

LUSAKA EAST FOREST RESERVE #27

THE LUSAKA EAST FOREST RESERVE, PFA #27, SOUTH END

By Mike Bingham, 18 April 2004; revised 20 Jan 2018



Google Earth Image Date 10-7-2016 The cleared strip at the top of the image is the ZESCO powerline clearing

The Lusaka East Forest Reserve, or Local Forest #27, was created in order to protect the headwaters of the Chalimbana River, which drains most of the area east of the city, and flows eastward to its confluence with the Chongwe R. south of Chongwe town.

The survey beacon Namabiro, near Trotover Farm, is the highest point in the reserve, at 1342m, and the lowest point, is where the Chalimbana crosses the eastern boundary, at 1220m. The Chalimbana tributaries have cut valleys through the schist. This hilly topography contrasts with most of Lusaka and the surrounding areas, which are generally flat.

The underlying geology is schist, which at the southern section of the reserve, frequently occurs in flat sheets. These have been much quarried in the past, and were used in the construction of the Cathedral of the Holy Cross. Although there may be no exposed limestone, the borehole at Talimitengo, about 250m from the southern boundary of the reserve, is limey, indicating subsurface limestone.

The southern sector of the reserve is here defined as that portion lying to the south of the Palabana-Lusaka ZESCO transmission lines. It is triangular in shape with each side approximately 1km.

Soil and groundwater

The woodland soil is red, sandy clay loam, and shallow, nowhere deeper than c.25cm except on derelict termite mounds, and in infilled valleys, where it may be up to 1m in depth. Surface erosion is restricted to paths and naturally bare patches, which are a common feature of the miombo woodlands of the schists of East Lusaka area.

Woodland vegetation

Three vegetation types can be recognised in this southern end of the PFA: open miombo woodland dominated by *Brachystegia utilis* on shallow soils, closed miombo woodland dominated by *Brachystegia boehmii*, and *Protea* savanna, both on deeper soil. These three types account for much of the vegetation of the schist hills which form the headwaters of the Chalimbana River.

The shallow soil which covers most of the reserve cannot hold sufficient water or nutrients to support either crops or pasture, and are susceptible to erosion once exposed. The protea savanna, which may also be described as semi-dambo, is relatively poorly drained, sandy and inherently infertile. The soil under the closed woodland at the valley bottoms is deep and well-drained, but is restricted to small patches, and susceptible to gully encroachment.

Only the top 5cm or so of the open woodland soil has a significant humus content, brown in contrast to the underlying red soil. The miombo woodland is generally fairly open, with a tree cover of about 50%. *Brachystegia utilis* is dominant throughout. Other canopy trees are mostly *B.boehmii*, *B.spiciformis*, *Julbernardia globiflora*, *Monotes glaber* and *M.katangensis*.

The smaller trees are even more sparse than the canopy species. While the canopy trees have seed which is either self dispersed (from exploding pods) or winged for wind dispersal, the small trees are almost invariably animal dispersed.

The herbaceous ground flora of miombo is very diverse, and is particular rich in grasses, legumes and composites. While the grasses are mostly past flowering at this time, the main flowering period of the legumes and composites starts now.

The trees have the advantage over the shallow rooting grasses and herbs. Their roots penetrate the decomposing schist to forage water and nutrients at depth. The established trees are not much affected by fires. Seedlings of *Brachystegia* and *Julbernardia*, and especially of the dominant *B.utilis*, with 2 leaves, established in recent years, are numerous, frequently as many as 5 per square metre, but saplings are rare. Intense competition for the scanty nutrient resources is the most likely cause of the apparent inability of the seedlings to progress.

Stumps of recently cut trees are common, and cutting continues. Coppice regrowth of cut trees accounts for most of the replacement of the canopy species.

Grass and fire

Although the ground flora in the open woodland is rich in species it is sparse, having a low

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biomass. Tall grasses are very scanty except in clearings, on old charcoal clamps, and in some naturally open areas. Thus fires are of low intensity and of little consequence to the vegetation. Fire has a greater impact in the closed miombo on deep soils, and especially in the protea savanna. Its effect is to suppress the saplings of trees and shrubs, and to favour the tall grasses.

The dominant grass, at least at this time of the year, is *Andropogon chinensis*. The taller culms of *Tristachya superba* occur mostly in the open spaces, together with sparse stands of other thatch grass, notably *Hyparrhenia filipendula*, which dominates most artificial clearings.

Naturally bare areas

A feature of the Lusaka East miombo woodland are patches of bare soil, either roughly circular and about 4m in diameter on level ground, or as bands following the contours on slopes. Dying grass tufts at the periphery and yellowing of the leaves of shrubs indicate a toxic factor, probably released by a fungus or cyanobacterium. These seem to last a few years, and are then slowly recolonised, first by mosses and later by annuals.

Annuals

The great majority of the ground flora species are perennials, surviving the dry season by means of underground storage organs. The annuals, which are obligatory seeders, are essentially opportunists, taking advantage of scraps of nutrients which have escaped the ubiquitous feeder roots of the perennials. Annuals, by their nature, are weedy, but some are more so than others. Those responding to available phosphate are the more obviously weedy, such as blackjack (*Bidens pilosa*) and the Mexican Daisy (*Tithonia rotundifolia*), which grow rank in nutrient enriched (polluted) areas around habitation, but fail to invade the woodland. *Tithonia* can grow to a height of 4m, with stems up to 6cm in diameter. The occasional specimens invading the fringes of the woodland are small and depauperate.

The biomass of annuals in natural woodland is minute, a reflection of the scarcity of available nutrients. Some plants are no more than 5cm high, consisting of a single spindly stem, a pair of tiny leaves, a single small flower.

The annuals of the Lusaka East woodlands occur in various habitats within the woodland:

1. Artificially phosphate enriched sites, invaded by weedy annuals such as *Amaranthus hybridus*, *Bidens pilosa* and *T.rotundifolia* - only sites of dumping of waste, or where fertilizer has been used in cultivation.
2. Communities of dwarf annuals in small areas, either open or lightly shaded, and sometimes following contours. The soil is particularly damp and there is partial capping by cyanobacterium. The annuals are interspersed with the small tufted perennial grass, *Microchloa kunthii*, which is characteristic of level, capped soils.
3. On bare patches in the woodland, where some toxic factor has killed off all other herbs, the small labiate *Plectranthus gracillimus* (Lamiaceae) thrives. It has a tiny root system, and apparently survives by taking up water only when the toxic factor is diluted during rain showers, and storing it for later use in its succulent tissues. At the end of the rains the water and nutrients are withdrawn from the leaves to produce the sticky, spidery panicle of small

blue flowers. At maturity the infructescence sticks to the fur of passing animals to disperse the seed.

The legumes

Leguminous plants (Family Fabaceae) are of particular importance in miombo woodland. They include not only most of the dominant trees (*Brachystegia* and *Julbernardia*) but also a great number of the ground flora species. Legumes are well known to develop root nodules containing nitrogen-fixing bacteria (*Rhizobium*). However, *Brachystegia* and *Julbernardia* and many other leguminous trees never develop nodules. Instead, most of them have fungal symbionts (ectomycorrhizae) in the root cortex, which play a role in the takeup of nutrients from the soil.

Since miombo woodland (by definition dominated by species of *Brachystegia*, *Julbernardia* and *Isobertinia*) almost invariably occurs on highly leached acid soils, the symbiotic soil microbes are of particular importance to the nutrient cycling of the system. The miombo woodlands are the major source of edible mushrooms, notably of *Amanita zambiana* (tente) and the brightly coloured chanterelles (*Cantharellus* spp., e.g. chitondo).

Nearly all the low growing leguminous species form root nodules, but they seem to be most prominent on the shorter-lived plants, and particularly the annuals. However, this might be an illusion because the perennials have longer roots with the activity mostly at the tips at some distance from the crowns, and are thus more difficult to find. Nodulation begins with the infection of the root, a process which may kill the weaker host plants, and it takes several weeks before the host receives any benefit from the association. Actively fixing nodules contain haemoglobin (as in vertebrate red blood corpuscles), which gives the tissue a red colour. Nitrogenous compounds are only released into the soil when the host plants and the nodules die and disintegrate.

A high proportion of legumes in herbaceous plant communities indicates a relative abundance of available phosphate. Non-N-fixing plants cannot use the phosphate unless sufficient N is available.

Termite mounds

Termite mounds, mostly derelict, occur sparsely throughout the woodland. Leaching over a long period, probably many centuries, has removed and dispersed much of the hard clay, which was a necessary component of the newly constructed mounds. The original builders, probably *Macrotermes subhyalinus*, are now rare or absent from the woodland, probably because the clay content of the soil is insufficient to enable them to keep the nest dry. The mounds have been taken over by termite species which may build small temporary structures, or have entirely subterranean nests. The vegetation of the mounds is mostly grass, with rarely more than one or two mature trees. Species recorded include *Combretum collinum*, *Euclea divinorum*, *Ficus burkei*, *Senna singueana*, *Steganotaenia araliacea* and *Zanha africana*. These trees are not typical associated with termite mounds, as are the woody Capparaceae (*Boscia*, *Capparis*, *Maerua*), which disappeared along with the *Macrotermes*. They belong to various woodland types, but mostly to miombo on more fertile soils.

Drought

Severe droughts have affected Lusaka during the past decades, in the early 1980s and especially between 1987 and 1995. Massive die-offs of mature trees occurred in the woodlands, affecting particularly the fruit trees, musuku (*Uapaca kirkiana*), mupundu (*Parinari curatellifolia*) and old mukuyus (*Ficus sycomorus*).

The rainy season of 2001-02 effectively ended at the end of December, wiping out the maize crop and also the native annuals, which failed to seed. Heavy rains in early November 2002 brought about germination, but hot dry spells later in the month, and continuing until the end of January, seriously disrupted the growth and flowering of many species. Very few *Brachystegias* have set fruit this year, and far fewer than usual of the later flowering *Julbernardia globiflora* are fruiting.

At this time last year (April 2002) the common pink-flowered woodland annual *Antherotoma naudinii* (Melastomataceae) was restricted to small patches near the lower end of slopes. This season, after the good rains of February and March it is common at all levels.

Damage and disturbances

Old charcoal clamps probably date back to the 1980s, when there was a serious breakdown of law enforcement in the forestry sector. Tree felling has continued, and replacement is largely confined to regrowth from stumps. It is likely, however, that the thinning out of trees has benefitted those that were left, and that these are larger than they would have been had the clearing not occurred.

A number of small quarries where slate has been mined are scattered through the area. During the past decade the popularity of slabs of marble (limestone), which are being mined in large quantities along the Leopards Hill Road, seem to have taken the pressure off demand for the schist slate. The impact is not great, although the quarries have been invaded by weedy shrubs such as *Phyllanthus muellerianus* and *Vernonia amygdalina*.

Harvesting of bark and roots for traditional medicine has left its mark. The only specimen of *Garcinia buchananii* (musongwa) found was completely girdled.

Orchids

Orchids are sensitive to droughts, dry spells and to drying influences, such as the thinning of the woodland, which exposes the vegetation to more sunlight and drying winds. I have found only one orchid epiphyte in this part of the PFA, a large, old specimen of *Tridactyle*, about 4m up on the trunk of a stunted *Brachystegia boehmii*. The tree is isolated, but was probably less so when the orchid became established. The only colony of an orchid of this genus (*T.bicaudata*) known to me in the vicinity of Lusaka is in closed woodland in the Lazy-J nature reserve.

Terrestrial orchids are still common at this end of the PFA. The white-flowered *Eulophia euantha* does not need shade, and one colony we found was in bare ground. The *Eulophias* are early-flowering. Their storage organs are tough, fibrous pseudobulbs which persist for many

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years and are very drought tolerant. The tuberous orchids are generally more susceptible to drought, and those growing on well drained sites need shade. The tuber lasts for just as long as it is needed to establish the new plant and to see it through while its replacement is formed.

The 2001-'02 rainy season, which effectively came to an end at the end of December, was very hard on the late flowering *Habenarias*. Flowering was interrupted and the plants switched their energy resources to securing their tubers, some producing a second one, evidently in a desperate rescue effort. The 2002-'03 season started with a bang in early November, but was followed by dry spells in November, December and most of January, with devastating results. Plants which have not begun to produce their replacement tubers so late in the season have little hope of surviving.

A small area of protea savanna investigated appears to be an infilled valley, with soil up to 1m deep, and incipient gullying. The soil is similar to the woodland soil, but with more clay at depth. No mottling or granulation was observed, indicating good drainage throughout. In addition to the proteas the most common tree is *Brachystegia spiciformis*. The grasses are more dense than in the woodland, with a higher proportion of *Hyparrhenia filipendula*, although *Andropogon chinensis* remains the dominant. This habitat also favours tuberous orchid species, particularly species of *Brachycorythis*.

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PROVISIONAL LIST OF PLANT SPECIES

This list includes most of the species which are readily identifiable at this time of the year.

Frequency Symbols

a	abundant
c	common
f	frequent
o	occasional
r	rare
l	local

MIOMBO WOODLAND

Canopy trees

<i>Albizia antunesiana</i>	o
<i>Brachystegia boehmii</i>	f
<i>Brachystegia spiciformis</i>	f
<i>Brachystegia utilis</i>	f (dominant)
<i>Burkea africana</i>	o
<i>Julbernardia globiflora</i>	f
<i>Monotes glaber</i>	f
<i>Monotes katangensis</i>	f

Smaller trees

<i>Combretum molle</i>	o
<i>Dalbergiella nyasae</i>	o
<i>Dichrostachys cinerea</i>	r
<i>Diplorhynchus condylocarpon</i>	o
<i>Entada abyssinica</i>	r
<i>Faurea saligna</i>	o
<i>Faurea rochetiana</i>	r
<i>Garcinia buchananii</i>	r
<i>Lannea discolor</i>	o
<i>Ochna schweinfurthiana</i>	f
<i>Protea angolensis</i>	o
<i>Protea gaguedi</i>	o
<i>Rothmannia engleriana</i>	r
<i>Strychnos innocua</i>	r
<i>Swartzia madagascariensis</i>	o
<i>Uapaca kirkiana</i>	o
<i>Uapaca nitida</i>	f

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Ximenia americana subsp. *caffra* f

Shrubs

Multidentia crassa f

Vernonia glaberrima o

Subshrubs

Fadogia ancylantha f

Lansea edulis f

Pavetta radicans lo

Psychotria pumila lo

Rhus kirkii r

GROUND FLORA

MONOCOTS (Monocotyledons)

Grasses (Family Poaceae)

Perennial:

Andropogon chinensis

Brachiaria serrata

Eragrostis racemosa

Hyparrhenia filipendula

Hyparrhenia newtonii

Microchloa kunthii

Tristachya superba

Zonotriche inamoena

Orchids recorded on this and previous visits

Brachycorythis

congolensis

tenuior

Eulophia

chilangensis

cucullata

euantha

katangensis

Habenaria

clavata

holubii

retinervis

tentaculigera

Other families:

Perennial:

Albuca abyssinica (Hyacinthaceae)

Boophone disticha (Amaryllidaceae)

Bulbostylis macra (Cyperaceae)

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Commelina africana (Commelinaceae)

Cyperus pubens (Cyperaceae)

Eulophia euantha (Orchidaceae)

Habenaria holubii (Orchidaceae)

Hypoxis goetzei (Hypoxidaceae)

Littonia littonioides (Colchicaceae)

Annual:

Commelina aspera (Commelinaceae)

DICOTS (Dicotyledons)

Herbaceous Dicotyledons

Legumes (Family Fabaceae)

Perennial:

Aeschynomene bracteosa

Crotalaria pallidicaulis

Eriosema macrostipulum

E.pumilum

Indigofera rhynchocarpa

Kotschya strobilantha

Macrotyloma fimbriatum

Rhynchosia sp. (creeping)

Vigna pygmaea

Vigna vexillata

Annual:

Chamaecrista

gracilior

mimosoides

Crotalaria

alexandri

anthyllopsi

cephalotes

lachnophora (weedy)

spartea

Desmodium

gangeticum

Indigofera

setiflora

Tephrosia purpurea

Zornia

glochidiata

Composites (Asteraceae, daisy family)

Perennial:

Aspilia pluriseta

Dicoma angustifolia

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Elephantopus scaber
Hypericophyllum compositarum
Pleiotaxis eximia
Schistostephium crataegifolium
Sonchus sp.
Vernonia musofensis

Annual:

Bidens
pilosa (weed)
steppia
Bidens sp. (#12660)
Emilia abyssinica
Laggera crispata

Labiates (Family Lamiaceae)

Perennials:

Aeollanthus subacaulis

Annuals:

Plectranthus gracillimus (Lamiaceae)
Pycnostachys dewildemanniana (Lamiaceae)

Other families

Perennials:

Agathisanthemum bojeri (Rubiaceae)
Clematis welwitschii (Ranunculaceae)
Clematopsis scabiosifolia (Ranunculaceae)
Cyphostemma junceum (Vitaceae)
Diplolophium zambesianum (Umbelliferae/Apiaceae)
Ectadiopsis producta (Asclepiadaceae)
Justicia phyllostachys (Acanthaceae)
Pentas angustifolia (Rubiaceae)
Thunbergia kirkiana (Acanthaceae)
Triumfetta dekindtiana (Tiliaceae)
Wahlenbergia denticulata (Campanulaceae)

Annuals:

Antherotoma naudinii (Melastomataceae)
Biophytum abyssinicum (Oxalidaceae)
Biophytum petersianum (Oxalidaceae)
Buchnera hispida (Scrophulariaceae)
Lindernia sp. (Scrophulariaceae)
Oldenlandia herbacea (Rubiaceae)
Oldenlandia sp.
Pandiaka rubro-lutea (Amaranthaceae)
Polygala petitiana (Polygalaceae)
Sebaea grandis (Gentianaceae)
Sebaea ?microphylla (Gentianaceae)

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Striga asiatica (Scrophulariaceae)

Wahlenbergia hirsuta (Campanulaceae)

TERMITE MOUNDS (derelict)

Zanha africana