

[MOZTIPA035], another mountain of western Zambézia Province. *C. salvatrix* is known to have buff coloured, cracked bark similar to the specimen description, although, like *C. zanguebariae*, is also a bush or small tree (Bridson & Verdcourt et al. 2003). Further collections of *Coffea* on Morrumbala are required to identify the taxon as there is a strong possibility it may be threatened species.

In addition to these threatened species, there are two Near Threatened species, *Searsia* (formerly *Rhus*) *acuminatissima* and *Cola mossambicensis*, that have been recorded from this IPA. Although not endemic, the ranges of both these species fall predominantly within Mozambique.

Overall, there are four Mozambican endemics known from this IPA, including the two threatened species *C. morrumbalensis* and *Celosia pandurata* alongside *Bothriocline moramballae* (LC) and *Pavetta gardeniifolia* var. *appendiculata*. Mount Morrumbala is the southernmost location for these latter two taxa, both of which are known from fewer than five locations globally.

There has been limited botanical collecting done within this IPA in recent decades, with many of the collections made in the 1940s (F.A. Mendonça and A.R. Torre) and in the 1970s (T. Müller and G. Pope). Further botanical surveying is needed to fully characterise the habitats and to establish the continued presence and population sizes of threatened species such as *Crassula morrumbalensis*. Further investigation could also reveal additional threatened or rare species.

There are two nationally threatened and restricted habitat types present at this IPA, low altitude moist forest and medium altitude moist forest. It is unlikely that there is enough medium altitude forest to trigger C(iii) as Morrumbala only reaches a peak of 1,172 m and so this habitat type is limited to a small area below the peak ridge. There is a much larger area of low altitude moist forest within this IPA, likely between 10 – 15 km². Overall, Morrumbala is one of five best sites for low altitude forest nationally and so triggers sub-criterion C(iii) of the IPA criteria, although further research is required to accurately delineate and measure this fragmented habitat at this site. To the north of this IPA, on the other side of Cundo-cundo stream, there is additional intact, lowland forest. This nearby area is currently understudied; however, it could be included in the IPA if found to be botanically interesting.

Habitat and geology

Mount Morrumbala is the result of multiple, predominantly syenite, intrusions in the surrounding plain (Coelho 1959; Araújo et al. 1973). The mountain reaches a peak of 1,172 m and is 15 km across from north to south and 5 km from east to west. Soils have not been fully categorised, but the lower slopes are known to have thin, rocky soils (Andrada #1570) while the soils towards the west of the IPA, by the Shire River, are clayey (Dungo #185). It is likely that the soils in gullies are deep and with greater fertility and moisture than elsewhere in this IPA.

The site experiences a winter dry season, between April and October, with temperatures recorded at nearby Morrumbala town ranging from an average low of 17.2°C and a high of 29.8°C in summer

(Ministério da Administração Estatal 2005). Average monthly precipitation in the district is 1,017 mm, however, given the topology of this IPA, there is likely a stark difference in precipitation and temperature compared to the surrounding plain, with the mountain experiencing lower temperatures and higher precipitation - some of which likely occurs through frequent mists.

According to analysis by Lötter et al. (2021), the northern and western lowlands of Mount Morrumbala can be classified as "Central Lowland Moist Forest". Although the species composition at this site is yet to be documented, some of the collections made in this area include species typical of this vegetation type (GBIF.org 2021). Canopy trees include *Albizia adianthifolia*, *Bersama abyssinica*, *Newtonia buchananii*, *Macaranga capensis* and *Terminalia* (formerly *Pteleopsis*) *myrtifolia*, while trees and shrubs in the understorey include *Cola greenwayi* and *Vangueria esculenta* alongside the herbaceous *Celosia pandurata* (VU). Lianas and climbers such as *Landolphia buchananii*, *Gouania longispicata* and *Tiliacora funifera* have also been recorded in these forests. At higher altitudes on the northern and western slopes, Lötter et al. (2021) delineate a small strip of Central Mid-elevation Moist Forest vegetation below the peak ridge. It is unclear how these forests may differ from the lowland forests at this site, however, in these forests *Newtonia buchananii* may be more dominant, as is the case in other moist mid-elevation forests.

On the eastward slopes of the mountain, the vegetation is largely moist miombo, similar to that found on the southern escarpments of Mount Gorongosa (Lötter et al. 2021). Little is known of this vegetation on Mount Morrumbala. One collection describes woodland on the mountain as dominated by *Brachystegia tamarindoides* subsp. *microphylla* (Muller & Pope #1973), a species typical of areas with thin soils over which also dominates the escarpment miombo of Mount Gorongosa. While this collection was made on the western slopes of the mountain, it is highly likely that the eastern miombo is also dominated by *B. tamarindoides* subsp. *microphylla* and that this vegetation type also occurs in a mosaic within the forests on the western slopes. The understorey of this woodland has not been documented; however, it is known to host the only known population of Critically Endangered species *Crassula morrumbalensis*, a perennial, succulent herb. As *Crassula* species are often associated with rocky areas, it is highly likely that this species occurs in areas of rocky miombo at this site.

There are a number of riverine forests in deep gorges on the mountain and it is very possible that the Vulnerable species *Khaya anthotheca* occurs in these areas as is the case in several other montane gallery forests. The herbaceous species *Impatiens oreocallis* was collected by a waterfall on the mountain, growing within the spray zone. A species native to Malawi, Mozambique and Tanzania, this is likely one of the southernmost collections of *I. oreocallis*.

Summit vegetation has not yet been described. *Decorsea schlechteri* is known to be associated with rocky outcrops on the mountain although this species likely occurs on the slopes below the summit.

Conservation issues

Mount Morrumbala does not fall within a protected area, Key Biodiversity Area or Important Bird Area. However, with the presence of the entire global population of Critically Endangered species *Crassula morrumbalensis*, the site would qualify as an Alliance of Zero Extinction site and KBA under sub-criterion A1e.

Many of the slopes of this site are theoretically protected by the Environment Act (Lei . 20/97 of 1997) which prohibits cultivation of annual crops on slopes greater than 7° and perennial crops on slopes greater than 14° (Timberlake et al. 2007). However, in practice this law appears to have little impact on preventing cultivation on this mountain, with a continued increase in agricultural expansion on Morrumbala. Agricultural expansion particularly impacts the miombo on the eastern slopes and the lowland forest on the western slopes, this is likely due to the flatter terrain in these places. Both the forest and miombo in these accessible areas are heavily fragmented, with the rate of tree cover loss in this IPA accelerating since 2001 (World Resources Institute 2021). Only the less accessible areas, including forests on steep slopes and in gullies, remain completely intact.

This loss of key habitats will inevitably be a major threat to the rare and range limited species that occur on Mount Morrumbala. Urgent research and conservation action is needed to protect these habitats and the species that reside within. One reason for the increased pressure on land within this IPA may be land disputes elsewhere, which are particularly pronounced in the Shire River valley and around nearby Morrumbala town (Ministério da Administração Estatal 2005). Work with local communities to solve these issues could go a long way towards minimising agricultural expansion onto Morrumbala. The land within Morrumbala District is otherwise highly favourable and the most productive across Zambézia Province. There is evidence that solving land disputes could be an effective strategy and this is one of the key actions implemented by the conservation and development project, Legado: Namuli, on Mount Namuli led by Legado and Nitidae (Nitidae 2021). This project has helped secure land rights for local people as a key action towards protecting valuable montane habitats from agriculture expansion. Applying this approach to Mount Morrumbala could similarly relieve pressures on the montane habitats of this site.

Slowing the rate of agricultural expansion on Mount Morrumbala, alongside restoration of habitats, may also be of great importance to local communities as the loss of woodland and forest, particularly at higher altitudes, may increase the risk of landslides. Loss of substrate stabilising forest on Serra Tumbine, a mountain 150 km to the north-east of this IPA with a similar syenite geology, led to a catastrophic landslide following heavy rains in 1998 (see MOZTIPA036). The World Bank categorise the rainfall-triggered landslide hazard as “very high” within this IPA (World Bank 2019). Further research is urgently required to understand if maintenance of complex forest and woodland ecosystems on this mountain could help mitigate the risk of landslide.

Given the number of threats, including catastrophic events such as landslides, ex situ conservation should be considered for *Crassula morrumbalensis* alongside in situ actions. *C. morrumbalensis* is predicted to have orthodox seed storage behaviour (Wyse & Dickie 2018) and so collection of seeds for seed banking is highly

recommended.

Much like the plant taxa of this site, the animal taxa of Morrumbala are yet to be inventoried. Inventory work for avian taxa has been described as urgent by Spottiswoode et al. (2008) due to the presence of evergreen forest, known to provide habitat for rare and threatened birds elsewhere in Mozambique.

Site assessor(s)

Assessed by:

Sophie Richards, Royal Botanic Gardens, Kew

Iain Darbyshire, Royal Botanic Gardens, Kew

IPA criterion A species

SPECIES	QUALIFYING SUB-CRITERION	≥ 1% OF GLOBAL POPULATION	≥ 5% OF NATIONAL POPULATION	1 OF 5 BEST SITES NATIONALLY	ENTIRE GLOBAL POPULATION	SOCIO-ECONOMICALLY IMPORTANT	ABUNDANCE AT SITE
<i>Crassula morrumbalensis</i> R.Fern.	A(i)	✓	✓	✓	✓	—	Unknown
<i>Celosia pandurata</i> Baker	A(i)	✓	✓	—	—	—	Unknown

IPA criterion C qualifying habitats

HABITAT	QUALIFYING SUB-CRITERION	≥ 5% OF NATIONAL RESOURCE	≥ 10% OF NATIONAL RESOURCE	1 OF 5 BEST SITES NATIONALLY	AREAL COVERAGE AT SITE
Low Altitude Moist Forest 100-600 m	C(iii)	—	—	✓	10
Medium Altitude Moist Forest 900-1400 m	C(iii)	—	—	—	2

General site habitats

GENERAL SITE HABITAT	PERCENT COVERAGE	IMPORTANCE
Forest - Subtropical/Tropical Moist Lowland Forest	—	Major
Forest - Subtropical/Tropical Moist Montane Forest	—	Minor
Savanna - Moist Savanna	—	Major
Rocky Areas - Rocky Areas [e.g. inland cliffs, mountain peaks]	—	Minor
Artificial - Terrestrial - Arable Land	—	Major

Land use types

LAND USE TYPE	PERCENT COVERAGE	IMPORTANCE
Agriculture (arable)	—	Major
Harvesting of wild resources	—	Unknown

Threats

THREAT	SEVERITY	TIMING
Agriculture & aquaculture - Annual & perennial non-timber crops - Small-holder farming	High	Ongoing - increasing
Residential & commercial development - Housing & urban areas	Low	Ongoing - trend unknown
Natural system modifications - Fire & fire suppression - Increase in fire frequency/intensity	Unknown	Ongoing - trend unknown

THREAT	SEVERITY	TIMING
Biological resource use - Logging & wood harvesting	Unknown	Ongoing - trend unknown
Geological events - Avalanches/landslides	High	Future - inferred threat

Management type

MANAGEMENT TYPE	DESCRIPTION	YEAR STARTED	YEAR FINISHED
No management plan in place		—	—

Bibliography

Google Earth 2020. **Google Earth Satellite Imagery.**

Geologia e Minas, Vol 37, page(s) 1-76

Spottiswoode, C.N., Patel, I.H., Herrmann, E., Timberlake, J. & Bayliss, J. 2008. **Threatened Bird Species on Two Little-Known Mountains (Chiperone and Mabu) in Northern Mozambique..** Ostrich, Vol 79, page(s) 1-7

Coelho, A.V.P. 1959. **Reconhecimentos Petrográficos Sumários Dos Maciços Da Lupata, Morrumbala, Chiperone-Derre e Milange.** Boletim Dos Serviços de Geologia e Minas, Vol 26, page(s) 1-47

Timberlake, J., Bayliss, J., Alves, T., Baena, S., Harris, T. & da Sousa, C. 2007. **Biodiversity and Conservation of Mount Chiperone, Mozambique.** Darwin Initiative Award 15/036: Monitoring and Managing Biodiversity Loss in South-east Africa's Montane Ecosystems, page(s) 1-33

GBIF.org 2021. **GBIF Occurrence Download. Mount Morrumbala.**

Ministério da Administração Estatal 2005. **Perfil Do Distrito de Morrumbala: Província Da Zambézia.**

World Bank 2019. **Disaster Risk Profile: Mozambique.**

Inguaggiato, C., Navarra, C. & Vailati, A. 2009. **The Role of Rural Producers' Organizations within Development Processes: a Case Study on Morrumbala District.** Dynamics of poverty and patterns of economic accumulation in Mozambique

Global Forest Watch 2021. **Global Forest Watch.**

Bridson, D. M., & Verdcourt, B. 2003. **Flora Zambesiaca Vol. 5, Part 3: Rubiaceae.**

Lötter, M., Burrows, J., McClelland, W., Stalmans, M., Schmidt, E., Soares, M., Grantham, H., Jones, K., Duarte, E., Matimele, H. & Costa, H. M. In Prep. **Historical Vegetation Map and Red List of Ecosystems Assessment for Mozambique – Version 1.0 – Final report.**

Nitidæ 2021. **NAMULI SKY ISLAND - Creation of a new protected area around Mount Namuli – Nitidæ.**

Wyse, S.V., & Dickie, J.B. 2018. **Taxonomic affinity, habitat and seed mass strongly predict seed desiccation response: A boosted regression trees analysis based on 17539 species.** Annals of Botany, Vol 121, page(s) 71-83

Araújo, J.R., Afonso, R.S. & Pinto, M.S. 1973. **Contribuição Para o Conhecimento Da Geologia Da Área de Morrumbala-Mutarara (Folha SUL-E-36/L, Grau Quadrado 1735).** Boletim Dos Serviços de