (immatures). Five widespread, fully flighted species were recorded in upland areas, of which the grass-mimic *Acrida coronata* Steinmann 1963, *Dnopherula cruciata* (Bolivar 1912), *Heteropternis coulouiana* (Saussure 1884) and the Nigerian Locust *Oedaleus nigeriensis* Uvarov 1926 (all true grasshoppers, family Acrididae) were abundant in montane grasslands and scrub, while the Giant Leaf Katydid *Arantia fasciata* (Walker, 1869) (family Tettigoniidae) was present only in wooded areas around streams; of these, *A. coronata*, *D. cruciata* and *A. fasciata* are essentially restricted to eastern and southern Africa, while *H. coulouiana* and *O. nigeriensis* are present over much of sub-Saharan Africa. All of these species, with the possible exception of *A. coronata*, can be found in a wide range of habitats, including relatively disturbed areas. Some of these are shown in Figure 11.

Seven flightless, range-restricted species were also recorded from Mafinga's montane grasslands:

- Chokwea bredoi* Uvarov, 1953 (Acrididae), a grasshopper so far known only from the types from Mbala;
- Acrophymus veseyi* Dirsh, 1963 (Acrididae), which is recorded across the eastern portion of Zambia and into southern Tanzania;
- Lophothericles carinatus* Descamps, 1977 (Thericleidae), recorded from Nyika and other plateaux within Malawi, but not previously confirmed from Zambia;
- Stenoscepa obscura* (Kevan, 1962) (Pyrgomorphidae), a blubber locust described from Mbala which is also recorded from southern Tanzania (with some Mbala specimens mistakenly referred to as Zimbabwean by subsequent authors);
- Ruspolia* near *R. lemairii* (Griffini, 1909) (Tettigoniidae). If conspecific with *R. lemairii*, this flightless conehead katydid is also known from types collected from an unspecified site in what is now Tanganyika Province of the D.R. Congo, but specimens seen and collected show distinct differences from Griffini's types so may prove to represent a new species;
- An undescribed species provisionally referred to *Chortoscirtes* Hemp 2010 (Tettigoniidae) but appearing to me to be intermediate between *Chortoscirtes* and the related *Melanoscirtes* Hemp 2010. A specimen will be forwarded to Dr. Hemp for confirmation and description as most described species of the East African subtribe Karniellina are extremely narrow-range endemics thus it is likely to be endemic to the Mafinga Hills;
- The armoured cricket *Enyaliopsis nyika* Glenn, 1991 (Tettigoniidae) previously only recorded from Nyika.

Of these, only *Enyaliopsis nyika* was not abundantly recorded, and only *Acrophymus veseyi* was detected on the wooded slopes, where it remained fairly conspicuous. *Chokwea bredoi*, *Ruspolia* nr. *R. lemairii* and the '*Chortoscirtes*' were primarily found on grass and continued to feed on these in captivity, while *Lophothericles carinatus* was typically found on the legume

Rhynchosia, which it continues to feed on in captivity. No foodplant was identified for the remaining species but other *Enyaliopsis* are typically omnivorous.



Figure 6. Orthoptera, Diptera and arachnids from the Mafinga uplands [all WN]. Top L, *Ruspolia* sp. nr. *R. lemairii*; top R, *Chokwea bredoi*; upper middle L, *Stenoscepa obscura*; upper middle R, *Lophothericles carinatus*; lower middle L, *Enyaliopsis nyikae*; lower middle R, *Chortoscirtes* sp. male; bottom L, *Peltacanthina mythoides*; bottom R, *Nephila senegalensis nyikae*.

A further bush-hopper, *Lophothericles burri* Descamps, 1977 (Thericleidae), was present in riparian thicket at the headwaters of the Luangwa. Although flightless, this species is distributed from northern Zimbabwe through the eastern portion of Zambia, likely entering Mozambique and Malawi. No specimens were taken and the foodplant remains unknown.

Three further species were identified from open woodland on the mountain slopes. Of these, the armoured cricket *Enyaliopsis parduspes* Glenn, 1991 (Tettigoniidae) and the painted grasshopper *Poecilocerastis striata* Ramme, 1929 are widespread in woodland and distributed areas across Katanga and much of Zambia, while the bush hopper, *Litothericles marginatus* Descamps, 1977, is known previously from type material collected at Mbala.

The three species that could not be satisfactorily identified include:- a singing grasshopper (Acrididae subfamily Gomphocerinae) of which nymphs were very common in the upper grasslands (from the small wing-scales of these nymphs, adults of this species may be flightless and could prove to be another endemic); a leaf katydid (Tettigoniidae subfamily Phaneropterinae) which appears close in structure to the flightless *Brinckiella* of South Africa, of which a single female nymph was found in seepage vegetation; and a true cricket (Gryllidae, probably subfamily Gryllinae) of which nymphs were relatively common on the wooded slopes, although no adult males usually necessary for identification of members of this family were seen or heard.

Other Invertebrates

Excluding caterpillars, nymphs, and largely unidentifiable alates of ants and termites, a further 76 species of non-orthopteran insects (25 Coleoptera, 19 Lepidoptera, 14 Diptera, 8 Hymenoptera, 7 Hemiptera, 1 Odonata and 1 Dictyoptera) were recorded on the current trip, as well as 7 spiders (Araneae), 1 non-parasitic mite (Trombidiformes), 1 harvestman (Opiliones), 2 tropical millipedes (Spirostreptida), 1 woodlouse (Isopoda) and 2 snails (Gastropoda). A full list of these is in progress. Species of note include:

Cymatura nyassica Breuning, 1935 (Coleoptera: Cerambycidae) – seemingly not previously recorded in Zambia, this species found on the wooded slopes is known from Tanzania and Malawi.

Catamerus revoili Fairmaire, 1887 (Coleoptera: Tenebrionidae) – likely to belong to subspecies *intermedius* Gahan, 1893. Adults and larvae of this darkling beetle were common and conspicuous on rocks and termite mounds. The species is widespread in southern and eastern Africa while the subspecies *intermedius* seems to be largely restricted to Zimbabwe, Eastern Zambia and Malawi. This likely hyper-parasitic species was recorded on the wooded slopes of the hills.

Exoprosopa sigmoidea Bezzi, 1912 (Diptera: Bombyliidae) – although widely recorded in Southern Africa, this bee-fly does not appear to have been previously recorded from Zambia.

Peltacanthina mythodes Hendel, 1914 (Diptera: Platystomatidae) – although widely, if patchily, recorded from sub-Saharan Africa, this species was described from Malawi, including the Nyika Plateau, so its presence at the source of the Luangwa is not unexpected, but does seem to be the first Zambian record.

Nephila senegalensis nyikae Pocock, 1898 (Araneae: Nephilidae) – although the species *Nephila senegalensis* is almost ubiquitous in sub-Saharan Africa, the subspecies *nyikae* has apparently not been recorded since its description from the Nyika Plateau in 1898. Females were fairly common on the wooded slopes, including disturbed areas.

Guruia africana (Karsch, 1878) (Opiliones; Phalangiidae) – the most widespread species of *Guruia*, this species is distributed across much of East Africa, but is not previously

recorded from Zambia, where only one other member of the order is known. It was fairly common, if usually inconspicuous, in montane grassland and scrub.

5. BOTANICAL AND CONSERVATION FINDINGS

Below some of the main botanical, ecological and conservation findings are discussed in more detail.

Ecology & Substrate

One of the most significant, and previously unreported, findings is that there are two types of grassland on the plateau at above 2000 m altitude – those on quartzite and metamorphosed fine-grained sandstone, and those on less-resistant medium- to coarse-textured sandstones or schists. The former generally consists of hard whitish rock and the terrain is gravelly with many small low rock outcrops, while the sandstone areas have a much more reddish soil, less gravel and rock outcrops are rare. This difference can also be seen on Google Earth imagery where the sandstone areas have a brownish or reddish tinge and smooth texture compared to the rougher texture and higher reflectance from the quartzite. It can also be seen at a landscape level on the ground where these sandstone areas have a more gentle, undulating relief, rather than the more jagged, rocky relief seen in quartzite areas. As in the Chimanimani Mountains, it is suspected that the quartzite soils are particularly nutrient-impooverished.

On preliminary investigation, there did not appear to be a great difference in vegetation composition between the two types of grassland, although *Xerophyta nutans* is far more common on quartzite, while the endemic *Dissotidendron lanatum* is more common on reddish sandstone-derived soils. There are also far more wet flushes as the quartzite substrate is far less permeable to rain. And any stands of bracken fern *Pteridium aquilinum* and its associated large-leaved *Vigna kirkii* are generally only found on sandstone soils. Lower down, from 1800–2000 m in the miombo woodland, *Brachystegia tamarindoides* subsp. *microphylla* seems to be associated primarily with quartzite.

Interestingly, this is a similar situation to that found in the Chimanimani Mountains on the Zimbabwe/Mozambique border, where the exceptionally high levels of plant endemism are associated almost entirely with the quartzite substrates (Wild 1964, Timberlake *et al.* 2016). What would be interesting to follow up on is (a) in an analogous situation with that on the Chimanimanis, once more comprehensive plant collecting has been undertaken are there found to be more endemic species on the Mafingas, and (b) whether the known endemics are primarily or only found on nutrient-poor quartzite substrates.

Vegetation Condition

Vegetation above 2000 m is in good condition, although fires are apparently not infrequent. The woodland from 1500–2000 m, however, has been much disturbed, at least on the southern slopes, but is still relatively intact and able to regenerate well.

The small patches of Afromontane forest above 2000 m appear to have been affected by frequent fires, often having 'hard' margins. Continued frequent fire will slowly destroy the scrubby and regenerating margins and may well lead to a diminution of forest extent.

It was not possible to determine whether the windward and wetter Malawi side of the massif had better-developed Afromontane forest, or whether grassland on the drier western side differed from that in the east. The prevailing moisture-bearing clouds come mostly from the east, from the Indian Ocean coast some 700 km away and across Lake Malawi about 80 km

away. The eastern slopes of the Mafingas should be significantly wetter than the drier western slopes.

Plant Species

A significant aspect of conservation interest is the range-restricted and endemic species, mostly plants, that are primarily found up on the grassland plateau above 2000 m altitude. Our collections did not cover all of these species (see Section 3), but certainly the near-endemic suffrutex *Protea kibarensis* subsp. *cuspidata* (also found on the Nyika Plateau but here seen only in grassland on reddish sandstone soils) and the endemic *Dissotidendron lanatum* were noted to be common, albeit localised.

Interestingly, there was little sign of miombo woodland or typical miombo species occurring on the plateau itself or above 2000 m. Whether it is just too cold, or whether this is due to poorer drainage conditions, is not known. Google Earth imagery shows that most miombo occurs up to 1900 m altitude, but small patches can be seen on the plateau margin up to 2150 m.

On some of the quartzite outcrops small, stunted, small-leaved *Podocarpus elongatus* trees are seen, which appear similar to those seen in similar situations on the Chimanimani Mountains. This is possibly a new taxon, but *Podocarpus* taxonomy remains unclear. What is new is a species of *Streptocarpus*, a herb found in quartzite crevices. This is unmatched with other species, but more material is required.

Effects of Fire

Fire seems to be the most significant threat to biodiversity and provision of ecosystem services up on the plateau. Although many grassland and scrub species can withstand it, a high frequency (say, any particular area burning more often than once every three or four years) is likely to shift composition towards fire-tolerant and fire-resistant species, hence some interesting but fire-sensitive species (possibly including some of the endemics) could be lost. It was interesting to note that nearly all plants of *Xerophyta nutans* had clear fire scars; the species itself is fire-tolerant.

Frequent fires seem to have reduced available standing plant biomass across the grasslands which may have caused, especially in the quartzite areas, a loss of humus and soil leading to more exposed rock and much more rapid runoff. It was notable that in heavy rains runoff from the quartzite areas was significantly higher than that from grassland on sandstone/gneiss. This reduces the integrity and value of the area as a catchment for the upper Luangwa River, as there is more rapid run-off and lesser storage capacity.

Where there is a forest patch, the soils are significantly more humus-rich and far better drained. Loss of extent of such patches will also reduce the moisture storage capacity of the plateau.

Conservation Issues

As stated above, high fire frequency is probably the biggest single threat to both biodiversity and provision of ecosystem services on the Mafinga plateau. Fire itself is undoubtedly natural, and plants and vegetation have evolved with it, but the present high frequency is man-made. The cause of fires is probably local people setting fire to the grass in order to provide a green flush for grazing cattle, or possibly to flush out mammals for hunting.

Cattle were seen to be grazing in the miombo woodland on the slopes, and some dung was seen across the grasslands. However, the grazing pressure does not seem high; not surprising as the quality of grasses is quite poor. The presence of cattle up in the open grasslands and without

herders (they are rounded up and brought down to the village only every two or three weeks, Mwandila, pers. comm.) also suggests a lack of any large predators.

Of particular note is the lack of large mammals up on the top. Given the sourveld grasses that dominate up there, the plateau probably never had great carrying capacity, or perhaps grass composition has been altered by repeated fire, but it would be interesting to look more closely at animal-plant interactions, particularly seed dispersal, to better understand any long-term impacts on the woody vegetation and general ecology.

Up on the plateau no evidence was seen of harvesting of plants, such as tree cutting, but this practice was not uncommon in miombo woodland lower down (at least on the southern slopes). Small patches of coppice were noted, obviously after clearance many years previously, and the occasional tree of *Pericopsis angolensis* had been cut to make bee-hives.

6. CONSERVATION RECOMMENDATIONS

1. As a high fire frequency is probably the main conservation issue on the Mafingas, efforts should be made to try and reduce fire frequency across the plateau grasslands, probably in the form of awareness-raising and education among the surrounding villages. It is not suggested that firebreaks are cut or any early-burning measures taken.
2. The ecotourism potential of the massif should be built upon. On both sides there are gazetted Forest Reserves, so the two Forest Departments are probably a good place to start. Access is realistically easier and quicker from the Malawi side, so perhaps some form of cross-border or joint-management between the Zambian and Malawi authorities is required. Access from the Zambian side would be much easier if the road being built from Isoka was resumed. If this happened, it would be useful to have a tourism presence from both the local livelihoods and biodiversity conservation perspectives.
3. Thought could be given to the construction and maintenance of one or two small wooden rest-huts at suitable locations on the plateau, similar to those seen on Mt Mulanje. These would not necessarily need to be manned or furnished. Such provision would encourage more national and international visitors as camping is not easy in the area, with not many sheltered places. It would also help facilitate formal and informal monitoring of illegal offtake activities.
4. A more comprehensive survey should be done of the plants of the area with particular reference to (a) range-restricted species and those of conservation concern, (b) Afromontane forest patches, and (c) riparian forests coming off the plateau. This is likely to turn up some new and endemic species, and may also identify species vulnerable to other threats (e.g. loss of pollinators or seed dispersers). The upper reaches of Mulangale Forest on the western flanks should also be of interest.
5. A comprehensive bird checklist has recently become available, but surveys looking at other species groups are now required, particularly reptiles and amphibians, butterflies and small mammals. For larger mammals a suitable survey time might be just before the rains when animals are concentrated near water sources. Once complete these surveys should be published and made more widely available, perhaps a special part of the Journal of Science & Technology (Zambia) or some other local or regional journal such as Kirkia.

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ANNEX 1. PRELIMINARY PLANT CHECKLIST FOR THE MAFINGA MOUNTAINS

Records are taken from Fanshawe (1973) – although no specimen citations are available – and collections made on the present trip. All specimens from 2018 identified by Kaj Vollesen, with the assistance of Nicholas Wightman (orchids). Nomenclature follows the African Plants Database and current usage at RBG Kew.

Species / Family	Fanshawe types							WESZ study	NOTES
	1.A1	1.A2	1.A3	1.B	2.1	3.1	3.2		
PTERIDOPHYTES									
Blechnaceae									
<i>Blechnum tabulare</i> (Thunb.) Kuhn				X				LM2361	
Cyatheaceae									
<i>Cyathea dregei</i> Kunze (=C. dregeana)				X					
<i>Cyathea manniana</i> Hook.				X					
Dennstaedtiaceae									
<i>Pteridium aquilinum</i> (L.) Kuhn subsp. centrali-africanum <i>Hieron</i> (=P. aquilinum)			X		X	X		s.r.	
Gleicheniaceae									
<i>Dicranopteris linearis</i> (Burm.f.) Underw.		X							
Marattiaceae									
<i>Ptisana fraxinea</i> (Sm.) Murdock (=Marattia fraxinea)				X					
Osmundaceae									
<i>Osmunda regalis</i> L.				X					
Polypodiaceae									
<i>Pleopeltis macrocarpa</i> (Willd.) Kaulf.								LM2409	
Pteridaceae									
<i>Cheilanthes inaequalis</i> (Kunze) Mett.								LM2342	
<i>Cheilanthes multifida</i> (Sw.) Sw.								LM2388	
GYMNOSPERMS									
Podocarpaceae									
<i>Podocarpus milanjanus</i> Rendle		X							
<i>Podocarpus elongatus</i> (Aiton) Pers.								JT6225, PS2075	
DICOTYLEDONS									
Acanthaceae									
<i>Blepharis buchneri</i> S.Moore	X								
<i>Dicliptera maculata</i> Nees subsp. maculata (=D. lingulata)		X							
<i>Hypoestes aristata</i> (Vahl) Roem. & Schult.				X					
<i>Hypoestes forskalii</i> (Vahl) Roem. & Schult. (=H. verticillaris)		X			X				
<i>Isoglossa strigosula</i> C.B. Clarke		X							
<i>Justicia nuttii</i> C.B. Clarke								LM2389	
<i>Justicia nyassana</i> Lindau				X					
<i>Mellera nyassana</i> S.Moore		X							
<i>Monechma</i> sp. (DF 11,966)				X					
Achariaceae									
<i>Rawsonia lucida</i> Harv. & Sond.		X							
Amaranthaceae									
<i>Achyranthes aspera</i> L.	X								

<i>Gymnanthemum myrianthum</i> (<i>Hook.f.</i>) <i>H.Rob.</i> (= <i>Vernonia myriantha</i> , <i>V. ampla</i>)			X					
<i>Helichrysum cymosum</i> (<i>L.</i>) <i>Less.</i>	X		X					
<i>Helichrysum densiflorum</i> <i>Oliv.</i>			X				MP28a	
<i>Helichrysum kirkii</i> <i>Oliv. & Hiern</i> var. <i>kirkii</i>					X	X		
<i>Helichrysum mechowianum</i> <i>Klatt</i> var. <i>ceres</i> (<i>S.Moore</i>) <i>Beentje</i> (=H. <i>ceres</i>)						X		
<i>Helichrysum milne-redheadii</i> <i>Brenan</i>						X		
<i>Helichrysum nitens</i> <i>Oliv. & Hiern</i>							PS2098	
<i>Helichrysum odoratissimum</i> (<i>L.</i>) <i>Sweet</i>	X		X		X			
<i>Helichrysum tillandsiifolium</i> <i>O.Hoffm.</i>							JT6228, LM2393	
<i>Helinus mystacinus</i> (<i>Aiton</i>) <i>Steud.</i>		X						
<i>Inula glomerata</i> <i>Oliv. & Hiern</i>			X					
<i>Laggera brevipes</i> <i>Oliv. & Hiern</i> (=Blumea <i>brevipes</i>)	X							
<i>Microglossa pyrifolia</i> (<i>Lam.</i>) <i>Kuntze</i>	X		X					
<i>Mikania carteri</i> <i>Baker</i> (=M. <i>cordata</i>)	X		X					
<i>Mikaniopsis tanganyikensis</i> (<i>R.E.Fr.</i>) <i>Milne-Redh.</i>			X					
<i>Nidorella spartioides</i> (<i>O.Hoffm.</i>) <i>Cronq.</i>						X	LM2371	
<i>Oocephala stenocephala</i> (<i>Oliv.</i>) <i>H.Rob.</i> (=Vernonia <i>stenocephala</i>)					X			
<i>Pleiotaxis pulcherrima</i> <i>Steetz</i>					X			
<i>Polydora bainesii</i> (<i>Oliv. & Hiern</i>) <i>H.Rob.</i> (=Vernonia <i>bainesii</i>)						X		
<i>Polydora chloropappa</i> (<i>Baker</i>) <i>H.Rob.</i> (=Vernonia <i>chloropappa</i>)					X			
<i>Polydora poskeana</i> (<i>Vatke & Hildebr.</i>) <i>H.Rob.</i> (=Vernonia <i>poskeana</i> subsp. <i>poskeana</i>)						X		
<i>Schistostephium artemisifolium</i> <i>Baker</i>					X	X		
<i>Senecio angulatus</i> (<i>Vahl</i>) <i>C.Jeffrey</i> (=S. <i>bojeri</i>)	X							
<i>Senecio proprior</i> <i>S.Moore</i>							LM2347	
<i>Solanecio mannii</i> (<i>Hook.f.</i>) <i>C.Jeffrey</i> (=Senecio <i>mannii</i>)	X		X	X				
<i>Stomatanthes africanus</i> (<i>Oliv. & Hiern</i>) <i>R.M.King & H.Rob.</i> (=Eupatorium <i>africanum</i>)						X	LM2338	
<i>Vernonia bellinghamii</i> <i>S.Moore</i>					X	X		
<i>Vernonia polysphaera</i> <i>Baker</i>					X			
Balsamaceae								
<i>Impatiens assurgens</i> <i>Baker</i>							PS2087, LM2356	
<i>Impatiens eryaleia</i> <i>Launert</i>							PS2068	1st Zam record
Bignoniaceae								
<i>Stereospermum kunthianum</i> <i>Cham.</i>	X							
<i>Tecomaria capensis</i> (<i>Thunb.</i>) <i>Spach</i> subsp. <i>nyassae</i> (<i>Oliv.</i>) <i>Brummitt</i>	X		X				PS2083	
Cannabaceae								
<i>Celtis africana</i> <i>Burm.f.</i>		X						
Caryophyllaceae								
<i>Silene burchellii</i> <i>Oth</i>							PS2085	
Celastraceae								
<i>Mystroxyton aethiopicum</i> (<i>Thunb.</i>) <i>Loes.</i> (=Cassine <i>aethiopica</i>)				X				
Chrysobalanaceae								
<i>Parinari curatellifolia</i> <i>Benth.</i>					X			
<i>Parinari excelsa</i> <i>Sabine</i>		X					MS535	

Clusiaceae									
<i>Garcinia huillensis Oliv.</i>			X						
<i>Garcinia kingaensis Engl. (=G. mlanjiensis)</i>		X							
<i>Garcinia smeathmannii (Planch. & Triana) Oliv.</i>		X							
<i>Garcinia volkensii K.Schum. subsp. spatulifolia (Stapf & Hutch.) Verdc. (=G. volkensii)</i>		X							
<i>Harungana madagascarensis Poir.</i>	X		X						
<i>Psorospermum febrifugum Spach</i>						X			
Combretaceae									
<i>Combretum molle G.Don</i>						X			
Connaraceae									
<i>Agelaea pentagyna (Lam.) Baill. (=A. ugandensis)</i>		X							
Convolvulaceae									
<i>Ipomoea alpina Rendle</i>								LM2408	
Crassulaceae									
<i>Crassula alba Forssk.</i>								PS2105, LM2389	1st Zam record
<i>Crassula vaginata Eckl. & Zeyh.</i>								JT6214	
Dipterocarpaceae									
<i>Monotes africanus (Welw.) A.DC.</i>						X			
Ebenaceae									
<i>Diospyros abyssinica (Hiern) F.White subsp. abyssinica</i>		X							
<i>Diospyros hoyleana F.White</i>		X							
<i>Diospyros whyteana (Hiern) F.White</i>		X	X						
<i>Euclea crispa (Thunb.) Gürke (=E. dekintii)</i>							X		
<i>Euclea racemosa Murray subsp. schimperi (A.DC.) F.White (=E. schimperi)</i>		X							
Ericaceae									
<i>Agarista salicifolia (Lam.) G.Don</i>			X					JT6209, PS2076	
<i>Erica benguelensis (Engl.) E.G.H.Oliv. (=Philippia benguelensis)</i>			X			X		JT6218, PS2081	
<i>Erica mannii (Hook.f.) Beentje subsp. pallidiflora (Engl.) E.G.H.Oliv. (=Philippia pallidiflora)</i>						X			
<i>Erica silvatica (Engl.) Beentje (=Blacteria patula)</i>							X	MS555	
<i>Ericinella microdonta (C.H.Wright) Alm & T.C.E.Fr.</i>							X		
Euphorbiaceae									
<i>Acalypha psilostachya A.Rich.</i>	X	X	X	X					
<i>Euphorbia sp., possibly E. depauperata A.Rich.</i>								JT6202	
<i>Macaranga capensis (Baill.) Sim var. kilimandscharica (Pax) Friis & M.G.Gilbert (=M. kilimandscharica)</i>		X						s.r.	
<i>Shirakiopsis elliptica (Hochst.) Esser (=Sapium ellipticum)</i>						X			
<i>Tragia benthamii Baker</i>	X								
Gelsemiaceae									
<i>Mostuea brunonis Didr.</i>		X							
Geraniaceae									
<i>Pelargonium luridum (Andr.) Sweet</i>								LM2367	
Gesneriaceae									
<i>Streptocarpus sp. nov.?</i>								LM2397	
Hypericaceae									
<i>Hypericum quartinianum A.Rich.</i>			X	X					

<i>Pterolobium stellatum</i> (<i>Forssk.</i>) <i>Brenan</i>				X					
Leg.: Mimosoideae									
<i>Acacia abyssinica</i> <i>Benth.</i>	X							s.r.	
<i>Albizia antunesiana</i> <i>Harms</i>					X				
<i>Albizia gummifera</i> (<i>J.F.Gmel.</i>) <i>C.A.Sm.</i>		X	X						
<i>Dichrostachys cinerea</i> (<i>DC.</i>) <i>Wight & Arn.</i>					X				
<i>Entada abyssinica</i> <i>A.Rich.</i>	X								
<i>Newtonia buchananii</i> (<i>Baker f.</i>) <i>G.C.C.Gilbert & Boutique</i>		X							
<i>Parkia filicoidea</i> <i>Oliv.</i>					X				
Leg.: Papilionoideae									
<i>Aeschynomene bracteosa</i> <i>Baker</i>					X				
<i>Aeschynomene oligophylla</i> <i>Harms</i>						X			
<i>Aeschynomene rubrofarinacea</i> (<i>Taub.</i>) <i>F.White</i>					X	X			
<i>Aeschynomene schliebenii</i> <i>Harms</i>			X		X	X		MS sn	
<i>Aeschynomene semilunaris</i> <i>Hutch.</i>						X			
<i>Aeschynomene sparsiflora</i> <i>Baker</i> (=DF 11,970)						X			
<i>Argyrobium rupestre</i> (<i>E.Mey.</i>) <i>Walp.</i> subsp. <i>aberdaricum</i> (<i>Harms</i>) <i>Polhill</i>								LM2387	
<i>Crotalaria grandistipulata</i> <i>Harms</i>	X					X			
<i>Crotalaria subcapitata</i> <i>De Wild.</i>	X								
<i>Dalbergia arbutifolia</i> <i>Baker</i>					X				
<i>Dalbergia lactea</i> <i>Vatke</i>		X							
<i>Dalbergia nitudula</i> <i>Baker</i>						X			
<i>Desmodium barbatum</i> (<i>L.</i>) <i>Benth.</i>						X			
<i>Desmodium repandum</i> (<i>Vahl</i>) <i>DC.</i>		X							
<i>Dolichos kilimandscharicus</i> <i>Taub.</i>							X		
<i>Dolichos pseudocomplanatus</i> <i>R.Wilczek</i>	X					X			
<i>Dumasia villosa</i> <i>DC.</i>		X							
<i>Eriosema buchananii</i> <i>Baker f.</i>								PS2094, LM2373	
<i>Eriosema ellipticum</i> <i>Baker</i> (=E. ellipticus)						X			
<i>Eriosema flexuosum</i> <i>Staner</i>								JT6227, LM2392	
<i>Eriosema lebrunii</i> <i>Staner</i>								LM2374	1st Zam record
<i>Eriosema nutans</i> <i>Schinz</i>	X								
<i>Erythrina abyssinica</i> <i>DC.</i>						X			
<i>Humularia bequaertii</i> (<i>De Wild.</i>) <i>Duvign.</i>						X			
<i>Indigofera arrecta</i> <i>A.Rich.</i>						X			
<i>Indigofera emarginelloides</i> <i>J.B.Gillett</i>						X			
<i>Indigofera patula</i> <i>Baker</i>								JT6223, LM2380	
<i>Indigofera podocarpa</i> <i>Baker f. & Martin</i>	X								
<i>Indigofera rumphiensis</i> <i>Schrire</i>								MS567	
<i>Indigofera schliebenii</i> <i>Harms</i> (=I. sp. DF 11,938)						X			
<i>Indigofera subcorymbosa</i> <i>Baker</i>	X		X						
<i>Indigofera sutherlandioides</i> <i>Baker</i>	X								
<i>Kotschya uguenensis</i> (<i>Taub.</i>) <i>F.White</i>			X					JT6204	1st Zam record
<i>Lotus discolor</i> <i>E.Mey.</i>	X								
<i>Lotus goetzei</i> <i>Harms</i>								LM2340	1st Zam record
<i>Mucuna pruriens</i> (<i>L.</i>) <i>DC.</i> var. <i>pruriens</i>	X								
<i>Mucuna stans</i> <i>Baker</i>						X			

<i>Neoboutonia melleri</i> (<i>Müll.Arg.</i>) <i>Prain</i> (=N. africana)		X							
<i>Pseudarthria hookeri</i> <i>Wight & Arn.</i>								MS569	
<i>Neorautanenia mitis</i> (<i>A.Rich.</i>) <i>Verdc.</i>	X				X				
<i>Rhynchosia clivorum</i> <i>S.Moore</i>	X		X						
<i>Sesbania sesban</i> (<i>L.</i>) <i>Merr.</i> var. <i>nubica</i> <i>Chiov.</i>					X				
<i>Tephrosia aequilata</i> <i>Baker</i> subsp. <i>aequilata</i>						X		JT6201, PS2080, PS2097	
<i>Tephrosia interrupta</i> <i>Engl.</i>						X			
<i>Vigna kirkii</i> (<i>Baker</i>) <i>Gillett</i>								JT6226, LM2383	
Lobeliaceae									
<i>Cyphia mafingensis</i> <i>Thulin</i>								PS2070	1st Zam record
<i>Lobelia giberroa</i> <i>Hemsl.</i>		X		X					
Loganiaceae									
<i>Polyscias fulva</i> (<i>Hiern</i>) <i>Harms</i>		X	X						
<i>Strychnos cocculoides</i> <i>Baker</i>						X			
<i>Strychnos innocua</i> <i>Delile</i>						X			
<i>Strychnos lucens</i> <i>Baker</i>		X							
<i>Strychnos pungens</i> <i>Solered.</i>						X			
Malvaceae									
<i>Abutilon englerianum</i> <i>Ulbr.</i>			X						
<i>Abutilon longicuspe</i> <i>A.Rich.</i>			X						
<i>Azanza garekeana</i> (<i>F.Hoffm.</i>) <i>Exell & Hillc.</i>	X								
<i>Hibiscus mechowii</i> <i>Garcke</i>	X								
<i>Hibiscus shirensis</i> <i>Sprague & Hutch.</i>			X						
<i>Urena lobata</i> <i>L.</i>			X						
Melastomataceae									
<i>Dissotidendron lanatum</i> (<i>A. & R.Fern.</i>) <i>Ver.-Lib. & Kadereit</i> (=Dissotis lanata)						X		JT6211, PS2062	
<i>Dissotis princeps</i> (<i>Kunth</i>) <i>Triana</i>	X		X					MS549	
<i>Memecylon flavovirens</i> <i>Baker</i>						X			
Meliaceae									
<i>Ekebergia benguelensis</i> <i>C.DC.</i>						X			
<i>Ekebergia capensis</i> <i>Sparmm.</i>		X							
<i>Entandrophragma excelsum</i> (<i>Dawe & Sprague</i>) <i>Sprague</i>	X								
<i>Lepidotrichilia volkensisii</i> (<i>Gürke</i>) <i>Leroy</i>			X						
Melanthaceae									
<i>Bersama abyssinica</i> <i>Fresen.</i>		X							
Menispermaceae									
<i>Cissampelos torulosa</i> <i>Harv.</i>		X							
<i>Stephania abyssinica</i> (<i>Quart.-Dill. & A.Rich.</i>) <i>Walp.</i> var. <i>abyssinica</i>	X	X							
<i>Tiliacora funifera</i> (<i>Miers</i>) <i>Oliv.</i>	X	X							
Moraceae									
<i>Ficus sur</i> <i>Forssk.</i> (=F. capensis)						X		s.r.	
Myricaceae									
<i>Morella salicifolia</i> (<i>A.Rich.</i>) <i>Verdc. & Polhill</i> subsp. <i>kilimandscharica</i> (<i>Engl.</i>) <i>Verdc. & Polhill</i> (=Myrica salicifolia)			X		X			PS2078	
Myrtaceae									
<i>Syzygium cordatum</i> <i>C.Krauss</i>					X				

<i>Syzygium guineense</i> (Willd.) DC. subsp. <i>afromontanum</i> <i>F. White</i>	X							
<i>Syzygium guineense</i> (Willd.) DC. subsp. <i>macrocarpum</i> (Engl.) <i>F. White</i>				X				
Ochnaceae								
<i>Ochna confusa</i> <i>Burt Davy & Greenway</i>				X			?JT6217	
<i>Ochna holstii</i> <i>Engl.</i>	X							
<i>Ochna puberula</i> <i>N. Robson</i>		X						
<i>Ochna schweinfurthiana</i> <i>F. Hoffm.</i>				X				
Olacaceae								
<i>Olax obtusifolia</i> <i>De Wild.</i>				X				
Oleaceae								
<i>Jasminum abyssinicum</i> <i>DC.</i>	X							
<i>Jasminum streptopus</i> <i>E. Mey.</i>				X				
<i>Olea capensis</i> <i>L.</i> subsp. <i>macrocarpa</i> (<i>C.H. Wright</i>) <i>I. Verd.</i> (= <i>O. capensis</i>)	X							
<i>Schrebera alata</i> (<i>Hochst.</i>) <i>Welw.</i>	X							
Opiliaceae								
<i>Opilia amentacea</i> <i>Roxb.</i> (= <i>O. celtidifolia</i>)	X							
Orobanchaceae								
<i>Buchnera crassifolia</i> <i>Engl.</i>								
<i>Buchnera nitida</i> <i>Skan</i>							FZ record	
<i>Buchnera speciosa</i> <i>Skan</i>				X			FZ record	
Oxalidaceae								
<i>Oxalis semiloba</i> <i>Sond.</i>							LM2396	
Pedaliaceae								
<i>Sesamum angolense</i> <i>Welw.</i>	X							
Penaceae								
<i>Olinia rochetiana</i> <i>Juss.</i> (= <i>O. usambarensis</i>)				X				
Peraceae								
<i>Clutia abyssinica</i> <i>Jaub. & Spach</i>	X	X						
Phyllanthaceae								
<i>Bridelia duvigneaudii</i> <i>J. Léonard</i>				X				
<i>Bridelia micrantha</i> (<i>Hochst.</i>) <i>Baill.</i>			X					
<i>Phyllanthus mafingensis</i> <i>Radcl.-Sm.</i>							FZ record	
<i>Phyllanthus parvus</i> <i>Hutch.</i>							LM2358	
<i>Pseudolachnostylis maprouneifolia</i> <i>Pax</i>				X				
<i>Uapaca kirkiana</i> <i>Müll. Arg.</i>				X			s.r.	
<i>Uapaca nitida</i> <i>Müll. Arg.</i> var. <i>nitida</i>				X				
<i>Uapaca robynsii</i> <i>De Wild.</i>		X	X				s.r.	
Piperaceae								
<i>Piper capense</i> <i>L.f.</i> var. <i>brachyrhachis</i> (<i>C.H. Wright</i>) <i>Verdc.</i> (= <i>P. brachyrhachis</i>)	X							
Polygalaceae								
<i>Polygala nyikensis</i> <i>Exell</i>							PS2093, LM2394	
<i>Polygala virgata</i> <i>Thunb.</i>		X						
<i>Securidaca longepedunculata</i> <i>Fresen.</i>				X				
Polygonaceae								
<i>Rumex abyssinicus</i> <i>Jacq.</i>							LM2403	
Primulaceae								
<i>Embelia schiperi</i> <i>Vatke</i>				X				

<i>Maesa lanceolata</i> Forssk.				X					
<i>Myrsine africana</i> L.		X							
<i>Rapanea melanophloeos</i> (L.) Mez.			X						
Proteaceae									
<i>Faurea intermedia</i> Engl. & Gilg					X				
<i>Faurea rochetiana</i> (A.Rich.) Pic.-Serm. (=F. speciosa)					X				
<i>Faurea saligna</i> Harv.			X	X	X			MP40	
<i>Protea angolensis</i> Welw. var. <i>divaricata</i> (Engl. & Gilg) Beard					X			JT6208, PS2100	
<i>Protea heckmanniana</i> Engl. subsp. <i>heckmanniana</i>						X		FZ record	
<i>Protea kibarensis</i> Hauman subsp. <i>cuspidata</i> (Beard) Chisumpa & Brummitt								JT6232, PS2099	
<i>Protea madiensis</i> Oliv.			X			X			
<i>Protea mafingensis</i> (Chisumpa & Brummitt) Beard								FZ record	
<i>Protea petiolaris</i> (Hiern) Baker & C.H.Wright					X	X			
<i>Protea rupestris</i> R.E.Fr.					X	X			
<i>Protea welwitschii</i> Engl.						X			
<i>Protea wentzeliana</i> Engl.						X			
Ranunculaceae									
<i>Clematis brachiata</i> Thunb.	X								
<i>Clematis villosa</i> DC. subsp. <i>villosa</i> (=Clematopsis scabiosifolia)	X							LM2377	
<i>Thalictrum rhynchocarpum</i> A.Rich.		X							
Rhamnaceae									
<i>Gouania longispicata</i> Engl.		X							
<i>Scutia myrtina</i> (Burm.f.) Kurz			X						
Rhizophoraceae									
<i>Cassipourea gummiflua</i> Tul.		X							
<i>Cassipourea malosana</i> (Baker) Alston (=C. congensis)		X							
<i>Cassipourea mollis</i> (R.E.Fr.) Alston						X			
Rosaceae									
<i>Prunus africana</i> (Hook.f.) Kalkman					X				
<i>Rubus apetalus</i> Poir. var. <i>apetalus</i>	X	X	X						
Rubiaceae									
<i>Anthospermum ternatum</i> Hiern subsp. <i>randii</i> (S.Moore) Puff (=A. erectum)						X			
<i>Anthospermum welwitschii</i> Hiern			X						
<i>Anthospermum whyteanum</i> Britten								LM2362	
<i>Breonadia salicina</i> (Vahl) Hepper & J.R.I. Wood (=Adina microcephala)					X				
<i>Chassalia cristata</i> (Hiern) Bremek.		X							
<i>Craterispermum schweinfurthii</i> Hiern (=C. laurinum)					X				
<i>Fadogia arenicola</i> K.Schum. & K.Krause						X			
<i>Fadogia homblei</i> De Wild. (=F. monticola)						X			
<i>Fadogia stenophylla</i> Hiern var. <i>odorata</i> (K.Krause) Verdc. (=E. odorata)							X		
<i>Fadogia triphylla</i> Baker var. <i>giorgi</i> (De Wild.) Verdc. (=F. giorgii)						X			
<i>Fadogiella stigmatoloba</i> (K.Schum.) Robyns						X			
<i>Galium stenophyllum</i> Baker								PS2103, LM2401	
<i>Gardenia imperialis</i> K.Schum. subsp. <i>imperialis</i>					X				
<i>Gardenia subacaulis</i> Stapf & Hutch.						X			

<i>Hedythyrus spermacocinus</i> (<i>K.Schum.</i>) <i>Bremek.</i>						X			
<i>Hedythyrus thamnoides</i> (<i>K.Schum.</i>) <i>Bremek.</i>							PS2065, LM2364		
<i>Hymenodictyon floribundum</i> (<i>Hochst.& Steud.</i>) <i>B.L.Rob.</i>			X						
<i>Keetia venosa</i> (<i>Oliv.</i>) <i>Bridson</i> (=Canthium venosum)		X							
<i>Leptactina benguelensis</i> (<i>Hook.f.</i>) <i>R.D.Good</i>						X			
<i>Mussaenda arcuata</i> <i>Poir.</i>					X				
<i>Mutidentia crassa</i> <i>Bridson & Verdc.</i> (=Canthium crassum)						X			
<i>Oldenlandia</i> sp.							LM2348		
<i>Otiophora parviflora</i> <i>Verdc.</i>							LM2334		
<i>Otiophora scabra</i> <i>Zucc.</i> subsp. <i>diffusa</i> (<i>Verdc.</i>) <i>Puff</i>						X			
<i>Pachystigma pygmaeum</i> (<i>Schltr.</i>) <i>Robyns</i>						X	X		
<i>Pavetta crassipes</i> <i>K.Schum.</i>						X			
<i>Pavetta schumanniana</i> <i>K.Schum.</i>						X			
<i>Pentas herbacea</i> (<i>Hiern</i>) <i>K.Schum.</i>	X								
<i>Pentas schimperi</i> (<i>Hochst.</i>) <i>Wieringa</i> subsp. <i>schimperi</i> (=P. schimperiana)			X						
<i>Phyllopentas schimperiana</i> (<i>A.Rich.</i>) <i>Kårehed & B.Bremer</i>							PS2102, LM2400		
<i>Psychotria djumaensis</i> <i>De Wild.</i> var. <i>zambesiaca</i> <i>E.M.A.Petit</i>			X						
<i>Psychotria eminiana</i> (<i>Kuntze</i>) <i>Petit</i> var. <i>eminiana</i>						X			
<i>Psychotria kirkii</i> <i>Hiern</i>						X	X		
<i>Psychotria peduncularis</i> (<i>Salisb.</i>) <i>Steyerm.</i> (=Cephaelis peduncularis)					X				
<i>Psychotria succulenta</i> (<i>Hiern</i>) <i>Petit</i>		X							
<i>Psydrax kraussioides</i> (<i>Hiern</i>) <i>Bridson</i> (=Canthium henriquesianum)					X				
<i>Psydrax livida</i> (<i>Hiern</i>) <i>Bridson</i> (=Canthium huillense)			X						
<i>Rothmannia engleriana</i> (<i>K.Schum.</i>) <i>Keay</i>						X			
<i>Rothmannia fischeri</i> (<i>K.Schum.</i>) <i>Bullock</i> subsp. <i>fischeri</i>		X							
<i>Rutidea fuscescens</i> <i>Hiern</i>					X				
<i>Rytigynia adenodonta</i> (<i>K.Schum.</i>) <i>Robyns</i> var. <i>adenodonta</i>							FZ record		
<i>Rytigynia monantha</i> (<i>K.Schum.</i>) <i>Robyns</i>							PS2079		
<i>Spermacoce dibrachiata</i> <i>Oliv.</i>							PS2106, LM2379		
<i>Spermacoce samfya</i> <i>Verdc.</i>							PS2088	2nd record	
<i>Tarena pavetoides</i> (<i>Harv.</i>) <i>Sim</i> subsp. <i>gillmanii</i> <i>Bridson</i>		X							
<i>Tricalysia pallens</i> <i>Hiern</i> (=T. myrtifolia)		X							
Rutaceae									
<i>Clausena anisata</i> (<i>Willd.</i>) <i>Benth.</i>		X	X						
<i>Toddalia asiatica</i> (<i>L.</i>) <i>Lam.</i>			X						
<i>Vepris nobilis</i> (<i>Delile</i>) <i>W.Mziray</i> (=Teclea nobilis)		X							
Rutaceae									
<i>Dovyalis macrocalyx</i> (<i>Oliv.</i>) <i>Warb.</i>		X							
<i>Flacourtia indica</i> (<i>Burm.f.</i>) <i>Merr.</i>						X			
Santalaceae									
<i>Osyris compressa</i> (<i>P.J.Berg.</i>) <i>A.DC.</i>			X	X					
<i>Osyris lanceolata</i> <i>Hochst. & Steud.</i>							PS2077		

<i>Thesium fastigiatum</i> A.W.Hill						X	PS2070, LM2357, LM2372	
Sapindaceae								
<i>Allophylus africanus</i> P.Beauv.				X				
<i>Allophylus chaunostachys</i> Gilg			X					
<i>Dodonaea viscosa</i> Jacq.			X	X				
<i>Pancovia golungensis</i> (Hiern) Exell & Mendonça		X						
Sapotaceae								
<i>Chrysophyllum gorungosanum</i> Engl.		X						
<i>Englerophytum magalismontanum</i> (Sond.) T.D.Penn. (= <i>Chrysophyllum magalismontanum</i>)		X		X			s.r.	
Scrophulariaceae								
<i>Crepidiorhpalon rupestris</i> (Engl.) Eb.Fisch.							JT6207, PS2064, LM2337	
<i>Hebenstretia angolensis</i> Rolfe							MS545	
<i>Hebenstretia dentata</i> L.					X	X		
<i>Sopubia mannii</i> Skan					X		JT6231	
<i>Sopubia simplex</i> (Hochst.) Hochst.						X		
Sladeniaceae								
<i>Ficalhoa laurifolia</i> Hiern		X						
Solanaceae								
<i>Solanum aculeatissimum</i> Jacq.			X					
<i>Solanum rohrii</i> C.H.Wright (=S. indicum subsp. rohrii)			X					
Sterculiaceae								
<i>Dombeya burgessiae</i> Harv. (=D. lasiostylis)			X					
<i>Dombeya torrida</i> (J.F.Gmel.) Bamps subsp. erythroleuca (K.Schum.) Seyani (=D. erythroleuca)			X					
<i>Triumfetta dekindtiana</i> Engl.					X			
<i>Triumfetta tomentosa</i> Bojer	X		X					
Stilbaceae								
<i>Nuxia floribunda</i> Benth.			X					
Thymelaeaceae								
<i>Craterosiphon scandens</i> Engl. & Gilg			X					
<i>Gnidia buchananii</i> Gilg					X			
<i>Gnidia glauca</i> (Fresen.) Gilg			X					
<i>Gnidia kraussiana</i> Meisn.						X		
<i>Peddiea fischeri</i> Engl.		X					LM2368	
Ulmaceae								
<i>Trema orientalis</i> (L.) Blume			X					
Urticaceae								
<i>Myrianthus holstii</i> Engl.		X						
Verbenaceae								
<i>Lippia baumii</i> Gürke var. nyassensis R.Fern.							PS2096, LM2398	1st Zam record
<i>Lippia javanica</i> (Burm.f.) Spreng.	X		X					
<i>Lippia plicata</i> Baker	X		X					
<i>Rothea myricoides</i> (Hochst.) D.A.Steane & Mabb. subsp. myricoides (=Clerodendrum myricoides)					X			
Vitaceae								
<i>Cyphostemma vandenbrandeanum</i> (DeWit) Wild & R.B.Drumm.							PS2074	

<i>Rhoicissus tridentata</i> (<i>L.f.</i>) <i>Wild & R.B.Drumm.</i>		X						
<i>Vitex madiensis</i> <i>Oliv.</i> subsp. <i>madiensis</i>					X			
Ximeniaceae								
<i>Ximenia americana</i> <i>L.</i> var. <i>americana</i>					X			
MONOCOTYLEDONS								
Anthericaceae								
<i>Chlorophytum pusillum</i> <i>Baker</i> vel. sp. aff.							LM2407	
<i>Chlorophytum cameroonii</i> (<i>Baker</i>) <i>Kativu</i> var. <i>pteroaulon</i> (<i>Baker</i>) <i>Nordal</i>							NN01	
<i>Chlorophytum colubrinum</i> (<i>Baker</i>) <i>Engl.</i>							LM2384	
<i>Chlorophytum sphacelatum</i> (<i>Baker</i>) <i>Kativu</i> var. <i>milanjianum</i> (<i>Rendle</i>) <i>Nordal</i>							LM2350	
Arecaceae								
<i>Raphia farinifera</i> (<i>Gaertn.</i>) <i>Hyl.</i>				X				
Asparagaceae								
<i>Asparagus africanus</i> <i>Lam.</i>					X			
<i>Asparagus racemosus</i> <i>Willd.</i>					X			
<i>Asparagus setaceus</i> (<i>Kunth</i>) <i>Jessop</i>	X							
<i>Dracaena laxissima</i> <i>Engl.</i>	X							
Asphodelaceae								
<i>Bulbine abyssinica</i> <i>A.Rich.</i>							PS2082, LM2369	
Colchicaceae								
<i>Gloriosa superba</i> <i>L.</i>							MS539	
Commelinaceae								
<i>Commelina africana</i> <i>L.</i> sensu lato							LM2389a, LM2402	
<i>Commelina kituloensis</i> <i>Faden</i>							LM2343	
Cyperaceae								
<i>Ascolepis capensis</i> (<i>Kunth</i>) <i>Ridl.</i> sensu lato							LM2382	
<i>Bulbostylis boeckleriana</i> (<i>Schweinf.</i>) <i>Beetle</i>							LM2345	
<i>Bulbostylis scabriacaulis</i> <i>Cherm.</i>							LM2411	
<i>Bulbostylis filamentosa</i> (<i>Vahl</i>) <i>C.B.Clarke</i>							LM2353, LM2378	
<i>Cyperus alternifolius</i> <i>L.</i> subsp. <i>flabelliformis</i> <i>Kük.</i>				X				
<i>Cyperus angolensis</i> <i>Boeck.</i>							LM2376	
<i>Kyllinga alba</i> <i>Nees</i>							LM2346, LM2390	
<i>Scleria bulbifera</i> <i>A.Rich.</i>							LM2352	
Dioscoreaceae								
<i>Dioscorea schimperiana</i> <i>Kunth</i> (=D. <i>schimperana</i>)		X						
Iridaceae								
<i>Lapeirousia erythrantha</i> (<i>Klatt</i>) <i>Baker</i>							JT6220, LM2336	
<i>Moraea schimperi</i> (<i>Hochst.</i>) <i>Pic.Serm.</i>							PS2084	
<i>Romulea camerooniana</i> <i>Baker</i>							LM2395	
Orchidaceae								
<i>Habenaria hologlossa</i> <i>Summerh.</i>							JT6205, JT6213	
<i>Polystachya mafingensis</i> <i>P.J.Cribb</i>							FZ record	
Poaceae								
<i>Andropogon schirensis</i> <i>Hochst.</i>							JT6230, PS2110	

<i>Digitaria diagonalis</i> (Nees) Stapf								PS2109	
<i>Exothea abyssinica</i> (A.Rich.) Anderss.								PS2107	
<i>Loudetia simplex</i> (Nees) C.E.Hubb.								JT6229	
<i>Microchloa kunthii</i> Desv.								PS2108	
<i>Phragmites mauritianus</i> Kunth				X					
Smilacaceae									
<i>Smilax anceps</i> Willd. (=S. kraussiana)			X					MS566	
Velloziaceae									
<i>Xerophyta equisetoides</i> Baker (=Vellozia equisetoides)			X		X	X			
<i>Xerophyta nutans</i> L.B.Smith & Ayensu								MS556, MP33	
Xanthorrhoeaceae									
<i>Aloe duckeri</i> Christian	X				X	X			
Xyridaceae									
<i>Xyris obscura</i> N.E.Br.								JT6206, PS2063, LM2386	
Zingiberaceae									
<i>Aframomum alboviolaceum</i> (Ridl.) K.Schum. (=A. biauriculatum)		X							

Note: s.r. = sight record

Collections: JT = Jonathan Timberlake; PS = Paul Smith; LM = Lari Merrett; MS = Mpande Sichamba

ANNEX 2. PRELIMINARY LIST OF BIRD SPECIES RECORDED FROM THE MAFINGA MOUNTAINS

This list is preliminary – no attempt has made here to incorporate records from published sources other than Dowsett & Stjernstedt (1973) and Leonard (2005, who lists 144 species) or from grid squares in the two bird atlases. In particular, the recent detailed checklist from Reynolds & Willems (2018) has not been included.

Sources: 1, Leonard 2005 (Zambia); 2, Dowsett-Lemaire & Dowsett 2006 (Malawi); 3, Dowsett & Stjernstedt 1973 (Zambia); 4, this trip. References in square brackets [] indicate uncertainty. Names and arrangement follow Dowsett *et al.* (2008).

Gymnogene	<i>Polyboroides radiatus</i>	3
African Goshawk	<i>Accipiter tachiro</i>	3
Augur Buzzard	<i>Buteo augur</i>	3
Rock (Common) Kestrel	<i>Falco tinnunculus</i>	1,3
Shelley's Francolin	<i>Francolinus shelleyi</i>	3
Hildebrandt's Francolin	<i>Francolinus hildebrandtii</i>	1,3
Red-necked Francolin	<i>Francolinus afer</i>	3
Common Quail	<i>Coturnix coturnix</i>	3
Denham's Bustard	<i>Otis denhami</i>	[3]
Temminck's Courser	<i>Cursorius temminckii</i>	[3]
Rameron Pigeon	<i>Columba arquatrix</i>	1,3
Cinnamon Dove	<i>Aplopelia larvata</i>	1,3
Pink-breasted Turtle Dove	<i>Streptopelia lugens</i>	3
Tambourine Dove	<i>Turtur tympanistria</i>	3
Schalow's (Green) Lourie	<i>Tauraco schalowi</i>	3
Wood Owl	<i>Strix woodfordii</i>	3
Mountain Nightjar	<i>Caprimulgus poliocephalus</i>	1[3]
Pennant-winged Nightjar	<i>Macrodipteryx vexillarius</i>	3
Scarce Swift	<i>Schoutedenapus myoptilus</i>	[3]
Mottled Swift	<i>Apus aequatorialis</i>	1
African Black Swift	<i>Apus barbatus</i>	1,3
Speckled Mousebird	<i>Colius striatus</i>	3
Bar-tailed Trogon	<i>Apaloderma vittatum</i>	1,3
Half-collared Kingfisher	<i>Alcedo semitorquata</i>	[3]
Little Bee-eater	<i>Merops pusillus</i>	3
Broad-billed Roller	<i>Eurystomus glaucurus</i>	3
Crowned Hornbill	<i>Tockus alboterminatus</i>	3
Trumpeter Hornbill	<i>Bycanistes bucinator</i>	3
Silvery-cheeked Hornbill	<i>Bycanistes brevis</i>	1,[3]
Moustached Green Tinkerbird	<i>Pogoniulus leucomystax</i>	1,3
Yellow-fronted Tinkerbird	<i>Pogoniulus chrysoconus</i>	3
Scaly-throated Honeyguide	<i>Indicator variegatus</i>	3
Greater Honeyguide	<i>Indicator indicator</i>	3
Olive Woodpecker	<i>Mesopicos griseocephalus</i>	3
African Broadbill	<i>Smithornis capensis</i>	3
White-headed Saw-wing	<i>Psaldoprocne albiceps</i>	3
Red-rumped Swallow	<i>Hirundo daurica</i>	1,3
African Rock Martin	<i>Hirundo fuligula</i>	3
Long-tailed Wagtail	<i>Motacilla clara</i>	3
Richard's Pipit	<i>Anthus richardi</i>	3

Long-tailed Pipit	<i>Anthus similis</i>	3
Striped Pipit	<i>Anthus lineiventris</i>	3
Eastern Mountain Greenbul	<i>Andropadus nigriceps</i>	1,3
Little Greenbul	<i>Andropadus virens</i>	3
Yellow-bellied Bulbul	<i>Chlorocichla flaviventris</i>	1
Grey-olive Bulbul	<i>Phyllastrephus cerviniventris</i>	3
Cabanis' Bulbul	<i>Phyllastrephus cabanisi</i>	3
Black-eyed Bulbul	<i>Pycnonotus barbatus</i>	3
Miombo Rock Thrush	<i>Monticola angolensis</i>	3
Olive Thrush	<i>Turdus olivaceus</i>	1
Kurrichane Thrush	<i>Turdus libonyana</i>	3
Orange Thrush	<i>Zoothera gurneyi</i>	3
White-chested Alethe	<i>Alethe fuelleborni</i>	1
Starred Robin	<i>Pogonocichla stellata</i>	3
Bocage's Robin	<i>Sheppardia bocagei</i>	3
Sharpe's Akalat	<i>Sheppardia sharpei</i>	1
Cape Robin	<i>Cossypha caffra</i>	1
Heuglin's Robin	<i>Cossypha heuglini</i>	3
Stonechat	<i>Saxicola torquatus</i>	3
Familiar Chat	<i>Cercomela familiaris</i>	3
Mocking Chat	<i>Myrmecocichla cinnamomeiventris</i>	3
Cinnamon Bracken Warbler	<i>Bradypterus cinnamomeus</i>	3
African Yellow Warbler	<i>Chloropeta natalensis</i>	3
Red-capped Crombec	<i>Sylvietta ruficapilla</i>	1
Yellow-throated Warbler	<i>Phylloscopus ruficapilla</i>	1
Wailing Cisticola	<i>Cisticola lais</i>	1
Rock Cisticola	<i>Cisticola aberrans</i>	3
Black-lored (Mountain) Cisticola	<i>Cisticola nigriloris</i>	1,2,3
Bar-throated Apalis	<i>Apalis thoracica</i>	3
Chestnut-headed Apalis	<i>Apalis chapini</i>	1,3
Brown-headed Apalis	<i>Apalis alticola</i>	3
Bleating Bush Warbler	<i>Camaroptera brachyura</i>	3
Slaty Flycatcher	<i>Melaenornis chocolatinus</i>	1,3
Southern Black Flycatcher	<i>Melaenornis pammelaina</i>	3
Dusky Flycatcher	<i>Muscicapa adusta</i>	3
Ashy Flycatcher	<i>Muscicapa caerulescens</i>	3
Cape Batis	<i>Batis capensis</i>	1,2
Chinspot Batis	<i>Batis molitor</i>	3
White-tailed Blue Flycatcher	<i>Elminia albicaudata</i>	3
White-tailed Crested Flycatcher	<i>Elminia albonotata</i>	1
Miombo Grey Tit	<i>Parus griseiventris</i>	1,3
Rufous-bellied Tit	<i>Parus rufiventris</i>	1,3
Collared Sunbird	<i>Anthreptes collaris</i>	3
Olive Sunbird	<i>Nectarinia olivacea</i>	3
Green-headed Sunbird	<i>Nectarinia verticalis</i>	3
Black Sunbird	<i>Nectarinia amethystina</i>	3
Yellow-bellied Sunbird	<i>Nectarinia venusta</i>	3
Miombo Double-collared Sunbird	<i>Nectarinia manoensis</i>	1,3
Eastern Double-collared Sunbird	<i>Nectarinia mediocris</i>	1
Yellow-tufted Malachite Sunbird	<i>Nectarinia famosa</i>	1
Bronze Sunbird	<i>Nectarinia kilimensis</i>	1
Yellow White-eye	<i>Zosterops senegalensis</i>	3

African Golden Oriole	<i>Oriolus auratus</i>	3
Eastern Black-headed Oriole	<i>Oriolus larvatus</i>	3
Fiscal Shrike	<i>Lanius collaris</i>	3
Southern Puffback	<i>Dryoscopus cubla</i>	3
Brown-headed Tchagra	<i>Tchagra australis</i>	3
Black-crowned Tchagra	<i>Tchagra senegalus</i>	3
Southern Boubou	<i>Laniarius ferrugineus</i>	[3]
Many-coloured Bush Shrike	<i>Malaconotus multicolor</i>	1
White Helmet Shrike	<i>Prionops plumatus</i>	3
Retz's Red-billed Helmet Shrike	<i>Prionops retzii</i>	3
White-necked Raven	<i>Corvus albicollis</i>	3
African Red-winged Starling	<i>Onychognathus morio</i>	3
Sharpe's Starling	<i>Cinnyricinclus sharpii</i>	1
Yellow-throated Sparrow	<i>Petronia supercilialis</i>	3
Bertram's Weaver	<i>Ploceus bertrandi</i>	1
Green Twinspot	<i>Mandingoa nitidula</i>	3
Blue-billed Firefinch	<i>Lagonosticta rubricata</i>	3
Swee Waxbill	<i>Coccopygia melanotis</i>	1
Cape Canary	<i>Serinus canicollis</i>	1
African Citril	<i>Serinus citrinelloides</i>	1
Bully Canary	<i>Serinus sulphuratus</i>	3
Black-eared Seedeater	<i>Serinus mennellii</i>	1
Streaky Seedeater	<i>Serinus striolatus</i>	1
Golden-breasted Bunting	<i>Emberiza flaviventris</i>	3
Cabanis's Bunting	<i>Emberiza cabanisi</i>	3