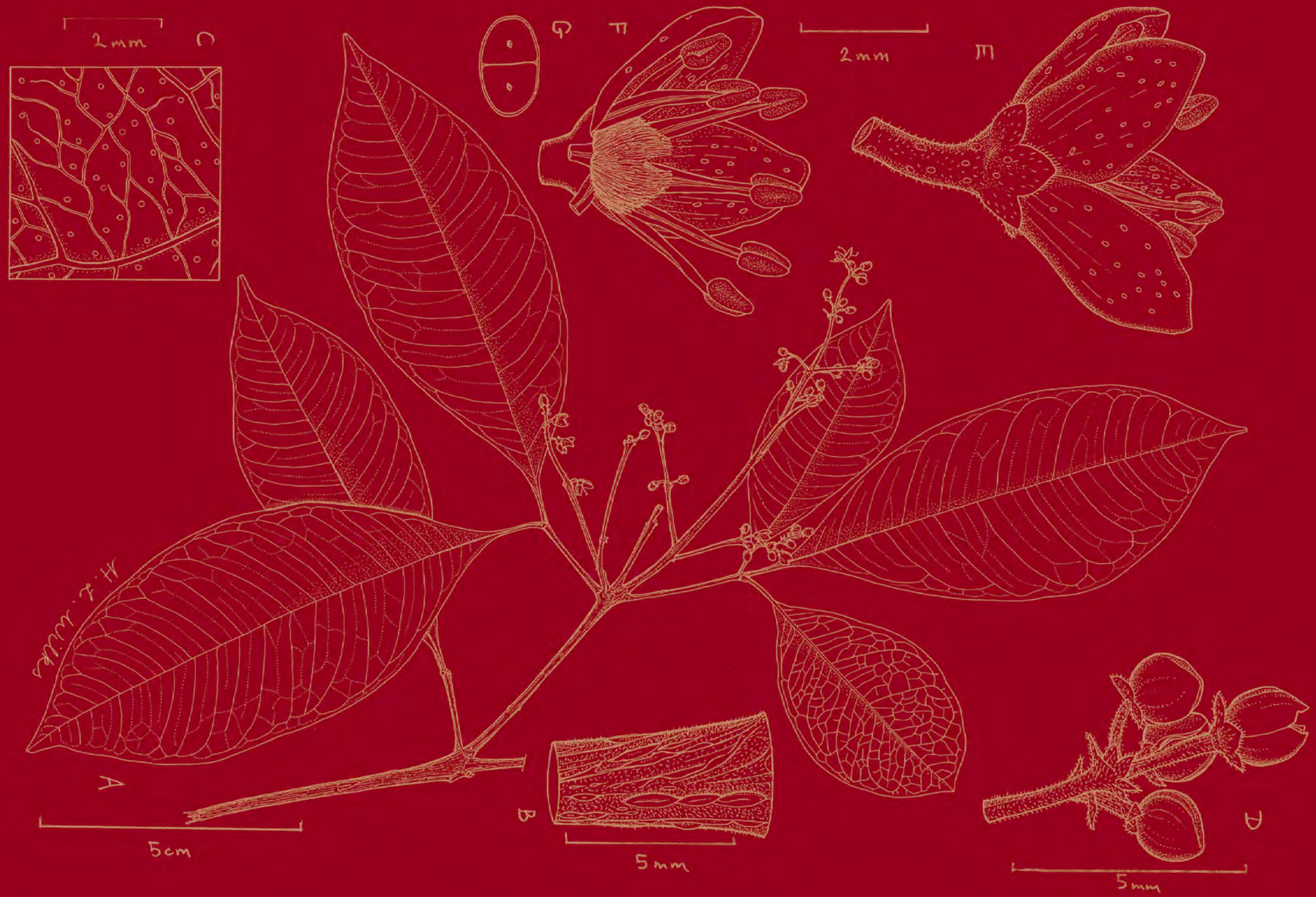
# IMPORTANT PLANT AREAS OF CAMEROON

Bruce Murphy, Jean Michel Onana, Xander van der Burgt, Eric Tchatchouang Ngansop, Jenny Williams, Barthélemy Tchiengué, Martin Cheek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# IMPORTANT PLANT AREAS OF CAMEROON

‘Important Plant Areas of Cameroon’ is an output of the Tropical Important Plant Areas programme of the Royal Botanic Gardens, Kew

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First published in 2023 by Royal Botanic Gardens, Kew,
Richmond, Surrey, TW9 3AE, UK
www.kew.org

ISBN 978-1-3999-5449-5

British Library cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Design by Jessica Harvey: jkharveydesign.co.uk
Copyediting by Gabrielle Brown: gabsbrown.com

Front cover: before and after photos showing the same view from the summit of Mt Elephant, an Important Plant Area in South Region, Cameroon. Above, showing unbroken intact, primary evergreen lowland rainforest in 1997. Below, the same in 2016 converted into oil palm plantations (*Elaeis guineensis*). Both photos by Dr Xander van der Burgt.

Back cover: map showing the names and distribution of the Important Plant Areas of Cameroon. Developed by Jenny Williams.

Citation for this publication:
Murphy B., Onana J. M., Burgt, X. M. van der, Ngansop Tchatchouang E., Williams J., Tchiengué B., Cheek M. (2023). Important Plant Areas of Cameroon. Royal Botanic Gardens, Kew.

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# Acknowledgements

The Cameroon Tropical Important Plant Areas (TIPAs) programme is generously supported by the players of the People's Postcode Lottery, the Bentham-Moxon Trust, and the John S Cohen Foundation.

We thank all those who helped review the draft TIPA datasheets at the Nkolbisson workshop in 2022: Ekwoge Abwe (Ebo Forest Research Project); Elvire Biyé and Murielle Simo-Droissart (University of Yaoundé I); Kenneth Tah (COMAID); Serges Mtemching, Kris Fominyam, Elias Ndive (Limbe Botanic Garden and Wildflower Foundation); Moses Njoya and Belinda Njombo (ANCO); Roger Fotso and Atanga Ekobo (WCS Cameroon); Gilbert Todou (University of Maroua); Olivier Séné (US Forest & Wildlife Service); Arnaud Tchassem (EDGE fellow [ZSL] UYI); Raphael Ayuk and Esau Ngong (AADA); Francis Ngome (IRAD); Eric Nana, Dieudonné Onana, Cecilia Mandah, Yannick Ella, Christiane Mayumgo, Adèle Magne Foaleng, Joan Suife, Hubert Mounmemi, Laura Ngome, Standly Nkemnyi, Gwendoline Egbe (IRAD-National Herbarium of Cameroon) and Nina Forgwe of the British Embassy.

Cecilia Mandah, Christiane Mayumgo and Yannick Ella are thanked for collecting data on conservation status, threats and species records of TIPAs in the Yaoundé Hill TIPAs.

We thank past and current senior staff at IRAD for their support of this programme in various ways: Dr Florence Ngo Ngwe, Prof. Jean Lagarde Betti, Prof. Eddy Ngonkeu, Dr Noé Woin.

We also thank the Kew Conservation Assessment team, especially Species Conservation Assessors and Species Researchers for Cameroon, Rebecca Lovell, Ashleigh Whittaker, Hannah Rotton, and Charlotte Phillips, and project co-ordinators Serene Hargreaves, Emma Williams and Jack Plummer, led by Eimear Nic Lughadha. Volunteers Margaret Joachim and Rosemary Lomer databased and georeferenced many hundreds of specimens of candidate-threatened species, facilitating their assessments.

Nina Davies, Renata Borosova, Maria Alvarez, Andrew Budden, Aurelie Grall, Harry Smith and Martin Xanthos of the Africa team collections dept. at RBG Kew helped to process and often identify Cameroon specimens, supporting species data provision, helped by volunteers Joan Reader, Helen Pickering and Rosemary Lomer. Marie-Helene Weech helped with digitising photographic slides.

Maria Alvarez and Aurelie Grall, currently or formerly of RBG Kew are thanked for supporting fieldwork in Cameroon towards TIPAs. George Gosline was crucial for devising and supporting the WTA database at RBG Kew from which our data was mainly derived and analysed. Dr Iain Darbyshire, leader of the Tropical Important Plant Areas programme at RBG Kew is thanked for guidance and inspiration, and for reviewing some of the text of this book. Eduardo Toledo brought into existence the TIPA explorer portal **https://tipas.kew.org/** and made available there to all the Cameroon TIPA datasheets (**https://www.kew.org/read-and-watch/tropical-important-plant-areas-explorer-launch**).

We are indebted to all those who co-assessed Cameroon TIPAs with us and to those who provided data and photos, including Gaston Achoundong, Murielle Simo-Droissart, Vincent Droissart, Duncan Thomas, Arnaud Tchassem, Thomas Doherty Bone, Leonard Usongo, Kenneth Tah, Gilbert Todou, Moses Njoya, Hazel Chapman, Terry Sunderland, Ekowge Abwe, Bethan Morgan, Eric Nana, Olivier Lachenaud, Thomas Couvreur, Elias Ndive, Kris Fominyam, Benedict Pollard, David Harris, Jan Wieringa, Ton van der Zon, Roger Fotso and James Acworth.

Karen Inwood and Fiona Perez at Plantlife International are thanked for publicising TIPAs through their Global IPA Network. Tom Lambert at BirdLife International provided their IBA dataset.

Finally, we thank the design and editorial team of Jessica Harvey and Gabrielle Brown for their fast, expert work in pulling together this book from the files submitted.

## This book is dedicated to Martin Etuge

Martin Etuge (1966–2020), outstanding Cameroonian botanical specimen collector.

Herbarium specimens such as those made by Martin are the foundations of the research featured in this book.

Martin was brought up in northern Bakossi, at Mejelet, where he was recruited as a botanical assistant and trained to collect specimens by Duncan Thomas. He was later employed by Limbe Botanic Garden, subsequently by the former Mt Kupe Project at Nyasoso, and over many years he supported the IRAD-National Herbarium-RBG Kew Earthwatch missions through many regions of Cameroon. Martin collected nearly 5,000 herbarium specimen numbers which are distributed among the main herbaria for African plants throughout the world. *Kupea martinetugei*, *Psychotria martinetugei, Dorstenia poinsettiifolia* var. *etugeana, Uvariopsis etugeana* and *Cola etugei* are named in his honour. The photo below was taken in his garden at Nyasoso where he cultivated indigenous threatened species such as the *Neoschumannia kamerunensis* (Apocynaceae-Asclepiadaceae, CR) with which he is photographed here.

**The late Martin Etuge with Critically Endangered *Neoschumannia kamerunensis*, which he rediscovered in Cameroon.**
Photograph M. Cheek.

# Preface

## D'une gestion rationnelle vers une gestion durable de la biodiversité des plantes

Le territoire du Cameroun est connu pour sa richesse en ressources naturelles biologiques, ou biodiversité. Avant l'indépendance, afin de préserver les essences forestières commercialisables, des réserves forestières avaient été créées. Depuis le troisième sommet sur le développement durable en 1992, la biodiversité est considérée au-delà de sa valeur commerciale et tient aussi compte des potentialités écologiques et génétiques de chaque espèce pour les générations actuelles et futures. D'où l'émergence du concept de gestion durable qui englobe l'histoire, le présent et le futur de la disponibilité des ressources. Afin de mettre en œuvre ses engagements en tant que Partie à la Convention sur la Diversité Biologique, la gestion rationnelle par des textes règlementaires tient désormais compte des résultats de la recherche scientifique. C'est ainsi que le classement des réserves forestières a été remplacé par la création d'aires protégées basées sur les principaux indicateurs scientifiques de la conservation que sont les espèces menacées d'extinction ou endémiques. La connaissance de ces indicateurs a provoqué un conflit d'intérêt entre les conservationnistes, qui voulaient enrayer la perte de biodiversité par la protection intégrale des ressources forestières d'une part, et les décisionnaires et populations, qui considéraient la conservation comme un obstacle à l'accès et à l'exploitation des ressources forestières pour le développement d'autre part.

C'est pour concilier la conservation et les besoins d'exploitation des services écosystémiques pour les générations actuelles et futures qu'a été élaboré le concept des Zones Tropicales Importantes pour les Plantes (ZTIP). Grâce aux résultats de la recherche sur les indicateurs de conservation et des check-lists pour la conservation qui prenaient déjà en compte les produits forestiers non ligneux et les usages des plantes, la biodiversité du Cameroun est abondamment documentée. Les ZTIP constituent donc des zones riches en biodiversité aussi bien pour la conservation que pour l'usage des populations. C'est pourquoi cet ouvrage présente, dans chaque fiche descriptive synthétique, les paramètres de chaque zone y compris les indicateurs de conservation, d'aménagement et d'usage des plantes, comme une boîte à outils pour la gestion durable dans le cadre de l'approche par écosystème et de la décentralisation de notre pays. Comme on peut le constater, il s'agit d'aller au-delà de la conservation au sens propre, afin que les bénéfices tirés de l'exploitation de la biodiversité soient partagés par tous, dans la mesure où ceux-ci peuvent aussi servir à la conservation participative par les populations elles-mêmes de leurs ressources et contribuer ainsi à une économie verte et circulaire.

Nous invitons par conséquent toutes les parties prenantes à s'imprégner et à s'approprier cet ouvrage afin que la République du Cameroun demeure le leader dans l'implémentation de ses engagements en matière de gestion durable de la biodiversité nationale et globale.

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Maitre de Recherches
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Université de Yaoundé I, Cameroun

**Jean Michel Onana in the field at Dom Community Forest.**
Photograph Y. Harvey, February 2006.

## From rationale to sustainable management of the biodiversity of plants

The territory of Cameroon is known for its richness in biological natural resources, or biodiversity. Before independence, forest reserves were created in order to preserve marketable forest species, then since the third sustainable development summit in 1992 biodiversity has been considered beyond its commercial value to also take into account the ecological and genetic potential of each species for current and future generations. Hence, the concept of sustainable management, which encompasses the history, present and future of the availability of the resources.

In order to implement its commitments as a Party to the Convention on Biological Diversity, rational management by administrative regulations now takes into account the results of scientific research. This is why the classification of forest reserves has been replaced by the creation of protected areas based on the main scientific indicators of conservation, such as endangered or endemic species. Knowledge of these indicators caused a conflict of interest between conservationists who wanted to stop the loss of biodiversity through the integral protection of forest resources and decision-makers and populations who considered that conservation was a major obstacle to the access and exploitation of forest resources for development.

The concept of Tropical Important Plant Areas (TIPAs) was then developed to reconcile conservation and the needs for the exploitation of ecosystem services for current and future generations. Thanks to the results of research on conservation indicators and checklists for conservation which already took into account non-timber forest products and the uses of plants, Cameroon's biodiversity is abundantly documented. TIPAs therefore constitute areas rich in biodiversity for both conservation and the use of populations. This is why this work presents, in each brief descriptive sheet, the parameters of each zone, including indicators of conservation, management, and use of plants, as a toolbox for sustainable management within the framework of the ecosystem approach and decentralisation of our country.

As can be seen, it is a question of going beyond conservation so that the benefits derived from the exploitation of biodiversity are shared by all, it being understood that these can also be used for participatory and integrated conservation by the populations themselves of their resources and thus contribute to a green and circular economy.

We therefore invite all stakeholders to immerse themselves in and appropriate this work so that the Republic of Cameroon remains a leader in the implementation of its commitments in terms of the sustainable management of global and national biodiversity.

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# Abbreviations and acronyms

## Acronyms

**AADA** = African Alliance for Developmental Action

**ANAFOR** = National Agency for Forest Development (formerly ONADEF, the National Forestry Development Office)

**ANCO** = Apicultural and Nature Conservation Organisation

**CBD** = Convention on Biological Diversity

**CITES** = Convention on International Trade in Endangered Species of Wild Fauna and Flora

**dbh** = diameter of a tree trunk at 1.3 m above the ground (breast height)

**EFRP** = Ebo Forest Research Project

**EOO** = Extent of Occurrence

**FCDO** = UK Foreign, Commonwealth & Development Office (includes the former DFID & ODA)

**GEF** = Global Environment Facility

**GBIF** = Global Biodiversity Information Facility

**GSPC** = Global Strategy for Plant Conservation

**IRAD** = Institute of Agricultural Research for Development

**IRD** = Institut de Recherche pour le Développement (French National Research Institute for Sustainable Development)

**HNC** = Herbier National de Cameroun (National Herbarium of Cameroon)

**IBA** = Important Bird Area

**IPA** = Important Plant Area

**IUCN** = International Union for Conservation of Nature

**KBA** = Key Biodiversity Area

**LBG** = Limbe Botanic Garden

**MCP** = Mt Cameroon Project (both that formerly at Limbe Botanic Garden, supported by FCDO, and that at Buea, supported by GTZ)

**MINEPDED** = Ministry of Environment, Nature Protection and Sustainable Development

**MINEF** = Former government ministry now divided into MINFOF and MINEPDED

**MINFOF** = Ministry of Forests and Fauna

**MINRESI** = Ministry of Scientific Research and Innovation

**MNHN Paris** = Museum National d'Histoire Naturelle, Paris (National Museum of Natural History, Paris)

**NGO** = non-governmental organization

**NTFP** = non-timber forest products

**PAC** = Plan d'Action de Conservation (Conservation Action Plan)

**pers. obs.** = personal observation

**RBG Kew** = Royal Botanic Gardens, Kew, UK

**RBS** = Rapid Botanic Survey

**REDD and REDD+** = an international framework to guide activities in forests to reduce carbon emissions from forest degradation and deforestation

**SEIA** = Social and Environmental Impact Assessment

**SEPFCO** = A logging company in Cameroon

**TIPA** = Tropical Important Plant Area

**UN** = United Nations

**UNCCD** = United Nations Convention to Combat Desertification

**UNESCO** = United Nations Educational, Scientific and Cultural Organisation

**USAID** = United States Agency for International Development

**UYI** = University of Yaoundé I

**WCS** = Wildlife Conservation Strategy, Cameroon

**WWF** = Worldwide Fund for Nature

**YA** = the internationally registered Index Herbariorum code for the National Herbarium of Cameroon

**ZSL** = Zoological Society of London

## IUCN Red List categories

**EX** = Extinct

**EW** = Extinct in the Wild

**CR** = Critically Endangered

**CR(PE)** = Critically Endangered (Possibly Extinct)

**EN** = Endangered

**VU** = Vulnerable

**NT** = Near Threatened

**LC** = Least Concern

**DD** = Data Deficient

**NE** = Not Evaluated

## Botanical abbreviations

**ined.** = ineditus = unpublished

**sp.** = species

**sp. nov.** = species novum (new species)

**sp. nov. aff.** = species novum affinis (new species similar to)

**spp.** = plural version of sp.

**var.** = variety

**subsp.** = subspecies

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# Introduction

## Objectives

This is the first book on the Important Plant Areas of any central African country. Its purpose is:

- To identify priority sites for plant conservation, providing accessible maps and data to allow local, national and international stakeholders to target conservation actions and resources
- To highlight globally and nationally important gaps in the existing Protected Area framework for Cameroon
- To help Cameroon fulfil international reporting obligations on biodiversity, including the Global Strategy for Plant Conservation (GSPC), the Convention on Biological Diversity (CBD), Aichi targets, the UN Sustainable Development Goals and its National Biodiversity Strategy and Action Plan (NBSAP)
- To highlight Cameroon's global importance for wild plant species, making data easily available to national and international scientists, policy makers, funders and tourists
- To encourage pride in the natural patrimony of Cameroon, its globally important plant species and habitats, and to support their conservation by future generations
- To improve livelihoods and community benefits in the buffer zones of Important Plant Areas through better awareness and management of plant resources for materials, food, ecosystem services, spiritual values and sustainable ecotourism

## Current and future extinction of Cameroon species

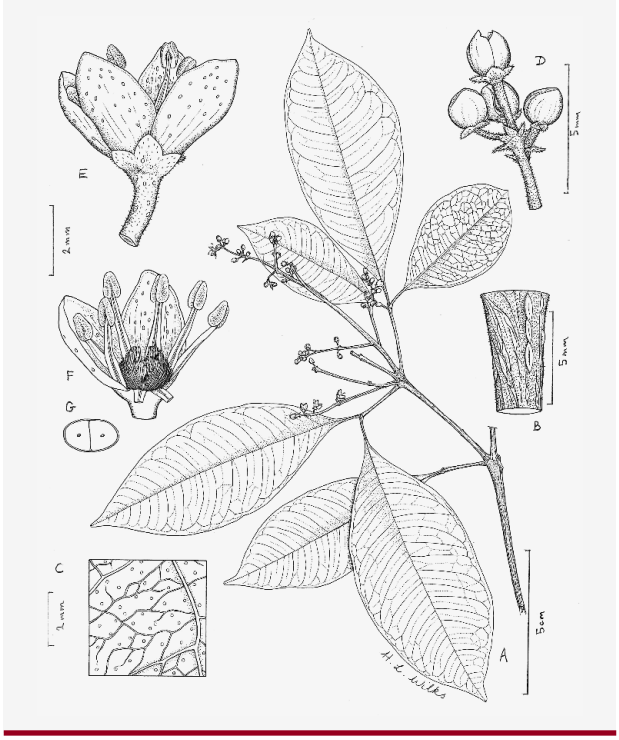
Improved prioritisation of conservation action is needed because Cameroon's rarest plant species are becoming globally extinct and their habitats are being irreversibly destroyed. In 2019, a global study of extinction of plant species showed that Cameroon is the country in continental tropical Africa with the highest recorded number of extinct plant species, with ten having been considered extinct, while four of these (one erroneously) were thought to have been rediscovered (Humphreys et al., 2019, see Table 1).

## Current and future extinction

| | Species | Family | "Extinct" | "Rediscovered" | Site | First/last seen (with herbarium specimen reference) |
|---|---|---|---|---|---|---|
| 1 | *Ardisia marcelianum (A. oligantha)* | Primulaceae (Myrsinaceae) | ✓ | | Mt Cameroon | c. 1906 (*Weberbauer* 46) |
| 2 | *Ardisia schlechteri* | Primulaceae (Myrsinaceae) | ✓ | | Bibundi-Mt Cameroon lowlands | April 1899 (*Schlechter* 12417) |
| 3 | *Beilschmiedia preussii* | Lauraceae | ✓ | | Bimbia-Bonadikombe, (Mt Cameroon lowlands) | May 1894 (*Preuss* 1272) |
| 4 | *Disperis kamerunensis* | Orchidaceae | ✓ | | Buea, Mt Cameroon | Sept. 1891 (*Preuss* 609) |
| 5 | *Eugenia kameruniana* | Myrtaceae | | ✓ | Mt Cameroon, Ototomo, near Yaoundé, Mt Eloumden | Pre-1897 (*Dusén* 9), 1970 (*Bos* 6928) |
| 6 | *Gastrodia africana* | Orchidaceae | | ✓ | Mt Cameroon, Mt Kala, Nkolandom | Pre-1897 (*Dusén* 397), 1968 (*Letouzey* 9509), 1975 (*de Wilde* 5448) |
| 7 | *Oxygyne triandra* | Thismiaceae (formerly Burmanniaceae) | ✓ | | Moliwe, Mt Cameroon lowlands | Sept. 1905 (*Schlechter* 15790) |
| 8 | *Pausinystalia brachythyrsum** | Rubiaceae | | ✓ | Bipindi-Ngovayang | 1898 (*Zenker* 1746) |
| 9 | *Pavetta bangweensis* | Rubiaceae | ✓ | | Bangwe (W of Dschang) | 1898–1899 (*Conrau* 66) |
| 10 | *Plectranthus (Coleus) dissitiflorus* | Labiatae | | ✓ | Buea-Bimbia, Mt Cameroon | Oct. 1891 (*Preuss* 1055) |

**Table 1. The ten Cameroon species which have been listed as globally extinct (Humphreys et al., 2019, mainly derived from Cable & Cheek, 1998), four of which have subsequently been considered rediscovered (Humphreys et al., 2019). However, one of these, *Ardisia schlechteri,* is now considered an extinct point endemic after all (Cheek pers. obs.), thus of these, six species appear extinct.**

*Considered a synonym of *Corynanthe macroceras* but opinion is divided (according to POWO).

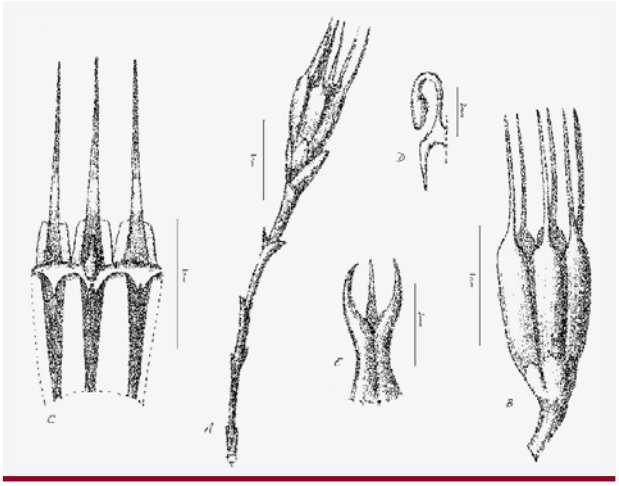


***Vepris bali,*** **a Cameroonian species endemic to the Bali Ngemba Forest Reserve, Bali, NW Region, now considered globally extinct (Cheek et al., 2018a). Extensive targeted searches 2000–2004 failed to re-find it.**

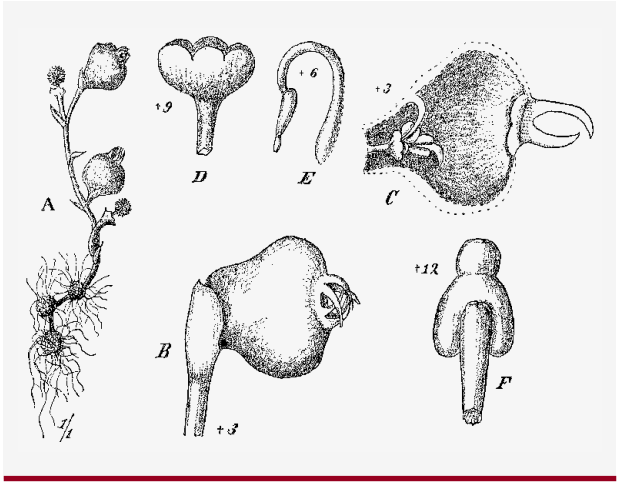
Drawing by Hazel Wilks.

***Vepris montisbambutensis,*** **a Cameroonian species endemic to the Lebialem Highlands, SW Region, near the Bamboutos Mts of West Region (Onana & Chevillotte, 2015). Recent searches have failed to re-find it.**

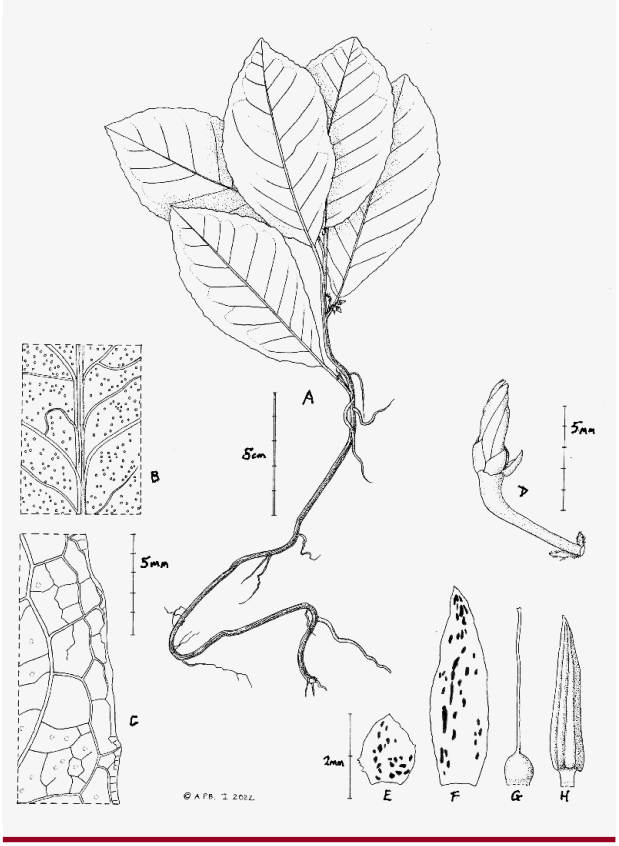
Photograph type specimen at the National Herbarium of Cameroon by Jean Michel Onana.



***Oxygyne triandra*, the best known of Cameroon's globally extinct plant species. Extensive targeted searches by multiple researchers from 1990–2016 failed to re-find it. Formerly endemic to Moliwe near Limbe, SW Region.**
Drawing from Schlechter, 1906.




***Afrothismia pachyantha*, a Cameroonian species endemic to Moliwe near Limbe, SW Region, now considered globally extinct (Cheek et al., 2019).**
Drawing from Schlechter, 1906.




***Ardisia schlechteri*, a Cameroonian species endemic to Bibundi near Limbe, SW Region, now considered globally extinct (Cable & Cheek, 1998). Purported rediscoveries in Gabon and elsewhere were misidentifications of other species.**
Drawing from the type specimen by Andrew Brown.

Subsequent to Humphreys et al. (2019), three additional species have been considered (so far) to be globally extinct in Cameroon based on being known as single-site endemics (often with a single specimen having been recorded) and not having been re-found despite targeted searches. These are: *Vepris montisbambutensis* Onana (Onana & Chevillotte, 2015) from SW Region, 25 km NNW of Dschang; *Vepris bali* Cheek (Cheek et al., 2018a) from Bali Ngemba Forest Reserve, NW Region; *Afrothismia pachyantha* Schltr. (Cheek et al., 2019) from Moliwe, the lowlands of Mt Cameroon. Currently we can be fairly confident that Cameroon has these nine globally extinct plant species; however, it is likely they are only the tip of the iceberg.

Numerous other rare Cameroon species have not been seen for over 60 years and may also be globally extinct but have not yet been subjected to intensive or targeted surveys (Table 2). However, in the last few decades, many botanical specimen-based surveys resulting in thousands of new herbarium specimens have been conducted over much of Cameroon. Hundreds of additional new species to science have been discovered, but despite this effort these 127 'missing species' have not been rediscovered. Targetting these species in order to rediscover them and conserve them if they are not already extinct should be a high priority. One example of a missing species is *Pyrostria bispathacea* (Mildbr.) Bridson, which has not been seen since its discovery in January 1914 10 km NW of 'Jaunde Station'. Since this site corresponds to Mt Nkolondom near Yaoundé, where some forest survives, it may be that it survives today and might be conserved. Should targeted searches by knowledgeable persons at the appropriate season fail to find this and the other possibly extinct species, then formal listing of their status as globally extinct will be in order.

**Table 2. List of the 127 Cameroonian potentially extinct plant species (not seen for 60 years or more). Source and nomenclature from Onana (2013). Nineteen species have been classified by the IUCN as 'Critically Endangered (Possibly Extinct)'. More from the list presented here might also merit this status although the 60-year period used here is not part of the IUCN criteria (IUCN, 2019).**

## Potentially extinct Cameroonian plant species

| Family | Species | Region: site | Date last collected | Herbarium reference |
|---|---|---|---|---|
| Acanthaceae | *Dischistocalyx rivularis* Bremek. | South: Bipindi | 1911 | Zenker 4056 (G, K, Z) |
| Acanthaceae | *Rungia caespitosa* Lindau | South: Bipindi | 1907 | Zenker 3399 (K, Z) |
| Acanthaceae | *Thunbergia rufescens* Lindau | Southwest: Barombi Ma Mbu in Kake (Also SE Nigeria) | 1896 | Preuss 432 (K) |
| Amaryllidaceae | *Crinum calamistratum* Bogner & Heine | Southwest: Kumba | 1948 | Gregory 332 (K, P) |
| Annonaceae | *Artabotrys jacques-felicis* Pellegr. | Centre: Ndikinimeki (Also in RD Congo) | 1938–1940 | Jacques-Félix 2490 (P) |
| Annonaceae | *Afroguatteria discostigma* (Diels) X.Guo & R.M.K.Saunders | South: Bipindi | 1904 | Zenker 2980, 3023 (K, Z) |
| Annonaceae | *Monanthotaxis dielsiana* (Engl.) P.H.Hoekstra | South: 60 km SW of Eseka 3.47N 10.5 E | 1965 | Leeuwenberg 5088 (B, K, MO, P, WAG, YA) |
| Annonaceae | *Uvariopsis sessiliflora* (Mildbr. & Diels) Robyns & Ghesq. | East: Lomié, between Bashonga and Djoni (3°31'N 12°25'E) | 1911 | Mildbraed 5239 (B) |
| Apocynaceae | *Pachycarpus medusonema* Bullock | Adamaoua: 80 km E of Ngaoundéré | 1962 | Piot 404 (P) |
| Araceae | *Amorphophallus mildbraedii* K.Krause | East: Babua | 1914 | Mildbraed 9287 (B, K) |
| Asparagaceae | *Albuca zenkeri* Engl. | Centre: Yaoundé | 1892–1894 | Zenker 1507a (Z) |
| Asparagaceae | *Dipcadi garuense* Engl. & K.Krause | North: Garoua | 1909 | Ledermann 3293 (B) |
| Asparagaceae | *Dipcadi ledermannii* Engl. & K.Krause | North: Mayo [Mao] Godi (8°47' N 14°10' E) | 1909 | Ledermann 4257 (B) |
| Asparagaceae | *Drimia ledermannii* K.Krause | Adamaoua: between Lubare and Bakari; Tschappe pass, Ouest: between Bamessing and Babungo | 1908-1909 | Ledermann 2264 (B)<br>Ledermann 2746 (B)<br>Ledermann 1963 (B) |
| Asparagaceae | *Scilla dualaensis* Poelin | Littoral: area of Douala, near Japoma [Yapoma] | 1904 | Winkler 717 (WRSL) |
| Asparagaceae | *Chlorophytum camporum* Engl. & K.Krause | Littoral: Bare (5°01' N 9°58' E) | 1908 | Ledermann 1401 (B) |
| Asparagaceae | *Chlorophytum candatibracteatum* Engl. & K.Krause | North: Garoua | 1909 | Ledermann 3408 (B) |
| Asparagaceae | *Chlorophytum baturense* K.Krause | East: near de Batouri | 1911 | Mildbraed 4834 (B) |
| Asparagaceae | *Chlorophytum brevipedunculatum* Poelin | North: Ssagdsche | 1909 | Ledermann 3748 (B) |
| Asteraceae | *Aedesia engleriana* Mattf. | Adamaoua: Kim-Njua (6°N 11°30' E) | 1912 | Thorbecke 701 (B, UPS) |
| Bignoniaceae | *Stereospermum zenkeri* K.Schum. ex De Wild. | Centre: Ototomo, 50 km W Yaoundé | 1950 | Tsoungui s.n. (P) |
| Celastraceae | *Elæodendron kamerunense* (Loes.) Villiers | Northwest: Babessi (6°01' N 10°34' E) (Also E R.D. Congo) | 1909 | Ledermann 5796, 5958 (B†) |
| Celastraceae | *Salacia conraui* Loes. | Sud-Ouest: Tali, 40 km NW Nguti | 1896–1899 | Conrau 104 (B†) |

*Potentially extinct Cameroonian plant species*

| Family | Species | Region: site | Date last collected | Herbarium reference |
|---|---|---|---|---|
| Celastraceae | *Pristimera biholongii* N.Hallé | Centre: Nkolbisson (Yaoundé) | 1962 | Breteler 2743 (WAG, YA); de Wilde W.c.s. 1371 (WAG, YA) |
| Celastraceae | *Pristimera breteleri* N.Hallé | Centre: Nkolbisson (Yaoundé) | 1962 | Breteler 2739 (YA) |
| Celastraceae | *Pristimera staudtii* (Loes.) R.H.Archer | Centre: Yaoundé, (also in Sierra Leone) | 1894 | Zenker & Staudt 325 (BM, G, K, Z) |
| Celastraceae | *Thyrsosalacia racemosa* (Loes. ex Harms) N.Hallé | Littoral: Loum (4º43'N 9º43'E) | 1909 | Ledermann 6420, 6438 (B†) |
| Commelinaceae | *Palisota gracilior* Mildbr. | Est: Lomié | 1911 | Mildbraed 5425 (B) |
| Costaceae | *Costus bicolor* J.Braun & K.Schum | Cameroun | | Flore du Cameroun Vol. 4 (Koechlin, 1965) |
| Costaceae | *Costus dendrophilus* K.Schum | South: Batanga | 1894 | Dinklage 1138 (B†) |
| Costaceae | *Costus ledermannii* Loes. | South: Route vers Bodje (=Ebodje) 2º33' N 9º49' E) | 1908, | Ledermann 344 (B†) |
| Dioscoreaceae | *Dioscorea claessensii* De Wild. | Centre: Yaoundé (Also in R.D. Congo) | 1893–1895 | Zenker 723 (B). |
| Euphorbiaceae | *Alchornea mildbraedii* Pax & K.Hoffm. | Adamaoua | | (Lebrun & Stork, 2006) |
| Euphorbiaceae | *Erythrococca rivularis* (Müll. Arg.) Prain | Southwest: John river near Limbe (also Bioko and Gabon) | 1861–1862 1961 in Gabon (GBIF.org) | Mann 1785 (K) |
| Fabaceae | *Grona zenkeri* (Schindl.) H.Ohashi & K.Ohashi | Littoral: Sud: Bipindi | 1896–1922 | Zenker 1615, 4787 (K) |
| Fabaceae | *Rhynchosia ledermannii* Harms | Northwest: Babadju | 1908 | Ledermann 1843 (K) |
| Fabaceae | *Ostryocarpus zenkerianus* (Harms) Dunn | Centre: Sanaga | 1890–1895 | Zenker 1453 (Z) |
| Fabaceae | *Platysepalum scaberulum* Harms | South: between Ebolowa and Sangmélima | 1911 | Mildbraed 5529 (B) |
| Fabaceae | *Pterocarpus zenkeri* Harms | Centre: Dikop near Eséka | About 1962 | Bounoungou in SRFK 2459 (K, YA) |
| Icacinaceae | *Stachyanthus cuneatus* Sleumer | Littoral: Loum (4°43' N 9°43' E) | 1909 | Ledermann 6437 (B†) |
| Lamiaceae | *Achyrospermum schlechteri* Gürke | Southwest: Buea, Mt Cameroun (Also SE Nigeria) | 1900 | Schlechter 12850 (K) |
| Lamiaceae | *Clerodendrum singwanum* B.Thomas | West: Marki Singwa) Mts Bamboutos) | 1908 | Ledermann 1684, 1669 (B) |
| Lamiaceae | *Coleus preussii* Gürke | Southwest: Buea | 1891 | Preuss 691 (B) |
| Lamiaceae | *Vitex benuense* Engl. | North: Riv. Benoué, Lagdo | 1909 | Ledermann 4400; 4778, 4764a; 4743 (B) |
| Lamiaceae | *Vitex dinklagei* Gürke | South: Batanga | 1894 | Dinklage 1341, 1394 (B) |
| Lamiaceae | *Vitex nlonakensis* Engl. ex G.Piep. | Littoral: Mt Nlonako | 1909 | Ledermann 6185 (B) |
| Lauraceae | *Beilschmiedia barensis* (Engl. & K.Krause) Robyns & Wilczeck | Littoral: Douala | s.d. (near 1962) | s.coll. in YA [SRFCam] 2119 (P) |
| Lauraceae | *Beilschmiedia congestiflora* (Engl. & K.Krause) Robyns & Wilczeck | Adamaoua: Tschappe Pass | 1908–1909 | Ledermann 2804 (B) |
| Lauraceae | *Beilschmiedia crassipes* (Engl. & K.Krause) Robyns & Wilczeck | Littoral: Loum | 1909 | Ledermann 6460 (B) |

*Potentially extinct Cameroonian plant species*

| Family | Species | Region: site | Date last collected | Herbarium reference |
|---|---|---|---|---|
| Lauraceae | *Beilschmiedia grandifolia* (Stapf) Robyns & Wilczeck | South: Bipindi (Also in Gabon) | 1930–1935 | Foury 79 (P) |
| Lauraceae | *Beilschmiedia hutchinsoniana* Robyns & Wilczek | Southwest: Bulifambo, Buea | 1929 | Maitland 559 (K) |
| Lauraceae | *Beilschmiedia jabassensis* (Engl. & K.Krause) Robyns & Wilczeck | Littoral: Yabassi, near river Wouri | 1908–1909 | Ledermann 1105 & 1107 (B) |
| Lauraceae | *Beilschmiedia kostermansiana* Robyns & Wilczeck | South: Bipindi | 1896–1922 | Zenker 4483 (B, P, Z) |
| Lauraceae | *Beilschmiedia lancilimba* Kosterm. | Northwest: Babanki Tungo, near Bamenda | 1908–1909 | Ledermann 5810 (B) |
| Lauraceae | *Beilschmiedia letouzeyi* Robyns & Wilczek | Centre: Oveng, Akono, (also in SW Centrafrique and Congo according to gbif.org) | 1959 | Letouzey SRFCam 1351 (P, YA) |
| Lauraceae | *Beilschmiedia membranifolia* Kosterm. | South: Bipindi | 1908 | Zenker 3562 (K, Z) |
| Lauraceae | *Beilschmiedia myrciifolia* (Moore) Robyns & Wilczeck | South: Bipindi<br>(Also SE Nigeria) | 1896–1922 | Zenker 2609 (Z) |
| Lauraceae | *Beilschmiedia ndongensis* (Engl. & K.Krause) Robyns & Wilczeck | Littoral: Ndongé, near Nkongsamba | 1909 | Ledermann 6165 (B) |
| Lauraceae | *Beilschmiedia nitida* Engl. | South: Lolodorf | 1895–1896 | Staudt 106 (P) |
| Lauraceae | *Beilschmiedia robynsiana* Kosterm. | Southwest: Banga near Kumba | 1948 | Brenan 9413 (K) |
| Lauraceae | *Beilschmiedia sessilifolia* (Stapf) Engl. ex Fouilloy | South: Bipindi | 1896–1912 | Zenker 2256 (P, Z) |
| Lauraceae | *Beilschmiedia staudtii* Engl. | Southwest: Kumba<br>South: Bipindi<br>(Also in Gabon) | 1895–1896<br>1896–1912 | Staudt 857 (B)<br>Zenker 4899 (Z) |
| Lauraceae | *Beilschmiedia zahnii* (K.Krause) Robyns & Wilczeck | Southwest: near Limbe | 1912 | Zahn 332 (B) |
| Loranthaceae | *Helixanthera periclymenoides* (Engl. & K.Krause) Balle | South: Bipindi, Mbiave island | 1908 | Zenker 3406 (B, BR, G, K, P, Z) |
| Malvaceae | *Hibiscus elongatifolius* Hochr. | Centre: Sanaga | 1897 | Zenker 1440 (BM, G, P, Z) |
| Malvaceae | *Hibiscus ledermannii* Ulbr. | North: Duma (= Doumo 10°03' N 13°18' E) | 1909 | Ledermann 4334 (B) |
| Malvaceae | *Cola bipindensis* Engl. & K.Krause | South: Bipindi | 1912 | Zenker 4479 (B, Z) |
| Malvaceae | *Cola edeensis* Engl. & K.Krause | Littoral: Edéa | 1909 | Büsgen 501 (B†). |
| Malvaceae | *Cola lomensis* Engl. & K.Krause | Littoral: Ndonge near Mt Nlonako | 1909 | Ledermann 6234 (B†) |
| Malvaceae | *Cola nana* Engl. & K.Krause | South: Fenda, 48 km Kribi | 1911 | Mildbraed 5898 (B†) |
| Malvaceae | *Cola ndongensis* Engl. & K.Krause | Littoral: Ndonge near Mt Nlonako | 1909 | Ledermann 6234 (B†, K) |
| Malvaceae | *Cola subglaucescens* Engl. | South: Kribi | 1911 | Mildbraed 6027 (B†) |
| Malvaceae | *Cola sulcata* Engl. | South: Bipindi | 1908 | Zenker 3724 (B†, Z) |
| Malvaceae | *Leptonychia lokundjensis* Engl. & K.Schum | South: Bipindi | 1908 | Zenker 3619 (B†, K, Z) |

*Potentially extinct Cameroonian plant species*

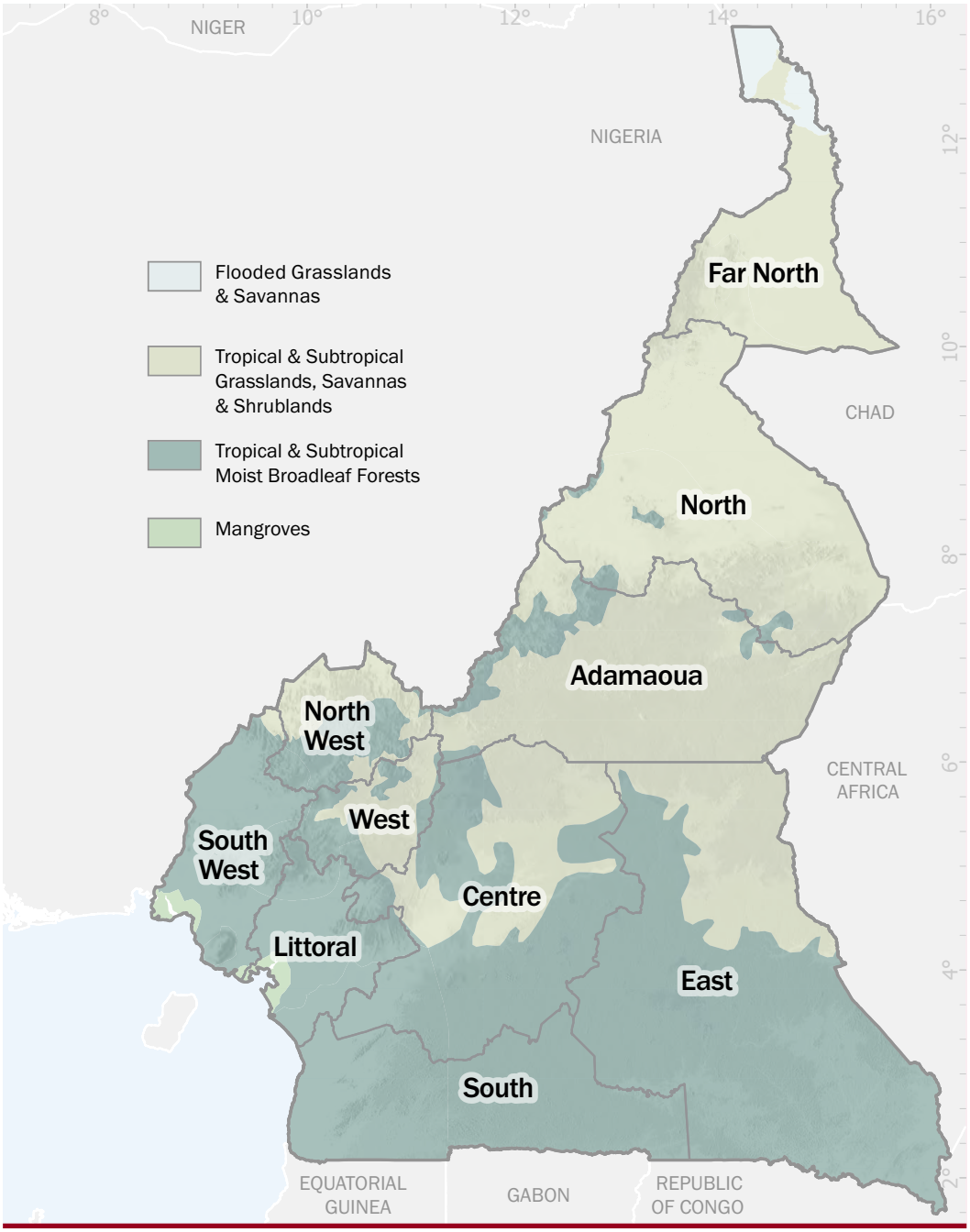
| Family | Species | Region: site | Date last collected | Herbarium reference |
|---|---|---|---|---|
| Malvaceae | *Pterygota adolfi-friederici* Engl. & K.Krause | East: Molundou (2° 00'N 15°12' E) | 1910 | Mildbraed 3969 (B†) |
| Malvaceae | *Scaphopetalum pallidinerve* Engl. & K.Krause | Littoral: Loum (4°43' N 9°43' E) | 1909 | Ledermann 6403, 6474 (B†) |
| Metteniusaceae | *Rhaphiostylis elegans* Engl. | South: Bipindi | 1908 | Zenker 3615 (B†, Z) |
| Metteniusaceae | *Rhaphiostylis poggei* Engl. | Southwest: Kumba, Barombi Mbo lake | 1889–1892 | Preuss 561 (B†) |
| Myrtaceae | *Eugenia buchholzii* Engl. | Southwest: Mungo | 1873–1874 | Buchholz s.n. (B) |
| Myrtaceae | *Eugenia dodoana* Engl. | Adamaoua: Dodéo [Dodo], Gendoro | 1909 | Ledermann 2856 (B) |
| Myrtaceae | *Eugenia ledermannii* Engl. & Brehm. | Northwest: Kumbo & probably West: Mts Bamboutos) | 1908–1909 | Ledermann 1997 (B) (Keay, 1954) |
| Myrtaceae | *Eugenia poliensis* Aubrév. & Pellegr. | North: near Poli, slopes of l'Hosséré Godé | 1946 | Aubréville 870 (P) |
| Orchidaceae | *Diaphananthe trigonopetala* Schltr. | S.loc. | 1904 | Leidien s.n. (Orchis 8: tafel 4 icon-) |
| Orchidaceae | *Diaphananthe vandiformis* (Kraenzl.) Schltr. | Southwest: Buea | 1952 | Gregory 581 (K) |
| Pandanaceae | *Pandanus crassilix* K.L.Huynh | Littoral: Malimba | 1863 | Krausse 3364, s.n. (B) |
| Pandanaceae | *Pandanus tenuimarginatus* K.L. Huynh | Littoral: Douala | 1888 | Brunt s.n. ? |
| Phyllanthaceae | *Maesobotrya scariosa* Pax & K.Hoffm. | East: Molundou | 1910–1911 | Mildbraed 4804 (B) |
| Podostemaceae | *Ledermanniella batangensis* (Engl.) C.Cusset | South: Grand Batanga, chutes de la Lobé | 1908–1909 | Ledermann 221 (B, U) |
| Podostemaceae | *Ledermanniella monandra* C.Cusset | Adamaoua: Mao Bika, near Dodéo (60 km W Tignère) | 1909 | Ledermann 2872 (B) |
| Primulaceae | *Ardisia dekinderi* Govaerts | South: Bipindi | 1922 | Zenker 4592 (G, BM, E, HBG, K, Z) |
| Primulaceae | *Ardisia polyadenia* Gilg | Northwest: Kebo | 1896–1899 | Conrau 215 (B†) |
| Putranjivaceae | *Drypetes gracilis* Pax & K.Hoffm. | East: Lomié | 1911 | Mildbraed 5042, 5046, 5070 (B) |
| Putranjivaceae | *Drypetes peltophora* S.Moore | South: Bitye | 1912 | Bates 1295 (BM) |
| Putranjivaceae | *Drypetes rubriflora* Pax & K.Hoffm. | East: near Deng Deng | 1914 | Mildbraed 8658 (B) |
| Rubiaceae | *Galium deistelii* K.Krause | Southwest: Buea | 1905 | Deistel 83 (B) |
| Rubiaceae | *Mussaenda leptantha* Wernham | South: river Bitye | 1919 | Bates 1212 (BM) |
| Rubiaceae | *Pavetta bangweensis* Bremek. | Southwest: Bangwe | 1896–1899 | Conrau 66 (B) |
| Rubiaceae | *Pavetta brachysiphon* Bremek. | East: Confluent Lom and Djerem, near de Deng Deng | 1914 | Mildbraed 8536 (K) |
| Rubiaceae | *Pavetta laxa* S.D.Manning | South: Mékomo, 8 km SW confluent Dja and Lobo | 1962 | Letouzey 4581 (YA, P) |
| Rubiaceae | *Psychotria microthyrsa* E.M.A.Petit | East: river Ngoko | 1899 | Schlechter 12731 (BR, B, BM, G, K, Z) |
| Rubiaceae | *Pyrostria bispathacea* (Mildbr.) Bridson | Centre: 10 km NW de Yaoundé | 1911–1914 | Mildbraed 7840 (B†, K) |

*Potentially extinct Cameroonian plant species*

| Family | Species | Region: site | Date last collected | Herbarium reference |
|---|---|---|---|---|
| Rubiaceae | *Rutidea tenuicaulis* K.Krause | East: Molundou, near Mwapak, 43 km Yokadouma–Lomé (3°24' N 14°36'–14°10'E) | 1911 | Mildbraed 4988 (B) |
| Rubiaceae | *Rytigynia subbiflora* (Mildbr.) Robyns | Centre: between Nanga Eboko and Ewésé | 1914 | Mildbraed 8323 (B) |
| Rubiaceae | *Sabicea amomii* Wernham | South: Bityé | 1906–1928 | Bates 1411 (BM) |
| Rubiaceae | *Sabicea brachiata* Wernham | Adamaoua: Tibati | 1909 | Ledermann 2450 (B) |
| Rubiaceae | *Sabicea composita* Wernham | Littoral: Mbo [Mbo plain] | 1908 | Ledermann 1515 (B) |
| Rubiaceae | *Sabicea gracilis* Wernham | South: Batanga | 1895–1904 | Bates 398 (BM) |
| Rubiaceae | *Sabicea stipularioides* Wernham | South: Batanga | 1895–1904 | Bates 423 (BM) |
| Rubiaceae | *Sabicea trigemina* K.Schum | South: Bipindi | 1898 | Zenker 1821 (K, Z) |
| Rubiaceae | *Spermacoce garuensis* (K.Krause) Govaerts ined. | North: Garoua | 1909 | Ledermann 4644 (B) |
| Rubiaceae | *Spermacoce ledermannii* (K.Krause) Govaerts ined. | North: Sagdsche (8°18' N 13°32' E) | 1909 | Ledermann 3929, 3760 (B) |
| Rubiaceae | *Tricalysia patentipilis* K.Krause | Adamaoua: Gondero–Gebirge, Tschape Pass | 1909 | Ledermann 2716 (B) |
| Rubiaceae | *Tricalysia subsessilis* K.Schum. | South: Lolodorf | 1896 | Staudt 422 (B) |
| Rubiaceae | *Trichostachys lehmbachii* K.Schum. | Southwest: Etinde | 1896–1898 | Lehmbach s.n (B†) |
| Rutaceae | *Vepris oubanguensis* (Aubrév. & Pellegr.) Onana | Adamaoua: near Ngaoundéré (also in C.A.R.) | 1938–1940 | Jacques-Félix 3463 (P) |
| Sapindaceae | *Pancovia polyantha* Gilg ex Engl. | Southwest: Kumba | 1897–1897 | Staudt 906 (B) |
| Sapotaceae | *Manilkara dukensis* (Engl. & K.Krause) H.J.Lam | North: Duka near de Garoua (9°06' N 13°23' E) | 1909 | Ledermann 3638 (B) |
| Sapotaceae | *Manilkara ilendensis* (Engl.) H.J.Lam | South: Campo | 1908 | Ledermann 627 (B) |
| Sapotaceae | *Mimusops dodensis* Engl. | Adamaoua: Dodo, towards Mao-Bika | 1909 | Ledermann 2891, 2976 (B) |
| Sapotaceae | *Mimusops ebolowensis* Engl. & K.Krause | South: between Ebolowa and Sangmelima (also in Angola according to POWO) | 1911 | Ledermann 5562 (B) |
| Sapotaceae | *Mimusops mildbraedii* Engl.& K.Krause | East: between Lomié, Assobam and Boumba | 1911 | Mildbraed 5062 (B) |
| Sapotaceae | *Mimusops ngembe* Engl. & K.Krause | South: near Campo | 1911 | Schorrkoff 42 (B) |
| Sapotaceae | *Pouteria hexastemon* Baehni | Southwest: Victoria [Limbe] | 1913 | Ludwigs 302 (M) |
| Selaginellaceae | *Selaginella serratosquarrosa* Quansah | Littoral: Logbatjeck, Edéa area | 1948 | Niklès 102 (P) |
| Zingiberaceae | *Renealmia alborosea* K.Schum | Southwest: Ikassa | 1900 | Rudatis 6 (K) |
| Zingiberaceae | *Renealmia batangana* K.Schum | South: Grand Batanga | 1887 | Dinklage 701b |
| Zingiberaceae | *Renealmia laxa* K.Schum | Centre: 23 km W Yaoundé | 1963 | Breteler 1573 (WAG, YA) |

## Cameroon overview

Cameroon is a medium-sized country in tropical West-Central Africa occupying 475,442 km². It is of major conservation importance, with high levels of remaining biodiversity across multiple taxonomic groups. Cameroon's flora is incompletely documented but 7,850 species were enumerated in the checklist of Onana (2011). Subsequently, 235 taxa have been described (IPNI data 2011–March 2023 inclusive, accessed April 2023) and therefore the total is now likely to be far higher than 8,000 species. This wealth of diversity is probably partly explained by the widely varying physical geography and range of habitats Cameroon incorporates, with the term 'Africa in miniature' often applied. It contains coastal mangroves, tropical rainforests, semi-deciduous forests, woodland, wooded grasslands, grasslands, submontane cloud forests, montane forests, subalpine vegetation, large rivers, waterfalls and rapids, swamps and crater lakes. The Cameroon Volcanic Line of mountains are the tallest in West or West-Central Africa and help produce some of the highest rainfall in the world as well as a wide range of altitudinal zones.




**Map 1. Vegetation and terrain map of Cameroon with administrative regions marked.**

Most of Cameroon fits into the equatorial climate zone, predominantly Koppen-Geiger types Aw (winter-dry) inland, and type Am (monsoonal) along the 100–200 km wide coastal band and in the far south-east (Beck et al., 2018; Kottek et al., 2006). The coastal band is globally important for its lowland tropical rainforests, although these are partially degraded and rapidly disappearing in places. It can be divided into two ecoregions separated by the Sanaga river: the Cross-Sanaga-Bioko Coastal Forests, which reach north into Nigeria, and the Atlantic Equatorial Coastal Forests, which extend southwards into Equatorial Guinea and Gabon (Olson et al., 2001). These zones together form the Congolian Coastal Forests ecoregion in the Global 200 priority classification of Olson and Dinnerstein (2002).

The high mountains of the Cameroon Volcanic Line, which bisect these forests and extend to the drier north-east of the country, form the Cameroonian Highlands forests ecoregion. Most notable of the peaks is Mt Cameroon which rises directly from the Gulf of Guinea coast to over 4,000 m and has been a focus for plant collectors since the 19th century. The Cross-Sanaga-Bioko region, which incorporates much of the montane topology as well as lush lowland forest, has been reported to have the highest generic and species diversity per degree square in tropical Africa (Barthlott et al., 1996; Dagallier et al., 2020).

In the south-east of the country, the sparsely populated South Cameroon Plateau is dominated by semi-deciduous rainforest that appears to be more moderately diverse in plants and is home to most of the remaining large-mammal populations. Further north, the vegetation transitions through wooded grasslands to steppe, interrupted by the unique submontane forests of the Mandara mountains which have been heavily transformed by a long history of high population density and agriculture. Overall, no less than six of the Global 200 priority ecoregions are represented in Cameroon (Olson and Dinnerstein, 1998, 2002). Cameroon's forests also cover the transition between two biological realms – the Guinean and Congolian forest regions – while the Cameroon Highlands bring elements from the Afromontane centre of endemism (White, 1983).

Compared with other parts of Africa, such as most West African countries, Cameroon has some large areas of remaining relatively intact vegetation. However, its forests are rapidly diminishing and certain habitats, such as the submontane forests of the Bamenda Highlands, have all but disappeared. In the period 2002–2020 Cameroon lost 708,000 ha (3.7%) of rainforest and 1.53 Mha (4.9%) of total tree cover (2001–2020). As a result, 903 mt of $CO_2e$ was released (Global Forest Watch, 2021). The annual rate of deforestation doubled from the 2006–2012 to the 2013–2019 period (Vancutsem et al., 2021). Logging, mining and agro-industry (particularly palm oil) are notable threats but small-scale agriculture probably remains the major driver of forest loss and, consequently, the major threat to plant species.

The Red Data Book of Cameroon (Onana & Cheek, 2011) provisionally assessed 815 plant species as globally threatened and as of July 2022, 911 Cameroon plant species were formally placed on the IUCN Red List of globally threatened species (IUCN, 2022), with many other provisionally threatened species awaiting assessment. Cameroon has the highest number of threatened trees in mainland Africa (414 species constituting 21% of its tree flora) and the highest number of documented plant global species extinctions in mainland tropical Africa (BGCI, 2021; Humphreys et al., 2019).

The existing protected area network, although substantial, is largely based on former hunting reserves and the conservation of large mammals. Rare and threatened plants are often little known and not evidenced at these sites. Generally, there is little easily available information or awareness concerning the most important sites for indigenous plant species or their current state of conservation. Previous publications by scientists in Cameroon – at Kew and elsewhere – have focused on checklists for a number of sites (Campo-Ma'an, Tchoutou, 2004; Ngovayang, Droissart et al., 2019, both in South Region), and also Conservation Checklists (incorporating Red Data assessments) for Mt Cameroon (Cable & Cheek, 1998), Kupe, Mwanenguba & the Bakossi Mts (Cheek et al., 2004), Lebialem Highlands (now Tofala Hills, Harvey et al., 2010) all in SW Region; Mt Oku & the Ijim Ridge (Cheek et al., 2000a), Bali Ngemba (Harvey et al., 2004), Dom (Cheek et al., 2010) in NW Region; Mefou proposed National Park (Cheek et al., 2011) in Centre Region, plus the Red Data Book of threatened species covering the whole of Cameroon (Onana & Cheek, 2011) and the synopsis of endemic and rare plants of Cameroon (Onana, 2013). It is these projects that have led to this current effort to demarcate the Important Plant Areas (IPAs) of Cameroon.

## Further information

**tipas.kew.org**

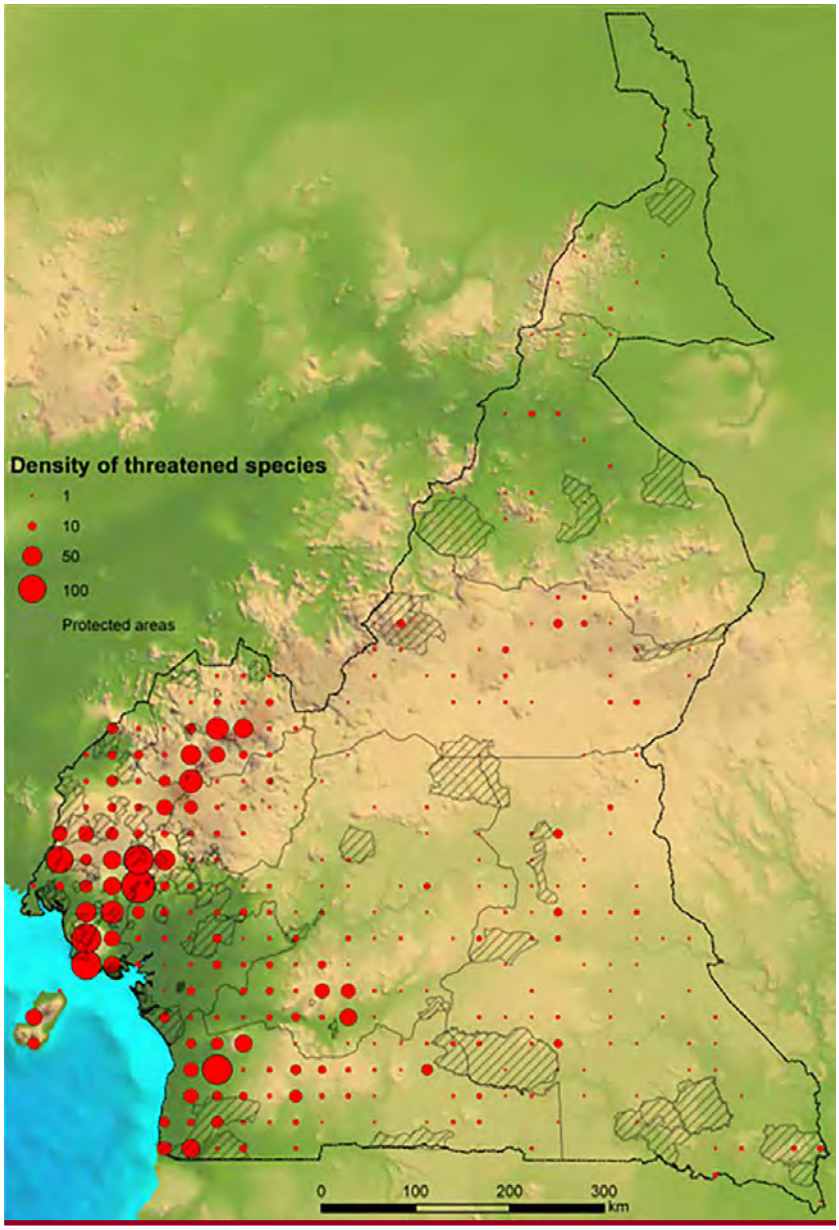
**www.kew.org/science/our-science/projects/tropical-important-plant-areas-cameroon**

**www.kew.org/science/our-science/projects/tropical-important-plant-areas**

**www.wri.org/data/cameroon-vegetation-cover**

## Cameroon and the origin of the programme for global IPAs in the tropics

The global programme for Important Plant Areas (IPAs) in the tropics (TIPAs) was launched in London in 2015 and was heavily based on and inspired by work in Cameroon. The Red Data Book of Cameroon Plants (Onana & Cheek 2011, see Map 2 below), showed that most threatened plant species are geographically clustered in hotspots of different sizes. Some of these are already conserved, such as the Korup National Park, and others not, such as the major cluster of the Ngovayang massif near Bipindi, which is highly threatened. Evidencing such areas as IPAs could help their conservation. The initiative of the Ministry of Forestry and Fauna (MINFOF, Government of Cameroon) also inspired us to proceed with the TIPAs project. MINFOF designated as protected areas the Mt Cameroon National Park, the Bakossi National Park and the Lake Oku Plant Sanctuary, all based on data on threatened plant species provided by a series of Conservation Checklists (e.g. Cable & Cheek, 1998; Cheek et al., 2004; Cheek et al., 2000a). These were the first protected areas set up in Cameroon justified by not only threatened animals but also evidence on threatened plant species. These MINFOF actions gave us hope that assembling data on threatened plant species of Cameroon on a Cameroon-wide basis, and evidencing Important Plant Areas of Cameroon, might result in further conservation-positive outcomes.




**Map 2. Concentrations of threatened plant species in Cameroon, mapped on ¼ degree squares (c. 30 km x 30 km); the smallest spots with 1 Red Listed species, the largest with 100 or more species. Analysis by S. Bachmann.**

Reproduced from Onana & Cheek (2011), The Red Data Book of Cameroon Plants.

## Cameroon Tropical Important Plant Areas programme: development

Cameroon was one of the seven regions across the world in which Tropical IPAs (TIPAs) were initiated in 2015. This was because of the long and productive partnership in plant science and conservation between the IRAD-National Herbarium of Cameroon and RBG Kew that dates back to 1992. Cameroon was also key as the country in which Tropical IPAs had been incubated (see above). The first workshops to consult on and establish interest in the possibility of a Cameroon TIPAs programme were held in December 2016 in Yaoundé with the IRAD-National Herbarium of Cameroon, firstly at IRAD-N'kolbisson, hosted by Prof. Eddy Ngonkeu, and then at the University of Yaoundé I, hosted by Dr Elvire Biyé with Dr Jean-Michel Onana. A further meeting at the Department for Wildlife and Protected Areas, MINFOF, then took place, arranged by Dr Barthélemy Tchiengué and Dr Florence Ngo Ngwe. A visit planned to Bamenda was cancelled owing to the outbreak of strife that launched the attempted secession of NW and SW Regions, which has caused much suffering and continues to the present (2023). For this reason, it has not been possible to access these two highly important regions for plant biodiversity during this time.

Following the visit of December 2016, publication of new species from Cameroon was increased to enable their formal Red Listing and the possibility of inclusion in the Tropical IPAs to be delimited. The first species to be published was *Ternstroemia cameroonensis*, a Critically Endangered medicinally important tree species thought to have been extinct until Barthélemy Tchiengué was handed material for identification. It now is only known to survive in the Lebialem Highlands of SW Region where the last trees are being killed for their bark. A total of 38 new species, including one new genus, were published or submitted for publication from Cameroon from 2017–2023 as a result, at least in part, of the Cameroon TIPAs programme, almost all of which are range restricted and threatened: Achoundong & Cheek (2023); Achoundong et al. (2021); Alvarez-Aguirre et al. (2021); Cheek (2017a, 2022); Cheek et al. (2017a, 2017b, 2018a, 2018b, 2018c, 2018d, 2020a, 2020b, 2020c, 2021a, 2021b; 2021c, 2022a, 2022b, 2022c, 2022d, 2023); Cheek & Onana (2021); Gosline et al. (2022); Onana et al. (2019); Stone & Cheek (2018). Apart from these, numerous species were published from Cameroon by other authors, notably 41 species and infraspecific taxa of *Psychotria* by Lachenaud (2019) and six species of *Aframomum* by Harris & Wortley (2018). Numerous other species are in the course of publication.

Compilation of Tropical IPA datasheets for Cameroon also began in 2017 with those for Ngovayang and for Mt Elephant thanks to the work of Xander van der Burgt. Xander compiled data from field surveys he made with colleagues from the National Herbarium of Cameroon to these sites, together with that collected by the University of Yaoundé I and IRD teams later published for Ngovayang as Droissart et al. (2019). In fact, the Droissart et al. (2019) 'Mine versus Wild' paper was essentially the first Cameroon IPA assessment under the new categories of Darbyshire et al. (2017).

Progress on analysing data for Tropical IPAs was otherwise slow due to other commitments and lack of funding. It was not until late 2019 that agreements from funders were made to finance the work needed for Cameroon TIPAs programme.

Red Listing of Cameroon threatened plant species, key to advancing any TIPAs programme, was helped by the fact that thanks to the Red Data Book of Cameroon Plants (Onana & Cheek, 2011) and subsequent support from the RBG Kew and IUCN Red List teams, many Cameroonian threatened plant species had already been assessed and were visible on **iucnredlist.org**. However, many remained which were not. In the Kew Conservation Assessment team, Rebecca Lovell worked as Species Conservation Assessor from December 2019 to December 2020, joined by Ashleigh Whittaker as the Species Conservation Researcher from January 2020–September 2021. The Species

***Ternstroemia cameroonensis*, a Critically Endangered medicinally important tree species considered likely to be extinct was rediscovered in an area bordering the Tofala Hills and Mt Bamboutos IPA sites in 2015. Only ten mature individuals were known to survive at this time. It was threatened by harvesting of its bark as well as land-use change.**

Conservation Assessor role was continued by Hannah Rotton from April 2021–September 2021 and April 2022–September 2022, and with Charlotte Phillips as Species Researcher in June/July 2022. Co-ordination of the project assessment process was undertaken by Serene Hargreaves between December 2019 and September 2020, by Emma Williams between September 2020 and January 2021, and by Jack Plummer from January 2021 onwards. Approximately 260 additional Red List assessments of threatened Cameroonian plant species were completed from 2020–2022 by this team. Dr Jean Michel Onana, co-chair of the IUCN Central Africa Plant Red List Authority, was the principal reviewer of these assessments. Increasingly, future Red Listing of Cameroon plant species should be done by Cameroonian botanists. To this end, Franklinia-funded Red List training of National Herbarium staff was recently arranged by Dr Eric Nana.

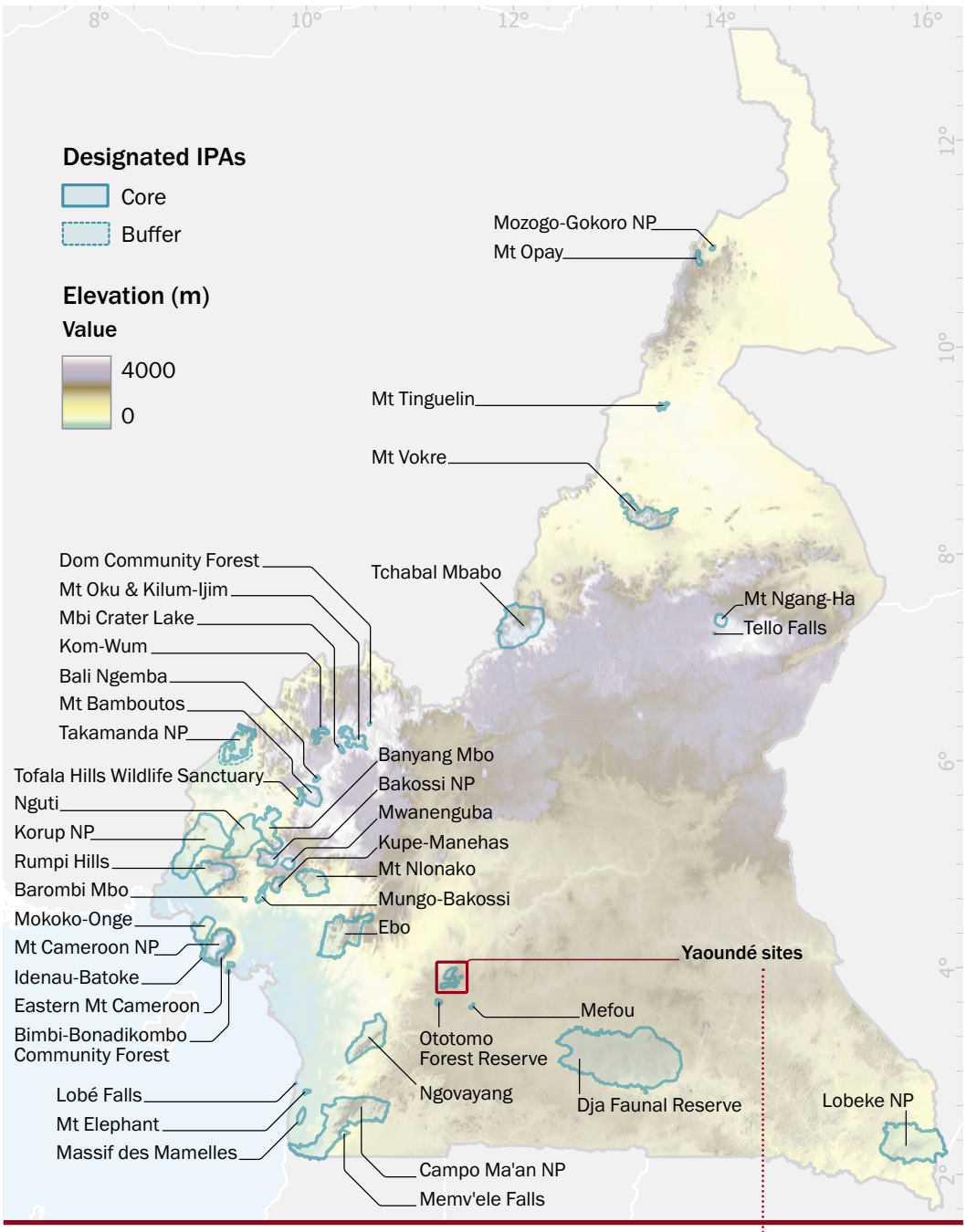
Dr Bruce Murphy was appointed Cameroon Tropical IPAs officer in May 2020, funded by PPL, and continued until January 2023, progressing the work of Xander and drafting the majority of the Tropical IPA data sheets in consultation with Cameroonian (and sometimes expatriate) scientists and conservationists working in the sites concerned. These are credited as assessors on the Tropical IPA data sheets that make up the major part of this book. The first data sheet to be officially completed and to appear on the publicly accessible Tropical IPA portal (**tipas.kew.org**) was that of the Ebo Forest, Littoral Region. The data from this data sheet was credited with contributing to the case for suspending the logging concession that had been made for this forest, strengthening hopes that the Cameroon TIPAs programme might indeed be as helpful to conserving the fantastic plant diversity of Cameroon.

Owing to the Covid-19 global pandemic, no fieldwork nor visits to Cameroon by British botanists were possible for the first years of the fully funded project (2020–2021). It was not until November 2022 that Tropical IPAs fieldwork began in and around Yaoundé and a workshop, on 29 November, was held for stakeholders in Cameroon at IRAD-Nkolbisson to review the drafted Tropical IPA datasheets. Those attending included Ekwoge Abwe (Ebo Forest Research Project); Jean Michel Onana (co-author), Elvire Biyé and Murielle Simo-Droissart (all three University of Yaoundé I); Kenneth Tah (COMAID); Serges Mtemching, Kris Fominyam, Elias Ndive (Limbe Botanic Garden and Wildflower Foundation); Moses Njoya and Belinda Njombo (ANCO); Roger Fotso and Atanga Ekobo (all WCS Cameroon); Gilbert Todou (University of Maroua); Olivier Séné (US Forest & Wildlife Service); Arnaud Tchassem (EDGE fellow [ZSL] UYI, Bamboutos Mts); Raphael Ayuk and Esau Ngong (both AADA); Eric Nana, Dieudonné Onana, Eric Ngansop, Cecilia Mandah, Yannick Ella, Christiane Mayumgo, Adèle Magne Foaleng, Joan Suife, Hubert Mounmemi, Laura Ngome, Standly Nkemnyi and Gwendoline Egbe (all IRAD-National Herbarium of Cameroon). The workshop was opened by Dr Francis Ngome, Deputy Director General and Director of Research of IRAD. The meeting was introduced by Nina Forgwe of the British Embassy.

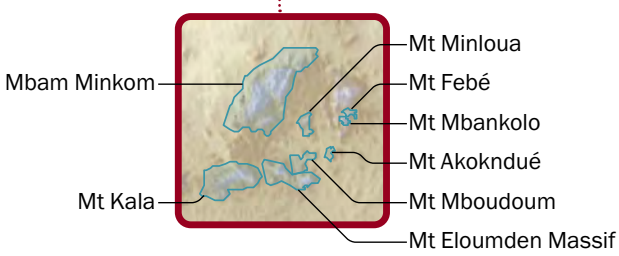
Fieldwork to four of the candidate IPAs in and around the city in Centre Region were made during November and December by Bruce Murphy and Martin Cheek with Eric Ngansop (initially), Cecilia Mandah, Christiane Mayumgo and Yannick Ella, collecting data on conservation status, threats and species records. These surveys were continued by the team after the departure of the Kew botanists. Eric Ngansop spent much of December 2022 at RBG Kew being trained in making taxonomic descriptions of further new Cameroon species, mentored by Dr Xander van der Burgt.

Following the November workshop, the Tropical IPA datasheets were finalised and the process for preparing for their formal publication began.

**Workshop reviewing Cameroon TIPAs held at IRAD-Nkolbisson, November 2022.**




**Map 3. Location of designated IPA sites in Cameroon, with enlarged detail of Yaoundé sites below.**




**Map 4. Detail of IPA sites clustered on the western side of Yaoundé.**

# Methodology

According to the revised guidelines detailed in Darbyshire et al. (2017), sites can qualify as IPAs under three broad criteria, relating to (A) threatened species, (B) botanical richness and (C) threatened habitat. These criteria are summarised in the table below.

| **Criterion A:** Threatened Species | | |
|---|---|---|
| A(i) | **Site contains** one or more globally threatened species. | Site known, thought, or inferred to contain ≥1% of the global population; AND/OR ≥5% of the national population; OR the 5 'best sites' for that species nationally – whichever is most appropriate. |
| A(ii) | **Site contains** one or more regionally threatened species. | Site known, thought, or inferred to contain ≥5% of the national population; OR the 5 'best sites' for that species nationally – whichever is most appropriate. |
| A(iii) | **Site contains** one or more highly restricted endemic species that are potentially threatened. | Site known, thought, or inferred to contain ≥1% of the global population; AND/OR ≥5% of the national population; OR the 5 'best sites' for that species nationally – whichever is most appropriate. |
| A(iv) | **Site contains** one or more range-restricted endemic species that are potentially threatened. | Site known, thought, or inferred to contain ≥1% of the global population; AND/OR ≥5% of the national population; OR the 5 'best sites' for that species nationally – whichever is most appropriate. |

| **Criterion B:** Botanical Richness | | |
|---|---|---|
| B(i) | **Site contains** a high number of species within defined habitat or vegetation types. | For each habitat or vegetation type: up to 10% of the national resource can be selected within the whole national TIPA network; OR the 5 'best sites' nationally – whichever is the most appropriate. |
| B(ii) | **Site contains** an exceptional number of species of high conservation importance. | Site known to contain ≥3% of the selected national list of species of conservation importance; OR the 15 richest sites nationally – whichever is most appropriate. |
| B(iii) | **Site contains** an exceptional number of socially, economically, or culturally valuable species. | Site known to contain ≥3% of the selected national list of socially, economically or culturally valuable species; OR the 15 richest sites nationally – whichever is most appropriate. |

| **Criterion C:** Threatened Habitats | | |
|---|---|---|
| C(i) | **Site contains** globally threatened or restricted habitat/ vegetation type. | Site known, thought, or inferred to contain ≥5% of the national resource (area) of the Threatened Habitat type; OR, site is among the best quality examples required to collectively prioritise 20–60% of the national resource; OR the 5 'best sites' for that habitat nationally –whichever is the most appropriate. |
| C(ii) | **Site contains** regionally threatened or restricted habitat/ vegetation type | Site known, thought, or inferred to contain ≥5% of the national resource (area) of the Threatened Habitat type; OR site is among the best quality examples required to collectively prioritise 20–60% of the national resource; OR the 5 'best sites' nationally – whichever is the most appropriate. |
| C(iii) | **Site contains** nationally threatened or restricted habitat/vegetation type, AND/OR habitats that have severely declined in extent nationally. | Site known, thought, or inferred to contain ≥10% of the national resource (area) of the Threatened Habitat type; OR site is among the best quality examples required to collectively prioritise up to 20% of the national resource; OR the 5 'best sites' nationally – whichever is the most appropriate. |

In this volume we have utilised criterion A and aspects of criterion B. Our methodology primarily utilises herbarium specimen records, an approach which has the advantage of being based on verifiable evidence that can be traced and checked In the accompanying supplementary data (available at **https://doi.org/10.5281/zenodo.8037037**) we have attempted to list collection records for the occurrence of cited taxa at each site. The taxonomic identifications used here can be verified by reference to these underlying specimen records. The data is compiled from records at YA and K and other herbaria throughout the world (primarily WAG, BR, MO, P) stored on Kew's Wet Tropics Africa (WTA) database or accessed through GBIF and the publicly available online catalogues of these institutions.

Building particularly on the work of Onana & Cheek (2011), Onana (2011) and Onana (2013), we have attempted to identify sites based on clustering of globally threatened taxa (criterion A), and of criterion B(ii) species (nationally endemic or range-restricted, where range-restricted refers to an Extent of Occurrence [EOO] of less than 10,000 km²). Under criterion A(i) only IUCN Red List published (or occasionally those in the process of publication having undergone external review) are accepted. Although, as part of our project our colleagues in the Plant Conservation Assessment Unit at RBG Kew have greatly assisted us in the formal assessing and publishing of many species provisionally assessed in Onana & Cheek (2011), there remain many taxa not yet published. Occasionally, for some of the smaller or lesser botanised sites, we mention in the datasheets or include in the tables some of these taxa for interest alone; they do not contribute to qualifying the sites under criterion A(i). However, these and other unassessed taxa are listed where appropriate under criterion A(iii) or A(iv) ('highly restricted endemics' with an EOO <100 km² or 'range-restricted endemics' with an EOO <5000 km², that are considered potentially threatened), or contribute to the overall botanical richness of the site as national endemics or range-restricted species (EOO <10,000 km²) under criterion B(ii).

Limitations with the criterion A(i) approach and the underlying IUCN Red List data are acknowledged; primarily, that many of the assessments are more than eight years old and in need of review, while many species have yet to be assessed. Occasionally, this has resulted in species continuing to possess a status of 'threatened' when subsequent recording demonstrates them to be more widely occurring than was first thought. The further restriction provided by the IPA criteria (that a site must be considered to represent 1% of the global population, 5% of the national population, or be one of the best five national sites for the taxon) ensure that such taxa do not undermine our aims. Despite its limitations, the Red List framework provides the most widely utilised and respected global approach based on easily applicable but scientifically justifiable principles for comparing extinction risk. Therefore, for the most part we avoid second-guessing the potential outcome of hypothetical reassessment of taxa even when additional records may appear to change the picture.

However, a special mention should be made for a particular subset of species that were assessed in 1998 on the basis of population decline, many of which are timber species or other harvested tree species (such as *Garcinia kola*) that remain relatively common and widespread. Although we do not dispute that many deserve a status of threatened due to global decline, these species occur at many (sometimes most) of the sites considered and are of little use for discriminating between sites of national botanic importance under criterion A. Therefore, they have been mostly omitted here, although sometimes

they are included if a site is considered particularly important for them or as a note of interest for less species-rich sites. They are never used to qualify IPA status alone.

Darbyshire et al. (2017) stipulate that utilisation of IPA criterion B(ii) requires a national list of taxa of high conservation importance against which sites can be checked for numbers of taxa present. We have here attempted to do this using subcriteria (a), national endemics, and (b) range-restricted (<10,000 km²) taxa, omitting criterion (c) because so many of the taxa included in the existing national Red List (Onana & Cheek, 2011) have subsequently been added to the IUCN Red List and are therefore already included under IPA criterion A. Our approach to the lists under the first two criteria was to compile preliminary candidate lists based on species listed for Cameroon from Plants of the World Online (formerly WCVP), the RAINBIO database, Onana (2011), Onana (2013) and records from RBG Kew's WTA database (Gosline, 2004). This preliminary list was used as input to the ConBatch R programme (part of the rCAT package) to calculate EOO, drawing on all Cameroon specimen records from both GBIF and the WTA database (Moat, 2020; R Core Team, 2021; GBIF.org, 2023). The list of species calculated to have a resulting EOO <10,000 km² was then manually checked for plausibility using other sources such as JSTOR Global Plants (2023), African Plants Database (2023), Onana & Cheek (2011), Onana (2013), relevant taxonomic literature and, where possible, examination of underlying GBIF records for accurate georeferencing and plausibility of identification. The online Geocat tool was used extensively for further checking of EOO in relation to individual records (Bachman et al., 2011a, 2011b). We excluded all infra-specific taxa from our criterion B lists both to reduce the scope of the task and because of the greater inconsistency in delimitation that probably attends infra-specific recognition across taxonomic groups. For national endemics, we cross-referenced occurrence records from various sources to eliminate taxa from an initial candidate list of endemics proposed by one or more of the mentioned sources. The flora of Cameroon is large and incompletely covered in existing accounts (such as the ongoing *Flore du Cameroun*), therefore our lists are far from perfect. However, they should provide a preliminary basis sufficient for comparing the sites. For purposes of numerical comparison, the two lists are combined here, with sites compared against the 3% criteria and top 15 sites as stipulated by Darbyshire et al. (2017). The full list of B(ii) species is provided in the supplementary data, available at **https://doi.org/10.5281/zenodo.8037037**

Despite the important addition of criterion B(iii) to the IPA criteria by Darbyshire et al. (2017), recognising the important role of many sites and taxa as sources of economic, social and cultural value (including foodstuff, medicines, building materials, and spiritual or cultural symbols or tools), we have yet to tackle the task of compiling a national list of such taxa that would enable comparison of potential Cameroon sites according to this criterion. There is a considerable literature to aid this task, from Burkill's (1985–2004) compendium, the PROTA database (Prota4U, 2023), timber lists (Mark et al., 2014; BGCI, 2021), information in IUCN Red List assessments, the Organization of African Unity Scientific Technical & Research Commission (OAU/STRC) study of Cameroon's Traditional Medicine and Pharmacopoeia (Adjanohoun et al., 1996), and many individual studies, and we hope that the task of compiling this data will be completed in the future.

We are also yet to assess potential sites under criterion C. This task primarily requires an up-to-date list of habitats and mapping or other analysis of their occurrence at potential sites. The monumental work of Letouzey (1985) should surely form the basis for this task but such is the subsequent extent of habitat loss that updating is required. Letouzey's schema may also be too detailed for the required purpose here, and other experts have acknowledged difficulties in attempting to apply his fine discriminations based on less comprehensive experience of the flora (Harris, 2009). In the following section and in the site profiles, we indicate where we think sites are likely to qualify under such a criterion when it is applied. Many of the sites already included are likely to be important for submontane forest, montane forest and various categories of lowland moist forest, while other categories may be less well represented, such as rocky cliffs and inselbergs, mangroves (for which Douala-Edea and Ndongere Proposed National Park are the obvious sites), semi-deciduous forest (represented so far particularly by Dja Faunal Reserve and Lobeke N.P.) and varieties of savanna, sahel and wetlands. Cameroon's important resource of rapids and waterfalls, with their unique and threatened flora, are also only partly covered here.

In the IPA datasheets that follow, plant family names follow POWO (continuously updated) for consistency, but other options are equally valid. For example, *Oxygyne triandra* is more correctly placed in Thismiaceae, not Burmanniaceae as it was formerly.

In the case of the large Leguminosae (Fabaceae) and Malvaceae sens. lat. families, where subfamily classification is important, we have used subfamily names alone in order to save column width space. Thus, Leguminosae Detarioideae is written in the family column as Detarioideae, and Leguminosae Papilionoideae is written as Papilionoideae. Similarly in Malvaceae sens. lat., Malvaceae Sterculioideae is written as Sterculioideae, and Malvaceae Grewioideae as simply Grewioideae.

# Summary of Results

## Cameroon Red List data

The IUCN Red List contains 919 threatened plant species (946 taxa) for Cameroon at the last update (December 2022), with 171 CR, 333 EN, and 415 VU. This is the second-highest number for any tropical African country after Tanzania (1,037 threatened species). Naturally, these figures are heavily dependent on assessment effort as well as the diversity of threatened species. Cameroon has had 2,898 of its plant species assessed, which is also the second highest in tropical Africa after Tanzania. Another 58 Cameroon species are considered DD and a further 27 (plus two DD) infra-specific taxa are threatened.

The IUCN data (**iucnredlist.org**) suggests 767 of the 919 threatened Cameroon species are from forest habitats, with 637 from 'subtropical/tropical moist lowland' forest and 200 from 'subtropical/moist montane' forest (some species are classified in more than one habitat). By contrast, only 36 species are from savanna or shrubland, 55 from grassland, 31 from rocky areas, and 67 from wetlands. This explains the high number of IPA sites in Cameroon's moist forest zones.

The breakdown of threats using the IUCN classification shows that 'agriculture and aquaculture' is the commonest threat category for Cameroon plant species (769 species threatened), subdivided into 741 species threatened by 'annual and perennial non-timber crops', 207 by 'wood and pulp plantations' and 126 by 'livestock ranching'. The 'annual and perennial' crops category is in turn subdivided into 349 species threatened by 'shifting agriculture', 559 by 'small-holder farming' and 210 by 'agro-industry farming'. Second to 'agriculture and aquaculture' as a threat to Cameroon's species is 'biological resource use' which is dominated by logging and wood harvesting, with 602 species threatened. 'Residential and commercial development' threatens 293 species and 'energy production and mining' 252 species (IUCN, 2023).

Table 3 shows the number of threatened taxa occurring at each site, along with the site area and the calculated number of taxa per km². A grid of all criterion A(i) species and the sites at which they occur is available online at **https://doi.org/10.5281/zenodo.8037037**

We calculate that the IPA network of 49 sites incorporates 790 (772 species and 8 infraspecific taxa) of the 946 threatened Cameroon taxa (919 species) on the IUCN global Red List. This total amounts to 83.5% of the nation's threatened taxa (or 85% of threatened species) included in an IPA site network totalling around 5% of the national area. Looked at in a different way, in the total IPA network there are 0.032 threatened plant taxa per km², compared with 0.002 per km² in Cameroon's total area. These figures include several threatened taxa that may have been lost (locally or globally extinct) from their sites, but this is often hard to verify. In addition, a few restricted endemics — IPA criterion A(iii) and A(iv) species — and seven DD taxa are also listed for the sites but not included in the summary statistics given here.

The sites vary greatly in area and in the number of threatened species. Although, unsurprisingly, there are typically many more threatened species at larger sites (overall), there is a negative correlation between the site area and species per area (Spearman's rank: Rho = -0.83), with some small sites such as Tello Falls having a very high number of threatened species per km², while the Dja Reserve is much the largest IPA site in Cameroon by area and has the fewest threatened species per unit area. However, it is important to remember that the relationship between species numbers and area is not linear, and the conservation value of sites with greatly different areas cannot easily be compared using the metric of threatened species per km².

The Ngovayang Massif has the highest number of threatened species of all IPAs in Cameroon, and, for one of the larger sites, a relatively high number of threatened species per km². Notably, this IPA site does not have any formal protection. Ngovayang's total of threatened species may be boosted partly by records which we allocated to the site of several little-known species collected over a century ago by Zenker from his base at Bipindi. However, recent work has emphasised the site's diversity, very high importance for conservation and, indeed, its status as an IPA (Droissart et al., 2019). Of the sites over 100 km² in area, Mt Kupe is notable for having a very high number of threatened species per km² compared with other sites.

Threatened taxa each occur at mean 2.62 and median 2 sites (SD: 2.1), while 81 (of 790) taxa occur at over five sites. Therefore, the sites would appear to have a good level of compatibility and are not reliant on the same few threatened taxa to qualify them.

**Table 3. Threatened taxa and area by IPA site. Red List status and totals as per IUCN December 2022 release. Note, apart from the area column, total values in the bottom three rows (in grey) are not totals of the columns above because taxa can occur at more than one site.**

## Threatened taxa and area by IPA site

| | | | Number of IUCN Red List taxa | | | | |
|---|---|---|---|---|---|---|---|
| **IPA Site** | **Region** | **Area** (km²) | **CR** | **EN** | **VU** | **Threatened** | **Threatened** (per km²) |
| Bakossi N.P. | Southwest | 293.2 | 13 | 41 | 68 | 122 | 0.42 |
| Bali Ngemba F.R. | Northwest | 20 | 8 | 9 | 27 | 44 | 2.20 |
| Banyang Mbo | Southwest | 666 | 6 | 19 | 22 | 47 | 0.07 |
| Bimbia-Bonadikombo | Southwest | 37.35 | 14 | 3 | 24 | 41 | 1.10 |
| Campo Ma'an N.P. | South | 2640.6 | 13 | 44 | 99 | 156 | 0.06 |
| Dja Faunal Reserve | East | 6278 | 5 | 15 | 29 | 49 | 0.01 |
| Dom Community Forest | Northwest | 4.5 | 9 | 4 | 13 | 26 | 5.78 |
| Eastern Mt Cameroon | Southwest | 178 | 8 | 22 | 32 | 62 | 0.35 |
| Ebo Forest | Littoral | 1423 | 23 | 20 | 55 | 98 | 0.07 |
| Idenau-Batoke | Southwest | 114 | 4 | 11 | 27 | 42 | 0.37 |
| Kom-Wum F.R. | Northwest | 117 | 0 | 1 | 8 | 9 | 0.08 |
| Korup N.P. | Southwest | 1873 | 17 | 45 | 85 | 147 | 0.08 |
| Lake Barombi Mbo F.R. | Southwest | 9.26 | 7 | 3 | 11 | 21 | 2.27 |
| Lobé Falls | South | 3.3 | 2 | 6 | 3 | 11 | 3.33 |
| Lobéké N.P. | East | 2164 | 1 | 6 | 23 | 30 | 0.01 |
| Massif des Mamelles | South | 93 | 1 | 7 | 9 | 17 | 0.18 |
| Mbam Minkom Hills | Centre | 86 | 3 | 9 | 16 | 28 | 0.33 |
| Mbi Crater Lake | Northwest | 5 | 1 | 4 | 5 | 10 | 2.00 |
| Mefou Proposed N.P. | Centre | 11 | 2 | 6 | 24 | 32 | 2.91 |
| Memv'ele Falls | South | 30 | 6 | 3 | 8 | 17 | 0.57 |
| Mokoko-Onge | Southwest | 395 | 10 | 19 | 52 | 81 | 0.21 |
| Mozogo-Gokoro N.P. | Far North | 17.24 | 0 | 1 | 2 | 3 | 0.17 |
| Mt Akokndoué | Centre | 1.6 | 3 | 1 | 3 | 7 | 4.38 |
| Mt Bamboutos | West | 340 | 3 | 6 | 16 | 25 | 0.07 |
| Mt Cameroon N.P. | Southwest | 581.78 | 12 | 29 | 54 | 95 | 0.16 |
| Mt Elephant | South | 23 | 4 | 12 | 25 | 41 | 1.78 |
| Mt Eloumden | Centre | 13 | 2 | 1 | 5 | 8 | 0.62 |
| Mt Febé | Centre | 1.55 | 1 | 2 | 4 | 7 | 4.52 |
| Mt Kala | Centre | 10 | 4 | 0 | 15 | 19 | 1.90 |
| Mt Kupe | Southwest | 146 | 19 | 37 | 89 | 145 | 0.99 |
| Mt Mbankoko | Centre | 1.25 | 0 | 1 | 1 | 2 | 1.60 |
| Mt Mbokdoum | Centre | 6.7 | 1 | 1 | 0 | 2 | 0.30 |
| Mt Minloua | Centre | 4.36 | 1 | 3 | 1 | 5 | 1.15 |
| Mt Mwanenguba | Southwest | 88 | 1 | 6 | 21 | 28 | 0.32 |
| Mt Ngang-Ha | Adamawa | 128 | 1 | 5 | 3 | 9 | 0.07 |
| Mt Nlonako | Littoral | 661 | 2 | 8 | 29 | 39 | 0.06 |
| Mt Oku & Kilum-Ijim | Northwest | 289 | 9 | 15 | 31 | 55 | 0.19 |
| Mt Opay | Far North | 61.4 | 0 | 2 | 2 | 4 | 0.07 |
| Mt Tinguelin | North | 53 | 0 | 2 | 1 | 3 | 0.06 |
| Mt Vokré | North | 962 | 1 | 5 | 10 | 16 | 0.02 |
| Mungo & Bakossi F.R. | Southwest | 104.86 | 4 | 6 | 21 | 31 | 0.30 |
| Ngovayang Massif | South | 527 | 24 | 50 | 92 | 166 | 0.31 |
| Nguti forests | Southwest | 1142 | 7 | 11 | 45 | 63 | 0.06 |
| Ototomo F.R. | Central | 45 | 3 | 1 | 2 | 6 | 0.13 |
| Rumpi Hills | Southwest | 495 | 9 | 18 | 43 | 70 | 0.14 |
| Takamanda N.P. | Southwest | 676 | 6 | 6 | 33 | 45 | 0.07 |
| Tchabal Mbabo | Adamawa | 1650 | 8 | 7 | 17 | 32 | 0.02 |
| Tello Falls | Adamawa | 0.5 | 1 | 4 | 2 | 7 | 14.00 |
| Tofala Hills | Southwest | 81 | 3 | 10 | 33 | 46 | 0.57 |
| **Sites total** | | **24551** | **148** | **265** | **377** | **790** | **0.032** |
| **Cameroon total** | | **475442** | **177** | **339** | **430** | **946** | **0.002** |
| **Percent of Cameroon total** | | **5.16%** | **83.62%** | **78.17%** | **87.67%** | **83.51%** | |

## Criterion B(ii)

Our overall list of national endemic and range-restricted (EOO <10,000 km²) criterion B(ii) species totalled 638 species (infra-specific taxa were excluded). The full list of B(ii) species is available online at **https://doi.org/10.5281/zenodo.8037037** Of these, 489 were nationally endemic and 564 range restricted, with 422 belonging to both lists. In total, 516 of these species (80%) were present at one or more of the IPA sites in our network. This percentage is very similar to the percentage given above for Red List species occurring (85%, or 83.5% of taxa). Table 4 shows the site totals for occurrence of these B(ii) species. Darbyshire et al., (2017) specify that a site may qualify under B(ii) if they are in the 15 top sites for number of B(ii) species or contain ≥3% of the national total. By coincidence, in our analysis of Cameroon's sites, the top 15 sites were the same as those meeting the 3% threshold (highlighted in the table). Under this criterion, it is difficult for small sites to qualify as they are in competition with larger sites. However, Mt Elephant and the Tofala Hills Wildlife Sanctuary do qualify, and the Bali Ngemba Forest Reserve and Bimbia Bonadikombo Community Forest are close to qualifying.

**Table 4. Totals of nationally endemic and range-restricted (EOO ≤ 10,000 km2) species per site. The shaded area indicates those sites qualifying under criterion B(ii) as IPAs according to the 3% or top 15 sites threshold stipulated by Darbyshire et al. (2017). The overall list totalled 638 species.**

## Nationally endemic and range-restricted (EOO ≤ 10,000 km$^2$) species per site

| | | National endemic and range-restricted taxa | | |
|---|---|---|---|---|
| **Region** | **Site** | **Number** | **Percentage** | **Rank by total** |
| South | Ngovayang Massif | 88 | 13.79% | 1 |
| Southwest | Korup N.P. | 85 | 13.32% | 2 |
| South | Campo Ma'an N.P. | 83 | 13.01% | 3 |
| Southwest | Mt. Kupe | 75 | 11.76% | 4 |
| Southwest | Bakossi N.P. | 69 | 10.82% | 5 |
| Southwest | Mt Cameroon N.P. | 60 | 9.40% | 6 |
| Littoral | Ebo Forest | 56 | 8.78% | 7 |
| Southwest | Mokoko-Onge | 47 | 7.37% | 8 |
| Southwest | Rumpi Hills | 46 | 7.21% | 9 |
| Northwest | Mt Oku & Kilum-Ijim | 34 | 5.33% | 10 |
| Southwest | Nguti forests | 29 | 4.55% | 11 |
| Southwest | Eastern Mt Cameroon | 27 | 4.23% | 12 |
| Southwest | Banyang Mbo | 24 | 3.76% | 13 |
| Southwest | Tofala Hills | 22 | 3.45% | 14 |
| South | Mt Elephant | 21 | 3.29% | 15 |
| Northwest | Bali Ngemba F.R. | 18 | 2.82% | 16 |
| South | Mbam Minkom Hills | 18 | 2.82% | 17 |
| Southwest | Bimbia-Bonadikombo | 17 | 2.66% | 18 |
| Southwest | Idenau-Batoke | 16 | 2.51% | 19 |
| West | Mt Bamboutos | 16 | 2.51% | 20 |
| East | Dja Faunal Reserve | 15 | 2.35% | 21 |
| Littoral | Mt Nlonako | 13 | 2.04% | 22 |
| Southwest | Lake Barombi Mbo F.R. | 12 | 1.88% | 23 |
| Southwest | Mungo & Bakossi F.R. | 12 | 1.88% | 24 |
| Southwest | Mt Mwanenguba | 12 | 1.88% | 25 |
| Adamaoua | Tchabal Mbabo | 12 | 1.88% | 26 |
| South | Lobé Falls | 12 | 1.88% | 27 |
| South | Massif des Mamelles | 11 | 1.72% | 28 |
| Centre | Mefou Proposed National Park | 11 | 1.72% | 29 |
| Northwest | Dom Community Forest | 9 | 1.41% | 30 |
| South | Memv'ele Falls | 9 | 1.41% | 31 |
| Southwest | Takamanda N.P. | 8 | 1.25% | 32 |
| Adamaoua | Mt Ngang-Ha | 8 | 1.25% | 33 |
| Centre | Mt Kala | 8 | 1.25% | 34 |
| Adamaoua | Tello Falls | 7 | 1.10% | 35 |
| Centre | Mt Eloumden | 7 | 1.10% | 36 |
| Centre | Mt Akokndoue | 6 | 0.94% | 37 |
| Centre | Mt Febe | 6 | 0.94% | 38 |
| North | Mt Vokré | 6 | 0.94% | 39 |
| Centre | Ototomo F.R. | 6 | 0.94% | 40 |
| Northwest | Mbi Crater Lake | 4 | 0.63% | 41 |
| Centre | Mt Mbokdoum | 4 | 0.63% | 42 |
| Centre | Mt Minloua | 4 | 0.63% | 43 |
| Northwest | Kom-Wum F.R. | 2 | 0.31% | 44 |
| North | Mt Tinguelin | 2 | 0.31% | 45 |
| Far North | Mt Opay | 2 | 0.31% | 46 |
| Centre | Mt Mbankoko | 1 | 0.16% | 47 |
| Far North | Mozogo-Gokoro N.P. | 1 | 0.16% | 48 |
| East | Lobéké N.P. | 0 | 0.00% | 49 |

## Potential additional IPAs

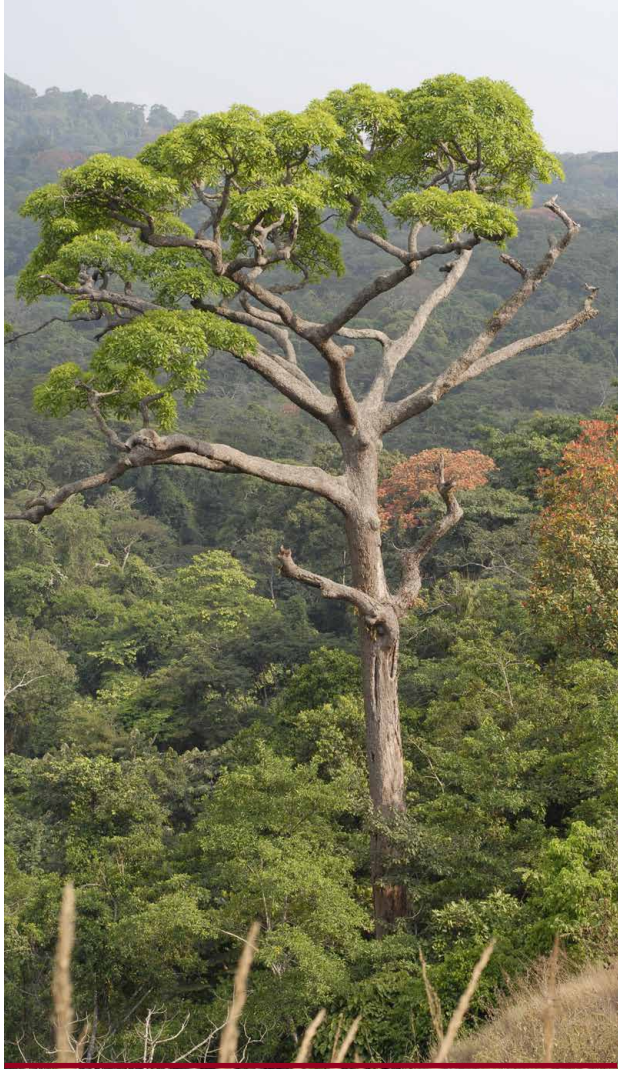
The sites included in this book incorporate a high proportion of the country's threatened, endemic and range-restricted taxa in around 5% of the national area. The sites are not evenly distributed geographically and the list is unlikely to be comprehensive. We have tried to include sites representing all of the country's administrative regions but it is significant that, with the exception of the Yaoundé inselbergs, sites are disproportionately from the Southwest, Northwest and South regions. These regions, together with Littoral Region, which has been less well botanised, contain a large proportion of the country's plant biodiversity and, by extension, of the threatened species. East Region is less botanically rich but densely forested, still largely intact and of immense importance for rare fauna. Many more of its plant species could become threatened if its intactness is not maintained. Adamaoua, North and Far North regions contain drier habitats, often much impacted by humans, with comparatively low species diversity. However, some rare and threatened species do occur, together with a variety of different habitats to be considered under Critioner C.

In all the regions there are further potential IPA sites which we mention briefly here.

**Southwest Region** is well covered by our network but is so botanically important that there are several additional sites that also deserve mention. The Mawne (or Mone) Reserve has been briefly botanised and is likely very rich and relatively intact. It would certainly merit IPA status. Significant species include *Saxicolella (Pohliella) laciniata* (VU), *Allophylus conraui* (VU), *Psychotria monensis* (locally endemic), *Eriocaulon mamfeense, Phyllanthus dusenii* (EN) and an undescribed endemic new species of *Mesanthemum*. It contains lush lowland evergreen forest with inselbergs, and impressive rapids likely containing rare or unknown rheophytes such as Podostemaceae.

Close to Bakossi National Park, Mt Kupe and Mt Mwanenguba, the Chide valley area revealed a very large number of rare and threatened species from a collecting locality centred around Ngomboku village (Cheek et al., 2004). While many of these also feature at the other included nearby sites, it is undoubtedly an important area potentially threatened by agricultural development of the valley. Other potential IPA forest sites in Southwest Region include Ejagham, Kagwene (shared with NW Region), Mak Betchou, Nta Ali and Meme forest reserves.

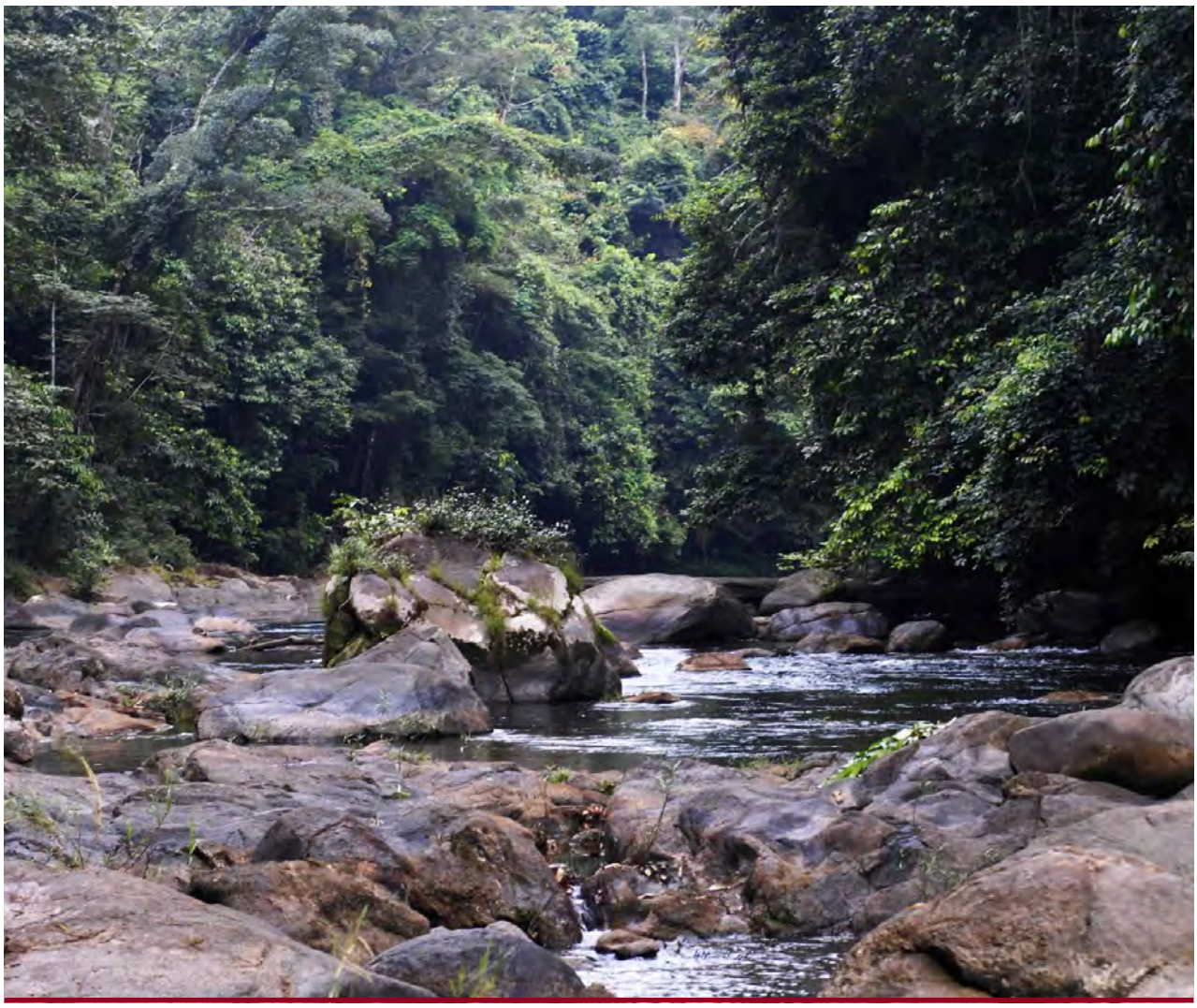
On the coast, the Ndongere proposed national park would certainly qualify under criterion C for its globally important mangrove forests. The other important area of mangroves in Cameroon is the Wouri estuary zone, extending from east of Limbe to the Sanaga river. It includes the Douala-Edéa Reserve in Littoral Region,



**Emergent tree in lowland evergreen forest, Mawne Forest Reserve, viewed from inselberg.**
Photographs M. Cheek, 2008.

which is known to contain a number of threatened species such as *Duguetia dilabens* (EN), *Octoknema dinklagei* (EN), *Englerodendron leptorrhachis* (CR), *Piptostigma goslineanum* (VU), *Rinorea amietti* (VU). Douala-Edéa may be the only site in Cameroon for *Ctenolophon englerianus,* a large swamp tree used for canoes and construction, gregarious where it occurs but limited to a narrow habitat. It is also notable for its phylogenetic significance (likely contribution to evolutionary diversity) as one of only two species in the monogeneric Ctenolophonaceae family (Hills, 2021; Kubitzki, 2014).

Onana & Cheek (2011) found the Southern Bakundu Forest Reserve to be one of the most notable hotspots of threatened species in Southwest Region and, indeed, in Cameroon. Sadly, it appears to be so degraded now as to not merit status as an IPA, although it is possible that surviving fragments are still worth preserving. It is a stark warning of the dangers to other sites.



**Rheophyte community along the Mawne river in lowland evergreen forest, Mawne Forest Reserve.**
Photographs M. Cheek, 2008.

**Northwest Region** contains a similar example of a lost IPA, in Bafut Ngemba Forest Reserve – an important historical collecting locality but now with little original forest remaining as it has been replaced by plantations of exotic *Eucalyptus*. In fact, despite the evident botanical importance of the Bamenda Highlands forests, Northwest Region has very few, and mostly very small, surviving sites of conservation importance for plants (Harvey et al., 2004; Cheek et al., 2010). However, the northern border region with Nigeria is less botanically known and likely contains surviving patches of important forest. The forest reserves of Ako Mbembe, Kimbi-Fungom, the Kagwene Wildlife Sanctuary, and the Ambelle and Babanki-Finge are potential IPA sites. Others include Njinsing-Tabenken, Mbingo and the royal forests of Bambalang and Mbiame.

**Littoral**, southernmost **West Region** and the part of **Centre Region** west of Ndikinimeki appear to contain much remaining forest that is botanically largely unknown, including parts of the Yabassi Bird Area north-west of Ebo and the rugged landscape including Santchou (*Rinorea faurei,* CR*; Isoglossa dispersa,* VU; *Psychotria recurva*, VU), Metchi-Ngooum, Tsena-Nkam, Moa, Maha, Bangombe and the Mongoe Nkam forest reserve. Further north, there are records of *Lefebvrea camerunensis* (EN) and *Eugenia gilgii* (CR) from Mt Mbam, of *Ficus oresbia* (EN) and *Dissotis longisetosa* (NT) from Mt Mbapit, and Mt Bana likely contains important species beyond the recorded *Bidens mannii* (VU). Massif de Nkogam between Foumban and Lake Bamending has records of *Artabotrys jollyanus* (CR). Further botanical surveying in these areas is much required. Further south in **Littoral Region**, the Bakaka Forest Reserve has also recorded several threatened species (*Palisota flagelliflora*, EN; *Ficus absocondita,* VU; *Saxicolella laciniata,* VU) and was identified by Onana & Cheek (2011) as a hotspot potentially worthy of protected status. However, like the Southern Bakundu Forest Reserve, it also has been highly degraded (Onana pers. obs.)

**Mt Nkolondom (Mt Yé-Yé) in Northern Yaoundé, another botanically interesting inselberg site. The summit area (pictured) has been partially cleared for crops.**
Photograph December 2022.

**Centre Region** also has the important faunal sites of the Mpem et Djim and Mbam et Djerem national parks, the latter of which has 'probably the greatest habitat diversity of any protected area in Cameroon' according to BirdLife International (2023a). These national parks may not be as botanically rich as sites nearer the coast but include important habitats and some noteworthy species such as *Dolichos reptans* (EN) and *Habenaria lelyi*. West of Mpem et Djerem a range of hills rises to 1,500 m and there are records of *Vepris mbamensis* (EN), *Crossopetalum (Pleurostylia) serrulatum* (VU) and *Epistemma rupestre* (EN) at Mt Ngoro.

There are likely further potential inselberg sites in Centre Region around Yaoundé, such as at Bot Makak, with records of *Callichilia monopodialis* (EN) and *Hymenostegia viridiflora* (VU), Nanga Eboka with *Anisotes zenkeri* (EN), and Colline de Kombeng with *Leptonychia subtomentosa* (EN). The Nachtigal Falls are the site of *Ledermanniella sanagaensis* (CR), *Ledermanniella thalloidea* (EN), *Monanthotaxis elegans*, *Cyclantheropsis occidentalis* (EN) and *Maranthes sanagensis* (VU). A dam has recently (2021) been built there and the continued presence of these species needs reconfirming. Similarly, *Winklerella dichotoma* (CR), *Dicraeanthus zehnderi* (CR) and *Ledermanniella schlechteri* (VU) may survive close to the hydroelectric dam on the waterfalls at Edéa in Littoral Region (Ghogue, 2010). There are several important collections of rare species from an area around the Kélé river 30–50 km NW of Eséka, including *Tricalysia ferorum* (EN) and *Piptostigma glabrescens* (NT). The Bokito and Bafia reserves at the junction of the Mbam and Sanaga rivers might also merit further investigation. There has been much important collecting on the Nyong river by the de Wildes and other collectors, and the swamp forest there was considered to merit a protected reserve in a regional review by Mackinnon & Mackinnon (1986). The Mbalmayo Forest Reserve which has seen recent records of *Oxyanthus lewisii* (VU) and *Talbotiella breteleri* (EN), might be a suitable IPA in this zone.

***Calvoa zenkeri* at Colline Nkoltsia, one of only a few sites in southern Cameroon and Gabon where it has been recorded.**
Photograph X.van der Burgt, October 2017.

In **South Region**, Colline Nkoltsia is a particularly notable additional site, about 18 km NW of Bipindi, where several important taxa have been recorded: *Begonia minuta* (CR, locally endemic), *Amphiblemma letouzeyi* (VU), *Julbernardia letouzeyi* (EN), *Euphorbia letestui* (VU), *Anthocleista microphylla* (VU), *Dorstenia involuta, Psychotria satabiei, Hymenostegia bakeriana* (VU) and *Memecylon simulans* (EN). It certainly merits IPA status. Nearby, Bella village has records of additional threatened species such as *Rinorea simoneae* (EN). Rocher de Ako'okas and various other rocky hills around Ebolowa have also recorded important species and might well justify IPA status. Further potential IPA sites include the Nkout ridge near Djoum and the area around Bitye slightly west of the Dja reserve where Bates made several collections of rare and threatened species including *Ixora batesii* (CR), *Dalbergia nervosa* (EN), *Agelanthus dichorus* (VU), *Synsepalum batesii* (CR), *Pavetta robusta* (EN) and *Pavetta cellulosa* (VU). There is also the RAMSAR wetland site on the Ntem river south of Campo Ma'an which would likely qualify under criterion C. In addition, Tchouto's work on the Campo Ma'an area drew attention to the important varieties of coastal forest west of Campo Ma'an. Much of this is occupied by FMU 09-025 which is being rapidly and controversially converted into palm oil plantation (Orozco et al., 2019). Based on Tchouto's (1994) findings, parts of this area would almost certainly justify being designated an IPA, although we have access to only very limited relevant specimen data. Many important records have also been made around Kribi and the Kienke river: this area should be surveyed for remaining fragments of forest.

In **East Region** there are large tracts of remaining forest and several large protected areas that are less surveyed botanically and may or may not differ significantly from Lobéké National Park, which we include here as an IPA. The importance of preserving as much forest as possible in this surviving remote area is clear, irrespective of whether it contains more threatened species or botanical richness than is currently known. Even if the general diversity is lower than other forests in Cameroon, there are likely to be unique sites such as the Niki Falls on the Dja

***Begonia minuta* (CR), is locally endemic to Colline Nkoltsia in South Region.**
Photograph A. Grall, October 2017.

river where, for example, *Ledermanniella bifurcata* (VU) is recorded. Further north in this region, several collections of rare or threatened species have been made in the area of the Deng Deng National Park and the Belabo Forest Reserve, but often not falling within their boundaries. Further surveying is needed to establish what areas might be of greatest botanical significance. Conservation organisations have ambitious plans for protecting and restoring wildlife corridors in this area (ERuDEF 2023a, 2023b).

In Adamaoua, North and Far North Regions, parts of the large national parks (Faro, Benoua, Bouba Ndjida, Waza) may merit IPA status for the habitat types they protect, such as the Waza Logone floodplain RAMSAR site, but there are few recorded threatened species and botanical richness is relatively low. The Mandara mountains have long been thought to be of great botanical significance and merited special status in White's (1983) Africa-wide vegetation classification and also in Letouzey's (1985) Phytogeography of Cameroon. They are undoubtedly severely degraded, but they have never been thoroughly botanised and very little is known to us of what survives. Further surveying to find areas for potential IPAs in this zone should be a priority but might be prevented by ongoing conflict. The Mayo Louti Forest Reserve is another site that stands out as an oasis of green on satellite imaging and may merit further botanical investigation. Around the border between Adamaoua and North Regions, the Valee du Mbere features *Chlorophytum camporum* (EN) and the waterfalls of Lanchernon, which may harbour rheophytic species (Cheek & Lovell, 2021a). Hilly terrain around Ngaoundere may also contain further important sites, such as Hosséré Sillé where *Eriosema adamaouense* (CR) is recorded (Cheek, 2015a). Several collections were made by Ledermann, Breteler and others near Lake Wakwa, including *Cyphostemma leucotrichum* (EN), while at the private Ngaoundaba ranch and IBA site there is another crater lake and apparently well-preserved habitat (BirdLife International, 2023b). At Mt Ngoundal, *Vepris adamaouae* (EN) and *Sericanthe raynaliorum* (VU) have been recorded (Cheek & Lovell 2021e, Lovell & Cheek, 2021d).

# Southwest Region

Cloud Forest of the Tofala Hills, near Bechati.
Photograph X.van der Burgt September 2006.

## IPA

# Mt Cameroon National Park

**International site name:** Mt Cameroon National Park (MCNP)
**Site code:** CMNTIPA039
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana

**Latitude** (decimal degrees)**:** 4.21400
**Altitude minimum:** 140
**Area** (km²)**:** 581.78
**Longitude** (decimal degrees)**:** 9.17610
**Altitude maximum:** 4040
**IPA criteria met:** A(i)

## Site description

At 4,040 m, Mt Cameroon, known locally as Fako, is the highest mountain in West or West-Central Africa and the only active volcano. It is the high point of the Cameroon Volcanic Line which extends between islands Annobon, São Tomé and Príncipe and Bioko, and then inland, roughly parallel to the Cameroon-Nigeria border. It has been a national park since 2009. On the south-western side, its border descends as low as 130 m asl, incorporating much of the transition from coastal lowland rainforest to sub-alpine summit grassland that makes the mountain unique in Africa. The border meets the Mokoko-Onge forests in the west and incorporates much of the former Bamboko Forest Reserve in the north-west. On the eastern side, the border is much higher up the mountain's flanks, up to 2,500 m in the north-east and further south above Likombe. Although incorporating the important upland forests of Mt Etinde (1,700 m) south of the main summit, the border runs at c. 500 m on the south side above Batoke, excluding the lower slopes.

## Botanical significance

Mt Cameroon is noted as the only site in Africa featuring an intact transition of natural vegetation from lowland forest at the coastal edge to sub-alpine summit grassland at 4,000 m altitude (Cheek et al., 1996; Forboseh et al., 2011). It has been a target for European botanists since 1861 when Gustav Mann collected hundreds of specimens there for RBG Kew's director Sir William Hooker (Cable & Cheek, 1998). The far greater altitude compared with any other site in West or West-Central Africa gives the site many locally or regionally rare taxa in the montane grassland zone from c. 1,900 m to the summit (Cable & Cheek, 1998). Some species are historically recorded with uncertain locations and may or may not be extant within forests of MCNP, including *Peperomia dusenii, Liparis kamerunensis, Triclisia macrophylla* and *Ardisia oligantha.*

Montane and submontane forest feature many species found also on other peaks of the Cameroon Volcanic Line and sometimes more distant montane sites. These include trees such as *Prunus africana, Morella arborea, Ixora foliosa* and *Astropanax* spp. Perhaps because of the unique climate or particular geology, some taxa at this altitude are also rare or locally endemic, such as *Impatiens etindensis* (EN).

The rare surviving lowland evergreen forest on the lower slopes is the most plant biodiverse and most threatened habitat. It extends down to below 200 m asl in the south-west where it adjoins the Mokoko-Onge

forest, and on the southern slopes the border meets the coastal plantation zone at 150–700 m asl. The forest around Mt Etinde is rich and relatively well preserved (BirdLife International, 2021a).

As an active volcano, Mt Cameroon is a constantly evolving habitat with recent lava flows gradually maturing into fertile soils. Together with the effects of altitude and climate, this makes it a particularly interesting theatre to observe ecological succession and evolution.

## Habitat and geology

Mt Cameroon has areas with some of the highest rainfall in the world but the climate varies considerably over relatively small distances. At Cape Debundscha, just outside the site boundary to the south-west, the long-term annual average from 1965–1993 was 9,086 mm, slightly less than the >10 m cited by Courade (1974), presumably from a shorter period; the maximum annual total was nearly 17 m (Fraser et al., 1998). Elsewhere, at Mokoko and Mbonge (15–20 km north-west of the boundary) and at Buea-Molyko (below the boundary on the eastern flanks at ca. 600 m), the yearly mean drops to 2–3 m. Precipitation follows a seasonal pattern, peaking in July and August when south-westerly winds bring moisture from the Atlantic, and becoming much reduced between November and March as the inter-tropical convergence zone moves south and the Harmattan is the prevailing wind, bringing dry dusty air from the north with less than 50 mm of rain per month away from the coast (Fraser et al., 1998).

Mean monthly maximum and minimum temperatures vary very little seasonally but minimums are a few degrees lower at Mokundange (17.1–18.9 °C) than at Debundscha (21.6–23.3 °C) and maxima a little higher (27.9–31.7 °C versus 27.2–30 °C).

Mt Cameroon is an active volcano with soils of varying age and maturity from different eruptions up to the present. It is formed of alkali basalt and basanite lavas overlying Cretaceous to Miocene (or more recent) sediments which in turn rest on Precambrian metamorphic basement rocks (Dereulle et al., 1987; Mathieu et al., 2011). The mountain is considered to be a horst structure by Dereulle et al. (1987), that is its height is constituted by uplift rather than just by accumulation of lava. Surface lavas have been dated to 1-2 mya (Marzoli et al., 2000; Mathieu et al., 2011; Wembenyui et al., 2020) although upper Miocene age was previously estimated by Vincent 1971 (Dereulle et al., 1987) and 10 Ma by Fitton (1983). The unusual nephelinitc larva (Etindite) of Mt Etinde has been dated to 0.65 Ma and is now considered approximately simultaneous with Mt Cameroon (Nkoumbou et al., 1995; Ntoumbe et al., 2016) having previously been estimated to represent an earlier – Miocene – volcanic formation than the main massif (Dereulle et al., 1987; Cable and Cheek, 1998).

**Gnarled trees at 3000 m on Mt Cameroon.**
Photograph Andrew McRobb, 1995–1996.

Seven eruptions were recorded in the 20th century from various Mt Cameroon vents, with major lava flows within the national park area associated with the 1909, 1922, 1954, 1982, 1999 and 2000 eruptions, and a further brief eruption in 2012. The 1922 eruption reached the sea at Bibundi-Idenau and the 1999 eruption descended 2500 m down the southern flank, stopping just before the sea to the west of Bakingili (Geiger et al., 2016). Landslides and block falls are also common (Thierry et al., 2008). Many cinder cones are also present on the southern flanks. The soils of Mt Cameroon are mostly highly fertile and targeted by farmers (Hawkins & Brunt, 1965). The southern coastal strip has been particularly targeted for agri-plantations.

Several different vegetation types have been distinguished within the national park area (Letouzey, 1968, 1985; Thomas & Cheek, 1992; Maley & Brenac, 1998; Cable & Cheek, 1998). As well as those discussed above and their subdivisions, a large area of Marantaceae open-canopy forest is notable on the western side between approximately 500 and 2,000 m (Cable & Cheek, 1999). The combined 1982–1999 lava flow, which reaches the coast near Bakingili, has been studied as a potential exclusion barrier, restricting elephants to the western side where they also frequent several crater lakes (Maicher et al., 2010). Lower tree diversity and a sparser, lower canopy with more large trees were found in the elephant zone.

## Conservation issues

Although better preserved than much of the surrounding forest, the national park is not without threats, particularly fire and small-scale timber and wood extraction by the growing populations of surrounding settlements, as well as farming within the park (Awono et al., 2014). BirdLife International (2021a) report that montane grassland is burnt annually in the dry season and is consequently impoverished. Clearance of forest outside the boundaries is also isolating the site and increasingly exposing the perimeter-to-edge effects. On the southern, south-western and eastern boundaries, many threatened taxa are recorded from very close to the boundary or just outside, and these populations are therefore highly threatened or may already be lost, particularly where agri-plantations have been established. The lack of protection even at high altitude on the eastern flanks above Buea is also of urgent concern since many important species are collected from here; this area is proposed as an additional (Eastern Mt Cameroon) IPA but would be best managed in close association with the national park.

The national park is unfortunately cut off from the coast, interrupting the unique altitudinal transition. A hard-surfaced coastal road runs between Idenau and Limbe, a town which is now connected to Mokundange and Batoke by continuous urban sprawl which has engulfed former plantation areas. A major new port – the Limbe Deep Seaport – is planned at Ngeme, east of Mokundange, which is anticipated to bring 20,000 jobs and stimulate development in the area (Ngah, 2016). There is also an oil refinery at Mokundange and oil prospecting in the area.

According to BirdLife International (2021a), the best surviving forest of the whole mountain is around Mt Etinde, although its lower slopes are outside the national park. Continued development around Batoke and the new seaport will inevitably further threaten these slopes unless serious conservation efforts are made. The port is also anticipated to increase tourism to the area which, if managed well, could be positive for conservation (Olsen et al., 2001). The DFID and German government funded Mt Cameroon Project, established in 1994, funded development projects in the area in collaboration with MINEF under a Participatory Biodiversity Conservation Strategy, but international funding has diminished since 2008.

As in many parts of Cameroon, high levels of internal migration – up to 90% in the north part of the park (Awono et al., 2014) – and community conflicts complicate conservation action and undermine traditional stewardship of natural resources and biodiversity by indigenous groups.

Lava flows and landslides have the potential to eliminate small populations of some taxa at any time.

## Key ecosystem services

MCNP is an important site for non-timber forest products (NTFPs) including several threatened species such as *Prunus africana* and *Oxyanthus montana* (Njo & Wanie, 2018).

The remaining forest cover likely gives some protection against the high risk of landslides (Thierry et al., 2008) as well as the threat of flash flooding in this very high-rainfall area. Despite the rainfall, there is limited permanently available water on the mountain due to

**Mt Cameroon N.P. Grassland at 2500 m.**
Photograph Andrew McRobb, 1995–1996.

the free-draining volcanic soils. The forest contributes to buffering rainfall while dense epiphytes in the cloud forest layer enlarge the overall surface area for intercepting atmospheric moisture and are likely to increase water availability, particularly in the dry season when there is less rainfall.

The site is an IBA, KBA and AZE site, important for a rich fauna including 210 bird species – two of which (*Zosterops melanocephalus*, VU and *Pternistis camerunensis*, EN) – are strictly endemic, two endemic shrews (*Crocidura eisentrauti*, VU and *Sylvisorex morio*, EN) and two endemic rodents (*Otomys burtoni*, EN and *Lophuromys roseveari)*. It is one of very few sites in western Cameroon with remaining forest elephants (*Loxodonta cyclotis*, CR) – estimated at 130 individuals (MINFOF, 2014) – and is also important for Preuss's guenon, *Allochrocebus preussi* (EN).

The lowland forests of Mt Cameroon were formerly a key part of the range for drills (*Mandrillus leucophaeus* [EN]) but these have likely been all but eliminated at the site (Gadsby et al., 2020).

The mountain is an obvious tourist attraction and close to the historic town of Limbe.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Local climate and air quality

**Regulating –** Carbon sequestration and storage

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

## IPA assessment rationale

Around 90 globally threatened species are thought to have populations at the site sufficient to qualify MCNP as an IPA under criterion A(i). It also qualifies under criterion B(ii) for its large number of nationally endemic and range-restricted species. The site would almost certainly also qualify under criterion C when fully assessed because of the uniqueness of the high-altitude zones as well as its other important habitats. Many species are also locally utilised, suggesting it might also qualify under criterion B(iii).

**Mt Cameroon at 2500 m. The treeline and grassland flora are partly influenced by annual burning.**
Photograph Andrew McRobb, 1995–1996.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Acanthopale decempedalis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brachystephanus longiflorus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brillantaisia lancifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Isoglossa nervosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Sclerochiton preussii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Stenandrium thomense* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Mischogyne gabonensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma macrophyllum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis submontana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apiaceae | *Afroligusticum townsendii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apiaceae | *Lefebvrea camerunensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araceae | *Amorphophallus preussii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Asparagaceae | *Chlorophytum petrophilum* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Asparagaceae | *Dracaena kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asteraceae | *Bidens mannii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asteraceae | *Helichrysum biafranum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Asteraceae | *Helichrysum mannii* | NT | | B(ii) | | | | |
| Asteraceae | *Mikaniopsis maitlandii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asteraceae | *Senecio burtonii* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens etindensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens frithii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens grandisepala* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | | ✓ | |
| Begoniaceae | *Begonia quadrialata* subsp. *dusenii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Boraginaceae | *Myosotis cameroonensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Burmanniaceae | *Oxygyne duncanii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | ✓ | | ✓ | |
| Campanulaceae | *Wahlenbergia ramosissima* subsp. *ramosissima* | VU | A(i) | | ✓ | | ✓ | |
| Caryophyllaceae | *Silene biafrae* | | | B(ii) | | | | ✓ |
| Celastraceae | *Salacia volubilis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Palisota preussiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Cyperaceae | *Bulbostylis densa* var. *cameroonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Crudia letouzeyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Dryopteridaceae | *Dryopteris glandulosopaleata* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Grossera major* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Hamilcoa zenkeri* | VU | A(i) | B(ii) | ✓ | | | |
| Euphorbiaceae | *Leeuwenbergia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Leeuwenbergia letestui* | EN | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | VU | A(i) | | | ✓ | ✓ | |
| Gentianaceae | *Anthocleista scandens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Juncaceae | *Luzula mannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Coleus cataractarum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Coleus insignis* | | | B(ii) | | | | |
| Lauraceae | *Beilschmiedia hutchinsoniana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum cheekii* | EN | A(i) | B(ii) | ✓ | | | |
| Menispermaceae | *Triclisia macrophylla* | CR | A(i) | | | | ✓ | |
| Myricaceae | *Morella arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum calvum* | VU | A(i) | | ✓ | | ✓ | |
| Orchidaceae | *Bulbophyllum gravidum* | VU | A(i) | | | | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Cheirostylis divina* var. *ochyrae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Disperis kamerunensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Disperis nitida* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Genyorchis macrantha* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria batesii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria microceras* | | | B(ii) | | | | |
| Orchidaceae | *Habenaria obovata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis kamerunensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Manniella cypripedioides* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya cooperi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Piperaceae | *Peperomia dusenii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Piperaceae | *Peperomia kamerunana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Piperaceae | *Peperomia laeteviridis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Agrostis mannii* subsp. *mannii* | | A(iv) | | ✓ | ✓ | ✓ | |
| Poaceae | *Andropogon pusillus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Deschampsia mildbraedii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Festuca camerunensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Poaceae | *Festuca rigidiuscula* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Poaceae | *Hypseochloa cameroonensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Poaceae | *Panicum acrotrichum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Sporobolus montanus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Trisetopsis mannii* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Polygalaceae | *Polygala tenuicaulis* subsp. *tenuicaulis* | VU | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Primulaceae | *Ardisia etindensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes burnleyae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Anopyxis klaineana* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Anthospermum asperuloides* | | | B(ii) | | | | |
| Rubiaceae | *Bertiera laxissima* | | | B(ii) | | | | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Chassalia petitiana* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mussaenda epiphytica* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Oxyanthus doucetii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus montanus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta hookeriana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria bimbiensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Psychotria piolampra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria geophylax* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria recurva* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea urbaniana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia atherura* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Salicaceae | *Oncoba lophocarpa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia maxima* | VU | A(i) | | | | ✓ | |
| Sapindaceae | *Lecaniodiscus punctatus* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola anomala* | | | B(ii) | | | | |
| Sterculioideae | *Cola metallica* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Thelypteridaceae | *Thelypteris pseudogueintziana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum kayserianum* | EN | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Mt Cameroon National Park | Protected/conservation area matches IPA |
| Important Bird Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area encompasses IPA |
| Key Biodiversity Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area encompasses IPA |
| Alliance for Zero Extinction Site | Mt Cameroon and Mokoko-Onge | Protected/conservation area encompasses IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Ongoing – trend unknown |
| Agro-industry farming | Medium | Ongoing – increasing |
| Development – housing and urban areas | Medium | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Hunting and collecting terrestrial animals | Medium | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |

## IPA

# Eastern Mt Cameroon

**International site name:** Eastern Mt Cameroon
**Local site name (if different):** Etinde and Woteva community forests
**Site code:** CMNTIPA041
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana

**Latitude** (decimal degrees)**:** 4.14000
**Altitude minimum:** 900
**Area** (km²)**:** 178.0
**Longitude** (decimal degrees)**:** 9.17000
**Altitude maximum:** 2,530
**IPA criteria met:** A(i)

## Site description

On the eastern flanks of Mt Cameroon, the existing national park boundary is mostly above 1,400 m and runs as high as 2,500 m in places, excluding most of the mid–lower slopes above Buea and Likombe. Together with the lower eastern and southern slopes of Mt Etinde, these degraded and threatened forests have recorded many threatened plant taxa and are here proposed as an Important Plant Area. The area includes the Etinde and Woteva community forests as well as a strip connecting these and extending below the former to the south-east of Boando where numerous cinder cones retain some forest. In the north-east, a further section is included between the national park and the north-east boundary of the Woteva forest. The site lies in Fako division of Southwest Region and straddles Muyaka and Buea subdivisions.

## Botanical significance

Mt Cameroon has been an important collecting site for botanists since the 19th century and many expeditions have been made from the towns of Buea and Limbe on the eastern side of the mountain. These have resulted in numerous rare or range-restricted species being recorded from this area (Cable & Cheek, 1998). Some of these are endemic to Mt Cameroon, such as *Angraecopsis cryptantha* (VU), only recorded from this site at 2,000 m, and *Liparis kamerunensis* (CR), which is endemic to upper Mt Cameroon, most recently collected from grassland and cloud forest within this site at c. 2,000 m (the type-specimen may have been recorded also from this site or perhaps within the national park). Other important taxa occur at additional mountain sites along the Cameroon Volcanic Line, such as *Habenaria thomana* (VU), *Palisota preussiana* (VU) and *Tiliacora lehmbachii* (EN), all otherwise known only from Mt Kupe.

Because of the expansion of Buea, confirmation is needed of the continued presence of some taxa. *Disperis kamerunensis* (CR) may have been lost from the Buea collection site but is included here since the only other record is close to the border of this IPA within the national park. *Coleus dissitiflorus* (CR) has only been recorded globally from near Buea over 130 years ago and may not have survived extinction.

The lower slopes of Mt Etinde and cinder cones around Boando are included within this site and are important for many taxa, such as *Ardisia etindensis* (CR) – a lowland species otherwise only recorded near Eseka – and *Cola metallica* (CR).

## Habitat and geology

Although the south-western side of Mt Cameroon is one of the wettest places in the world, the eastern slopes are drier due to the rain-shadow effect: at Molyko, a suburb of Buea below the proposed boundary of this IPA at 620 m, annual mean precipitation is 2–3 m compared with nearly 10 m at Debundscha (Fraser et al., 1998). There is a seasonal climate with >100 mm precipitation per month from April to November (peaking in August), and <50 mm in December, January and February as the inter-tropical convergence zone moves south and the northerly Harmattan wind prevails, bringing dry dusty air from the Sahara (Fraser et al., 1998, data for 1984–1993). At the south of the site, precipitation is higher, with nearly 5 m a year on average at Mokundange on the coast below Mt Etinde and >1 m per month mean for July and August when there is rain nearly every day.

Maximum and minimum monthly temperatures vary little with means of 24.4 °C and 19.1 °C respectively, although maxima drop slightly in the rainy season (data for Tole, south of Buea, at c. 630 m, years 1970–76 and 1983–1993).

Mt Cameroon is the highest mountain in West or Central Africa (west of the Albertine rift), 1000 m higher than Mt Oku further north along the Cameroon Volcanic Line. It is an active strato-volcano of mainly alkali basalt and basanite overlying uplifted Cretaceous to Quaternary sediments and Precambrian metamorphic basement rocks (Dereulle et al., 1987; Mathieu et al., 2011). While surface lavas are variously interpreted as ancient to recent (Ateba, 2000, Fitton, 1983), all dated samples are <3 Ma (Marzoli et al., 2000; Wembenyui et al., 2020). There have been several historical eruptions but only two have left lava fields within the proposed IPA: the 1959 eruption on the north-eastern flank, which descended towards Ekona Mbengue, and the 2000 eruption south of the summit, which descended the south-eastern side to c. 2,000 m (Njome et al., 2008, Ateba et al., 2009, Geiger et al., 2016). The nephelinitic lavas of Mt Etinde are distinct and unusual but not necessarily more ancient as was once thought (Nkoumbou et al., 1995; Ntoumbe et al., 2016). Landslides and block falls are common (Thierry et al., 2008) and a large fan of lahars is mapped north of Buea by Ateba et al. (2009). Many cinder cones are also found in the southern part of the site around Boando.

With the exception of recent flows and the Etinde lavas, the soils of Mt Cameroon are mostly highly fertile and targeted by farmers (Courade, 1974). Because of rejuvenation by ash fall on the upper slopes, soil fertility does not fall with increasing altitude as on other tropical mountains due to leaching; organic content is positively correlated with altitude due to reduced temperature – with a lapse rate of 0.6 °C per 100 m (Proctor et al., 2007). According to Payton (1993) the andisols of the eastern slopes are much deeper and more fertile than the older, leached lowland soils below 600 m on the south and western sides.

***Prunus africana*** **(VU), a widespread species that has been heavily impacted by destructive harvesting for its bark which is sold as 'Pygeum', a herbal treatment for prostate conditions. Growing above Likombe, 1995.**

Several different vegetation types have been distinguished within the national park area (Letouzey, 1968, 1985; Thomas & Cheek, 1992; Maley & Brenac, 1998; Cable & Cheek, 1999). The site proposed here includes mainly montane forest and submontane (discontinuous canopy) forest, and montane grassland and scrub. The montane forest contains trees of considerable size for the altitude (particularly *Astropanax* and *Syzygium* spp.), probably explained by the comparatively fertile, well-drained soils and high organic content (Payton et al., 1993).

Forest gives way to grassland between 2,000 and 2,500 m but the level of the tree-line is heavily impacted by the free-draining substrate, fire (natural and anthropogenic) and volcanic eruptions (Cable & Cheek, 1998; Proctor et al., 2007).

## Conservation issues

The site is under pressure from farming and logging related to the expansion of communities around Buea (KBA Partnership, 2021a). Agro-plantations attract migrant workers, increasing the demand for land and fuelwood (MINFOF, 2014). Two community forests are included within the site boundary: Etinde and Woteva. While much heralded for integrating local people with conservation and sustainable development, the success of community forests in Cameroon has been mixed (Ngalim & Simbo, 2016; Minang et al., 2019). At nearby Bimbia-Bonadikombo, forest loss has continued without apparent benefit to the community as a whole (Nkemenyi, 2016, Adeyanju, 2017). There is some indication that Woteva has been more successful in benefitting the community and there have been some reforestation efforts at Etinde and Woteva (Ngang et al., 2018; Piabuo, 2018; Adeline, 2015).

The tree-line around 2,000–2,500 m is largely shaped by volcanic disruption and fire, including anthropogenic burning, rather than climate (Proctor et al., 2007). Fire, often started by hunters, is a major threat to the montane and submontane forests, and montane grassland, particularly because of the free-draining, drought-prone soils, with few permanent rivers or springs (Cable & Cheek, 1998; Payton, 1993; BirdLife International, 2021a). This could also render them particularly vulnerable if climate change reduces precipitation and cloud cover.

## Key ecosystem services

The main tourist routes to the summit of Mt Cameroon run up through these eastern slopes, bringing business to the communities below. Tourist value is partly dependent on the forest and wildlife it supports but supplemented by volcanic landmarks and nearby historical sites. The proposed IPA is part of an IBA, KBA and AZE site, with a rich fauna including 210 bird species (of which two are strictly endemic: *Zosterops melanocephalus* [VU] and *Pternistis camerunensis* [EN]); two endemic shrews (*Crocidura eisentrauti* [VU] and *Sylvisorex morio* [EN]) and two endemic rodents (*Otomys burtoni* [EN] and *Lophuromys roseveari*). It is one of few sites in western Cameroon with remaining forest elephants (*Loxodonta cyclotis* [CR]) – estimated at 130 individuals (MINFOF, 2014) – and is also important for Preuss's guenon (*Allochrocebus preussi* [EN]).

The slopes are prone to landslides; protection of forest vegetation is likely to mitigate this risk as well as that of flash flooding (Payton, 1993; Thierry et al., 2008), while regulating fresh water supply.

The forest supplies an array of timber and non-timber forest products, including many medicines that are important in local villages where commercial medicines are often unaffordable (Focho et al., 2010; Fongod et al., 2013).

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

## IPA assessment rationale

The site supports globally or nationally significant populations of as many as 60 globally threatened plant taxa (57 species), thereby qualifying as an IPA under criterion A(i). It also qualifies under criterion B(ii) for the number of range-restricted and nationally endemic species and could potentially meet the B(iii) criteria also for social and economically useful species.

**Mt Cameroon and Etinde viewed from the Eastern lowlands.**
Photograph A. McRobb, 1995-1996.

**Mt Etinde is an ancillary peak to the south of Mt Cameroon's main summit. Only the upper slopes are included within Mt Cameroon National Park. The important but unprotected forests of the lower slopes contribute several threatened species to Eastern Mt Cameroon IPA.**
Photograph A. McRobb, 1995-1996.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Acanthopale decempedalis* | VU | A(i) | | ✓ | | | |
| Acanthaceae | *Dicliptera alternans* | VU | A(i) | | | ✓ | ✓ | |
| Acanthaceae | *Pseuderanthemum dispermum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Sclerochiton preussii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Stenandrium thomense* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | | | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | | ✓ | ✓ | |
| Apocynaceae | *Neoschumannia kamerunensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Amorphophallus preussii* | VU | A(i) | B(ii) | ✓ | | | |
| Araliaceae | *Astropanax hierniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens etindensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | ✓ | | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia rubromarginata* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia volubilis* | VU | A(i) | | ✓ | | ✓ | |
| Chrysobalanaceae | *Dactyladenia gilletii* | VU | A(i) | | | ✓ | ✓ | |
| Chrysobalanaceae | *Dactyladenia mannii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Commelinaceae | *Aneilema silvaticum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Palisota preussiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia bipindensis* | VU | A(i) | | | | | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | | ✓ | |
| Euphorbiaceae | *Leeuwenbergia letestui* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Salicaceae | *Oncoba lophocarpa* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Lamiaceae | *Coleus dissitiflorus* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lecythidaceae | *Rhaptopetalum cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | | |
| Menispermaceae | *Tiliacora lehmbachii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia poinsettifolia* var. *achoundongiana* | | (Aiv) | | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia prorepens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia kalbreyeri* | | | | | | | |
| Ochnaceae | *Lophira alata* | VU | A(i) | | | | | |
| Orchidaceae | *Angraecopsis cryptantha* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Orchidaceae | *Angraecum sanfordii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum bifarium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Disperis kamerunensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria batesii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria thomana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | | | ✓ | |
| Orchidaceae | *Liparis kamerunensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya albescens subsp. angustifolia* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya superposita* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Ormocarpum klainei* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Piperaceae | *Peperomia kamerunana* | EN | A(i) | | ✓ | | ✓ | |
| Poaceae | *Andropogon pusillus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Panicum acrotrichum* | VU | A(i) | | ✓ | | ✓ | |
| Poaceae | *Trisetopsis mannii* | | A(iv) | B(ii) | ✓ | | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Primulaceae | *Ardisia etindensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora delicatula* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Mitriostigma cameroonense ined.* | | A(iv) | B(ii | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus montanus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria asterogramma* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria piolampra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea urbaniana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea xanthotricha* | EN | A(i) | | ✓ | | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | ✓ | | |
| Sapindaceae | *Deinbollia pycnophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola metallica* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola praeacuta* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Zingiberaceae | *Aframomum kayserianum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum plicatum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (production) | Etinde Community Forest; Woteva Community forest | IPA encompasses protected/conservation area |
| National Park | Mt Cameroon National Park | Protected/conservation area is adjacent to IPA |
| Important Bird Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| Key Biodiversity Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| Alliance for Zero Extinction Site | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – housing and urban areas | Medium | Ongoing – increasing |
| Shifting agriculture | High | Ongoing – increasing |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |
| Agro-industry farming | Medium | Future – inferred threat |

## IPA

# Mokoko-Onge

**International site name:** Mokoko-Onge
**Site code:** CMMTIPA040
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana

**Latitude** (decimal degrees)**:** 4.36000
**Altitude minimum:** 50
**Area** (km²)**:** 395.0
**Longitude** (decimal degrees)**:** 9.00000
**Altitude maximum:** 500
**IPA criteria met:** A(i)

## Site description

The Mokoko-Onge forests neighbouring the Onge river on the western side of Mt Cameroon are the best preserved of the dense lowland forests once surrounding this huge volcanic mountain (Mwachala & Cheek, 2012). The area demarcated here incorporates the Onge proposed integral reserve and the former Mokoko River Forest Reserve, although these have been largely subsumed within a large logging concession as UFA 11-008 on recent maps of Cameroon's forestry estate (MINFOF & WRI, 2021). The site extends from the villages of Mokoko and Barombi Mokoko in the north, south to Bonjaro and Boa, then west of the logging concession to meet the border of the proposed Ndongere National Park and south and east along the coast to the palm oil plantations at Idenau. East of the Onge river, which forms the eastern border of UFA 11-008, the border incorporates the Onge proposed integral reserve and extends north to Bambuko at the north-east tip of the UFA. Although it omits degraded habitat surrounding the Bomana Bakweri–Koto–Bambuko road, this area extending to the western boundary of the Mt Cameroon National Park would best be considered a buffer zone of the park and all further development considered subject to the impact on the neighbouring forests and their connectivity.

## Botanical significance

This lowland forest site is one of the most important habitats in Cameroon due to the rarity of surviving coastal lowland rainforest, the very high biodiversity specific to the Mt Cameroon area, and its contribution to a surviving gradient of natural vegetation from sea-level forest to sub-alpine summit grassland that is unique in Africa (Cheek et al., 1996; Forboseh et al., 2011). It is part of a zone that has the highest plant species and generic diversity per degree square in tropical Africa (Barthlott et al., 1996; Dagallier et al., 2020) and much of this diversity is supplied by the unprotected dense lowland forests rather than the higher slopes which constitute the bulk of the Mt Cameroon National Park (Cable & Cheek, 1998; Mwachala & Cheek, 2012).

Over 70 globally threatened plants are recorded. *Octoknema mokoko* (CR), *Afrothismia foertheriana* (CR) and *Mitriostigma bakweri* (ined.) are considered globally unique to the site, while *Cola cecidiifolia* (CR) may also be endemic since it is likely to have been lost from the only other known sites (nearby Southern Bakundu and Bimbia Bonadikombo), which have suffered severe degradation (Cheek et al., 2018d; Cheek & Lawrence, 2018). Several other taxa are only known from elsewhere in the Mt Cameroon area or from one or two other key sites such as Korup National Park.

## Habitat and geology

Mt Cameroon is an active volcano and the highest mountain in West or Central Africa. It is part of the Cameroon Volcanic Line which extends north-eastward from the offshore islands of Annobon, São Tomé and Bioko, through south-western Cameroon to the Bamenda Highlands and beyond. The mountain is formed of alkali basalt and basanite lavas overlying Cretacious to Miocene (or more recent) sediments which in turn rest on precambrian metamorphic basement rocks (Déreulle et al., 1987; Mathieu et al., 2011). Recent research and dating methods suggest most of the surface lavas appear to be relatively recent (<2 Ma) and roughly contemporaneous, although eruptions continue to the present.

Soils of the Mokoko-Onge area are predominantly volcanic, mostly relatively old and well weathered, and fertile (fertility class 2 of 4, according to Hawkins and Brunt's [1965] classification) but with one major incursion of new lava from the 1922 eruption that reached the coast near Idenau, where there is also a patch of alluvial soils. Hawkins and Brunt (1965) map the area as an association of old volcanic (red, clayey, acidic, deep, well-draining with lateritic rubble) and sedimentary soils from overlying sediments, while Valerie (1970) indicates a juxtaposition of eutrophic brown mull soils with red ferrallitic sesquioxide soils on basic rocks. Sandy areas are also mentioned on specimen records cited by Mwachala & Cheek (2012). Fertility of remaining well-forested areas may be less high than areas already cleared for farming.

The Mt Cameroon area has a seasonal monsoon climate but with considerable local variation in levels of precipitation due to the orographic influence of the 4,000 m mountain immediately adjacent to the Atlantic Ocean. Between April and October south-west winds bring rain which is deposited in especially high volumes at the south-west foot of the mountain (Cable & Cheek, 1998). Long-term (30–40 year) records up to 1993 indicate an annual mean of 8,392 mm at Idenau at the south-eastern tip of this site, and 9086 mm at Debundscha, 15 km to the south, where a maximum of nearly 17 m was recorded in one year (Fraser et al., 1998). By contrast, at Mokoko on the northern edge of the site the mean drops to 2844 mm, with three months (December–February) registering <25 mm – although the measuring period was much shorter (N = 9–13). Temperatures varied relatively little seasonally but were slightly higher in the north, with Mokoko registering monthly means ranging from 27.5–31.8 °C while at Idenau the range was only 29–30.4 °C.

Under Letouzey's (1985) scheme the area is mostly designated as Atlantic Biafran forest with 'Caesalpiniaceae' (type 228) punctuated by semi-deciduous colonising elements (type 167).

## Conservation issues

The Bambuko-Balundu Native Authority Reserve was originally demarcated in 1936–7 and gazetted in 1952 by the colonial authorities as a timber reserve, with a secondary aim of watershed protection (Acworth et al., 2001). It became the Mokoko River Forest Reserve in the 1970s. To the north and west, the 'Boa plain', approximately 30,000 ha of secondary forest on floodplain, was targeted by colonial farmers for plantations and later reverted to the state to be leased to the Cameroon Development Corporation (CDC). Although by the mid 1900s only c. 2500 ha had been actively planted by the CDC and another 4,000 ha 'illegally' squatted by small-scale farmers, planting of oil palm has intensified in the last decade (Mbom, 2009).

Population pressure is high with 50,000 people estimated to live on these plains, mostly in fishing villages on the coast but with c. 90% of households actively farming the land. High levels of migration due to fertile soils and employment opportunities in the CDC plantations, along with the confused colonial legacy of land tenure and the lure of logging profits, have created complex relationships between those competing for resources (Acworth et al., 2001).

Intentions of the MCP, funded by the UK and German governments, to promote sustainable resource use in the Mokoko reserve gave way to involvement in more urgent processes at the 'farm-forest' interface of the Boa plain area, which acts as a protective belt for the Mokoko reserve itself. Although the MCP eventually managed to assuage mistrust of some groups and promote sustainable management of the forests in a participatory context, and organisations such as the Mokoko Wildlife Management Association (MWMA) have formed to promote sustainable wildlife management within the forests, the MCP withdrawal in 2002 threatened to leave a void. Cheek & Prance (2015) report that although logging was occurring in the Onge forests, this has not proceeded as fast as was once feared, while the much feared privatisation of the CDC and associated acceleration of plantation development has not occurred. However, efforts to establish an Onge integral forest reserve have yet to bear fruit and most of the habitat connecting the slopes of Mt Cameroon with the lowland forests has been severely degraded, only leaving a precarious remaining wildlife corridor. In the Bomana area, conservation efforts have also met opposition from local interests keen to strike deals with logging firms (Acworth et al., 2001).

Most of the heart of the IPA forms a 160 km² section of production forest, UFA 11-008, which has two further disjunct units north-west and south-west of Bakossi National Park and is leased to the Cameroonian company SEPFCO. Forest monitoring suggests 553 ha of forest was lost between 2001 and 2018, with disturbance mainly in the north-west part (Open Timber Portal, 2021).

The local organisations ERUDEF and Ecological Balance have implemented a project to replenish stocks and protect existing trees of the commercially valuable *Microberlinia bisulcate* (zebrawood) in the Mokoko forest where it has been the subject of heavy logging (ERUDEF, 2021; Truscott, 2021).

## Key ecosystem services

The site provides stocks and a genetic reservoir of valuable timber species such as *Microberlinia bisulcata* (zebrawood). Seedlings have been raised from here to replenish other areas (Truscott, 2021).

Existing forest cover provides watershed protection for rivers supplying a large population with drinking water and important coastal nurseries, as well as protecting against flooding (Yaron, 1998).

The site provides very important habitat for threatened animals: it is a major part of a zone demarcated as an IBA, KBA and an Alliance for Zero Extinction site.

The forest is a valuable store of carbon which, in estimations of alternative land-use options in the 1990s, was much the largest contributor to scenarios in which sustainable land-use in the Mokoko area exceeded the dollar value of timber, palm oil and agricultural use (Yaron, 1998).

Mt Cameroon is a significant tourist destination. The lowland forests have great untapped potential to be part of ecotourist ventures.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Carbon sequestration and storage

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

## IPA assessment rationale

The Mokoko-Onge forests qualify under IPA criterion A(i) as they harbour important populations of numerous globally threatened species. The site also qualifies under criterion B(ii) as one of the richest sites for nationally endemic and range-restricted species. It would very likely also qualify under criterion C as its unique coastal lowland rainforests at the foot of Mt Cameroon are of great national and regional significance.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | | ✓ | |
| Acanthaceae | *Brillantaisia lancifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Achariaceae | *Dasylepis thomasii* | NT | A(i) | B(ii) | | | | |
| Ancistrocladaceae | *Ancistrocladus le-testui* | VU | A(i) | | | | ✓ | |
| Annonaceae | *Piptostigma longepilosum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma oyemense* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asparagaceae | *Chlorophytum petrophilum* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Asparagaceae | *Dracaena mokoko* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia laporteifolia* | | | B(ii) | | | | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | ✓ | |
| Boraginaceae | *Hoplestigma pierreanum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia foertheriana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Burmanniaceae | *Afrothismia hydra* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lenticellosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia nigra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia volubilis* | VU | A(i) | | ✓ | | ✓ | |
| Chrysobalanaceae | *Dactyladenia cinerea* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Dactyladenia mannii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia kola* | VU | A(i) | | | | | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Commelinaceae | *Floscopa mannii* | EN | A(i) | | | | ✓ | |
| Detarioideae | *Anthonotha xanderi* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Detarioideae | *Cryptosepalum korupense* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Englerodendron leptorrhachis* | CR | A(i) | | ✓ | | ✓ | |
| Detarioideae | *Eurypetalum unijugum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Guibourtia tessmannii* | EN | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Tessmannia korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | A(i) | | | | ✓ | |
| Euphorbiaceae | *Hamilcoa zenkeri* | VU | A(i) | B(ii) | ✓ | | | |
| Euphorbiaceae | *Leeuwenbergia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Leeuwenbergia letestui* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Icacinaceae | *Pyrenacantha longirostrata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Vitex lokundjensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Linaceae | *Hugonia macrophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos elaeocarpa* | VU | A(i) | | ✓ | | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | | ✓ | ✓ | |
| Moraceae | *Dorstenia dorstenioides* | | | B(ii) | | | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Ochnaceae | *Lophira alata* | VU | | | | | | |
| Olacaceae | *Octoknema mokoko* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Orchidaceae | *Gastrodia africana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya albescens* subsp. *angustifolia* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Haplormosia monophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Leptoderris aurantiaca* | VU | A(i) | | | ✓ | ✓ | |
| Peridiscaceae | *Medusandra richardsiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Guaduella humilis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes burnleyae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Rhizophoraceae | *Anopyxis klaineana* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Belonophora ongensis* | CR | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Belonophora talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Cuviera talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Gaertnera letouzeyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis minor* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis rammelooana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mitriostigma bakweri ined.* | | | B(ii) | | | | ✓ |
| Rubiaceae | *Pauridiantha arcuata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pseudosabicea batesii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria asterogramma* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria bimbiensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Psychotria elephantina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria njumei* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria piolampra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria recurva* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea medusula* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea urbaniana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea xanthotricha* | EN | A(i) | | ✓ | | ✓ | |
| Rutaceae | *Vepris lecomteana* | VU | A(i) | | ✓ | | | |
| Sapindaceae | *Deinbollia maxima* | VU | A(i) | | | | ✓ | |
| Sapindaceae | *Namataea simplicifolia* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Englerophytum sylverianum* | | | B(ii) | | | | |
| Simaroubaceae | *Nothospondias staudtii* | VU | A(i) | | | | ✓ | |
| Sterculioideae | *Cola cecidiifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola metallica* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola praeacuta* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola suboppositifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Thymelaeaceae | *Dicranolepis polygaloides* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Triuridaceae | *Kupea martinetugei* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Violaceae | *Rinorea amietii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea dewitii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum makandensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum plicatum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum tchoutoui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Conservation designation | Protected area name | Relationship of IPA to protected area |
| National Park | Mt Cameroon National Park | Protected/conservation area is adjacent to IPA |
| National Park | Ndognere Proposed National Park | Protected/conservation area is adjacent to IPA |
| Important Bird Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| Key Biodiversity Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| Alliance for Zero Extinction Site | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| RAMSAR site | Estuaire du Rio Del Rey | protected/conservation area is adjacent to IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | High | Ongoing – trend unknown |
| Agro-industry farming | High | Ongoing – trend unknown |
| Oil and gas drilling | Low | Future – inferred threat |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| War, civil unrest and military exercises | Low | Ongoing – trend unknown |

## IPA

# Idenau-Batoke Coastal Forest

**International site name:** Idenau-Batoke Coastal Forest
**Site code:** CMNTIPA042
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana

**Latitude** (decimal degrees): 4.09400
**Altitude minimum:**
**Area** (km²): 114.0
**Longitude** (decimal degrees): 9.01300
**Altitude maximum:** 700
**IPA criteria met:** A(i)

## Site description

The Idenau-Batoke coastal forest is a much degraded but unique very wet lowland evergreen rainforest strip beneath the boundary of Mt Cameroon National Park. The area here demarcated includes 114 km², but this includes approximately 55 km² designated as palm oil plantations as well as other cultivated and degraded areas, and the settlements of Idenau, Njonji, Bakingili and Cape Debundscha. Populations of several recorded species may already be lost from this site. The site borders three other proposed IPAs: Mt Cameroon National Park, Mokoko-Onge, and Eastern Mt Cameroon. While several species are shared with one or more of these sites, major variation in local climate and topography – as well as the highly threatened status of these other sites – justify its additional inclusion.

## Botanical significance

The much larger total area of the Mt Cameroon massif contains the highest recorded diversity of vascular plants in tropical Africa, with 2,345 species (Cable & Cheek, 1998). It is the only remaining area in Africa with a continuous gradient of vegetation from lowland rainforest at sea level to sub-alpine summit grassland (Cheek et al., 1996; Forboseh et al., 2011). Although a large part of this is protected as the Mt Cameroon National Park, the lower slopes and foothills of the massif lie largely outside this zone, are highly threatened, and are botanically very significant due to the rarity of lowland coastal forest, the globally unique (endemic) species and the exceptional climate created by Mt Cameroon. In contrast, many species from the upper areas are more secure from immediate threats and often occur at several other montane sites along the Cameroon Volcanic Line (Cable & Cheek, 1998).

At least two species, *Carapa littoralis* and *Ardisia schlechteri* (CR), are considered globally endemic to these remaining scraps of forest. A large proportion of the other listed threatened species, and also several not listed here but included for Mt Cameroon National Park, are found close to the boundary of the park, which is imperfectly protected and suffering from incursions and border effects. It is unlikely that these populations can survive without efforts to conserve and restore habitat below the national park boundary.

## Habitat and geology

At over 4,000 m and by far the highest peak in West or West-Central Africa, Mt Cameroon has a profound influence on local climate, with great variation in rainfall even along the c. 30 km length of this coastal

site. Cape Debundscha is considered one of the wettest places on earth, frequently cited as having an average of over 10 m of rain per year based on data from Courade (1974). More recently published long-term annual averages extending from 1965–1993 show this reduced somewhat to 9,086 mm, with a maximum of nearly 17 m (Fraser et al., 1998). Rainfall is also very high further west at Idenau, with a mean of 8,392 per annum. However, at Mokundange at the south-eastern tip of this site, only 19 km from Debundscha, the mean per annum drops to 4,935 mm. Further inland (outside the site) only 2–3 m falls in the rain shadow on Mt Cameroon's eastern flanks. Rainfall is strongly seasonal throughout the site, with south-westerly prevailing winds driving a wet season peaking in July and August and then replaced by the dry and dusty north-easterly Harmattan as the intertropical convergence zone moves south. At Mokundange there is frequently less than 50 mm of rain per month during December and January.

Mean monthly maximum and minimum temperatures vary very little seasonally but minima are a few degrees lower at Mokundange (17.1–18.9 °C) than at Debundscha (21.6–23.3 °C), and maxima a little higher (27.9–31.7 versus 27.2–30 °C).

Mt Cameroon is the only active volcano in mainland Africa west of the Virunga mountains in eastern Democratic Republic of Congo. It is formed of alkali basalt and basanite lavas overlying Cretaceous to Miocene (or more recent) sediments, which in turn rest on Precambrian metamorphic basement rocks (Dereulle et al., 1987; Mathieu et al., 2011). The mountain is considered to be a horst structure by Dereulle et al., (1987); i.e. its height is constituted by uplift from below rather than only by accumulation of lava. The age of surface lavas is unclear, with upper Miocene age estimated by Vincent (1971) and 10 Ma by Fitton (1983) but <3 Ma by Marzoli et al. (2000) and other sources (Mathieu et al., 2011), and recent geological dating suggesting 1–2 Ma (Wembenyui et al., 2020).

The unusual nephelinite lava (etindite) of Mt Etinde, the southern slopes of which are partly located within this TIPA site, have been dated to 0.65 Ma and are considered approximately simultaneous with Mt Cameroon (Nkoumbou et al., 1995; Ntoumbe et al., 2016) but have previously been estimated to represent an earlier, Miocene, volcanic formation to the main massif (Dereulle et al., 1987; Cable & Cheek, 1998). Seven eruptions were recorded in the 20th century from various Mt Cameroon vents, with a further brief eruption in 2012. Only two of these eruptions reached this site: the 1922 eruption which flowed down the western slope to meet the sea at Bibundi-Idenau and the 1999 eruption which descended 2,500 m down the southern flank to stop just before the sea to the west of Bakingili (Geiger et al., 2016).

Recent alluvial soils are also exposed near Idenau (Cable & Cheek, 1998). The soils of this coastal strip, except around Etinde and the insufficiently weathered 20th-century lavas, are generally highly fertile and have been targeted for agri-plantations, while further west in the Onge reserve area they are apparently less rich and contain areas of white sand (Cable & Cheek, 1998). Many cinder cones are also present on the southern flanks; a few of these are within the site boundaries.

**Succession vegetation on the 1922 Idenau lava flow.**
Photograph A. McRobb, 1995-1996.

**Bomana waterfall in lowland coastal forest.**
Photograph A. McRobb, 1995–1996.

**Forest interior near Idenau.**
Photograph A. McRobb, 1995–1996.

## Conservation issues

Much of the coastal strip between the lower national park boundary and the coast has already been replaced with palm oil plantations where the original vegetation is entirely destroyed (MINFOF & WRI, 2021). Outside the plantations, small-scale agriculture and logging have severely degraded most of the area (BirdLife International, 2021a). A hard-surfaced road also runs between Idenau and Limbe, separating the extreme coastal fringe from the mountain and connecting the various settlements. Limbe is now connected to Mokundange and Batoke by continuous urban sprawl which has engulfed former plantation areas. The national park is unfortunately cut off from the coast, interrupting the unique altitudinal transition.

A major new port – the Limbe Deep Seaport – is planned at Ngeme, east of Mokundange, which is anticipated to bring 20,000 jobs and stimulate development in the area (Ngah, 2016). There is also an oil refinery at Mokundange and oil prospecting in the area. According to BirdLife International (2021a), the best surviving forest of the whole mountain is around Mt Etinde, although its lower slopes are outside the national park. Continued development around Batoke and the new seaport will inevitably further threaten these slopes unless serious conservation efforts are made. The port is also anticipated to increase tourism to the area which, if managed well, could be positive for conservation (Olsen et al., 2001). The DFID and German government funded Mt Cameroon Project, established in 1994, funded development projects in the area in collaboration with MINEF under a Participatory Biodiversity Conservation Strategy.

The proposed IPA area incorporates the Bakingili community forest, established in 2000. REDD+ initiatives have been developed elsewhere around the mountain but apparently not in this area (Awono et al., 2014). Native reforestation efforts within exhausted palm oil plantation zones could be investigated and could be worthwhile because of the unique climate conditions; such projects have been implemented elsewhere on the mountain (ERUDEF, 2021; Truscott, 2021).

## Key ecosystem services

The area has potential for ecotourism which could be increased if the coastal forests were able to regenerate. Landslides and flooding are a risk to local communities and are mitigated by forested slopes (Payton, 1993; Thierry et al., 2008; Mathieu et al., 2011). The site would previously have helped support the rich fauna of the area but its value has been greatly diminished in this respect.

## Ecosystem service categories

**Provisioning –** Medicinal resources

**Regulating –** Moderation of extreme events

**Cultural –** Tourism

## IPA assessment rationale

Although little natural habitat remains, the many rare and threatened species recorded from this area qualify it as an IPA under criterion A(i). The uniqueness of the habitat in this very high-rainfall coastal forest zone would also almost certainly qualify it under criterion C if enough salvageable forest remains.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Asystasia lindauiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | | | |
| Annonaceae | *Mischogyne gabonensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma macrophyllum* | VU | A(i) | B(ii) | ✓ | | | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | | | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | | | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | | | |
| Asparagaceae | *Chlorophytum petrophilum* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia mbangaensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Burseraceae | *Pachylobus igaganga* | VU | A(i) | | | ✓ | ✓ | |
| Clusiaceae | *Garcinia afzelii* | VU | A(i) | | | ✓ | | |
| Ebenaceae | *Diospyros crassiflora* | VU | A(i) | | | | | |
| Ebenaceae | *Diospyros korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Leeuwenbergia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | | | | |
| Meliaceae | *Carapa littoralis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Meliaceae | *Leplaea thompsonii* | VU | A(i) | | | | | |
| Moraceae | *Dorstenia prorepens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia kameruniana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum porphyrostachys* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Cheirostylis divina* var. *ochyrae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Leptoderris aurantiaca* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia schlechteri* | CR | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Putranjivaceae | *Drypetes burnleyae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | | |
| Rhizophoraceae | *Anopyxis klaineana* | VU | A(i) | | | | | |
| Rubiaceae | *Belonophora ongensis* | CR | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Globulostylis minor* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mitriostigma cameroonense ined.* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | | | |
| Rubiaceae | *Psychotria asterogramma* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria darwiniana* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Psychotria elephantina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria lophocarpa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Rutidea nigerica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris lecomteana* | VU | A(i) | | ✓ | | | |
| Sapindaceae | *Allophylus zenkeri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia maxima* | VU | A(i) | | | | ✓ | |
| Sterculioideae | *Cola praeacuta* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea dewitii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Mt Cameroon National Park | Protected/conservation area is adjacent to IPA |
| Key Biodiversity Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| Important Bird Area | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |
| Alliance for Zero Extinction Site | Mt Cameroon and Mokoko-Onge | Protected/conservation area overlaps with IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Agro-industry farming | High | Ongoing – increasing |
| Oil and gas drilling | Unknown | Future – inferred threat |
| Small-holder farming | High | Ongoing – stable |
| Roads and railroads | Medium | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Development – commercial and industrial areas | Medium | Ongoing – increasing |

**Successional forest on the 1922 Idenau lava flow.**
Photograph A. McRobb, 1995-1996.

## IPA

# Bimbia Bonadikombo Community Forest

**International site name:** Bimbia Bonadikombo Community Forest (BBCF)
**Site code:** CMNTIPA024
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana

**Latitude** (decimal degrees)**:** 4.00000
**Altitude minimum:**
**Area** (km²)**:** 37.35
**Longitude** (decimal degrees)**:** 9.24500
**Altitude maximum:** 400
**IPA criteria met:** A(i)

## Site description

The Bimbia Bonadikombo Community Forest (BBCF) covers 3,735 ha on the edge of the growing town of Limbe in Fako division, Southwest Region (Nkemnyi, 2016). The site is within the lowland Atlantic rainforest belt and six main types of vegetation are officially recognised in the management plan: mangrove, swamp forest, littoral vegetation, coastal bar forest, lowland forest and fresh water habitats (Ngalim & Simbo, 2016). Located at the foot of Mt Cameroon, on the south-eastern side, it is within one of the highest rainfall areas of tropical Africa, although precipitation is not as high as it is on the western side of the mountain (Fraser, Hall & Healey, 1998).

Community Forest status was granted in 2002 based on the new forestry laws of 1994 and following work by the Mount Cameroon Project (partly funded by DFID, UK and the Global Environmental Facility) and local partner organisations (Ngalim & Simbo, 2016). National government retains ownership rights and the initial period of community forest management was set for 25 years, with the potential for renewal as well as forfeiture if obligations are not met (Adeyanju, 2017). The forest is managed as nine compartments, with three of these (Dikolo, Likomba laMbenge and LIkomba Lelu, total area 1,200 ha) considered of high conservation value and in principle strictly protected, with only scientific research, environmental education and ecotourism activities allowed (Ahimin & Mbolo, 2010).

## Botanical significance

The BBCF is one of very few patches of surviving coastal low-elevation rainforest within the Cross-Sanaga-Bioko coastal forests ecoregion (Olson, 2001), a unique, richly biodiverse zone characterised by greater and more seasonally concentrated precipitation than elsewhere in the Guineo-Congolian forest region (White, 1983; Ngalim & Simbo, 2016; Cheek et al., 2001). The site is consequently of great importance for the survival of this habitat and the plants found there. Ferenc et al. (2018) found tree species richness to be greater than at comparable higher altitude (but still lowland) sites within the national park. Several taxa known from the BBCF are recorded at very few other sites and some species, such as *Drypetes moliwensis* (CR), are believed to be narrowly endemic to the site itself (Onana & Cheek, 2011).

Many globally threatened species have been recorded but some are potentially or likely extinct

at the site; these include *Afrothismia pachyantha, Oxygyne triandra and Beilschmiedia preussii*, all CR and known from nowhere else in the world though they have not been recorded since 1905 (Onana & Cheek, 2011). More recently recorded, in 1992, *Drypetes moliwensis* (CR) is also globally endemic to the site if it still survives there (Onana & Cheek, 2011; Cheek et al., 2000b). Threatened species potentially locally extinct at the site but with populations elsewhere include *Afrothismia winkleri* (CR), *Begonia preussii* (VU), *Ancistrocladus grandiflorus* (VU), *Liparis goodyeroides* (CR), *Neoschumannia kamerunensis* (CR) and *Cola cecidiifolia* (EN). Two CR species of *Psychotria, P. moliwensis* and *P. bimbiensis* were also discovered at this site and named for the area; currently they are each known from only one other locality.

## Habitat and geology

The BBCF is within one of the wettest parts of West or Central Africa and the climate fits into type A of the Kloppen classification. Mean annual precipitation measured at Mabeta (20 m asl), 10–15 km east of the site and at Mokundange (40 m asl), a similar distance west, were 4,384 mm and 4,935 mm respectively over c. 30 years, with a strongly seasonal, monsoon pattern peaking in July and August when maximum temperatures are also somewhat cooler (Fraser et al., 1998). Mean daily temperatures vary by only a couple of degrees throughout the year, with diurnal cycles exceeding this seasonal range. Early in the rainy season there are often storms and heavy rain, with less intense but more constant rain in later months (White, 1983; Fraser et al., 1998). Precipitation is likely to be somewhat greater in the higher altitude parts of the site closer to Mt Cameroon.

Within the vegetation classification of White (1983) the site corresponds to vegetation type 1a, Wetter Guineo-Congolian rainforest plus areas of mangrove forest, while in the classification of Olson et al. (2001) the site corresponds to the Cross-Sanaga-Bioko coastal forests. Under the more detailed scheme of Letouzey (1985) the remaining original forest patches are classified as Atlantic Biafran forest with 'Caesalpiniaceae' (now Detarioideae) and semi-deciduous elements, but variously categorised degraded forest and plantation types are also indicated.

Mt Cameroon is the highest peak in the Cameroon Volcanic Line, a 1,600 km chain of intermittent mountains following a fault separating the Congo and West African cratons. Although there have been several 20th-century eruptions of Mt Cameroon, magmas in the volcanic line date back through most of the Cenozoic era (Suh et al., 2003; Marzoli et al., 1999). The BBCF site lies on older volcanic rocks outside the range of recent lava flows, which are largely restricted to the summit area but approach the western side of Limbe (Wantim et al., 2013; Anaka, 2018). Although the age and nature of these older rocks is not reported, Mt Cameroon is predominantly basaltic from eruptions within the last 10 Ma and mostly within the last 3 Ma (Suh et al., 2003; Marzoli et al., 2000). Soils are described as old laterites but potentially fertile where protected by remaining forest (Anaka, 2018; Ngalim & Simbo, 2016).

## Conservation issues

Of four intended community forests proposed by the Mount Cameroon Project, Bimbia Bonadikombo was the only one successfully implemented (Adeyanju, 2017). Unfortunately, much of the promise of the community forest designation, both in terms of biodiversity conservation and economic improvement for local people, appears not to have been fulfilled (Nuesiri, 2014, 2022; Ngalim & Simbo, 2016). Visits by staff from Limbe Botanic Garden and RBG Kew in 2007–2009 suggested that most of the forest had been cleared, with palm oil plantations and small-holder agriculture the main drivers (Onana & Cheek, 2011). Many of the rare and threatened taxa recorded from the site have not been seen since the early 1990s or even much earlier, and in several cases despite targeted searching (Onana & Cheek, 2011).

Continued expansion of Limbe, which has a population of 124,000 (Anaka, 2018), puts increasing pressure on surviving forest, with houses being built within the forest boundaries using felled timber (Ngalim & Simbo, 2016). Even the best-preserved areas have been selectively logged and small-scale cultivation is found throughout much of the forest, while limited resources and social conflict apparently hinder efforts to police even the designated high conservation value areas (Ngalim & Simbo, 2016; Ferenc et al., 2018).

Charcoal production has increased rapidly, driving forest loss and degrading the rhizosphere (Ngalim & Simbo, 2016). Non-timber forest products have been over-exploited, although there have also been significant efforts to regulate harvesting while encouraging sustainable sources of income (Ngalim & Simbo, 2016; Kilang, 2018).

There has apparently been little significant income generation from ecotourism (Nuesiri, 2014) and this development model is severely threatened by bushmeat hunting and loss of habitat (Ngalim & Simbo, 2016). Although Cameroon has generally struggled to develop a tourist industry commensurate with its spectacular natural riches (Mesmin et al., 2009), the site is a particularly promising ecotourist area due to the proximity of Mt Cameroon and the coastal town of Limbe with its unusual black sand beaches, botanic gardens, wildlife centre, cafes and fishing villages. The village of Bimbia itself also has historic significance as a major slave port, with a fortress which tourists can visit (Anaka, 2018).

It has been difficult to convince local people of the case for conservation in the absence of economic improvement (Ngalim & Simbo, 2016; Anaka, 2018). Elite capture, lack of funds and corruption are dominant themes (Nuesiri, 2022). Analyses appear to suggest that the small size and degraded status of the forest make even timber harvesting unprofitable if the proceeds are to be divided on a community basis (Nuesiri, 2016, 2022). External funding associated with the initiation of the community forest has dried up, making administrative and salary costs hard to meet (Anaka, 2018; Nuesiri, 2016, 2022).

Many botanical specimens from the BBCF as well as other sites in the Mt Cameroon area were deposited at a newly re-established herbarium at Limbe, close to the site, but this also seems to have suffered from lack of funds, and specimens are reported to be in a poor state of preservation. The initial term of the community forest expires in 2027 and it is doubtful that the forest can be preserved under the community forest model without significant external income targeted at conservation (Nuesiri, 2022).

Due to the small size and inadequate management, both closer operational collaboration and also habitat continuity with MCNP are urgently required (Ferenc et al., 2018).

## Key ecosystem services

The site provides timber, wood and various non-timber forest products to local people but exploitation of some resources may not be sustainable. Bush mango (*Irvingia gabonensis*), bush pepper (*Piper guineensis*), Ngongo leaf (*Megaphrynium macrostachyum*) and bitter kola (*Garcinia kola*) are some of the NTFPs targeted for sustainable economic development (Kilang, 2018). Many other useful species are recorded (Ngalim & Terrence, 2016).

**Charcoal production is a major threat to the forest at Bimbia.**
Photograph May 2021, © Elias Ndive.

The site provides habitat for a diverse fauna, with records including several monkeys, blue duiker (*Philantomba monticola*), dwarf crocodile (*Osteolaemus tetraspis*, VU), African rock python (*Python sebae*), pangolins and even chimpanzees and drills. However, several of these were already thought to be almost extinct in 1994 (Ngalim and Simbo, 2016). Anaka (2018) suggests that drills, chimpanzees, gorillas and elephants are all locally extinct as they are not mentioned by respondents in their questionnaire, but elsewhere the author indicates that the forest elephant may survive and records a hunter describing how drill is hunted at the site. Red-eared monkey (*Cercopithecus erythrotis*, VU), Preuss's monkey (*Allochrocebus preussi*, EN), crowned monkey (*Cercopithecus pogonia*, NT) and mona monkey (*Cercopithecus mona*, NT) are all thought to be present along with black-bellied pangolin (*Phataginus tetradactyla*) and white-bellied pangolin (*Phatgainus tricuspis*). Five of the seven species of sea turtle (sub-family Chelonioidea, all globally threatened) are also recorded from the coastal Dikolo peninsula part of the site (Ngalim & Simbo, 2016; Ahmin & Mbolo, 2010).

A study of carbon sequestration at the site estimated a total carbon stock of 38.61 t/ha, giving a total of 105,598 tonnes carbon if assumed to be typical for the whole 3,735 ha of the site (Longonje et al., 2018). Although the authors suggest otherwise, the per ha total is not particularly high compared with other sites (FAO, 2020) which may be due to the degraded nature of the site or possibly methodological variation. However, if the forest was better conserved and allowed to recover it could likely be a useful contributor through the REDD+ strategy.

Landslides are a common concern in mountainous areas of Cameroon and the steep unstable topography of cinder cones puts this area at particular risk. In 2001, the deadliest recorded landslides and floods in the history of Cameroon struck the north-west part of Limbe and parts of the BBCF in the vicinity of the existing Mabeta fault-line, killing 24 people and rendering 2,800 people homeless (Ayonghe et al., 2004). Researchers directly implicated inappropriate land-use and deforestation in the high death toll and damage. Recommendations were made for reforestation and restrictions on land-use (Ayonghe et al., 2004). Therefore, the preservation and restoration of the BBCF has an essential role in protecting the Limbe area community (Ahmin and Mbolo, 2001). Given the role of flooding in this disaster and the expected impacts of climate change, the mangrove forest areas in and around the BBCF also contribute to this security, as well as likely performing other important roles such as fish nurseries.

Areas of the BBCF are used for sacred and ritual purposes, particularly in the Bimbia compartment in the south. Burial grounds and shrines are also present (Anaka, 2018).

## Ecosystem service categories

**Provisioning** – Food
**Provisioning** – Raw materials
**Provisioning** – Fresh water
**Provisioning** – Medicinal resources
**Regulating** – Carbon sequestration and storage
**Regulating** – Moderation of extreme events
**Habitat or supporting services** – Habitats for species
**Cultural** – Tourism
**Cultural** – Education
**Cultural** – Cultural heritage

## IPA assessment rationale

The Bimbia Bonadikombo Community Forest qualifies as a potential IPA under criterion A(i) due to records of a large number (considering its small size) of globally threatened species, four of which have been recorded nowhere else in the world. It should be noted that most of these species were recorded between 30 and 120 years ago and several have not been seen since, sometimes despite targeted searches (Onana & Cheek, 2011). There are also many utilised species, suggesting that the site could also potentially qualify under criterion B(iii). Although small, the site is also significant as a rare remnant of low elevation coastal forest in the high rainfall Cross Sanaga-Bioko ecoregion. However, survival of the forest has been critical for some time already and remaining botanical value likely depends on urgent intervention.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | | | |
| Ancistrocladaceae | *Ancistrocladus grandiflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Neoschumannia kamerunensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Culcasia sanagensis* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Aristolochiaceae | *Aristolochia preussii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | | |
| Burmanniaceae | *Afrothismia pachyantha* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Burmanniaceae | *Afrothismia winkleri* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Oxygyne triandra* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Celastraceae | *Campylostemon mitophorum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lehmbachii* var. *pes-ranulae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia nigra* | VU | A(i) | | ✓ | | ✓ | |
| Chrysobalanaceae | *Magnistipula cuneatifolia* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | | | |
| Detarioideae | *Daniellia oblonga* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Englerodendron leptorrhachis* | CR | A(i) | | ✓ | | ✓ | |
| Euphorbiaceae | *Grossera major* | VU | A(i) | B(ii) | ✓ | | | |
| Lauraceae | *Beilschmiedia preussii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Loganiaceae | *Strychnos elaeocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | ✓ | | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | | | |
| Melastomataceae | *Warneckea austro-occidentalis* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Meliaceae | *Carapa littoralis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia poinsettifolia* var. *achoundongiana* | | A(iv) | | ✓ | ✓ | ✓ | |
| Ochnaceae | *Lophira alata* | VU | A(i) | | | | | |
| Orchidaceae | *Bulbophyllum bifarium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Orchidaceae | *Bulbophyllum platybulbum* | VU | A(i) | | ✓ | ✓ | | |
| Orchidaceae | *Liparis goodyeroides* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Craibia atlantica* | VU | A(i) | | | ✓ | ✓ | |
| Papilionoideae | *Millettia pilosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Peridiscaceae | *Medusandra richardsiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes moliwensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Mitriostigma cameroonense ined.* | | A(iv) | B(ii | | | ✓ | |
| Rubiaceae | *Pauridiantha arcuata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria bimbiensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria moliwensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris lecomteana* | VU | A(i) | | ✓ | | ✓ | |
| Sterculioideae | *Cola cecidiifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola nigerica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Xylariaceae | *Xylaria moliwensis* | | | B(ii) | | | | ✓ |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Community conservation area | Dikolo, Likomba laMbenge and LIkomba Lelu | IPA encompasses protected/conservation area |

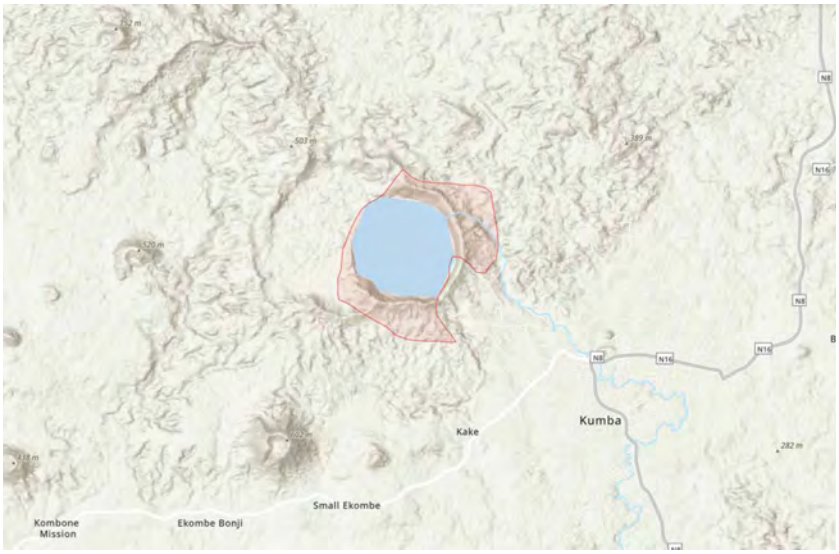
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – housing and urban areas | Medium | Ongoing – increasing |
| Shifting agriculture | High | Ongoing – increasing |
| Gathering terrestrial plants | Low | Ongoing – trend unknown |
| Logging and wood harvesting | High | Ongoing – increasing |
| Agro-industry farming | Medium | Future – inferred threat |
| War, civil unrest and military exercises | Low | Ongoing – trend unknown |

## IPA

# Lake Barombi Mbo Forest Reserve

**International site name:** Lake Barombi Mbo Forest Reserve
**Local site name (if different):** Elefanten See (Elephant Lake)
**Site code:** CMNTIPA032
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana




**Latitude** (decimal degrees)**:** 4.66130
**Altitude minimum:** 280
**Area** (km²)**:** 9.26
**Longitude** (decimal degrees)**:** 9.40200
**Altitude maximum:** 475
**IPA criteria met:** A(i)

## Site description

Lake Barombi Mbo is a deep crater lake with a narrow surrounding perimeter of tropical forest, located above the town of Kumba in Meme division, Southwest Region, Cameroon. It is an internationally recognised RAMSAR site (no. 1643), within a slightly larger national forest reserve. The reserve, covering 926 ha, was established in 1940, subsequently falling under the 1994 Forest Law (Law. 94-01) (Fonge, 2019; Schliewen, 2006). The RAMSAR designation, bestowed in 2006 to make it Cameroon's second RAMSAR site, covered only the lake itself and crater rim (415 ha). It was based largely on the remarkable diversity of endemic, sympatrically evolved cichlid fish species and the consequent global significance of the site to evolutionary biology (Schliewen, 2006).

## Botanical significance

Together with the larger Southern Bakundu Forest Reserve, Barombi Mbo was considered a second-tier, 'meso' hotspot for threatened species by Onana & Cheek (2011). The site is historically important as the original collecting location of several species collected by Preuss and Staudt in the 19th century. Much of the more recent scientific collecting at the site and nearby has been by Duncan Thomas of Missouri Botanic Gardens, who lived at Kumba in the 1980s (Onana & Cheek, 2011).

The site is considered the sole location in the world for *Acridocarpus staudtii* (CR) which was rediscovered there in 1986 and 1999 nearly a century after it was initially collected by Staudt (Lovell & Cheek, 2020a). It is also the site of the only Cameroonian collections of *Thunbergia rufescens* (CR) and *Rhaphiostylis poggei* (CR), also made in the 1890s (Cheek, 2014; Cheek & Lovell, 2020e). Unfortunately, these species have not been rediscovered here and whereas the former has been collected in Nigeria, the latter has never been found elsewhere and is thought possibly extinct. Preuss also first collected *Dielsantha galeopsoides* (NT) from the location, where again it has also not been recollected. It remains rare but not threatened, having been collected at several other sites (Cheek and Thulin, 2015). Other threatened species such as *Pancovia polyantha* (CR), *Crotonogyne impedita* (CR), *Deinbollia macrantha* (CR) and *Strombosia gossweileri* (EN) have been found nearby but not necessarily at the lake site itself (Cheek, 2004a, 2017d; Lovell & Cheek, 2021b; Simo-Droissart & Stevart, 2021).

Pollen cores indicating continuously low grass pollen percentages through the last 25,000 years suggest the Barombi Mbo area may have been a refuge for forest taxa (Giresse, 1991; Maley et al., 1990).

## Habitat and geology

The crater lake was formed by an explosive eruption around 1 Ma which punched through basaltic layers and older basement complex rocks (Maley et al., 1990). Three successive volcanic series are evident at the site: a Tertiary age 'lower black series', a Neogene 'medium white series' of trachytes and phonolites, and a Quaternary basaltic 'upper black series'. The latter is most prominent but older basement-complex crystalline rocks also outcrop in the catchment area west of the lake and influence the lake sediment (Maley, 1990; Giresse et al., 1991). Within the steep c.100 m crater wall itself, two similar series of basaltic tuff lapilli are evident (Schliewen, 2006).

The surface of the lake today is approximately 315 m asl. Unlike some similar crater lakes in the region, Lake Barombi Mbo has an inflow and outflow. The outlet, the Kaké, believed to be of recent age, flows through a steep gorge in the south-eastern rim and serves the town of Kumba as the major water resource before joining the Mungo river system (Schliewen, 2006). The inlet on the eastern side, the river Sofo, and its tributary Toh Mbok, are disconnected from major river systems and the drainage basin extends only to the perimeter of the older, secondary crater area (c. 8 km²) immediately adjacent to the lake.

The site has a two-season equatorial climate, with a short dry season from December to February and 3,000–4,000 mm total precipitation per year (Fonge et al., 2019). Schliewen (2006) reports a lower range of 1,825–3,000 mm per annum. Mean annual temperature is reported as 18 °C by Schliewen (2006), with humidity ranging between 70–84%.

The lake lies within Letouzey & Fotius's (1985) wet Atlantic–Biafran zone of the evergreen Guineo-Congolian rainforest (Cross-Sanaga-Bioko coastal forests ecoregion of Olson et al., 2001). More precisely, it is part of subcategory 228, 'Foret Atlantiques biafreenes à Caesalpiniaceae', of Letouzey & Fotius's (1985) vegetation classification. However, pockets of semi-deciduous forest also occur in this area.

## Conservation issues

The nearby town of Kumba is a regional transport hub and trade centre with a growing population. Demand for land, timber and fuel wood associated with this growth have driven extensive habitat loss and degradation in the area, and these are the main threats to the forest at Barombi Mbo (Cheek & Lovell, 2020e; Fonge et al. 2019; Sounders & Kimengsi, 2011). Fonge et al. (2019) found that 90% of dense forest-cover in the 3,000 ha surrounding the lake had been lost between 1986 and 2014, mainly through conversion to open forest and forest mosaic. Cocoa cultivation appears to be a major driver of this change, along with palm oil and subsistence crops such as coco yams (Fonge et al., 2019). An agro-industrial plantation has also been designated 1 km to the north of the lake (MINFOF & WRI, 2020) and satellite imagery suggests it may already have exceeded its boundaries in the direction of the lake.

A greater proportion of dense forest has survived in the area immediately bordering the lake, which constitutes the protected area (Fonge et al., 2019). However, this is unlikely to be large enough to support rare species in isolation in the long term, and this forested perimeter has also suffered loss, with farming occurring within the crater rim itself (Schliewen, 2006; Fonge et al., 2019).

Conversion to farmland threatens the aquatic biodiversity of the lake. The western rim of the lake is lower than that on the other sides and there is consequently a large catchment area to the immediate west of the lake, apparently on the site of a second, shallow, filled-in lake crater (Giresse et al., 1994). Ferralitic soils have developed on this area and there are many scattered buildings and signs of forest clearance and agriculture.

Apart from loss of forest, disturbance to this area threatens the high clarity and unique chemical balance of the lake water (Schliewen, 2006). It is to be recommended that this area is treated as part of the conservation area up to the watershed approximately 2 km west of the lake's west rim. This would also increase the area and chance of survival for threatened plant species. Regular fish-death events seem to take place associated with increased turbidity from natural causes, but pesticide contamination and phosphate and heavy metal enrichment from cocoa farms could also threaten the lake ecology (Fonge et al., 2019; Schliewen, 2006).

Over-fishing and apparent introduction of non-native fish species are additional threats to the extremely important aquatic fauna (Schliewen, 2006). Unsustainable extraction of drinking water for the growing town of Kumba may also become a concern (Schliewen, 2006)

Kumba has good transport connections and the site is a potential tourist attraction. This has so far not been developed, but local schools use the site for educational purposes (Schliewen, 2006).

## Key ecosystem services

The lake contains a remarkable 12 endemic species of sympatrically evolved fish, making it one of the densest and most biologically important sites for endemic fish species in the world (Schliewen et al., 1994; Schliewen, 2006). Freshwater sponges are also present, including the endemic *Corvospongilla thysi* (Schleiwen, 2006).

The lake is the main source of clean water for Kumba (Schliewen, 2006). The surrounding forest is likely

to be essential to maintaining good water quality through prevention of soil erosion, sedimentation and eutrophication (Schliewen, 2006; Balgah & Kimengsi 2011).

To the Barombi people the lake is a sacred site and is also relied upon for food and income through fishing (Schliewen, 2006).

The lake is 110 m deep and 4.5 km in area making it the largest crater lake in Cameroon. It is one of the oldest dated lakes in Africa, at approximately 1 Ma, and a valuable source of information about past climate and habitat (Giresse et al., 1994).

## Ecosystem service categories

**Provisioning** – Food

**Provisioning** – Raw materials

**Provisioning** – Fresh water

**Regulating** – Erosion prevention and maintenance of soil fertility

**Habitat or supporting services** – Habitats for species

**Cultural** – Tourism

**Cultural** – Spiritual experience and sense of place

**Cultural** – Education

**Cultural** – Cultural heritage

## IPA assessment rationale

Although a small site, with c. 40% of the area open water, the Lake Barombi Mbo Forest Reserve qualifies as a potential IPA under criterion A(i) through several globally threatened species, including two considered CR and globally endemic to this site: *Acridocarpus staudtii* and *Rhaphiostylis poggei.*

**Lake Barombi Mbo.**
Photograph M. Cheek. November 1984

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Thunbergia rufescens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Whitfieldia preussii* | VU | A(i) | | ✓ | | | |
| Apocynaceae | *Isonema buchholzii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia preussii* | CR | A(i) | | ✓ | | ✓ | |
| Begoniaceae | *Begonia laporteifolia* | | | B(ii) | | | | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | | |
| Capparaceae | *Ritchiea macrantha* | VU | A(i) | | | ✓ | ✓ | |
| Convolvulaceae | *Calycobolus micranthus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | | | |
| Malpighiaceae | *Acridocarpus staudtii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Meliaceae | *Trichilia zewaldae* | VU | A(i) | | ✓ | | ✓ | |
| Metteniusaceae | *Rhaphiostylis poggei* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Peridiscaceae | *Medusandra richardsiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha divaricata* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Pavetta muiriana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria asterogramma* | EN | A(i) | B(ii) | | | ✓ | |
| Rubiaceae | *Psychotria minimicalyx* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria moliwensis* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Rutidea nigerica* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Trichostachys interrupta* | VU | A(i) | | ✓ | | ✓ | |
| Sapindaceae | *Deinbollia macrantha* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sapindaceae | *Pancovia polyantha* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (conservation) | Barombi Mbo Forest Reserve | Protected/conservation area matches IPA |
| Ramsar | Barombi Mbo Crater Lake | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – housing and urban areas | Medium | Ongoing – increasing |
| Shifting agriculture | High | Ongoing – increasing |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| Fishing and harvesting aquatic resources | Low | Ongoing – trend unknown |
| Nutrient loads | Unknown | Future – inferred threat |
| Soil erosion, sedimentation | Unknown | Future – inferred threat |
| Herbicides and pesticides | Unknown | Future – inferred threat |
| Invasive non-native/alien species/diseases | High | Future – inferred threat |
| Abstraction of surface water | Unknown | Future – inferred threat |

## IPA

# Rumpi Hills

**International site name:** Rumpi Hills
**Site code:** CMNTIPA036
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Duncan Thomas, Olivier Lachenaud

**Latitude** (decimal degrees)**:** 4.90000
**Altitude minimum:** 25
**Area** (km²)**:** 932.0
**Longitude** (decimal degrees)**:** 9.15000
**Altitude maximum:** 1,750
**IPA criteria met:** A(i)

## Site description

The Rumpi Hills Forest Reserve was established originally in 1937 (Forestry Ordinances 38 of 1937 and 16756/79 of 2 July 1941). Despite proposals for an IUCN category IV Wildlife Sanctuary, there has been no formal change of status since (Sainge, 2016; Protected Planet, 2021). The forest reserve of 454 km² is horseshoe shaped, with the two arms facing west and sloping downhill. One arm terminates at Mundemba and the other where the Makunge tributary joins the Melange river in the region of Ekondo Titi. The arch of the horseshoe is in the north-east and at higher altitude, with Mt Rata, the highest point in the area at 1,750 m, part of an adjacent but separate 39 km² forest reserve to the east (MINFOF & WRI, 2020). The latter is included as part of the IPA proposed here.

A number of important species listed here are recorded only from areas just outside the reserve boundaries, mainly to the north and east. While it is possible many of these also occur inside, we have included additional forest to the north and east to incorporate known locations. The area within the concavity of the horseshoe has also been included within the proposed IPA, increasing the total area to 932 km². While there is little data from this area and much of it is currently demarcated as a council production forest in the process of classification (MINFOF & WRI, 2021), this area was categorised with the rest of the reserve as 'intact forest landscape' (Potapov et al., 2016) and appears to have changed little since then (Hansen et al., 2013, updated 2020). Consequently, there is reason to expect high plant diversity from this area too.

## Botanical significance

Like nearby Korup National Park, Rumpi Hills lies within a very high rainfall area of the Biafran rainforest block (Letouzey, 1968), which is a part of the Guineo-Congolian Regional Centre of Endemism (White, 1983). It is probably the best example in West or Central Africa of a forest altitudinal gradient from lowland rainforest near sea level to upper submontane or montane cloud forest at 1,750 m (D. Thomas, 2022, pers. comm., 18 April; Sainge et al., 2019). Together with Korup National Park and Mokoko-Onge the site is also probably the most important remaining area of low altitude rainforest in this ecologically important zone; areas such as Southern Bakundu and other low foothills around Mt Cameroon are badly degraded. It is one of few areas of 'Intact Forest Landscape' in western Cameroon (Potapov et al., 2016;

Greenpeace et al., 2021). The ravines, rapids and waterfalls of the Mana river and tributaries to the north of the existing reserve and east of Korup National Park are of particular significance for rare rheophyte species such as the local endemic *Ledermanniella prasina*.

Although only partially surveyed for plants, research by Letouzey (1968, 1986), Thomas (1996), Lachenaud et al. (2013) and Sainge et al. (2019) indicates very high diversity and many endemic or nearly endemic species. Sainge et al. (2019) identified 617 morphospecies >= 1 cm dbh from 25 one-ha plots representing seven distinct areas of the park from the ends and the apex of the horseshoe, but without sampling most of the area in between. Of these, 311 trees >= 10 cm dbh were identified to species level. The area is likely very high in submontane endemics, vascular/non-vascular epiphytes and species associated with ravines and waterfalls (Thomas, D., 2021, pers. comm., 18 April).

Five threatened species of *Begonia* and several of *Psychotria*, both often indicators of important refugial areas, are recorded. Three plant species are considered narrowly endemic to the site: *Kuloa* (*Ocotea*) *ikonyokpe* (CR), *Ledermanniella prasina* (VU) and *Craterispermum rumpianum* (CR). Other notable threatened species include *Korupodendron songweanum* (EN), *Gambeya korupensis* (VU), *Piptostigma submontanum* (EN) and *Deinbollia unijuga* (EN). *Pavetta baconiella* (VU) is included here but needs confirmation because the only Rumpi record, a plot recording by Sainge et al. (T15337) without an available specimen, is from 1,700 m, while the only other record with altitudinal data was at 50 m at nearby Korup. *Justicia leucoxiphus* (EN) is also rare and otherwise recorded only from the Bakossi area but the 'Mbu Bolomi' location is probably too far (c. 10 km) north-east of the reserve to justify extending our proposed IPA boundary further. *Deinbollia angustifolia* (VU) has been recorded from close to the western tip of the reserve and therefore may potentially also occur within its boundaries.

## Habitat and geology

Rumpi Hills has a two-season climate with a dry season between December and March with rainfall peaking in August and averaging 4,933 mm per annum at Dikome Balue 1,100 m above sea level. Sainge et al. (2016) suggest highest rainfall is in the south-west corner. At Mundemba, to the west of the reserve, mean rainfall averaged 5,272 mm for the period 1973–1994, with annual totals of 4,027–6,368 mm; the months of July and August both averaged over 900 mm (Beckline et al., 2018). Mean temperature is reported as around 22 °C (Sainge et al., 2020). Thomas (2022, pers. comm., 18 April) suggests that the seasonal climate may be mitigated by the amphitheatre-like Rumpi topology, with high cloud-cover and more dry-season precipitation making it close to a true aseasonal, equatorial climate. Plant and especially epiphyte diversity might therefore be expected to be especially high.

The geological map of Yerima & Van Ranst (adapted from Nougier, 1980) indicates the Rumpi Hills lying on a large basalt area. However, Ayonghe et al. (1999) suggests a more complex geology, with the site situated at the edge of a volcanic zone where pre-Cambrian basement metamorphic rocks are

**Rumpi Hills.**
Photograph © Olivier Lachenaud, 2009.

overlain successively by Cretaceous-Cenozoic sediments (sandstones and shales), which outcrop in the extreme south-east, and Tertiary volcanics (basalts, trachytes and tuffs), which underlie the elevated north-eastern area including Mt Rata. Sainge et al. (2019) also indicate an area of forest on giant basalt rocks in the north-western part of the reserve. While volcanic rocks underlie the hilly areas, extensive recent faulting has apparently dictated the current topography of mountainous plateaus dissected by narrow valleys (BirdLife International, 2021b; Ayonghe et al., 1999).

Soils are mainly brown to yellow sandy loams and clays derived from sandstone, shales and volcanic material (Ayonghe et al., 1999; Yerima & Rans, 2005; Etongo & Glover, 2012). Impermeable clay layers are intercalated with permeable sandstones and make the terrain prone to landslides (Ayonghe et al., 1999).

Sainge (2016) and Letouzey (1985) recognise several vegetation types at the site, mainly variations on evergreen lowland rainforest (with infrequent emergents and many species and individuals of Leguminosae, Annonaceae, Phyllanthaceae and Lecythidaceae), and submontane cloud forest with abundant epiphytes and smaller trees and shrubs (particularly Rubiaceae, Euphorbiaceae, Clusiaceae, Meliaceae, Olacaceae and Salicaceae). A more open, lower and florally distinct montane (or upper submontane) vegetation is also apparent in the Mt Rata area (O. Lachenaud, 2021, pers. comm., 24 June). A distinct lowland forest on basalt rock with abundant *Crateranthus talbotii* has also been identified in the west (Sainge, 2016).

## Conservation issues

As elsewhere in Cameroon, the main threats to the plant life are logging and clearance (often with fire) for small-scale agriculture (Beckline et al., 2018; BirdLife International, 2021b; Onana & Cheek, 2011). Agro-industrial palm oil plantations have also become a major concern, creating an abrupt border at the edge of the forest, sometimes encroaching boundaries, and increasing population pressure and access to the area (Kimengsi & Lambi, 2015). Plantations have existed here since the German colonial period but development has accelerated recently (Kimengsi & Lambi, 2015).

Sainge et al. (2016) estimated that less than 10% of the original reserve had been encroached by agriculture. Other assessments from 2013 and 2018 (BirdLife International, 2021b; Key Biodiversity Areas Partnership, 2020) report extensive degradation from logging and from agricultural encroachment, although the forest was considered better preserved around Mt Rata. According to Sainge (2019) there are no villages within the reserve area, but 12 within 3 km of the boundaries. However, other sources report 52 temporarily occupied offshoot villages and 19 farm settlements within the reserve, as well as other uses and claims to reserve land (Wikipedia, 2020).

To the south-west, there is considerable development threatening the forest beyond and potentially within the reserve. Large palm oil plantations are established at the ends of both arms of the reserve, while inside the horseshoe shape a 34,400 ha Mundemba council forest is apparently in the process of being classified as a production forest (MINFOF & WRI, 2020). The N16 road to Ekondo Titi and Mundenba also provides good access to this area from the coast as well as Kumba and further east, and appears to cut across the extreme south-western tip of the reserve near Mundemba (Beckline et al., 2018). To the north, much of the area between Korup National Park and the reserve was targeted by the SGSOC/Herakles palm oil concession which provoked an international reaction and was downscaled, and apparently halted but not revoked (Kupsch et al., 2014; MINFOF & WRI, 2020). This area has been described as having 'exceptionally high numbers of threatened and endemic tree species' and as meeting FSC High Conservation Value (HCV) criteria for categories 1.2 and 1.3, relating to threatened species and endemic species respectively (Kupsch et al., 2014). The area might also be included in the TIPA proposed here but unfortunately specimen data from the survey does not appear to be available and the released data does not make it possible to locate particular species to the Ndian concession block, which adjoins the Rumpi reserve.

Large-scale palm oil development is also leading to additional small-scale palm oil farming through increased availability of seed (Beckline et al., 2018). This may encroach the reserve more insidiously.

There have been some efforts at reforestation at villages just ouside the edges of the reserve (Sainge et al., 2016). As with other proposals at Mt Kupe, Manwenguba, Ebo and Tchabal Mbabo, the drive for a more strictly protected wildlife sanctuary appears to have stalled (Sainge et al., 2019).

## Key ecosystem services

The site supports important fauna, including the endemic shrew *Myosorex rumpii* (EN) and endemic amphibian *Alexteroon jynx* (CR) (Kennerley, 2016; IUCN SSC Amphibian Specialist Group, 2018). Drill, Nigeria-Cameroon chimpanzee (*Pan troglodytes* ssp. *ellioti*) and other primate species are recorded, along with forest elephants (*Loxodonta cyclotis*, CR), many reptiles and amphibians, and 198 bird species including *Kupeornis gilberti* (VU), *Picathartes oreas* (VU) and *Malaconotus gladiator* (VU) (Sainge, 2016; BirdLife International, 2021b).

Rumpi Hills contributes important drainage basins to several rivers: to the north-west, tributaries join the Ndian river which then curves southwards via Korup National Park to empty into the Rio del Rey estuary. Sainge (2016) suggests tributaries also ultimately connect the area to the Congo, Cross, Chad, Benue, Mungo, Wouri and Sanaga, although

the complex hydrography makes it hard to identify these connections. To the south, various rivers also emerge via the Moko, Melange and, to the south-east, Meme. The forests of the reserve help protect the drainage basins in this very high-rainfall area, maintaining water quality and limiting flooding, silting and sedimentation downstream.

Many villages surround the site and some are located within the larger area circumscribed here. Three ethnic groups, the Ngolo, Bima and Balues, are demographically dominant (Beckline et al., 2018). Villagers utilise the forest for various timber and non-timber forest products (Etongo & Glover, 2012; Sainge, 2016; Mukete et al., 2018).

Landslides have occurred in swarms at nearby Bafaka and are a danger in the area due to high rainfall and interbedded layers of sandstone and shale or clay which form sliding surfaces (Ayonghe et al., 1999). Natural forest-cover on sloping areas is likely to mitigate the danger from such processes, particularly at settlements such as Dikome-balue, which lies at the foot of Mt Rata.

The area has high potential for tourism, with the variety of forests, mountains, rivers and waterfalls, creating more scenic views than at Korup (Thomas, D. 2022, pers. comm., 18 April).

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Carbon sequestration and storage

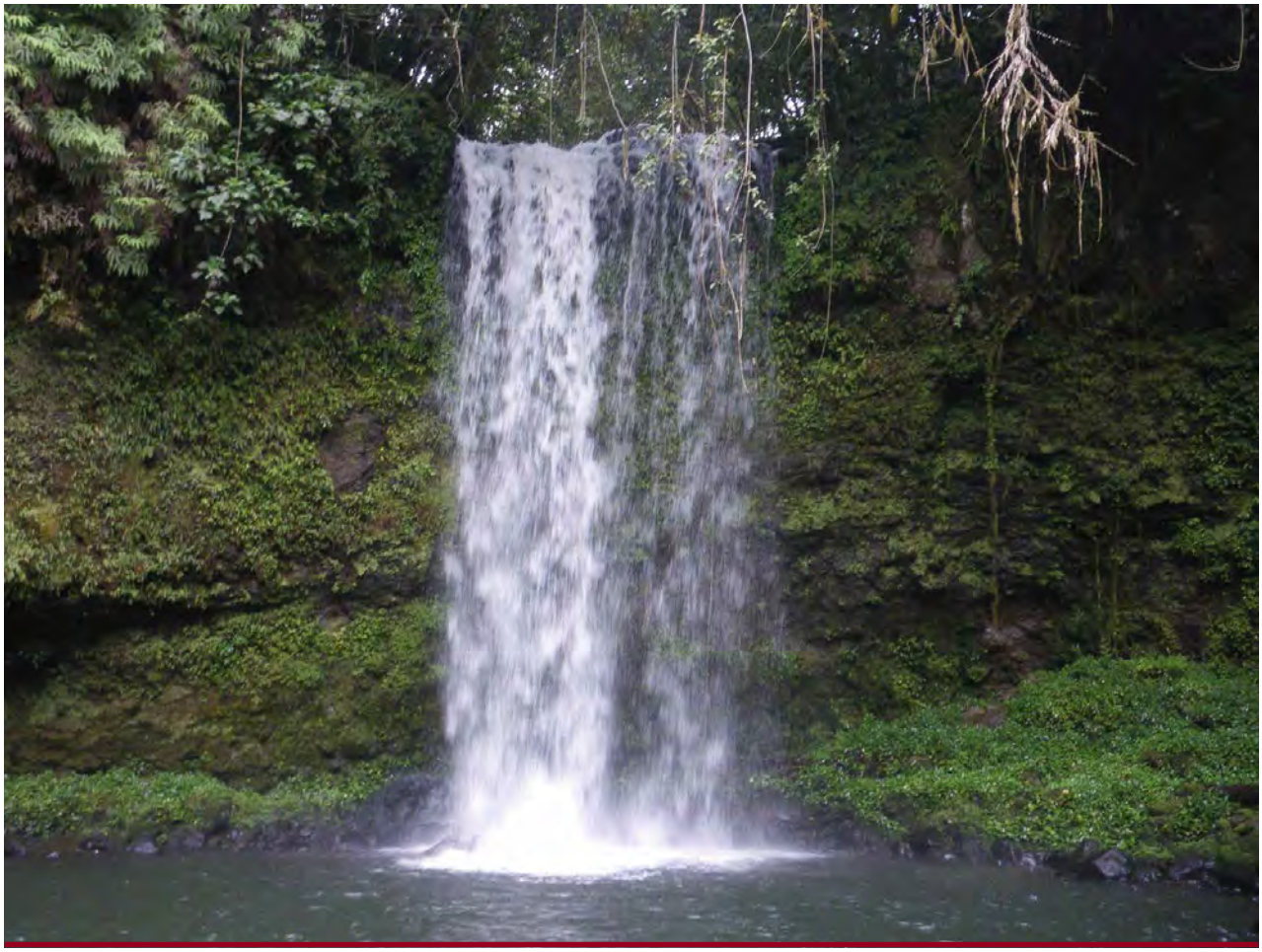
**Regulating –** Moderation of extreme events

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

## IPA assessment rationale

Rumpi Hills qualifies as a potential IPA through criterion A(i) on the basis of numerous globally threatened plant species with important populations at the site. Of these, *Kuloa (Ocotea) ikonyokpe*, *Craterispermum rumpianum* (CR) and *Ledermanniella prasina* (VU) are particularly noteworthy as being globally unique to Rumpi Hills. The site also qualifies under criterion B(ii) as one of the richest sites for nationally endemic and range-restricted species. In addition, the diverse lowland and submontane forests and other habitats of Rumpi Hills remain relatively intact. It is therefore likely to also qualify under criterion C.



**A waterfall at Rumpi Hills.**
Photograph © Olivier Lachenaud, 2009.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Mendoncia camerounensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | | | |
| Achariaceae | *Dasylepis thomasii* | NT | | B(ii) | | | | |
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | | ✓ | |
| Ancistrocladaceae | *Ancistrocladus grandiflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma macrophyllum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma submontanum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | | ✓ | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | | | |
| Annonaceae | *Uvariopsis submontana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia adpressa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia bonus-henricus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia duncan-thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia prismatocarpa* subsp. *delobata* | | A(iv) | | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Magnistipula conrauana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Combretaceae | *Terminalia ivorensis* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | ✓ | | | |
| Detarioideae | *Berlinia hollandii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Leonardoxa africana* subsp. *rumpiensis* | | A(iv) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | | | |
| Detarioideae | *Talbotiella bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella korupensis* | EN? | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella velutina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | VU | A(i) | | | | ✓ | |
| Gentianaceae | *Anthocleista scandens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Grewioideae | *Microcos rumpi* | CR? | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lamiaceae | *Coleus insignis* | | | B(ii) | | | | |
| Lauraceae | *Beilschmiedia jacques-felixii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Kuloa ikonyokpe* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lecythidaceae | *Crateranthus talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | | | |
| Lecythidaceae | *Rhaptopetalum geophylax* | | | B(ii) | | | | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Melastomataceae | *Memecylon candidum* | VU | A(i) | | ✓ | | ✓ | |
| Olacaceae | *Octoknema bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | | | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Orchidaceae | *Bulbophyllum porphyrostachys* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Gastrodia africana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya bicalcarata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya cooperi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Peridiscaceae | *Medusandra mpomiana* | | | B(ii) | | | | |
| Podostemaceae | *Ledermanniella prasina* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Aulacocalyx mapiana* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Chassalia petitiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Craterispermum rumpianum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Cuviera trilocularis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Gaertnera letouzeyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mussaenda epiphytica* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Oxyanthus okuensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta baconiella* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta owariensis* var. *satabiei* | | A(iv) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria bimbiensis* | CR | A(i) | B(ii) | ✓ | | | |
| Rubiaceae | *Psychotria cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria darwiniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria geophylax* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria lophocarpa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria recurva* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria retrofracta* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea bullata* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Sabicea urbaniana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia elmar* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Trichostachys interrupta* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Salicaceae | *Oncoba lophocarpa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia unijuga* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Englerophytum sylverianum* | | | B(ii) | | | | |
| Sapotaceae | *Gambeya korupensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Manilkara lososiana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Pradosia spinosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Simaroubaceae | *Hannoa ferruginea* | VU | A(i) | | ✓ | | ✓ | |
| Sterculioideae | *Cola mamboana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola megalophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola suboppositifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Urticaceae | *Myrianthus fosi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea fausteana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Vochysiaceae | *Korupodendron songweanum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum tchoutoui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (production) | Rumpi Hills Forest Reserve | IPA encompasses protected/conservation area |
| Key Biodiversity Area | Mount Rata and Rumpi Hills Forest Reserve | IPA encompasses protected/conservation area |
| Important Bird Area | Mount Rata and Rumpi Hills Forest Reserve | IPA encompasses protected/conservation area |
| Alliance for Zero Extinction Site | Mount Rata and Rumpi Hills Forest Reserve | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – increasing |
| Agro-industry farming | High | Ongoing – increasing |
| Roads and railroads | High | Ongoing – increasing |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |

**Rumpi Hills.**
Photograph © Olivier Lachenaud, 2009

## IPA

# Korup National Park

**International site name:** Korup National Park
**Site code:** CMNTIPA035
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Xander van der Burgt

**Latitude** (decimal degrees)**:** 5.20000
**Altitude minimum:** 50
**Area** (km²)**:** 1,873.0
**Longitude** (decimal degrees)**:** 8.90000
**Altitude maximum:** 1,080
**IPA criteria met:** A(i)

## Site description

Korup National Park in Southwest Region, Manyu and Ndian divisions, Cameroon, was established in 1986 following research by primatologists and NGOs such as Worldwide Fund for Nature (WWF) from the late 1970s. It expands on the former Korup Forest Reserve, which dates to the 1930s. The national park's borders encompass 1,259 km² of lowland forest rainforest, with another 600 km² demarcated through a 3 km buffer zone all around the perimeter, except where it joins the border with Nigeria. A 100 km² core zone in the south near Mundemba is further demarcated, and agencies and government have also targeted for development and conservation work a much larger Korup Project Area, incorporating the Ejagham Forest Reserve to the north, the Nta Ali reserve in the north-east, Rumpi Hills in the east, and land in the south up to the mangrove forest of the Ndongere proposed national park. The boundaries of the IPA proposed here are constituted by the Korup National Park and buffer zone. The park has its official entrance – the iconic suspension bridge spanning the river Ndian – in the south, close to the town of Mundemba. The towns of Nguti and Manyemen serve the north-east part. Principal access is along a 120-km-long unpaved road from Kumba to Mundemba, and can be difficult in the wet season.

## Botanical significance

Korup is situated within the Biafran rainforest block (Letouzey, 1968), a part of the Guineo-Congolian Regional Centre of Endemism (White, 1983). The floral and faunal diversity of the Biafran rainforest zone is very high and there are many endemics (Gartlan, 1994). South-western Cameroon has been indicated to have the highest diversity of both species and genera per degree square in tropical Africa (Barthlott et al., 1996; Dagallier et al., 2020). The national park is nearly completely covered in lowland and sub-montane evergreen rainforest and is one of the most important botanical areas in tropical Africa (Gartlan, 1994). The site is relatively well studied compared with other areas of coastal forest in neighbouring Nigeria and Cameroon, and is known to harbour very high plant-diversity, with around 3,500 vascular plant species (Gartlan, 1994), but this remains to be fully evidenced.

Many species are endemic to the site itself or known only from Korup and a few other nearby sites, such as Mt Cameroon, Rumpi Hills, the Ejagham Forest Reserve or Oban Hills in Nigeria. Exceptionally high rainfall and particular edaphic properties may partly explain the botanical richness. Korup is also considered a forest refugium where the climate has

**The iconic Mana Bridge entrance to Korup National Park. The river is seen in the dry season but swells dramatically.**
Photograph X. van der Burgt, February 2008.

been relatively stable during the Pleistocene, enabling the forest to persist during periods with a generally cooler and drier climate (Maley, 1998; Sosef, 1994). The tree species composition in the southern part of the park shows a remarkably low presence of pioneer species, which indicates that this part of the park has been little affected by natural and anthropogenic disturbances (Burgt et al., 2021). Elsewhere in the park, some areas with secondary forest occur (Gartlan, 1994).

## Habitat and geology

Korup has a two-season climate, with the wet season running between March and November. It is one of the wettest areas in tropical Africa. In the south of the park, total annual rainfall averaged 5,382 mm over a 14-year period, with the months December to February averaging c. 100 mm per month, and July and August each averaging c. 1,000 mm per month. Rainfall is considerably less in the north of the park, averaging 2,200 mm, although measurements were from a different source and averaged over a much shorter period (Rodewald et al., 1994). Mean monthly temperatures range from c. 24–30 °C, and mean peak temperatures range seasonally between c. 30–32 °C, with a diurnal range of 10 °C (Chuyong, 2004; Thomas et al., 2015).

The area is underlain by ancient metamorphic basement rocks, with some granitic outcrops and boulders (Letouzey, 1985; Burgt, 2018). Soils are classified as predominantly yellow ferralitic soils over acid rocks according to Vallerie (1970) or nitisols according to Yerima & Van Ranst (2005). They are typically described as strongly weathered, sandy, acidic and infertile, with deficient phosphate and potassium (Burgt, 2018; Chuyong, 2004; Newbery et al., 2004). Periodically inundated soils occur along streams and rivers (Burgt, 2018).

Three rivers flow through the park, taking different routes to meet the sea in the same approximate area. The Ndian river flows south from Ejagham, through the middle of the park, then forms the eastern boundary and is joined by tributaries from the Rumpi Hills area before continuing to meet the sea at the Rio del Rey. The Korup river forms the western boundary of the park and part of the international border with Nigeria, flowing south to join the Cross river estuary. The Munaya river flows north from the Rumpi Hills through north-west Korup, to join the Cross river which also eventually turns southwards towards the Bight of Bonny.

Nearly 50% of the national park is below 360 m altitude (Rodewald et al., 1994). Mt Yuahan or Mt Rana, near the middle of the park, is the highest point at 1,080 m, and there is also steep terrain in the north-west part. Closed-canopy, lowland, coastal evergreen rainforest covers almost the entire site but patches of periodically inundated rainforest occur along watercourses and some submontane forest appear on the highest points; tree species from the Leguminosae-Detarioideae are locally abundant and sometimes dominant in groves (Newbery et al., 2004). There are also a few granite inselbergs and steep granite slopes with shrubby vegetation and bare rock.

Some areas have been cleared for cocoa farming, and extensive areas in the buffer zone for palm oil (Diaw et al., 2003; Siewe et al., 2017).

## Conservation issues

Korup National Park represents one of the first attempts in West or Central Africa at integrated conservation and development (Malleson, 2002). Agencies including WWF-UK, WCS, UK ODA (now FCDO), the German development agency GTZ (now GIZ) and the European Commission were involved with the Cameroon government in the establishment and funding of the national park and associated Korup Project (Oates et al., 2004). Implementation has been criticised for the treatment of villagers inside the park (Diaw et al., 2003; Siewe et al., 2017). Five villages remain within the park boundary (Erat, Bera, Esukutan, Ikenge and Bareka Batanga) and another 25 are situated within the buffer zone where development projects have been focused (Siewe et al., 2017; Malleson, 2002). One village, Ikondo-Kondo, has been relocated, in 2000, while other efforts have been abandoned (Malleson, 2002). The relocation policy has been controversial and villagers have reportedly been left feeling angry and betrayed (Malleson, 2002; Diaw et al., 2003). Since 2017, a new collaborative management approach has been attempted and villagers and other stakeholders have provided input to the 2017–2021 management plan (Shu & Ebua, 2018). This development has also led to permanent use zones (PUZs), legalising the status of two of the remaining five villages within the park. As of 2017, PUZs had yet to be implemented for the remaining villages (Shu & Ebua, 2018).

Up to 8% of the national park area has apparently been cultivated by villagers, with cultivation increasing in response to the abandonment of relocation plans and restrictions on use of the forest for hunting and other resources (Malleson, 2002). Cocoa farming is the main agricultural activity and almost universally practised by villagers (Siewe et al., 2017). However, villagers continue to utilise the forest and bushmeat hunting was reported as continuing, with sales across the Nigerian border evading policing efforts (Malleson, 2002; Siewe et al., 2017). Large-scale oil palm cultivation is evident in the buffer zone, logging is reported to remain a major threat nearby, and numerous forestry concessions surround the park and overlap the buffer zone (KBA partnership, 2021b; WRI, 2020). The anglophone crisis has interrupted conservation work and brought significant numbers of people seeking refuge within the forest, likely increasing agricultural and hunting activity (Linder et al., 2019).

***Cryptosepalum korupense*** **(EN). Another rare grove forming Detarioid legume tree known only from southern Korup and two other nearby threatened locations.**
Photograph X. van der Burgt.

***Englerodendron korupense*** **(EN), one of several rare trees in the Detarioideae subfamily of legumes which is important in African lowland forests. Only 12 mature trees of this species have ever been encountered and it appears to be endemic to Korup and restricted to a relatively small area in the south of the national park.**
Photograph X. van der Burgt.

Korup National Park is adjacent to the protected Cross River National Park in Nigeria, which enhances the size and importance of the overall habitat. There are also connections with other IPAs and conservation sites in Cameroon, including the Ejagham and Nta Ali forest reserves, the Rumpi Hills and Banyang-Mbo Wildlife Reserve, the Ndongere proposed national park and the Mt Cameroon area. Connecting corridors are, however, increasingly threatened by development, which may limit dispersal and migration. Populations of mammals have declined significantly as a result of poaching and this may negatively affect the recruitment of many plant species in the forest that are reliant on mammal dispersers (Abernethy et al., 2013; Estrada et al., 2017).

## Key ecosystem services

Korup National Park is one of the most important botanical areas in tropical Africa, with a high floral and faunal species diversity and many endemic or near-endemic species (Gartlan, 1994). The site is an important Bird Area and Key Biodiversity Area, with 419 bird species recorded within the national park, including grey parrot (*Psittacus erithacus*, EN) (Bobo et al., 2005). Preuss's red colobus monkey (*Piliocolobus preussi*, CR) has its stronghold here, while forest elephant (*Loxodonta cyclotis*, CR), Preuss's monkey (*Allochrocebus preussi*, EN), Nigeria-Cameroon chimpanzee (*Pan troglodytes* ssp. *ellioti*, EN), mandrill (*Mandrillus leucophaeus*, EN) and other threatened species also occur (KBA partnership, 2021b; Linder et al., 2019).

Tourism has been promoted at Korup, with trails and lodges built, but it remains small scale and has been disrupted by the anglophone crisis and by local hostility to conservation and development plans (Oates et al., 2004; Linder et al., 2019). Scientific research is also well established with long-term plot studies and basic facilities available for scientists, although the tourist and scientific camps inside the park were destroyed by villagers c. 2008 and the plots discontinued due to the crisis.

Villagers inside and outside the forest rely on many non-timber forest products to supplement their livelihoods; the importance of these goods has been increasingly recognised by conservation and development agencies (Malleson, 1993; Malleson, 2002).

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Carbon sequestration and storage

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

**Cultural –** Education

**Cultural –** Cultural heritage

## IPA assessment rationale

Korup National Park qualifies as an IPA under criterion A(i) due to the presence of a very high number of globally threatened species, several of which are locally endemic or nearly so. It also qualifies under criterion B(ii) as one of the two or three richest sites for range-restricted and nationally endemic species, along with with Campo Ma'an and the Ngovayang Massif. The site is also very likely to qualify under criterion C(iii) as one of the best representatives of evergreen lowland forest and would potentially also qualify under B(iii) for its species of social, economic or cultural value.

**A very large specimen of *Microberlinia bisulcata*, a grove forming Detarioid legume species.**
Photograph X. van der Burgt, 2005.

***Gluema korupensis* (EN). Another large tree (>40 m), nearly endemic to Korup. The fruits are unusual for the Sapotaceae family having ballistic seed dispersal.**
Photograph X. van der Burgt.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Asystasia lindauiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Justicia tenuipes* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Physacanthus talbotii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Staurogyne kamerunensis* subsp. *calabarensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Achariaceae | *Dasylepis thomasii* | NT | | B(ii) | | | | |
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | | ✓ | |
| Ancistrocladaceae | *Ancistrocladus grandiflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Ancistrocladaceae | *Ancistrocladus korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Anisophylleaceae | *Anisophyllea neopurpurascens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Isolona pleurocarpa* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma longepilosum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma macrophyllum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma mayndongtsaeanum* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma oyemense* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Callichilia basileis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Landolphia maxima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | | ✓ | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | ✓ | |
| Begoniaceae | *Begonia prismatocarpa* subsp. *delobata* | | A(iv) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia quadrialata* subsp. *dusenii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia rubromarginata* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Bombacoideae | *Rhodognaphalon brevicuspe* | VU | A(i) | | | | ✓ | |
| Boraginaceae | *Hoplestigma pierreanum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia hydra* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia korupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Byttnerioideae | *Scaphopetalum parvifolium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Caesalpinioideae | *Calpocalyx cauliflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lehmbachii* var. *pes-ranulae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lenticellosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lucida* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia nigra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia volubilis* | VU | A(i) | | ✓ | | | |
| Chrysobalanaceae | *Magnistipula butayei* subsp. *korupensis* | | A(iii) | | ✓ | ✓ | ✓ | ✓ |
| Chrysobalanaceae | *Magnistipula cuneatifolia* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Magnistipula multinervia* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Clusiaceae | *Garcinia afzelii* | VU | A(i) | | | | ✓ | |
| Clusiaceae | *Garcinia kola* | VU | A(i) | | | | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Connaraceae | *Jollydora glandulosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Costaceae | *Costus acutissimus* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Anthonotha xanderi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Berlinia hollandii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Detarioideae | *Berlinia korupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Cryptosepalum korupense* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Daniellia oblonga* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Didelotia korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Detarioideae | *Englerodendron korupense* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Detarioideae | *Eurypetalum unijugum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron newberyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia bakeriana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia talbotii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella korupensis* | (EN) | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella velutina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Detarioideae | *Tessmannia korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Tetraberlinia korupensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Dichapetalaceae | *Dichapetalum korupinum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Dichapetalaceae | *Dichapetalum letouzeyi* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Ebenaceae | *Diospyros crassiflora* | VU | A(i) | | | | ✓ | |
| Ebenaceae | *Diospyros korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Crotonogynopsis korupensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Grossera major* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Gentianaceae | *Anthocleista scandens* | VU | A(i) | | ✓ | | | |
| Lamiaceae | *Vitex lokundjensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia jacques-felixii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Crateranthus talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | | ✓ | |
| Lecythidaceae | *Rhaptopetalum cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Linaceae | *Hugonia batesii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos gnetifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon candidum* | VU | A(i) | | ✓ | | ✓ | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon korupense* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Melastomataceae | *Memecylon mamfeanum* | | | B(ii) | | | | |
| Melastomataceae | *Memecylon rheophyticum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Melastomataceae | *Warneckea austro-occidentalis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Leplaea thompsonii* | VU | A(i) | | | | ✓ | |
| Moraceae | *Scyphosyce pandurata* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia dusenii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Ochnaceae | *Lophira alata* | VU | A(i) | | | | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum comatum* var. *comatum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum porphyrostachs* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum subligaculiferum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Corymborkis minima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis gracilenta* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Millettia laurentii* | EN | A(i) | | | ✓ | ✓ | |
| Phyllanthaceae | *Amanoa strobilacea* | VU | A(i) | | | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus dusenii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Poaceae | *Guaduella humilis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Macropodiella pellucida* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes gracilis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes moliwensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Rhizophoraceae | *Cassipourea atanganae* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rhizophoraceae | *Cassipourea korupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Belonophora ongensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Belonophora talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Craterispermum capitatum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia cupularis* | | | B(ii) | | | | |
| Rubiaceae | *Cuviera talbotii* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Cuviera trilocularis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Empogona talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Gaertnera letouzeyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Gardenia epiphytica* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis minor* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora delicatula* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mitriostigma cameroonense ined.* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta baconiella* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Pavetta grossissima* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | B(ii) | | | ✓ | |
| Rubiaceae | *Psychotria elephantina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria korupensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria minimicalyx* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Psychotria piolampra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria titanophylla* | | | B(ii) | | | | |
| Rubiaceae | *Sabicea medusula* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Tricalysia achoundongiana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia ferorum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia lejolyana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Trichostachys interrupta* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Virectaria angustifolia* var. *schlecteri* | | A(iv) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris letouzeyi* | EN | A(ii) | B(ii) | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris trifoliolata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus nigericus* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Aporrhiza multijuga* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Chytranthus micranthus* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia angustifolia* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sapindaceae | *Deinbollia pycnophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia saligna* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia unijuga* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Namataea simplicifolia* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Placodiscus angustifolius* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Sapindaceae | *Placodiscus caudatus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Placodiscus opacus* | VU | A(i) | | ✓ | | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | A(i) | | | | ✓ | |
| Sapotaceae | *Englerophytum sylverianum* | | | B(ii) | | | | |
| Sapotaceae | *Gambeya korupensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Gluema korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Lecomtedoxa plumosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sapotaceae | *Manilkara lososiana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Neolemonniera ogouensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola brevipes* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola mamboana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola megalophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola nigerica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola praeacuta* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola suboppositifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola zemagoana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sterculioideae | *Pterygota bequaertii* | VU | A(i) | | | | | |
| Thymelaeaceae | *Dicranolepis polygaloides* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Violaceae | *Allexis cauliflora* | VU | A(i) | | | ✓ | ✓ | |
| Violaceae | *Rinorea thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Vochysiaceae | *Korupodendron songweanum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum makandensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum plicatum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum tchoutoui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Korup National Park | Protected/conservation area matches IPA |
| Important Bird Area | Korup National Park | IPA encompasses protected/conservation area |
| Key Biodiversity Area | Korup National Park | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Ongoing – trend unknown |
| Small-holder farming | Medium | Ongoing – trend unknown |
| Agro-industry farming | Low | Ongoing – increasing |
| Hunting and collecting terrestrial animals | high | Ongoing – trend unknown |
| Logging and wood harvesting | low | Ongoing – trend unknown |

## IPA

# Mungo and Bakossi Forest Reserves

**International site name:** Mungo and Bakossi Forest Reserves
**Site code:** CMNTIPA031
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Jean Michel Onana, Martin Cheek

**Latitude** (decimal degrees)**:** 4.69000
**Altitude minimum:** 80
**Area** (km²)**:** 104.86
**Longitude** (decimal degrees)**:** 9.56000
**Altitude maximum:** 700
**IPA criteria met:** A(i)

## Site description

This proposed IPA site is constituted by two adjacent forest reserves in the Meme and Kupe-Muanenguba divisions of Southwest Region, Cameroon. Located between the towns of Kumba and Tombel and separated by the Mungo river which runs north-south between them the Bakossi and Mungo river forest reserves were created along with the Loum and Manehas forest reserves, by the colonial government of the Southern Cameroons during the League of Nations Mandate period, apparently in reaction to rapid development of cash crop farming in the area from 1920 (Wild, 2004b).

## Botanical significance

Although less diverse and well preserved than nearby sites such as Mt Kupe, the Mungo River and Bakossi reserves are a valuable site of lowland forest, supplementing the limited remaining resources of this habitat in the area. They also harbour several taxa not otherwise known from nearby sites, such as *Belonophora ongensis, Salacia lehmbachii* var. *pes-ranulae* and two globally unique taxa: *Vitex yaundensis,* which is assumed extinct at its only other recorded location, and *Coffea charrieriana,* a low-caffeine coffee species which may have potential for crop breeding or as a gene donor. *Cola metallica, Cola praecuta* and *Chlamydocardia subrhomboidea* are other notably rare species found here. Additionally of note is the rare and enigmatic *Eugenia buchholzii*, recorded in 1874 from 'Mungo', Cameroon, and never subsequently collected. The exact locality of the collection is unknown (Onana & Cheek, 2011). The Mungo River Forest Reserve is probably most famous botanically as the type location for the bright-orange flowered epiphytic monotypic orchid genus *Ossiculum aurantiacum*, first collected in 1980 and assessed as CR. About 25 years later it was rediscovered at Banyang-Mbo and a record was also found in the Republic of Congo (Onana & Cheek, 2011). Now transferred to the genus *Calyptrochilum* it was re-assessed as EN in 2018.

Large areas of these forests remain botanically unexplored and additional species of conservation importance can be expected to be found if surveys are put in place.

## Habitat and geology

The site slopes down from around 700 m in the north extreme of the Bakossi reserve to c. 80 m in the south along the Mungo river. The Bakossi Reserve, in two separated parts east of the Mungo river, has more undulating terrain, perhaps cinder cones of

***Salacia nigra*** **(VU) at Mungo-Bakossi IPA.**
Photograph M. Cheek.

***Chlamydocardia subrhomboidea*** **(EN) at Mungo-Bakossi IPA.**
Photograph M. Cheek.

minor eruptions similar to those described by Wild (2004) as occurring between Tombel and Loum. The narrow far end of the northern section extends up the south-western foothills of Mount Kupe to Mahole and towards Nyasoso. The Mungo River Forest Reserve, west of the river is flatter, sloping gradually south and west down to the river.

The geology of this area is complicated but the site is mainly basaltic with lava flows filling a trough formed in association with the uplifted horst of Mt Kupe and a layer of windblown ash and scoria deposited over this (Yerima & Van Rast, 2005). Volcanic soils in the area are often highly fertile (Wild, 2004) although Cheek et al., (2004) suggests those at the site are less so than in the Jide valley further north. Low resolution soil maps indicate eutrophic, humic brown soils on basic rocks in the northern section of the Bakossi Forest Reserve and brown ferrallitic soils on acid rocks in the other areas of the site (Vallerie, 1970).

This is one of the wettest areas of tropical Africa and the western flanks of Mt Kupe are subject to particularly high rainfall as they induce orographic precipitation. Mean rainfall at Tombel and Nyasoso just east of the Mungo-Bakossi site was 3,657 mm and 4,045 mm respectively, with the single drier season falling between November and February (Ejedepang-Koge, 1986 cited by Wild, 2004a). Temperature fluctuates little seasonally around a mean of 25 °C and humidity is consistently high.

Letouzey & Fotius's (1985) vegetation maps assign the intact areas of the site to the Atlantic-Biafran sector of the dense humid evergreen Guineo-Congolian forest, particularly to subcategories 228 ('Foret Atlantiques biafreenes à Caesalpiniaceae') and 231 ('Foret Atlantiques biafreenes à Caesalpiniaceae encore abondantes, avec Sarcoglottis gabonensis et autres indices littoraux'), both with additional semi-deciduous elements.

## Conservation issues

The site was established as a production forest and has been selectively logged (Cheek et al., 2004). Under its current status of 'Forest Reserve' it is not listed as a production forest on the Cameroon Forest Atlas (2021) and it is unclear if official logging continues. Encroachment for unofficial logging and firewood extraction has been reported and likely continues (Cheek et al., 2004). Some areas have been replanted with timber trees such as Meliaceae according to collector notes to specimen Cheek 10152 (**http://specimens.kew.org/herbarium/K000008854**).

Conversion to farmland has also taken place, particularly following logging incursions (Cheek et al., 2004) and around the Kumba-Mamfe road. The great majority of people in and around Tombel and Kumba are employed in agriculture (PNDP, 2011) and agro-industry draws in migrant workers, creating additional demand for subsistence farming. Extensive banana and palm oil plantations surround Kumba and appear to have infringed on marked boundaries in the south-west of the site, with informal cultivation and degradation also apparent in this area from satellite imagery. Extensive deforestation for new banana and cocoa plantations was observed in 2017-2018 near the bridge at Ebondji, with several rare epiphytic orchids collected from freshly felled trees (V. Droissart, 2023, pers. comm., 26 May).

Anthropogenic activity further north threatens the water quality of the river and therefore the habitats of some species at the site, such as *Brillantaisia lancifolia* (Cheek, 2014b). A banana plantation also abuts the eastern boundary of the site and a huge mining reconnaissance permit overlaps the south-eastern corner.

The north-eastern part of the site is close to the proposed Mount Kupe IPA and efforts should be made to ensure habitat continuity between these sites in the area between Nyasoso and Nguti.

## Key ecosystem services

The site is the only recorded location of the coffee wild relative *Coffea charrieriana*, a species of potential commercial interest due to its low caffeine levels.

Located between the Bakossi area to the north and Mt Cameroon and the remains of Southern Bakundu Reserve to the south, the Mungo-Bakossi reserves are an important link in a forest corridor allowing potential genetic exchange and migration, particularly in response to climate change.

The forest limits soil erosion on the sloping land and protects the Mungo river from the downstream pollution and silting, which would be caused by further expansion of settlements or agricultural plantations onto this land. The forested banks will also help regulate flow and limit downstream flooding.

The site could be an important recreation and educational resource for residents of Kumba.

## Ecosystem service categories

**Provisioning** – Raw materials

**Provisioning** – Medicinal resources

**Regulating Services** – Moderation of extreme events

**Habitat or supporting services** – Habitats for species

**Habitat or supporting services** – Maintenance of genetic diversity

**Cultural Services** – Recreation and mental and physical health

**Cultural Services** – Education

## IPA assessment rationale

The Mungo river and Bakossi forest site qualify as a potential IPA under criterion A(i) through its important populations of globally threatened species such as *Piptostigma goslineanum* (VU), *Chlamydocardia subrhomboidea* (EN), *Belonophora ongensis* (CR), *Cola metallica* (CR) and local endemics *Vitex yaundensis* (CR) and *Coffea charrieriana* (CR).

### Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Brillantaisia lancifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Chlamydocardia subrhomboidea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Whitfieldia preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma goslineanum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | | | |
| Aristolochiaceae | *Aristolochia goldieana* | VU | A(i) | | | ✓ | ✓ | |
| Celastraceae | *Salacia lehmbachii* var. *pes-ranulae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia afzelii* | | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron ebo* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Guibourtia tessmannii* | EN | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | ✓ | | |
| Lauraceae | *Beilschmiedia cuspidata* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos elaeocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Marantaceae | *Marantochloa mildbraedii* | EN | A(i) | | | | ✓ | |
| Meliaceae | *Leplaea cedrata* | VU | A(i) | | | | | |
| Orchidaceae | *Bulbophyllum subligaculiferum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Calyptrochilum aurantiacum* | EN | A(iv) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Diaphanathe lanceolata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA Criterion A | IPA Criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Orchidaceae | *Diaphananthe spiralis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum obanense* | VU | A(i) | B(ii) | | | ✓ | |
| Orchidaceae | *Rhipidoglossum ochyrae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Peridiscaceae | *Medusandra richardsiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | | |
| Rhizophoraceae | *Anopyxis klaineana* | VU | A(i) | | | | | |
| Rubiaceae | *Belonophora ongensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Coffea charrieriana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Pauridiantha divaricata* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Trichostachys petiolata* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Sterculioideae | *Cola metallica* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola praeacuta* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Thymelaeaceae | *Dicranolepis polygaloides* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Vitaceae | *Vitex yaundensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area | Areal overlap ($km^2$) if known |
|---|---|---|---|
| Forest Reserve (Production) | Mungo River Forest Reserve and Bakossi Forest Reserve | Protected/conservation areas matches IPA | 100% |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Ongoing – increasing |
| Agro-industry farming | Medium | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Soil erosion, sedimentation | Medium | Ongoing – trend unknown |

## IPA

# Nguti Forests

**International site name:** Nguti Forests
**Site code:** CMNTIPA043
**Administrative region:** Southwest
**Site Assessed by:** Bruce Murphy, Eric Ngansop

**Latitude** (decimal degrees)**:** 5.29790
**Altitude minimum:** 225
**Area** (km²)**:** 1,142.0
**Longitude** (decimal degrees)**:** 9.35640
**Altitude maximum:** 1,047
**IPA criteria met:** A(i)

## Site description

This site is based on an area of predominantly lowland rainforest investigated through the European Forestry Institute (EFI) funded Rapid Botanical Survey (RBS) performed by Dr Peguy Tchouto and colleagues and reported by Hawthorne (2015). It fills a gap between three major protected areas: Korup National Park, the Banyang-Mbo Wildlife Sanctuary and Bakossi National Park, an area previously suspected to be of botanical importance (Philips & Miller, 2002; Cheek et al., 2004) but with few collected specimens. The boundary demarcated here is based on a maximal inclusive polygon incorporating the 25 sample locations of the RBS team with an enlargement of c. 2 km added to the coordinates of the outer points. The boundary was additionally modified slightly along the western and eastern boundaries to adjoin Korup National Park and the Banyang-Mbo Wildlife Sanctuary respectively, to incorporate a few species-records near Ntale in the east and to avoid overlap with the two parts of FMU 11-008 in the south-east. The towns of Nguti and Manyemen are within the site along the N8 Kumba-Mamfe road, which bisects the site from north to south.

## Botanical significance

A large number of globally threatened and sub-endemic species have been recorded from the relatively little collecting that has been done in the region. *Cola metallica* (CR), *Tricalysia lejolyana* (EN), *Cola suboppositifolia* (EN) and *Warneckea ngutiensis* (CR) are recorded from the site close to the Banyang-Mbo Wildlife Sanctuary and are included in both TIPA sites, although the latter is thus far known from a single collection and therefore could be endemic to the Nguti TIPA.

While the terrain rises to over 1,000 m in the north-west of the site, all the RBS sample locations were below 500 m and therefore the submontane flora is little known; perhaps for this reason there are notably few orchid species recorded. None of the recorded species are endemic to the site itself; however, this is probably due to the RBS method which might fail to record or recognise undescribed species from the often-infertile specimens collected.

Not surprisingly, the flora has affinities with the nearby sites of Korup, Rumpi Hills, Bakossi National Park and Banyang-Mbo. Several of the taxa listed here are otherwise known only from one of these sites, such as *Keetia bakossiorum*, *Deinbollia unijuga* and *Memecylon bakossiense* (VU), *Hugonia macrophylla* (VU) and *Uvariopsis korupensis* (EN).

The site also shares affinities with more distant sites in the south of Cameroon such as the Ngovayang massif and Campo Ma'an. This is likely

due to the lowland nature of these sites. Some of these records represent a significant northern range expansion, such as *Rinorea microglossa, Dictyophleba setosa, Heckeldora leptotricha* and *Lychnodiscus brevibracteatus,* and should be treated with some caution.

Although not globally threatened, *Microcoelia bulbocalcarata* has a highly disjunct distribution and is only known in Cameroon from one collection near Nguti, close to Banyang-Mbo.

Amongst the social, economic and culturally important species recorded are *Microberlinia bisulcata* (CR), a valuable zebrawood timber.

## Habitat and geology

The site has a high-rainfall seasonal climate with mean annual rainfall of 3,725 mm recorded at Nguti, peaking at 620 mm in July and dropping to 30 mm in January and December (Rodewald et al., 1994). However, rainfall is likely to vary across the site, with only 2,200 mm recorded at the Ikenge Research Station (IRS) west of the site. Nguti would appear to lie within a rainshadow, so this data is surprising and may be an anomaly due to the short (two-year) recording period. An average of 2,646 mm is elsewhere cited for Nguti municipality (Nguti Council, 2009; data for years 2005–2008). Mean monthly minima and maxima at Nguti ranged from 23.0–32.6 °C between September 1991 and August 1992 and from 17.5–33.2 °C over a 27-month period at IRS, where the dense forest may contribute a cooling effect (Rodewald et al., 1994).

The terrain is mainly fairly flat at around 300 m asl but the hills directly west of Nguti rise to over 1,000 m near the north-western border, while in the south-west the terrain also rises towards the Rumpi Hills region, reaching 1,000 m within the proposed IPA area. South-east of Manyemen, the terrain also reaches over 700 m. Geologically the area lies at the boundary of the Cameroon Volcanic Line and the more ancient, weathered basement rocks which underlie Korup National Park to the west. Soils are indicated as predominantly red basic and acid yellow ferralitic sesquioxides (ORSTOM, 1970; Letozey, 1985) or as haplic nitisols in association with rhodic nitisols (Yerima & Van Ranst, 2005).

The site is mostly covered in closed rainforest, mapped by Letouzey (1985) as type 228, 'Atlantic Biafran forest with Caesalpiniaceae', with more semi-deciduous elements in the south towards the Rumpi Hills (type 205) and submontane forest on the higher hills. Along the Kumba-Mamfe road the forest is cleared around several towns (Nguti, Manyemen, Bayib-Asibong) and there are further large areas of farmland and degraded land along the D100a road west of Manyemen. A substantial area has been degraded or converted to palm oil plantation east of the Kumba-Mamfe road, south of Manyemen. However, further areas demarcated as palm oil plantations in the south-west around Sambaliba, and east of Nguti adjacent to the Banyang-Mbo reserve still appear on satellite imagery to have mainly intact forest (Global Forest Watch, 2021).

***Camoensia brevicalyx*, which occurs at Nguti, is categorised as LC but is arguably more threatend.**
Photograph M. Cheek.

***Cola suboppositifolia* (EN) has been recorded from the area where Nguti Forests IPA borders Banyang Mbo Wildlife Sanctuary.**

## Conservation issues

The site was threatened with a very large palm oil project which received significant attention from local people, conservation organisations and media. After an initial 73,000 ha planned development, 20,000 ha was granted through presidential decrees in 2013 (416-418) and an area of 882 ha was estimated to have been cleared between December 2011 and March 2016 (Greenpeace, 2016). There were numerous accusations of illegal expropriation and other objections. Although the American company Herakles Farms withdrew from the project, forest clearance was reported to have continued and even increased under new ownership (Cannon, 2016). This can be seen starkly on satellite imagery in the concession area south of Manyemen and east of the N8 road but not in the other areas (Global Forest Watch, 2021). However, there is also considerable tree-cover loss in other areas of the site south of Nguti around this time, perhaps indirectly related to these plantations. The SGSOC lease was due to expire in November 2016 (Deugogue, 2016).

In addition to the palm oil concessions, the IPA area also includes four community forests (covering c. 13,000 ha), parts of Nguti and Mamfe council forests (c. 17,000 ha) and parts of FMUs 11-006 and 11-001 (c. 6,500 ha).

Much of the data assembled here is based on a survey conducted partly in response to the disputed environmental study performed for Herakles-SGSOC which was used to argue the forest was largely degraded with relatively low conservation value (Asamoah, 2011; Kupsch et al., 2014; Hawthorne, 2015). Not surprisingly, however, given the location of the site, surrounded by five major conservation areas (Korup National Park, Bakossi National Park, Rumpi Hills, the Banyang-Mbo Wildlife Sanctuary and the Nta Ali Forest Reserve), the area was revealed to be of high conservation value, with 23 large mammals recorded and all threatened animals known from Korup present, including the Critically Endangered forest elephant, endangered Nigeria-Cameroon chimpanzee and drill, as well as the many plant species of conservation importance listed here (Kupsch et al., 2014; Hawthorne, 2015).

It should be noted that to the west of the southern part of the site, the area of forest between Korup and Rumpi Hills has also been targeted with a SGSOC concession plot. Although Kupsch et al. (2014) also reported high numbers of trees of conservation importance from this plot, the area is not included in the IPA proposed here as it was not included in Hawthorne (2015) and would constitute a considerable enlargement of an already large site. It is likely to warrant inclusion as a separate IPA. Several rare species have also been collected south of the site, around the village of Mbu.

## Key ecosystem services

Kupsch et al., (2014) estimated the total carbon stock for the concession area as 259 t/ha. Extrapolating this to the entire area designated here would give a total of 29.6 Gt biomass carbon stock. Based on a carbon stock estimate for oil palm plantations of 38.8 t/C ha, the forest can be estimated to be sequestering c. 220 tC/ha compared with this alternative land use. While these estimates take into account below-ground biomass, they do not include soil carbon. Kupsch et al., (2014) use an estimate of 40.8 tC/ha loss of soil carbon from conversion to oil palm and then calculate a total $CO_2$ emission value of 957 $tCO_2e$/ha. This gives an estimate of 109.3 Gt $CO_2e$ for the whole designated IPA area. While this estimate is likely too high due to not taking into account existing degraded areas, palm oil has a relatively higher carbon stock than some other likely land uses.

Local opposition to the palm oil plantations has largely been motivated by conflict over land for farming, which also threatens the forest and biodiversity. However, the forest provides other products of value. According to the Rainforest Foundation (2016), farming is the main economic activity (70%), followed by hunting (20%), fishing (5%) and non-timber forest products ('NTFPs' – 5%). Cocoa is the main crop by area and is often grown in forest shade. Loss of forest threatens water supplies and fish stocks. Much timber is also harvested for both local use and export (Nguti Council, 2009).

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Carbon sequestration and storage

## IPA assessment rationale

The site qualifies as an IPA under criterion A(i) due to the considerable number of globally threatened species with populations of national or international importance. The intensive survey has also revealed enough range restricted and nationally endemic species for it to qualify under criterion B(ii).

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | | | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Anacardiaceae | *Antrocaryon micraster* | VU | | | | ✓ | | |
| Ancistrocladaceae | *Ancistrocladus grandiflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Ancistrocladaceae | *Ancistrocladus korupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | | | |
| Annonaceae | *Piptostigma goslineanum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvaria buchholzii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | ✓ | | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Amorphophallus preussii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia laporteifolia* | | | B(ii) | | | | |
| Begoniaceae | *Begonia prismatocarpa* subsp. *delobata* | | A(iv) | | ✓ | ✓ | ✓ | |
| Boraginaceae | *Cordia platythyrsa* | VU | | | | | | |
| Byttnerioideae | *Scaphopetalum paxii* | | | B(ii) | | | | |
| Caesalpinioideae | *Calpocalyx cauliflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lenticellosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Thyrsosalacia pararacemosa* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | | |
| Combretaceae | *Terminalia ivorensis* | VU | | | | | | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | | | |
| Detarioideae | *Berlinia hollandii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | ✓ | | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | | | |
| Euphorbiaceae | *Grossera major* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Icacinaceae | *Pyrenacantha longirostrata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Crateranthus talbotii* | VU | A(i) | | ✓ | ✓ | | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Linaceae | *Hugonia macrophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos elaeocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos mimfiensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Amphiblemma amoenum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon bakossiense* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | | | |
| Melastomataceae | *Memecylon mamfeanum* | | | B(ii) | | | | |
| Melastomataceae | *Warneckea ngutiensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Meliaceae | *Entandrophragma candollei* | VU | | | | | | |
| Meliaceae | *Trichilia zewaldae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Penianthus camerounensis* | | | B(ii) | | | | |
| Ochnaceae | *Lophira alata* | VU | | | | | | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Calyptrochilum aurantiacum* | EN | A(i) | | ✓ | | | |
| Orchidaceae | *Rhipidoglossum obanense* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Millettia laurentii* | EN | A(i) | | | ✓ | ✓ | |
| Papilionoideae | *Ormocarpum klainei* | EN | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Peridiscaceae | *Medusandra mpomiana* | | | B(ii) | | | | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Aulacocalyx mapiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | | ✓ | | |
| Rubiaceae | *Chassalia cupularis* | | | B(ii) | | | | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Keetia bakossiorum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria darwiniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria njumei* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Rothmannia ebamutensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia lejolyana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus conraui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia unijuga* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Pradosia spinosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola megalophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola metallica* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola suboppositifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum makandensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum plicatum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum tchoutoui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Korup National Park | Protected/conservation area is adjacent to IPA |
| National Park | Bakossi National Park | Protected/conservation area is adjacent to IPA |
| IV: Wildlife Sanctuary | Banyang-Mbo | Protected/conservation area is adjacent to IPA |

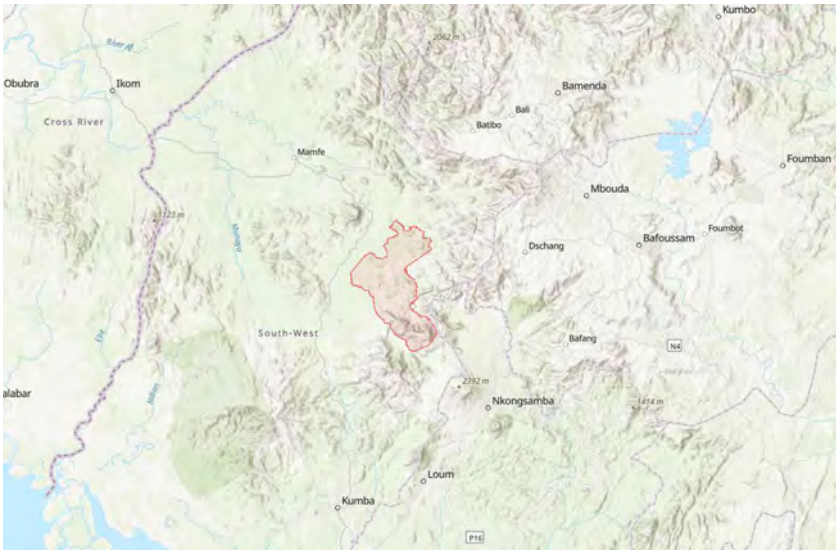
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – increasing |
| Agro-industry farming | High | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Roads and railroads | Medium | Ongoing – increasing |
| War, civil unrest and military exercises | Low | Ongoing – trend unknown |
| Residential and commercial development | Medium | Ongoing – trend unknown |

## IPA

# Banyang-Mbo Wildlife Sanctuary

**International site name:** Banyang-Mbo Wildlife Sanctuary
**Site code:** CMNTIPA030
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana




**Latitude** (decimal degrees)**:** 5.32000
**Altitude minimum:** 160
**Area** (km²)**:** 666.0
**Longitude** (decimal degrees)**:** 9.63000
**Altitude maximum:** 1,817
**IPA criteria met:** A(i)

## Site description

Officially gazetted in 1996 as Cameroon's first nationally protected faunal reserve, the Banyang-Mbo Wildlife Sanctuary constitutes over 66,000 ha of lowland and submontane rainforest in Manyu and Kupe-Muanenguba divisions, Southwest Region. The boundary forms a boot shape, with the toe located at the south-eastern extreme in a steeply mountainous part of the Bakossi mountains known as the Mwenzekong range, which rises to 1800 m east of Ntale. As the name indicates, the protected area status was designated primarily with a view to preserving animals, especially the notable birdlife and megafauna, which includes rare primates and elephants (Ajonina et al., 2014).

A research station is based in the forest a few kilometres west of the reserve boundary towards the town of Nguti on the main Kumba-Mamfe road. A new road now connects Nguti with Bangem to the south-east of the park. Bangem also serves as the north-eastern gateway town to Bakossi National Park which is only 4 km south of the southern boundary of Banyang-Mbo. The two reserves are separated by the Mbu valley through which the new road is routed. Further north, the smaller proposed Mak Betchou wildlife sanctuary is only a couple of kilometres east of Banyang-Mbo's north-east corner, while the Tofala Hills Wildlife Reserve and Lebialem highlands are another 15–20 km to the north where the forest rises steeply before giving way to the largely denuded Mt Bamboutos and the Bamenda Highlands.

## Botanical significance

In contrast to its acknowledged status as a wildlife sanctuary, Banyang-Mbo has been relatively little surveyed for plants. Despite this, there are enough records to indicate high diversity, with considerable areas of relatively untouched high-quality forest in addition to logged secondary forest (BirdLife International, 2021c). Ajonina et al., (2014) report 543 species, representing 75 families, have been recorded but the source of this is not clear. It may refer to Gentry's 1988 'Banyong' transect, which is cited as indicating the highest plant diversity in Central Africa, but Gentry's survey was actually along the eastern border of Korup National Park, at least 25km outside the boundary of the sanctuary (Philips & Miller, 2002; Ajonina et al., 2014).

Zapfack et al. (2010) found 93 orchid species in and around Banyang-Mbo. The 48 actually within the sanctuary constituted 12% of orchids species known

to occur in Cameroon. Several of these are globally threatened and included below as IPA criterion A(i) species. A useful study by Nchanji & Plumptre (2003) records a number of taxa germinated from seeds found in elephant dung collected within the sanctuary, but inevitably this type of study records few rare species. Other collections have mainly been made from close to the Nguti research station, with many possibly slightly outside the boundary (including *Warneckea ngutiensis*, CR), or close to Ebamut village in the south-east. Because of the limited data available, the list of IPA taxa is relatively short (compared with the nearby Bakossi and Korup national parks) but there are enough records from the limited collecting efforts to suggest similarly high phytodiversity. Notable taxa that are particularly reliant on the sanctuary include *Coffea bakossi* (EN), *Piptostigma goslineanum* (VU), *Cola metallica* (CR), *Diaphananthe lanceolata* (CR), *Rothmannia ebamutensis* (EN) and *Warneckia ngutiensis* (CR). The latter is narrowly endemic, having only so far having been collected from intact high-quality forest in what is the planned palm oil concession neighbouring the sanctuary boundary.

*Coffea leonimontana* (CR), previously considered possibly extinct, has also been recorded from the sanctuary, although this location was not included in the IUCN assessment. *Salacia conraui* (CR) is known only from the type location near Tali, 4 km north of the national park boundary.

## Habitat and geology

The sanctuary area can be divided into three areas (Zapfack et al., 2010; BirdLife International, 2021c). The western section is largely flat and low (200–300 m), although there are some hills in the far north rising to c. 550 m. This is predominantly high canopy, evergreen lowland forest with emergents. This forest reportedly transitions into semi-deciduous forest in the far north (Abugiche, 2009). In the south-east, the site touches the Cameroon Volcanic Line region which thrusts the Mwenzekong mountains up to 1,800 m. Between these lowland and submontane areas, an intermediate area is characterised by inselbergs with low-canopy forest (BirdLife International, 2021c).

The steeply rugged Mwenzekong mountains are separated by the Mbu valley from the Mwendolengo mountains to the south, which fall within Bakossi National Park. The Mfi-Mie river valley forms much of the eastern border of the reserve and separates the northern edge of the Mwenzekong mountains from the slightly higher Ekomane arc to the north. However, the eastern-most border is at 1,500 m, passing through a high ridge connecting these ranges to the east. Mt Manengouba is also connected by terrain not dropping below 1,200 m. The Mwenzekong mountains are likely early Quaternary, uplifted basement complex (gneisses and schists) without the more recent volcanic material of Mts Kupe and Manengouba (Wild, 2004a; Abugiche, 2009; Enang et al., 2020).

***Ledermanniella linearifolia* (EN) in flower as the stream level drops. A rare rheophytic species recorded at Banyang Mbo.**
Photograph M. Cheek.

The soils on the steep slopes are thin and easily eroded and appear to lack the high fertility of the volcanic peaks (Abugiche, 2009; Wild, 2004a). These hills are clothed in submontane cloud forest, rich in mosses, ferns and epiphytes (Wild, 2004a). More generally, the soils in the sanctuary are described as clayey to sandy (Abugiche, 2009).

Rivers in the sanctuary flow north-west into the Manyu which then joins the Cross river north-west of Mamfe.

The area has a very wet, two-season climate, with c. 3,000 mm of rainfall per annum (BirdLife International, 2021c). This is likely exceeded on steep western slopes and supplemented by 'horizontal' or 'occult' precipitation induced by cloud forest vegetation (Ajonje et al., 2014; Wild, 2004a). Nchanji & Plumptre (2003) also report 4,083 ± 487 mm in Nguti just outside the western boundary. The wet season runs from mid-March to October but patterns vary across the site. In Nguti, October was the wettest month, and at Bangem data shows July and August to have more than twice as much total precipitation as October (Nchanji & Plumptre, 2003; Ejedepang-Koge, 1986, cited by Wild, 2004a). Temperature varies relatively little seasonally around an annual mean of 23 °C (at Bangem, 1,120 m) but daily variation in the highland areas will be more significant (Ejedepang-Koge, 1986, cited by Wild, 2004a).

## Conservation issues

The main threats are from subsistence farming and small-scale cash-cropping. There are 54 villages within 10 km of the boundary (Ajonina et al., 2014). Of these, 24 have direct impact on the forest, according to Abugiche (2009). The status of Wildlife Sanctuary allows local villagers to continue to use the forest for hunting and other products so long as this does not conflict with conservation objectives. Locals also manage the sanctuary with assistance

from MINEF and WCS (Rose, 2002). The boundary is not demarcated on the ground and villagers develop farms within the sanctuary (Hill et al., 2002). Zapfack et al. (2010) suggest such activities are 'progressively destroying' the forest. This practice also increases conflicts over crop-raiding by large mammals, an unresolved problem hindering wildlife conservation efforts in the park and surrounding area (Rose, 2002; Nchanji, 2002). Although conservation species are in theory excluded from hunting, bushmeat consumption is a serious problem and traditional taboos protecting forests and large fauna are breaking down. However, the forest is still fundamental to local livelihoods and culture (Abugiche, 2009; Rose, 2002; Nchangi, 2002).

Archaeological evidence points to a history of settlement within the forest dating back to the 9th century, which has likely influenced the habitat (Oslily et al., 2000). Part of the lowland forest is reported to be secondary forest that has been more recently logged (Abugiche, 2009).

A new road has recently been built along the site's southern border, connecting Nguti and Bangem. This seems likely to increase clearance and bushmeat exploitation within the sanctuary and threatens to limit faunal migration between the site and Bakossi National Park and other areas. Between the town of Nguti and the western boundary, a 2,500 ha palm oil plantation has been designated. Several threatened species have been collected from this site and most of these, including the CR narrowly endemic *Warneckea ngutiensis*, have not yet been collected within the gazetted borders, although they may occur there. Zapfack et al. (2010) found that more species of orchid were found outside than inside the boundaries (although it is unclear how collecting effort compared). Habitat loss and settlement have also disrupted connections with Mt Manengouba, Mt Kupe and Mt Nlonako and efforts should be made to restore these forest corridors and to protect those linking the site with Korup National Park, Nta Ali Forest Reserve, Rumpi Hills, and the Mak-Betchou and Tofala Hills wildlife sanctuaries.

It should be noted that Lake Bermin, a site of remarkable biological significance for its nine endemic sympatrically evolved fish species (Schliewen et al., 1994), lies just outside the boundary in the zone between the site and Bakossi National Park.

## Key ecosystem services

Banyang-Mbo supports a rich fauna, including many globally threatened species. At least 322 species of birds have been recorded, including the Mt Kupe Bush-shrike (*Telophorus kupeensis*, EN), as well as 33 large mammals, including highly threatened species such as elephants (*Loxodonta africana*, CR), mandrills (*Mandrillus leucophaeus*, EN), the Nigeria-Cameroon chimpanzee (*Pan troglodytes* subsp. *ellioti*) Preuss's monkey (*Cercopithecus preussi*, EN), forest buffalo (*Syncerus caffer* subsp. *nanus*), giant pangolins and red-eared guenons. With 71 amphibians recorded, Riley & Riley (2005) described Banyang-Mbo as having 'perhaps the densest and most diverse frog population in the world', although subsequent claims have been made for nearby Mts Manenguba and Nlonako. Seventy-three reptiles, including 23 lizards and 46 snakes, are also known from the site (BirdLife International, 2021c; Ajonina et al., 2014; Abugiche, 2009). The site has an established but still relatively small-scale wildlife tourism industry.

The forest, particularly the upland cloud forest, feeds several rivers and provides water, food, medicines and other resources to many local communities. It harbours genetic reserves of important timber and food species, including the rare *Coffea bakossii* (CR).

The large area of tropical moist forest is likely to be a major carbon sink and could form a significant part of Cameroon's Redd++ strategy.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Carbon sequestration and storage

**Habitat or supporting services –** Habitats for species

**Habitat or supporting services –** Maintenance of genetic diversity

**Cultural –** Tourism

**Cultural –** Cultural heritage

## IPA assessment rationale

The Banyang Mbo Wildlife Sanctuary qualifies as an IPA under criterion A(i) because of its significant populations of globally threatened species such as *Warneckea ngutiensis* (CR), *Diaphananthe lanceolata* (CR), *Coffea bakossi* (EN), *Piptostigma goslineanum* (VU), *Cola metallica* (CR) and *Rothmannia ebamutensis* (EN). Despite limited data surveying it, it also qualifies under criterion B(ii) for its diversity of endemic and range-restricted species. It is also likely to qualify under criterion C(iii) for its well preserved lowland and submontane rainforest habitats.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | ✓ | | |
| Ancistrocladaceae | *Ancistrocladus grandiflorus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma goslineanum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia prismatocarpa* subsp. *delobata* | | A(iv) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia conraui* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Detarioideae | *Afzelia bipindensis* | VU | A(i) | | | | | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | | | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | | | |
| Detarioideae | *Plagiosiphon discifer* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Crateranthus talbotii* | VU | A(i) | | | ✓ | ✓ | |
| Melastomataceae | *Warneckea ngutiensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Olacaceae | *Octoknema bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidacaeae | *Diaphananthe garayana* | | A(iv) | | ✓ | ✓ | ✓ | |
| Orchidacaeae | *Diaphananthe lanceolata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidacaeae | *Diaphananthe spiralis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum egertonii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum micropetalum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum subligaculiferum* | EN | A(i) | | | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum summerhayesianum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum vanum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Calyptrochilum aurantiacum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Manniella cypripedioides* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya farinosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya kornasiana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya principia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya superposita* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum obanense* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Craibia atlantica* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Aulacocalyx mapiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Belonophora talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Coffea bakossii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Empogona talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha arcuata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pseudosabicea pedicellata* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Psychotria bimbiensis* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Rothmannia ebamutensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia lejolyana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rutaceae | *Vepris letouzeyi* | EN | A(ii) | B(ii) | ✓ | | ✓ | |
| Sapindaceae | *Allophylus conraui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | A(i) | | | | | |
| Sapotaceae | *Pradosia spinosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola metallica* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea fausteana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Banyang-Mbo Wildlife Sanctuary | Protected/conservation area matches IPA |
| Key Biodiversity Area | Banyang-Mbo Wildlife Sanctuary | Protected/conservation area matches IPA |
| IV: Wildlife Sanctuary | Banyang-Mbo Wildlife Sanctuary | Protected/conservation area matches IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Ongoing – increasing |
| Roads and railroads | Medium | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Hunting and collecting terrestrial animals | High | Ongoing – trend unknown |
| Agro-industry farming | Medium | Ongoing – increasing |

## IPA

# Bakossi National Park

**International site name:** Bakossi National Park
**Site code:** CMNTIPA027
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Barthélemy Tchiengué, Jean Michel Onana

**Latitude** (decimal degrees)**:** 5.06000
**Altitude minimum:** 340
**Area** (km²)**:** 293.2
**Longitude** (decimal degrees)**:** 9.62000
**Altitude maximum:** 1,979
**IPA criteria met:** A(i)

## Site description

Bakossi National Park is a large area of submontane rainforest in Kupe-Mwanenguba division, Southwest Region, Cameroon, along the Cameron Volcanic Line, approximately 100 km from the coast. The main north–south running Kumba-Mamfe N8 road lies 10–15 km to the west, and to the east towns and villages lie along the Chide valley, which separates the park from Mt Mwanenguba and Mt Kupe further to the south. The administrative headquarters are sited within the town of Bangem, 5 km beyond the north-east border.

The national park corresponds largely to the Mwendolengo mountains as well as part of the Edib hills to the south. The range to the north of the Mbwe (Mbu) valley border is known as the Mwenzekong mountains, which forms the south-eastern part of the large Banyang-Mbo reserve. The national park takes its name from the much larger Bakossi tribal area (Cheek et al., 2004). It was created in November 2007 by prime ministerial decree (2007/1459/PM), with safeguarding plant as well as animal species explicitly cited as objectives, together with protection of watersheds (Govt. Cameroon, 2007). This followed focus on the area by the WWF and San Diego Zoo, Kew Gardens and the National Herbarium of Cameroon, thanks to the GEF-World-Bank-MINEF (now MINEPDED) and Earthwatch-Darwin Initiative projects. These projects surveyed the plant diversity of the previously botanically almost unknown wider Bakossi area between 1995 and 2003 (Cheek et al., 2004), resulting in proposals for a network of protected areas. Of these, however, only Bakossi National Park and the Banyang-Mbo Wildlife Sanctuary have been officially gazetted up to now.

## Botanical significance

The Bakossi mountains are a major and relatively well-preserved part of the Cameroon Highlands Forests ecoregion (Cheek et al., 2004), which represents one of the most diverse areas of tropical Africa. Cheek et al., (2004) report 2,412 species in the larger 2,390 km² Bakossi checklist area and a particularly large number of local endemics. The richness per unit area is likely to be higher within the national park area although the number of local endemics may have been reduced somewhat by subsequent discoveries in other areas.

The Cameroon Highlands follow a geological fault and represent a relatively narrow and small zone of submontane and montane forest in West or Central

Africa. Still close to the coast, diversity is boosted by high rainfall, while further north much of these highlands have also been severely degraded by settlement and agriculture, with only small outposts of intact forest remaining (Cheek et al., 2000a; Cheek et al., 2004; Cheek et al., 2010).

A very high number of species from within the national park have been assessed as globally threatened under the IUCN Red List and for a large proportion of these, Bakossi National Park (sometimes together with Mt Kupe which has been more intensively surveyed) likely represents the most significant, if not the only, known population. Species currently endemic to the site itself include: *Ledermanniella onanae, Hypolytrum subcompositus, Keetia bakossiorum, Pavetta rubentifolia, Memecylon bakossiense* and *Cola kodminensis*. Unfortunately, many taxa recorded in Cheek et al., (2004) were collected around sites just outside the later gazetted national park boundaries at Kodmin, Lake Edip and Nyandong. A certain latitude has been taken here to include several of these taxa where exact collection sites are unknown or interpreted to be very close to the boundary, which is still not demarcated on the ground. However, a number of taxa had to be excluded and sites such as Lake Edip to the south and Bime rock to the north-east are notable, phytologically important, physical features requiring additional protection.

## Habitat and geology

Although the terrain of the entire Kupe-Bakossi-Mwanenguba area is linked to the Cameroon Volcanic Line where the Congo craton and the West African plate meet, there is geological variation between the various peaks, for which several phases of geological activity are responsible. Uplifted basement complex rocks constitute part of the Bakossi mountains area (Cheek et al., 2020b) and Wild (2004a) refers to metamorphic schists. However, much more recent volcanic activity is also prominent. Older than Mt Kupe and Mwanenguba, the volcanic rocks apparently derive from a period in the late Neogene when eruptive activity formed an inferior 'white series' (Sieffermann, 1973; Wild, 2004a). Pouclet et al. (2005) date phonolite extrusions in the Bakossi mountains to the upper Miocene (7.55 ± 0.18 Ma), making them somewhat younger than trachytes of Ekomane in the Banyang-Mbo sanctuary and much younger than the Pleistocene lava flows in the Bangem area. Intrusive (granite or syenite) inselbergs are also found throughout the area, such as Bime on the north-east border and Nyale rock in the south-east (Wild, 2004a). Like Mt Mwanenguba to the east (Wild, 2004a), the Edib mountains, at the southern edge of the site, are an extinct volcano. Edib crater lake is just outside the site boundary.

The volcanic terrain gives rise to andosols in much of this area, although more clayey Nitrosols are predominant to the west, and ferralsols to the east and north and may also feature in non-volcanic areas (Ngachi et al., 1992; Yerima & Ranst, 2005). Gleying also occurs due to high precipitation and mist (Wild, 2004a). Edib volcanic soils are less fertile than the highly cultivated soils on the lower slopes of Kupe and Mwanenguba, corresponding presumably to their greater age (Wild, 2004a; Cheek et al., 2020b). BirdLife International (2021d) describes clearings in the forest, especially near Kodmin, where forest apparently struggles to regrow. This may reflect poor soils and perhaps seasonal aridity without existing forest to draw down mist as horizontal precipitation, as well as reduced growth due to the impact of altitude and cloud on temperature, insolation and soil nutrient cycling (Wild, 2004a). It has strong conservation implications for forest clearance and shifting agriculture.

The whole region has high precipitation, augmented by horizontal precipitation which probably mitigates against reduced dry season rainfall. BirdLife International (2021d) suggests the Edib hills are the wettest part of the Bakossi IBA but parts of south western Kupe are likely wetter still, with up to 6–7 m possible (Cheek et al., 2020b) and a mean of 4 m recorded at Nyasoso. At Bangem, to the north-east, the mean is only 2.8 m, although sources and periods differ (Wild, 2004a, adapted from Ejedepang-Koge, 1986). Temperature varies

**Fast-flowing streams are an important habitat in the Bakossi National Park where threatened species such as *Coleus cataractarum* (VU) and *Ledermanniella onanae* (EN, pictured here) are recorded.**

little seasonally, around 23–24 °C, and daily cycles are far greater. While latent heat from condensing air may in theory slightly reduce the normal lapse-rate of 0.6 per 100 m, reduced insolation due to cloud more than makes up for this (Wild, 2004a). Cloud cover and cloud forest – characterised by reduced tree stature, increased stem density and abundance of tree ferns, epiphytes, mosses and ferns draping the forest – apparently extends to lower elevations in parts of Bakossi National Park than nearby Mt Mwanenguba and Mount Kupe (Wild, 2004a).

The area is an important watershed. The river Jide (Chide or Chede) flows south between the Bakossi mountains and Mwanenguba and joins the Mungo near Tombel. Another tributary of the Mungo river flows from the west of the Bakossi National Park, while the main tributary flows from Rumpi Hills. The Mbwi (Mbu) drains to the north, flowing between Banyang and Bakossi to join the Cross river flowing west to Nigeria. The river Dikombe is fed by eastern Kupe and Mwanenguba and flows south to join the Wouri.

The vegetation of the wider area is extensively discussed by Cheek (2004b). The site is predominantly submontane cloud forest, rich in epiphytes. There are also rocky areas, streams with rheophytic communities, crater lakes and curious 'grassland' areas amidst the forest.

## Conservation issues

The boundaries of the national park do not incorporate all of the rare or threatened taxa recorded, with particularly richly sampled areas close to the borders at Nyandong, Kodmin, Enyandong and Lake Edip (Cheek et al., 2004). For this reason, sensitive management of the border regions are particularly important. The lowland forest to the west of the park is poorly surveyed and conservation-important forest habitat likely extends beyond the boundary to the Kumba-Mamfe road and indeed beyond to the Rumpi Hills area. Beyond the western border, and also to the north-west between the site and the Banyang-Mbo Wildlife Sanctuary, this forest is designated as production forest reserves, and a smaller area of palm oil plantation, all of which are currently inactive (MINFOF & WRI, 2021). It is important that if these areas become actively exploited again they are well managed and every effort is made to ensure forest species are retained and habitat corridors remain to link the protected areas. To the east, north-east and south, small-scale cultivation and settlement around the existing communities and roads are the main threats. Bangem is a moderately sized administrative town and the highlands between Mt Mwanenguba and the site boundary, as well as the Jide valley, have been substantially deforested.

**The Bakossi mountains landscape.**

Although mineral exploitation permits have appeared to overlap the national park (MINFOF & WRI, 2013), the area is not among those where proven deposits have been demonstrated and mining activity does not appear to be an urgent threat (Tchindjang et al., 2017).

Support for conservation amongst local leaders has been strong, although there is also local demand for roads and development (Cheek et al., 2004).

## Key ecosystem services

The official decree establishing the national park cited protection of watersheds as a fundamental objective. The high annual rainfall is largely seasonal but the Mungo river, a major tributary of which flows from the west of the park, is renowned for maintaining a stable flow (WWF, 2020a). The submontane cloud forest, with its dense structure of vegetation, including trees, vines, epiphytes and bryophytes, likely plays a vitally important role in this, both by condensing mist as horizontal precipitation and by buffering and recycling vertical precipitation. The former is especially important during the marked dry season between November and April (Williams et al., 2004). Studies in other parts of the world have shown that horizontal precipitation may contribute up to 46% of total precipitation (Hu & Rivers-Iregui, 2016). At nearby Mt Kupe, seasonal reduction in dry season water level of streams has alarmed local villagers who attribute it to upland deforestation (Williams et al., 2004), while downstream the Mungo river is vital to the health and livelihoods of people in various ways (WWF, 2020a).

The site provides valuable habitat, particularly rare cloud forest, for a diverse range of birds, reptiles, amphibians, fish and mammals, including drills and Nigerian-Cameroon chimpanzees. Elephants occur to the north and south in the Banyang-Mbo sanctuary and Mungo-Bakossi forest reserve, making Bakossi National Park a potential migratory route (Wild et al., 2004; Wild et al., 2005; Morgan et al., 2011).

Although like most of Cameroon, ecotourism is poorly established, the Kupe-Bakossi-Mwanenguba area has great potential but requires careful management. For this to happen it is likely necessary for the charismatic fauna to be preserved and encouraged, which depends on not only safeguarding forest within the park but also protecting and re-establishing habitat corridors between neighbouring sites including the Banyang-Mbo Wildlife Sanctuary, Mungo-Bakossi forest reserves, Mt Kupe, Mt Mwanenguba, Mt Nlonako, Rumpi Hills and even Korup National Park.

The Bakossi people rely on the forest to meet many of their basic needs. Many edible, medicinal and other useful species are recorded from the site and used by local people (Pollard, 2004). Traditional houses called 'Ndabechung' are built with stems of the tree fern *Cyathea*. The area also harbours many sacred sites for the Bakossi people (Ejedepang-Koge, 1986; Wild, 2004c).

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating Services –** Carbon sequestration and storage

**Regulating Services –** Moderation of extreme events

**Regulating Services –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

**Cultural Services –** Cultural heritage

## IPA assessment rationale

With abundant evidence documented here of globally threatened species that have significant populations at the site, Bakossi National Park easily qualifies as an IPA under criterion A. It also qualifies under Criterion B(ii) ranking as one of the 15 richest sites with over 6% of the national list of B(ii) (range restricted and national endemic) species present. It has also been reported to have a high number of social, economic or culturally important species and is therefore likely to qualify under Criterion B(iii) when this aspect is formally assessed (Cheek et al., 2004). As one of the largest and most intact areas of submontane moist tropical forest in Cameroon it would also very likely qualify under criterion C for its nationally important submontane forest.

***Justicia leucoxiphus* (EN) is known only from the Bakossi mountains and one other site.**
Photograph M. Cheek, 1998.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Acanthopale decempedalis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | | | |
| Acanthaceae | *Justicia leucoxiphus* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Justicia orbicularis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Mendoncia camerounensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Pseuderanthemum dispermum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Amaranthaceae | *Cyathula fernando-poensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma submontanum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | | ✓ | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | | ✓ | |
| Annonaceae | *Uvariopsis submontana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Marsdenia magniflora* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Neoschumannia kamerunensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Secamone letouzeana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Secamone racemosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Amorphophallus preussii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araceae | *Rhaphidophora pusilla* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax hierniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | ✓ | | ✓ | |
| Asparagaceae | *Dracaena kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asteraceae | *Mikaniopsis maitlandii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens frithii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens letouzeyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia adpressa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia bonus-henricus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia duncan-thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia furfuracea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia laporteifolia* | | | B(ii) | | | | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia pelargoniiflora* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia prismatocarpa* subsp. *delobata* | | A(iv) | | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Leptonychia kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Dactyladenia johnstonei* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Magnistipula conrauana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Allanblackia gabonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Cyperaceae | *Hypolytrum pseudomapanioides* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Cyperaceae | *Hypolytrum subcompositus* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Cyperaceae | *Scleria afroreflexa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Plagiosiphon discifer* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Ebenaceae | *Diospyros kupensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Eriocaulaceae | *Mesanthemum jaegeri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Croton aubrevillei* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | VU | A(i) | | ✓ | | | |
| Salicaceae | *Oncoba lophocarpa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Gentianaceae | *Anthocleista microphylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Gesneriaceae | *Streptocarpus lineatus* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Coleus cataractarum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia cuspidata* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Crateranthus talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum geophylax* | | | B(ii) | | | | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | | | |
| Marantaceae | *Sarcophrynium villosum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Amphiblemma monticola* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon bakossiense* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Entandrophragma cylindricum* | VU | A(i) | | | | | |
| Meliaceae | *Entandrophragma utile* | VU | A(i) | | | | | |
| Menispermaceae | *Triclisia lanceolata* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Triclisia macrophylla* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia astyanactis* | VU | A(i) | | | ✓ | ✓ | |
| Moraceae | *Dorstenia poinsettifolia* var. *etugeana* | | A(iii) | | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia fernandopoana* | VU | A(i) | | | ✓ | ✓ | |
| Ochnaceae | *Lophira alata* | VU | A(i) | | | | | |
| Olacaceae | *Octoknema bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum bifarium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum gravidum* | VU | A(i) | | | | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria batesii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis ascendens* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis goodyeroides* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Manniella cypripedioides* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya superposita* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum polydactylum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Vigna desmodioides* | EN | A(i) | | | ✓ | ✓ | |
| Peridiscaceae | *Medusandra richardsiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus caesiifolius* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus nyale* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella letouzeyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella onanae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Ledermanniella thalloidea* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Macropodiella pellucida* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia koupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Putranjivaceae | *Drypetes magnistipula* | EN | A(i) | | | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Bertiera laxissima* | | | B(ii) | | | | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Coffea bakossii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Coffea montekupensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Keetia bakossiorum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Kupeantha kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mussaenda epiphytica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus montanus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta muiriana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta owariensis* var. *satabiei* | | A(iv) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta rubentifolia* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Pseudosabicea batesii* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Psychotria bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria darwiniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria geophylax* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria retrofracta* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Rothmannia ebamutensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea bullata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea xanthotricha* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Trichostachys interrupta* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris lecomteana* | VU | A(i) | | ✓ | | ✓ | |
| Rutaceae | *Vepris trifoliolata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus conraui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Placodiscus opacus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | A(i) | | | | | |
| Sapotaceae | *Englerophytum sylverianum* | | | B(ii) | | | | |
| Sapotaceae | *Manilkara zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Simaroubaceae | *Hannoa ferruginea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Simaroubaceae | *Nothospondias staudtii* | VU | A(i) | | | ✓ | ✓ | |
| Sterculioideae | *Cola kodminensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Urticaceae | *Myrianthus fosi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea fausteana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum kodmin* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Bakossi National Park | Protected/conservation area matches IPA |
| Important Bird Area | Bakossi mountains IBA | IPA encompasses protected/conservation area |
| Key Biodiversity Area | Bakossi mountains KBA | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Low | Ongoing – trend unknown |
| Hunting and collecting terrestrial animals | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | Low | Ongoing – trend unknown |
| Increase in fire frequency/intensity | Low | Past, likely to return |
| Transportation and service corridors – roads and railroads | Medium | Future – inferred threat |

## IPA

# Mt Kupe

**International site name:** Mt Kupe
**Site code:** CMNTIPA028
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana

**Latitude** (decimal degrees)**:** 4.81000
**Altitude minimum:** 300
**Area** (km$^2$)**:** 146.0
**Longitude** (decimal degrees)**:** 9.71000
**Altitude maximum:** 2,064
**IPA criteria met:** A(i)

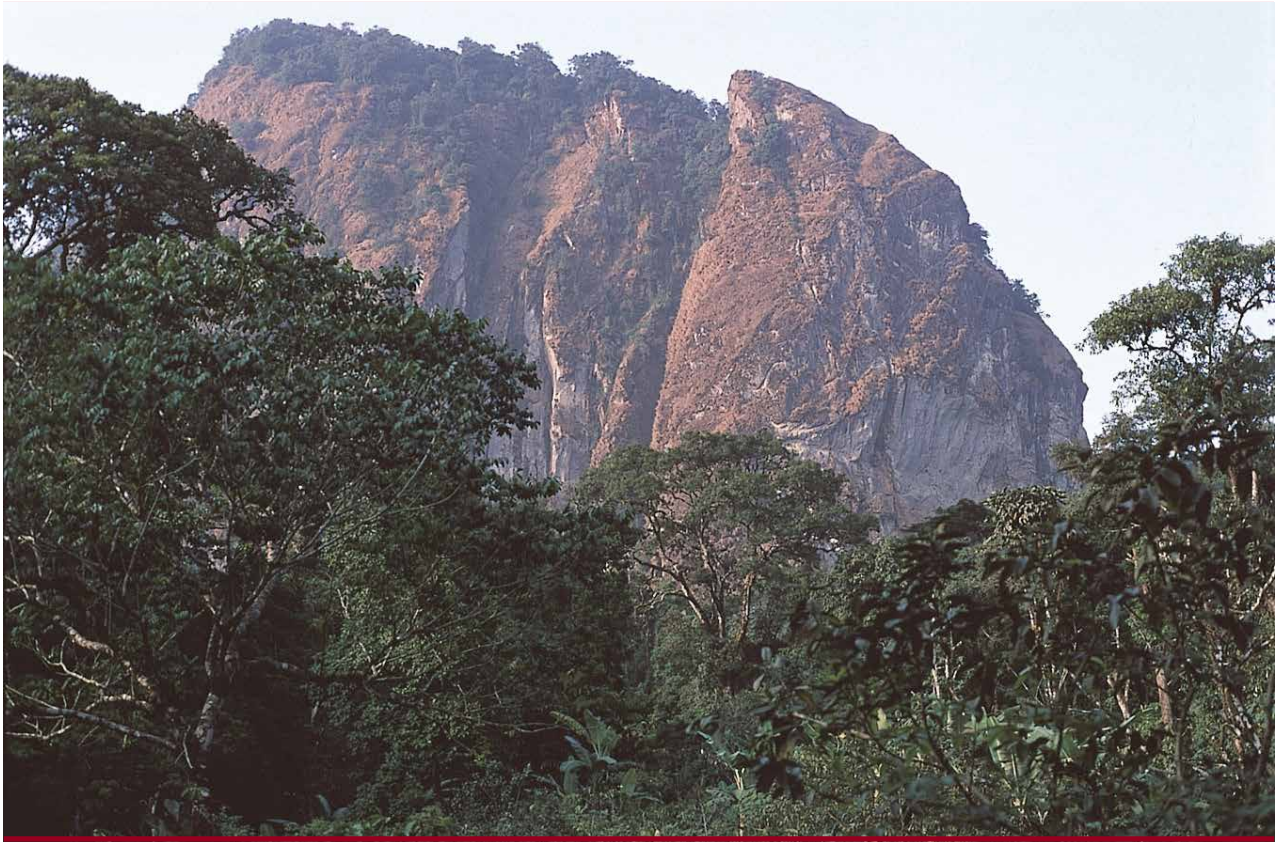
## Site description

Mt Kupe is a 2,000 m high forested mountain located approximately 100 km from the Atlantic coast and spanning the Southwest and Littoral regions of Cameroon. It lies between the N5 Douala-Bafoussam and Tombel-Bangem roads, close to the towns of Loum, Tombel and Manjo. Within the foothills of the mountain there are two forest reserves that are included here within the proposed IPA boundary: Manehas Forest Reserve to the north and Loum Forest Reserve to the south. Mt Kupe has been proposed as an Integral Ecological Reserve covering 46,000 ha (Wild, 2004b). However, this has not been officially gazetted. The IPA area incorporates the proposed protected area and extends beyond this to include populations of other important taxa.

## Botanical significance

Mt Kupe forms a link in the chain of Afromontane vegetation sites along the Cameroon Volcanic Line, one of the few points in West or Central Africa reaching above 2,000 m and therefore featuring genuine montane vegetation as well as the naturally more extensive but now highly threatened submontane habitat (White, 1983; Cheek et al., 2004). Compared with neighbouring sites (Mt Manengouba, Mt Nlonako, the Mwenzekong mountains of Banyang-Mbo and the Mwendolengo mountains and Edib Hills of Bakossi National Park), Mt Kupe has benefitted from much greater concentration of collecting effort (Cheek et al., 2004). This has revealed a very high number of threatened and geographically restricted species within the c. 50 km² of the proposed ecological reserve or the c. 150 km² proposed here as an IPA.

Most of the diversity is from the submontane forest, which has been considerably reduced in extent by anthropic activity, but the naturally less rich montane forest also contains rare endemic species. Fourteen species are narrowly endemic to the site. Some examples include: *Lefebvrea kupense, Brachystephanus kupensis, Bulbophyllum jaapii, Cola etugei, Polystachya kupensis, Ardisia alabastro-alata, Afrothismia kupensis, Vepris zapfacki, Stachyanthus cuneatus, Beilschmiedia crassipes, Memecylon kupeanum, Cyperus microcristatus*. Cheek et al. (2004, p78) give a higher number of 26 taxa – this includes some still undescribed taxa that are not included here (Cheek et al., 2019). Numerous other species are endemic to the Kupe-Bakossi area. Of the >120 threatened species listed here, no less than 17 are Critically Endangered.



**The 'Kupe Rock' cliff face of an inselberg rising from the south-west side of the mountain at approximately 1200 m asl.**
Photograph 2004.

Mt Kupe and the Bakossi mountains are also of significance as part of a postulated glacial refugium where evergreen forest species were able to survive the colder, drier conditions at higher altitude (though isolated from other populations these may have diverged genetically). Species with poor dispersal ability, such as yellow-flowered begonias, are thought to have subsequently remained restricted to such areas (Sosef, 1994; Sosef, 1996; Cheek, 2004c). A large number of such species have been described from the Kupe-Bakossi area (Cheek, 2004c).

Some species recorded by Ledermann from Lom – which appears to be Loum (Hepper, 1978) – are included here although possibly extinct due to loss of lowland forest around the town. These include *Beilschmiedia crassipes* (CR), *Stachyanthus cuneatus* (CR) and *Thyrsosalacia racemosa* (VU). Others such as *Crotonogyne impedita* (CR) have been more recently re-recorded at the site.

## Habitat and geology

Although the terrain of the entire Kupe-Bakossi-Manengouba area is linked to the Cameroon Volcanic Line where the Congo craton and the West African plate meet, there is geological variation between the various mountains. Several phases of tectonic activity are responsible (Cheek et al., 2020c; Wild, 2004). Mt Kupe is a synenitic horst of basement complex rocks (or possibly more recent intrusive material) uplifted in the early Eocene (Lamilen et al., 1989 cited by Pouclet et al., 2014; Enang et al., 2020). This is overlain by more recent basaltic and pyroclastic rocks from late Pliocene to late Pleistocene eruptions, which have weathered into highly fertile soils at the foot of the mountain (Enang et al., 2020).

The volcanic terrain gives rise to andosols in much of this area although there is much local variation (Wild, 2004). More clayey nitisols are predominant to the west and ferralsols to the east and north of the area; these may also feature in non-volcanic parts of the Kupe-Bakossi zone (Ngachi et al., 1992; Yerima & Ranst, 2005). Sieffermann (1973) described fertile andosoils and brown eutrophic soils on the lower eastern slopes that are important to farming. These soils are porous and well-drained, rich in organic matter and with high nutrient availability (Wild, 2004). Enang et al. (2020) suggest andosols and cambisols derived from pyroclastic parent rocks are dominant, particularly on the western slopes, with stratification and erratic variation of physical and chemical properties. This micro-variation might partly explain the high plant diversity. The topsoils are acidic (pH 5) and subsoils around pH 6.5 (Wild, 2004).

The whole region has high precipitation, augmented by horizontal precipitation which probably mitigates against reduced dry-season rainfall. South-western Kupe is particularly wet, with up to 6–7 m possible

(Cheek et al., 2020b) and 4 m mean recorded at Nyasoso, compared with 3 m from Loum to the south-east and 2.8 m from Nkongsamba to the north-east (Wild, 2004, adapted from Ejedepang-Koge, 1986). Temperature varies little seasonally, around 23–24 °C, and daily gradients, influenced by altitude, are much greater.

Cloud cover is less stable than in the Bakossi mountains or Mt Manengouba, and cloud forest – characterised by enveloping mist, stunted trees and abundant epiphytes, mosses and ferns – is less developed and descends less far (Wild, 2004).

A variety of vegetation types are present. There is a small area of semi-deciduous lowland forest in the degraded Loum reserve and lowland evergreen forest would cover much of the remaining area below 800 m but is much cleared for farming. The submontane forest is most abundant but also encroached at lower levels: in 2001 up to 1,500 m on the eastern side and up to 750–1,100 m on the western and northern sides (BirdLife International, 2021e), with subsequent additional clearance (ERuDeF, 2016). Montane forest, cliff-faces and inselbergs, montane grassland and seasonal streams are other important habitats (Cheek et al., 2004).

## Conservation issues

The Loum and Manehas forest reserves were created by the British colonial administration (Wild, 2004b). Manehas is still a protected forest reserve but the Loum reserve appears not to be demarcated on any administrative maps and has been badly degraded and partially absorbed into the Loum urban area (MINFOF & WRI, 2021).

The upper submontane and montane forest area of Mt Kupe has been proposed as a 46,000 ha Integrated Ecological Sanctuary, having the same degree of protection as a national park, but this has not been gazetted despite local support and the clear biological significance of the site (Wild, 2004b). There has been considerable degradation of the lowland and lower submontane forest from continuing small-scale logging and conversion to farmland, which has been renewed following the withdrawal of international NGOs faced with the stalled gazettement status (ERUDEF, 2016).

Although fertile, the soils are quickly degraded due to high precipitation and steep slopes, potentially leading to soil erosion, landslides and abandoned land where diverse forest may struggle to return (Yerima & Ranst, 2005; Zogng et al., 2007; Mukenga et al., 2016).

Cooperation between local groups to protect watersheds has reportedly broken down, with renewed forest conversion threatening water supply to 20 villages (ERUDEF, 2016).

Extensive lowland areas to the east and south of the site, around Tombel, Loum and Manjo, have been cleared for agro-plantation (MINFOF & WRI, 2021; Google Earth, 2021). As indicated by the development plan for the Tombel agglomeration, local populations are overwhelmingly employed in agriculture (PNDP, 2011). Although historically Mt Kupe has been a sacred site to the Bakossi people, traditions and taboos that protect such sites have begun to erode and may be opposed by immigrant populations drawn to the rich soil and agro-plantation employment (Chuo, A. & Angwafo, T., 2017; Ngea, 2006).

Active management is advisable to preserve this very important site. Forest corridors linking the proposed integral reserve with neighbouring sites should be maintained or restored to ensure genetic exchange and migratory routes. The site has great potential for eco- and wildlife-tourism which has languished following withdrawal of international NGOs (ERuDeF, 2016). However, conservation is strongly supported by local elders (Ngea, 2005).

***Mendoncia camerunensis*** **(EN), a rare liana species from Mt Kupe.**
Photograph X. van der Burgt, 2017.

## Key ecosystem services

The forest supports important faunal populations. The avian fauna has attracted ornithological tourism and led to BirdLife International instigating the former Mount Kupe Forest Project. The Mt Kupe bush shrike (*Chlorophoneus kupeensis*, EN), considered endemic until subsequent populations were found in the Bakossi mountains and in Nigeria, is one of 330 bird species recorded from Mt Kupe. It was a major draw for bird ecotourists until the security situation declined in late 2016. There is also a rich diversity of reptiles and amphibians, while chimpanzees and drills are amongst the mammalian fauna (Wild et al., 2004, 2005).

Local support for conservation has been partly motivated by concern over water supplies in nearby villages (Williams et al., 2004; ERUDEF, 2016). Deforestation of the slopes threatens the dry season supply because cloud forest vegetation creates orographic and horizontal (or 'occult') precipitation, as well as buffering heavy rains (Williams, 2004; Wild, 2004). Furthermore, loss of vegetation will potentially diminish water clarity and quality downstream due to soil erosion. Loss of soil and nutrients and landslides are also major concerns arising from upland deforestation at such sites (Zogning et al., 2006; Yerima & Ranst, 2005).

***Kupea martinetugei*** **(CR), a new species, genus and tribe of nonphotosynthetic mycoheterotrophs in the family Triuridaceae, first discovered at Mt Kupe.**
Photograph M. Cheek, 1999.

As well as water, local people rely on the remaining forest for a variety of food, medicines, firewood and building materials (ERuDeF, 2016).

The Mt Kupe forest is the most important of all sacred sites for the Bakossi people, with huge spiritual significance as a taboo place where ancestors commune. Its cultural significance extends, in fact, beyond the Bakossi people and even to Francophone Cameroon and the Igbo of Nigeria (pers. comm., J-M Onana, 2021; Wild, 2004c).

## Ecosystem service categories

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Moderation of extreme events

**Cultural –** Aesthetic appreciation and inspiration for culture, art and design

**Cultural –** Spiritual experience and sense of place

**Cultural –** Cultural heritage

## IPA assessment rationale

The very large number of threatened and endemic taxa recorded at Mount Kupe easily qualify it as a potential IPA under criterion A(i). Fourteen threatened species are considered locally endemic. The site ranks fourth for the number of endemic and range-restricted species, therefore qualifying under criterion B(ii). It is also likely to qualify under criterion B(iii) for its diversity of socially, economically or culturally important species. Furthermore, the areas of submontane and montane forests are likely amongst the most important areas of these habitat types in Cameroon and the wider West and Central Africa region, potentially qualifying the site under criterion C(iii).

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Acanthopale decempedalis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Asystasia glandulifera* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brachystephanus kupeensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Acanthaceae | *Brachystephanus longiflorus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Justicia camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Mendoncia camerounensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Sclerochiton preussii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Amaranthaceae | *Cyathula fernando-poensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Monanthotaxis glaucifolia* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma goslineanum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis submontana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis vanderystii* | VU | A(i) | | | ✓ | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apiaceae | *Lefebvrea kupense* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Apocynaceae | *Neoschumannia kamerunensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Amorphophallus preussii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | | | |
| Aristolochiaceae | *Aristolochia goldieana* | VU | A(i) | | | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Asparagaceae | *Dracaena kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asparagaceae | *Dracaena viridiflora* | VU | A(i) | | ✓ | | ✓ | |
| Asteraceae | *Bidens mannii* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Asteraceae | *Crassocephalum bauchiense* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Asteraceae | *Mikaniopsis maitlandii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asteraceae | *Mikaniopsis vitalba* | VU | A(i) | | | ✓ | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia adpressa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia bonus-henricus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia duncan-thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia furfuracea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia laporteifolia* | | | B(ii) | | | | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Boraginaceae | *Cordia platythyrsa* | VU | A(i) | | | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia fungiformis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia kupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Burmanniaceae | *Afrothismia saingei* | EN | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Burmanniaceae | *Afrothismia winkleri* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Leptonychia kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Scaphopetalum pallidinerve* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Celastraceae | *Thyrsosalacia racemosa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Dactyladenia johnstonei* | CR | A(i) | | | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Chrysobalanaceae | *Magnistipula conrauana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Allanblackia gabonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Aneilema silvaticum* | VU | A(i) | | | ✓ | ✓ | |
| Commelinaceae | *Palisota preussiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Costaceae | *Costus kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Momordica enneaphylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Cyperaceae | *Cyperus microcristatus* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Cyperaceae | *Mapania ferruginea* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | | | |
| Detarioideae | *Anthonotha xanderi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | ✓ | | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | | | |
| Detarioideae | *Talbotiella ebo* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros kupensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Croton aubrevillei* | VU | A(i) | | | ✓ | ✓ | |
| Euphorbiaceae | *Crotonogyne impedita* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Hamilcoa zenkeri* | VU | A(i) | B(ii) | ✓ | | | |
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | VU | A(i) | | ✓ | | ✓ | |
| Gentianaceae | *Anthocleista microphylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Gentianaceae | *Anthocleista scandens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Gentianaceae | *Streptocarpus lineatus* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Grewioideae | *Microcos magnifica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Icacinaceae | *Pyrenacantha cordicula* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Icacinaceae | *Stachyanthus cuneatus* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lamiaceae | *Clerodendrum anomalum* | VU | A(i) | | | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia crassipes* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lauraceae | *Beilschmiedia cuspidata* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia preussioides* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | | | |
| Lecythidaceae | *Rhaptopetalum cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum geophylax* | | | B(ii) | | | | |
| Linaceae | *Hugonia macrophylla* | VU | A(i) | | | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | | | |
| Loranthaceae | *Tapinanthus preussii* | VU | A(i) | | ✓ | | ✓ | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | | ✓ | |
| Melastomataceae | *Memecylon kupeanum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Meliaceae | *Entandrophragma cylindricum* | VU | A(i) | | | | | |
| Meliaceae | *Heckeldora ledermannii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Menispermaceae | *Tiliacora lehmbachii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Triclisia macrophylla* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia astyanactis* | VU | A(i) | | | ✓ | ✓ | |
| Moraceae | *Dorstenia prorepens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum pyriforme* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum sanfordii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum bifarium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Orchidaceae | *Bulbophyllum calvum* | VU | A(i) | | ✓ | | ✓ | |
| Orchidaceae | *Bulbophyllum jaapii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Orchidaceae | *Bulbophyllum micropetalum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum nigericum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum summerhayesianum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbostylis densa* var. *cameroonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Disperis mildbraedii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria thomana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya bicalcarata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya cooperi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya farinosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya kupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Orchidaceae | *Rhipidoglossum polydactylum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Piperaceae | *Peperomia kamerunana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia alabastroalata* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Primulaceae | *Ardisia koupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Chassalia petitiana* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Coffea bakossii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Coffea montekupensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Cuviera talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Keetia bakossiorum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Kupeantha kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mussaenda epiphytica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha arcuata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta cellulosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta kupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Phyllopentas ledermannii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria asterogramma* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria darwiniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | B(ii) | | | | |
| Rubiaceae | *Psychotria geophylax* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria njumei* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psydrax bridsonianus* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Rutidea nigerica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia atherura* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris lecomteana* | VU | A(i) | | ✓ | | ✓ | |
| Rutaceae | *Vepris onanae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rutaceae | *Vepris trifoliolata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris zapfackii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Salicaceae | *Homalium hypolasium* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Salicaceae | *Oncoba lophocarpa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus conraui* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Sapindaceae | *Deinbollia insignis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia onanae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Simaroubaceae | *Hannoa ferruginea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola etugei* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Thymelaeaceae | *Dicranolepis polygaloides* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Triuridaceae | *Kupea martinetugei* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum kamerunicum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aframomum plicatum* | VU | A(i) | B(ii) | ✓ | ✓ | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Reserve (proposed) | Mt Kupe Integral Ecological Reserve (Proposed) | IPA encompasses protected/conservation area |
| Important Bird Area | Mt Kupe IBA | Protected/conservation area overlaps with IPA |

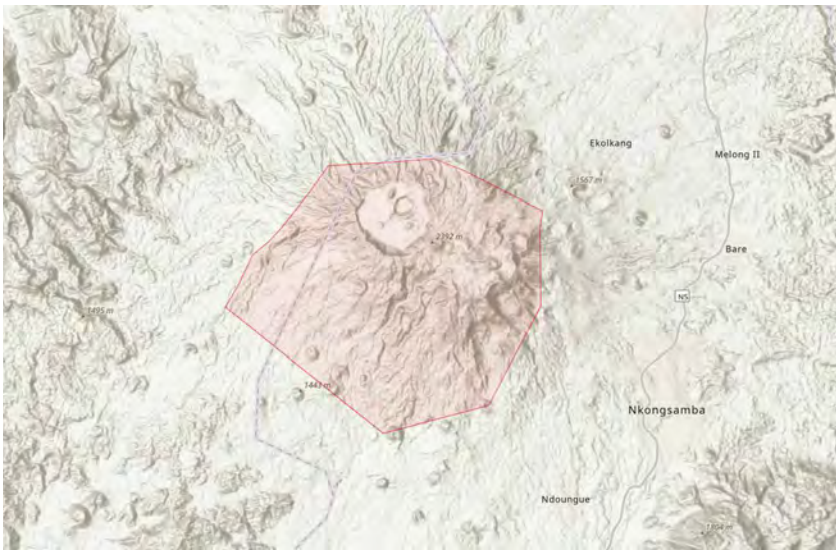
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Ongoing – increasing |
| Agro-industry farming | Medium | Ongoing – trend unknown |
| Hunting and collecting terrestrial animals | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – increasing |
| Avalanches/landslides | Low | Ongoing – trend unknown |
| Soil erosion, sedimentation | Medium | Ongoing – trend unknown |

## IPA

# Mt Mwanenguba

**International site name:** Mt Mwanenguba
**Site code:** CMNTIPA033
**Administrative region:** Southwest and Littoral
**Assessed by:** Bruce Murphy, Martin Cheek, Leonard Usungo




**Latitude** (decimal degrees)**:** 5.02900
**Altitude minimum:** 1,100
**Area** (km²)**:** 119.0
**Longitude** (decimal degrees)**:** 9.83390
**Altitude maximum:** 2,411
**IPA criteria met:** A(i)

## Site description

Mt Mwanenguba (also written as Manengouba, Manengouba or Muanengouba) is one of the highest peaks in Cameroon, located along the Cameroon Volcanic Line approximately 125 km inland, close to the large town of Nkongsamba. The site defined here incorporates, and is larger than, the proposed Integral Ecological Reserve of 52 km² or Herpetological sanctuary of 47 km². It extends down to around 1,000 m asl on the southern slopes, nearly to Mwanenguba village in the south-east, and to c. 1,500m in the east above Nkongsamba. The western slopes reach down to the road around 1,300 m and the and the site also includes the Mwandon ('Etuge') crater lakes region in the south-west. The Mt Manengouba Key Biodiversity Area, which covers 88 km², includes a greater area to the north but appears badly degraded and we only include the northern upper slopes. Mwanenguba's caldera and crater lakes are relatively easily reached via a road from Bangem which ascends 800 m rather directly. The forested southern and eastern summit area is less accessible from Nkongsamba via Mwanenguba village or Manjo via Nsong village.

## Botanical significance

Mt Mwanenguba is one of several biologically important sites along the Cameroon Volcanic Line. Compared with nearby Mt Kupe, Mt Nlonako and the Bakossi mountains, less submontane forest has survived at Mt Mwanenguba but unlike the latter two sites it features genuinely montane (>2,000 m) habitat, although this is perhaps less well preserved than that of Mt Kupe. The species list presented here is considerably shorter than those for Mt Kupe and Bakossi National Park, as the site was surveyed in a much more limited fashion by the RBG Kew-HNC-Earthwatch team (Cheek et al., 2004). Montane forest also has fewer endemic species and more wide-ranging species than submontane forest. Nonetheless, the site is of great importance for these habitats and features numerous globally threatened species.

*Beilschmiedia ndongensis* (CR), *Aframomum kodmin* (EN) and *Ledermanniella thalloidea* (EN), collected near Ndoungue in the valley between Mt Mwanenguba and Mt Nlonako, are outside the boundary of the site as considered here but deserve mention. The former species is considered globally endemic to this location, having only been collected once at 700–800 m over a century ago (Cheek et al., 2004; de Kok, 2021).

Every effort should be made to ensure habitat continuity between these mountains despite the difficulty of development along the valley. Some species, such as *Impatiens letouzeyi* (EN), are only recorded from the Mwandon crater lakes region which is on the south-west slopes at around 1,200 m asl, outside the forest reserve and proposed Herpetological sanctuary.

## Habitat and geology

One of the major features of the Cameroon Volcanic Line, Mt Mwanenguba is a recent but extinct multi-stage volcano rising above 2,400 m and connected west- and southwards by 1,000+ m ridges to the Bakossi mountains and Mt Kupe respectively. It is separated by the lower (700–800 m) Nkongsamba valley and Mbo Plain from, respectively, Mt Nlonako to the east and the Bamileke plateau and Bamboutos mountains to the north. The summit region of Mwanenguba features the Eboga caldera with its twin 'male' and 'female' crater lakes plus various peaks east of the caldera rim, including the 2,444 m summit pinnacle. Previous research interpreted the caldera as the collapsed remains of the Eboga stratovolcano, which had itself formed inside an earlier, poorly defined Elengoum caldera (Fitton & Dunlop, 1985). However, more recent interpretation by Pouclet et al. (2014) argues conclusively that the eastern Elengoum extrusive complex is more recent (0.89–0.7 Ma) than the older Eboga (0.94–0.89 Ma) stratovolcano and caldera. Both are built on an older but still recent (1.55–0.94 Ma) shield volcano, which evolved into the Eboga stratovolcano. The largely deforested western, south-western and north-western flanks correspond to the basaltic and intermediate flows from the Eboga stratovolcano, while the steep, forested south-eastern slopes – which constitute most of the proposed Integral Ecological Sanctuary and Herpetological Sanctuary land – are based on pyroclastic, acidic trachytes. However, numerous yet more recent (0.5–0.1 Ma) cinder cones and lava flows are found on the flanks and covering the Eboga caldera, as well as constituting the 2,441 m summit pinnacle. These are mainly basaltic, with basanite, Hawaiite and mugearite predominant. Rocks from the shield stage, as well as pre-Mwanenguba lavas and uplifted basement rocks, occur mainly outside the area here considered (Pouclet et al., 2014). Andosols, rich in trace elements, are common across the mountain, resulting in large areas cleared for cultivation (Tefogoum et al., 2014).

Mount Mwanenguba is situated in one of the wettest areas of tropical Africa and high altitude adds additional orographic and occult precipitation. The latter is induced by the cloud forest vegetation (although this is likely much reduced from its natural state) and probably helps maintain high year-long moisture despite low rainfall from December to February (Wild, 2004a). Total annual precipitation for both Nkongsamba in the east and Bangem in the west

**The 'male' crater lake of Mt Mwanenguba's caldera, 1950 m. The surrounding grassland is burnt and grazed.**
Photograph G.Gosline, June 2007.

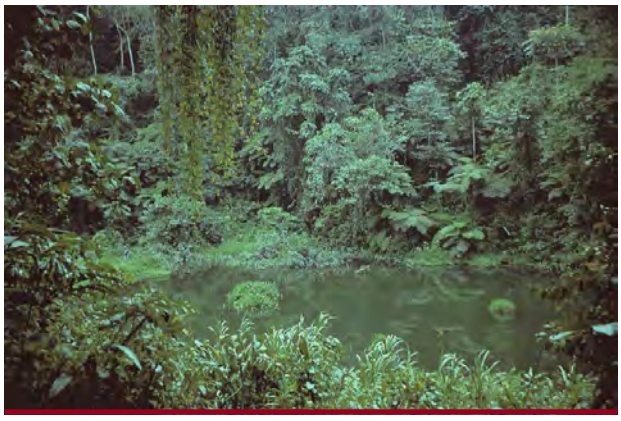
is c. 2,800 mm but is likely to be greater at higher altitudes, particularly on the south-western slopes (Wild, 2004a). Temperature varies little seasonally, averaging around 23–24 °C; daily gradients, influenced by altitude, are greater. Cloud forest – characterised by enveloping mist, stunted trees and abundant epiphytes, mosses, and ferns – is stable and well developed from around 1,200 m up to the caldera.

Submontane forest extended down the eastern valley to Ndongue when surveyed by Ledermann in 1908 but much has subsequently been cleared and what remains has been inadequately surveyed (Cheek et al., 2004). It is unclear to what extent the mosaic of grassland and forest that remains is a natural formation. The montane forest on the summit and south-east flanks is also little surveyed. Montane grassland, regularly burnt and grazed, fills most of the large caldera (1,900–2,000 m) and much of the northern and eastern slopes at similar altitude.

## Conservation issues

Preserving the unprotected remaining montane and submontane forest in the south-east and on the summit above the caldera to the east, are probably the conservation priorities from a botanical perspective, even though these forests are relatively little known (Cheek et al., 2004). Many of the species cited here come from grassland areas in the caldera region. Buildings are evident within the caldera and this habitat is threatened by cultivation. Burning and grazing by horses, cattle and goats is implicated in the existence of the caldera grassland and scrubby forest cover (Cheek et al., 2004; KBA partnership, 2023a; Blackburn, 2008). On the lower slopes, and up to 1,700 m in places, the main threats are shifting agriculture and informal logging by residents of the local villages and expanding towns below (KBA Partnership, 2023a; Rainforest Trust, 2021).

Introduction of non-native fish species to the lakes is a major threat to these aquatic systems (Cheek et al., 2004). Chameleons and goliath frogs are hunted for the pet trade and food; agricultural contamination also threatens amphibians as well as human water supplies (Hirschfield et al., 2016; Rainforest Trust, 2021). Climate change and chytrid disease (*Batrachochytrium dendrobatidis*) are further threats to amphibians (Hirschfield et al., 2016). Quarrying of the volcanic rock for pozzolana to make cement and roads is also common on the lower slopes (Tefogoum et al., 2014).



**Mwambong lake at 1,150 m on the south-west side of the mountain.**
Photograph 2004.

Despite the many previously proposed protected areas and conservation zones (Wild, 2004b), the mountain remains legally unprotected. The latest effort, a proposed Herpetological Sanctuary, targets only a relatively small proportion of the mountain but would appear to include most of the more intact area and has the advantage of not including any dwellings (Rainforest Trust, 2021).

Local elites have backed conservation efforts in this region (Cheek et al., 2004) and the conservation of forest on the south-east slopes is attributed to awareness by Nsong villagers of the biological importance of the forest, partly following work by J.L Amiet studying amphibians in the 1970s (KBA partnership, 2023a). The Herpetological sanctuary is backed by the Rainforest Trust and the local groups including the Cameroon Herpetology-Conservation Biology Foundation (CAMHERP-CBF) and the Environment and Rural Development Foundation (ERUDEF). Successful sensitisation work was reported (Rainforest Trust, 2021) and efforts towards gazettement continue. Eventual withdrawal of WWF from the Kupe-Mwanenguba area after frustration of efforts towards gazettement of earlier proposals has reportedly left locals distrustful (Rainforest Trust, 2018).

Like the Mwanenguba KBA, the site proposed here is adjacent to the Eastern Bamenda and Associated Hydrobasin KBA, which extends to Mt Kupe and includes the Ngomboaku area, where many important plant species have been recorded and an unusual area of highland *Raphia regalis* is located (Cheek et al., 2004; KBA partnership, 2023a). Habitat connectivity with the biologically related Bakossi mountains, Mt Kupe and Mt Nlonako are crucial aims for conservation work in this area. Loss of elephants (hunted to extinction by, 1984; Wild, et al., 2004b) and other megafaunal seed dispersers is conjectured to threaten the long-term viability of some plant species. Efforts should be made to enable their return via such forest corridors.

## Key ecosystem services

The site is of great importance for amphibians, with over 100 species in total and four locally endemic, Critically Endangered frogs (Blackburn, 2007; Rainforest Trust, 2021). Mwanenguba also has 270 species of bird and the joint highest number (16) of local endemic birds in the region, as well as the region's highest chameleon diversity (Graham et al., 2005; Gonwouo et al., 2006; Blackburn, 2007).

The mountain is a watershed for the Cross and Wouri rivers and the cloud forest is important in attracting precipitation, maintaining water quality, and preventing soil erosion, flash flooding and landslides (Wild, 2004a; Zogning et al., 2007).

The site was frequently visited by tourists before the anglophone crisis and has potential for further ecotourism development, although the 20th-century elimination of large, charismatic fauna (elephant, leopard, chimpanzee, giant pangolin) is limiting (Wild, 2004b). Mandrill and both red-eared guenon and Preuss's guenon were reported by Wild (2004) to still occur. The site has been suggested to have potential for geo-tourist development (Tefogoum et al., 2014).

***Begonia preussii*** **(VU), one of the threatened species recorded at the site.**
Photograph G.Gosline, June 2007.

A great many plant species from the area are used for a variety of purposes by local peoples (Pollard, 2004; Etuge, 2004). The twin lakes of the caldera area are of great spiritual and cultural significance to the Bakossi people and are considered of national importance (Wild, 2004c). Of similar importance is the ancestral burial ground at Mwekan on the western slopes of the mountain, a little outside the boundary proposed here.

## Ecosystem service categories

**Provisioning** – Fresh water

**Provisioning** – Medicinal resources

**Regulating** – Moderation of extreme events

**Regulating** – Erosion prevention and maintenance of soil fertility

**Habitat or supporting services** – Habitats for species

**Cultural** – Tourism

**Cultural** – Aesthetic appreciation and inspiration for culture, art and design

**Cultural** – Spiritual experience and sense of place

**Cultural** – Education

**Cultural** – Cultural heritage

## IPA assessment rationale

Mt Mwanenguba qualifies as a potential IPA by virtue of several globally threatened plants that are partly reliant on this site for their survival. Greater surveying would very likely record more threatened and endemic taxa. The site would potentially also qualify under criterion C for its cloud forest and montane forest habitats.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Asystasia glandulifera* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | | | |
| Araliaceae | *Astropanax hierniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | | | |
| Asteraceae | *Bidens mannii* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Balsaminaceae | *Impatiens letouzeyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | ✓ | | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Campanulaceae | *Wahlenbergia ramosissima* subsp. *ramosissima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Cyperaceae | *Bulbostylis densa* var. *cameroonensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Coleus insignis* | | | B(ii) | | | | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Myricaceae | *Morella arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Disperis nitida* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria nigrescens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya albescens* subsp. *manengouba* | | A(iii) | | ✓ | ✓ | ✓ | ✓ |
| Orchidaceae | *Polystachya cooperi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya farinosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya geniculata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum polydactylum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Crotalaria ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Piperaceae | *Peperomia kamerunana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Eragrostis camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta hookeriana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Phyllopentas ledermannii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Scrophulariaceae | *Rhabdotosperma densifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Scrophulariaceae | *Rhabdotosperma ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola anomala* | | | B(ii) | | | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Mt Manengouba | Protected/conservation area overlaps with IPA |
| Key Biodiversity Area | Mt Manengouba | Protected/conservation area overlaps with IPA |
| Alliance for Zero Extinction Site | Mt Manengouba | Protected/conservation area overlaps with IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – increasing |
| Livestock farming and ranching | High | Ongoing – trend unknown |
| Mining and quarrying | Low | Ongoing – trend unknown |
| Increase in fire frequency/intensity | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| Soil erosion, sedimentation | Medium | Ongoing – trend unknown |
| Invasive and other problematic species, genes and diseases | High | Ongoing – increasing |

## IPA

# Tofala Hill Wildlife Sanctuary, Lebialem Highlands

**International site name:** Tofala Hill Wildlife Sanctuary, Lebialem Highlands
**Site code:** CMNTIPA007
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Martin Cheek, Barthélemy Tchiengué

**Latitude** (decimal degrees)**:** 5.65000
**Altitude minimum:** 130
**Area** (km²)**:** 15.0
**Longitude** (decimal degrees)**:** 10.00000
**Altitude maximum:** 1,115
**IPA criteria met:** A(i)

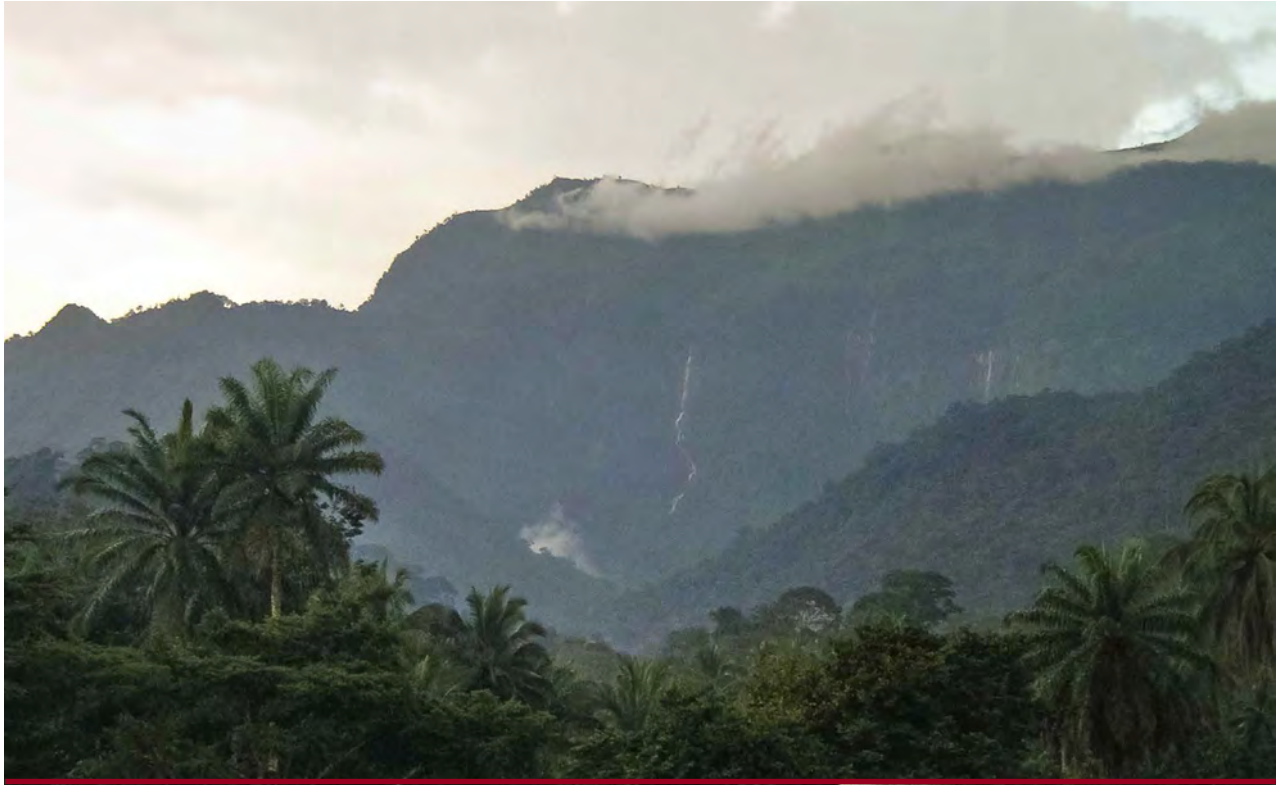
## Site description

The Lebialem Highlands, covering around 1,200 km² in Northwest, West and Southwest regions of Cameroon, is part of the line of volcanic uplands running from the Atlantic islands north-eastwards near the Nigerian-Cameroon border area. Tofala Hill Wildlife Sanctuary, formally recognised in 2014 (prime ministerial decree number 20145212), forms a small part of these highlands, with an area of 8,087 ha. It is situated in Wabane and Alou districts and has its administrative headquarters in Bechati. Although this part of Cameroon is highly populated and the site is surrounded by ten villages and is less than 40 km from Bamenda, the third largest city in the country, it is quite remote from access routes (Harvey et al., 2010). Rapid botanical surveys by teams from Kew and the National Herbarium of Cameroon were instigated between 2004 and 2006 from Fosimondi, reached via Dschang and Baranka. A fourth survey from Bechati, reached via Dschang and Menji (Fontem), was launched in September 2006.

Although the main purpose of the THWS is the conservation of primates, such as the Critically Endangered Cross-river gorilla (*Gorilla gorilla diehli*), Nigeria-Cameroon chimpanzee (*Pan troglodytes ellioti*) and drill (*Mandrillus leucophaeus*), as well as other animals, the threatened and fragmented submontane forest habitat critical to the survival of these species is also of great botanical importance (Harvey et al., 2010). While all remaining forest of the Lebialem highlands and neighbouring Bamboutos mountains is likely valuable, the THWS has been repeatedly surveyed between 2004 and 2006, culminating in the publication of a Conservation Checklist (Harvey et al., 2010). This revealed numerous threatened plant species and also some local endemics. Tofala Hill Wildlife Sanctuary was established after extensive consultations between local stakeholders, the government Ministry of Forestry and Wildlife (MINFOF) and the Environment and Rural Development Foundation (ERuDeF, a Cameroon NGO). It represents one part of a wider effort to save the remaining forest habitat in the Lebialem Highlands while enabling sustainable development for local people (Nkemngu, 2017).

## Botanical significance

There has been very little botanical collecting in the Lebialem Highlands prior to the work of RBG Kew and the National Herbarium of Cameroon, particularly through Barthélemy Tchiengué, from 2003 onwards



**The steep Lebialem ridge viewed from Bechati village on the western side.**
Photograph X. van der Burgt, September 2006.

(Harvey et al., 2010). Therefore, compared with other important highland areas in the west of the country (such as Bakossi, Mt Oku and Mt Cameroon) relatively little is known to science about the flora of this area. The neighbouring Bamboutos mountains have been better studied historically but have subsequently lost much of their natural vegetation.

Forest appears to be rapidly diminishing too within the Lebialem highlands (Harvey et al., 2010; Nkemengu, 2017). However, the aforementioned rapid surveys have identified over fifty species which are considered threatened by the IUCN Red List criteria, with over 30 of these already published on the Red List and approximately one in ten of all species identified in Harvey et al. (2010) considered threatened. The surveys were mainly conducted along a transect through the area now demarcated as the THWS from Fosimondi village in the east at the top of the west facing scarp slope at ca. 2,000 m altitude, down to around 200 m at Bechati in the west. Most of the threatened species collected are from submontane forest where the steep gradients contribute to a rich diversity of species. The primary lowland forest at the western edge has been less well surveyed, as have the northern and southern parts of the site. Therefore, many more species are likely yet to be found.

As well as being an important sanctuary for many threatened species, the site also appears to be an interesting link in our ecological knowledge of the Cameroon Highlands, revealing apparent differences between the Bamenda Highlands to the north and the Mt Kupe area to the south.

Harvey et al. (2010) listed six taxa as strictly endemic to the site. Of these *Argocoffeopsis fossimondi*, now *Kupeantha fossimondi* (CR), (Harvey et al., 2010; Cheek et al., 2018b; Cheek, 2017c), is the only species so far published. However, several other published species are endemic to one or two other sites in the western highlands. For example, *Heckeldora ledermanii* (EN) and *Trichostachys petiolata* (EN) are also known from the Kupe-Bakossi area while *Cincinnobotrys letouzeyi* (EN) is known only from THWS and a site near Numba 30 km to the north-east (Cheek, 2015b). Although there are relatively few (published) strict endemics, there appear to be a high number of nationally endemic species known from the site. Species collected from Mt Bamboutos, such as *Vepris montisbambutensis* (CR) known only from the type collected between Baranka and Fossimondi on the edge of the Tofala Hill reserve, may also occur here. *Ternstroemia cameroonensis* (CR), is also thought to have its only surviving global population at the edge of the site.

## Habitat and geology

The Lebialem Highlands constitute the west and south facing slope of the Bamboutos mountains and are part of the Cameroon Highlands series of volcanic uplands which extend in a north-east direction along a geographic fault line from off-shore islands such as Bioko through prominent Cameroonian peaks such as Mt Cameroon, Mt Kupe and Mt Oku. The THWS slopes steeply to the east and north with the highest point around 1,900 m in the east and the lowest at c. 200 m

in the south-west. In the lower part, free draining sandy soils of very low fertility have formed from the ancient, decomposed basement-complex rocks which have been eroded by the topology and high annual rainfall (c. 3–4 m), much of which is concentrated in a single wet season. However, at the top of the slope, the village of Fossimondi is situated on apparently Neogene basalts and trachytes which give rise to moist volcanic soils of moderate fertility (Harvey et al., 2010; Courade et al., 1974; Hawkins & Brunt, 1965). Partly for this reason and also due to severe population pressures, the uplands have been targeted for agriculture with crops such as *Coffea arabica* commonly grown. Cattle are also grazed on the high lava plateau. However, farming on the steep slopes has led to severe erosion in the western highlands of Cameroon (Lambi & Ndenecho et al., 2009).

The interaction of the steep scarp slope with the moist south-westerly winds of the wet season and the arid north-easterly harmattan, as well as the variable geology and erosion, likely create multiple contrasting microclimates which favour high species-diversity and endemicity.

## Conservation issues

The uplands of western Cameroon have suffered severe deforestation, primarily for logging and agriculture. Farming of these highlands may have been practised for several thousand years (Vansina et al., 1984; Tamura, 1999), and therefore some disturbance of natural habitat is likely ancient. However, the pace of deforestation has hugely increased in the last century. Overall, Cheek et al. (2000a) estimated that over 95% of the original montane and submontane forest above 1,500 m had been lost in the nearby Bamenda Highlands. This deforestation is ongoing, with forest losses at Kilum-Ijum and at Dom-Kejodsam estimated as respectively 25% over eight years and 50% over fifteen years (Cheek et al., 2000a; Cheek et al., 2010).

The Bamboutos mountains, of which the Lebialem Highlands form the western slope, have been largely denuded of natural vegetation under severe population pressure and agricultural conversion. Increasingly even steep slopes that have hitherto survived as forest are also coming under cultivation despite the difficult, often dangerous terrain and resultant soil erosion, landslides and rapid loss of fertility (Tchiengué, 2010; Nkemngu, 2017). While quantitative data is lacking for

**The hills rise steeply above the village and are frequently shrouded in mist.**
Photograph A. Horwath 2005.

the Lebialem Highlands, forest loss appears to be high and ongoing. At the site itself, Tchiengué (2010) reports that on subsequent annual visits areas that had been forested had been converted to farmland, including the area where the Lebialem endemic *Kupeantha fosimondi* was collected. Further dramatic losses on the slopes were observed on a visit in 2016 (B. Tchiengué 2021, pers. comm., 7 October). Overgrazing, mining and infrastructure construction in and around the site are also reported (Nkemngu, 2017). Agricultural pressure is apparently less in the lower, infertile areas of the site to the west, although here there is also logging and semi-natural palm oil harvesting (Harvey et al., 2010; Linnarz, 2017).

ERuDeF, supported by the Rainforest Trust USA and a member of BGCI, has been active in promoting conservation at the site and in the wider region, gaining official status for the THWS in 2014 following long consultations and sensitisation efforts. Although MINFOF has supported protection of the forest, it has been difficult to achieve this on the ground. Harvey et al. (2010) report support from local villagers who were said to value the forest but not all villages have apparently been easily convinced of the merits of the sanctuary despite consultation or because of perceived failings in this process, or simply due to the lack of alternatives for sustaining livelihoods (Nkemngu, 2017).

Linnarz (2017) reports that the southern part of the THWS has little natural forest remaining and that the northern part is also considerably encroached. The gorilla population for which the sanctuary was primarily established was reported to be severely diminished, with gorillas confined to a central 6.5 km patch and only 2–4 gorillas estimated to be remaining from observed evidence of nesting (Linnarz, 2017). Numerous signs of shooting and snaring for bushmeat were found, and farming activity was found even in the most remote parts of the forest. In 2013 in Pinyin village, a group of angry villagers killed a silverback gorilla, demonstrating that at least some local people remained unconvinced of the merit of wildlife conservation (Nkembe & Leke, 2013). Drills and elephants have also diminished but 300 chimpanzees are still known to persist in the forest and may remain the best hope for preserving the vegetation on which they depend (Nkemngu, 2017).

ERuDeF's ambitious projects to establish a Mone forest corridor and to protect the much larger Lebialem-Mone forest landscape bode well for the conservation of viable populations of threatened plants which, like the primates, risk being cut off from other populations. Local awareness of the importance of the forest in protecting against soil erosion has also helped drive local conservation action such as tree-planting. Subsequent to THWS being officially recognised, ERuDeF has been involved in consultation and drafting of a management plan, forest restoration and creation of habitat corridors linking the site to other remaining habitat. The separatist conflict which began in 2016 and has been active in the Lebialem area has interrupted conservation efforts but may also have slowed habitat loss in the forest.

**Forest near Bechati.**
Photograph X. van der Burgt, September 2006.

## Key ecosystem services

Because of the steep gradient, the forest at THWS plays a vital role in preventing soil erosion, landslides and silting of water supply, problems which are particularly serious in this area when farmers resort to such slopes. The retention of these forest soils, as well as the above-ground biomass, is also of importance to the continued sequestration of $CO_2$. The site is surrounded by ten villages which utilise (and probably overexploit) the forest for wood, timber and non-timber resources such as medicines, food and bushmeat (Nkemngu, 2017). The exceptionally rare and Critically Endangered *Ternstroemia cameroonensis* is a medicinal plant which may have its sole remaining population a little outside the site boundary, higher up the mountain (Cheek et al., 2017a). The forest also supports severely threatened primates such as the Critically Endangered Cross-river gorilla (*Gorilla gorilla diehli*), the Nigeria-Cameroon chimpanzee (*Pan trogylodites ellioti*) and drill (*Mandrillus leucophaeus*) as well as forest elephants (*Loxodonta cyclotis*) and birds such as grey-necked rock fowl (*Picarthates oreas*) and Bannerman's turaco (*Touraco bannermani*). Through the work of ERuDeF and its UK partner the Cross River Gorilla Project with their 'Gorilla Club' project, the forest also helps supports environmental education activities both in Cameroon and the UK (CRGP, 2021).

## Ecosystem service categories

**Provisioning** – Food

**Provisioning** – Raw materials

**Provisioning** – Fresh water

**Provisioning** – Medicinal resources

**Regulating** – Moderation of extreme events

**Regulating** – Erosion prevention and maintenance of soil fertility

**Cultural** – Tourism

**Cultural** – Education

**Cultural** – Cultural heritage

## IPA assessment rationale

Although a relatively small site, Tofala Hills Wildlife Sanctuary qualifies as an IPA under criterion A(i) through the recorded presence of over 40 globally threatened plant species. It is also close to meeting the threshold under criterion B(ii). The steep west-facing submontane forest is rare in this region and therefore the site might also qualify under criterion C.

### Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax hierniana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens letouzeyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia adpressa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia pseudoviola* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Leptonychia kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | ✓ | | | |
| Celastraceae | *Salacia lebrunii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastracea | *Salacia lehmbachii* var. *pes-ranulae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Magnistipula conrauana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Allanblackia gabonensis* | VU | A(i) | | ✓ | | ✓ | |
| Clusiaceae | *Garcinia kola* | VU | | | | | | |
| Commelinaceae | *Aneilema silvaticum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | | A(i) | | ✓ | ✓ | | |
| Gentianaceae | *Anthocleista scandens* | VU | A(i) | | ✓ | | ✓ | |
| Gramineae | *Eragrostis camerunensis* | VU | A(i) | | ✓ | | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Icacinaceae | *Pyrenacantha longirostrata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Coleus insignis* | | | B(ii) | | | | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum geophylax* | | | B(ii) | | | | |
| Melastomataceae | *Cincinnobotrys letouzeyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Dissotis bamendae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Heckeldora ledermannii* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Myrsinaceae | *Ardisia bamendae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | | | |
| Orchidaceae | *Bulbophyllum nigericum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya bicalcarata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Pentaphylaceae | *Ternstroemia cameroonensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Panicum acrotrichum* | VU | A(i) | | ✓ | | ✓ | |
| Rosaceae | *Prunus africana* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Coffea montekupensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Kupeantha fosimondi* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta hookeriana* | VU | A(i) | B(ii) | ✓ | | | |
| Rubiaceae | *Psychotria cheekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea xanthotricha* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia elmar* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Trichostachys petiolata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | | ✓ | |
| Sapindaceae | *Allophylus conraui* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | | | | | | |
| Scrophulariaceae | *Rhabdotosperma densifolia* | VU | A(i) | | ✓ | ✓ | | |
| Simaroubaceae | *Hannoa ferruginea* | VU | A(i) | | ✓ | ✓ | | |
| Urticaceae | *Myrianthus fosi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| IV: Wildlife Sanctuary | Tofala Hill Wildlife Sanctuary | Protected/conservation area matches IPA |

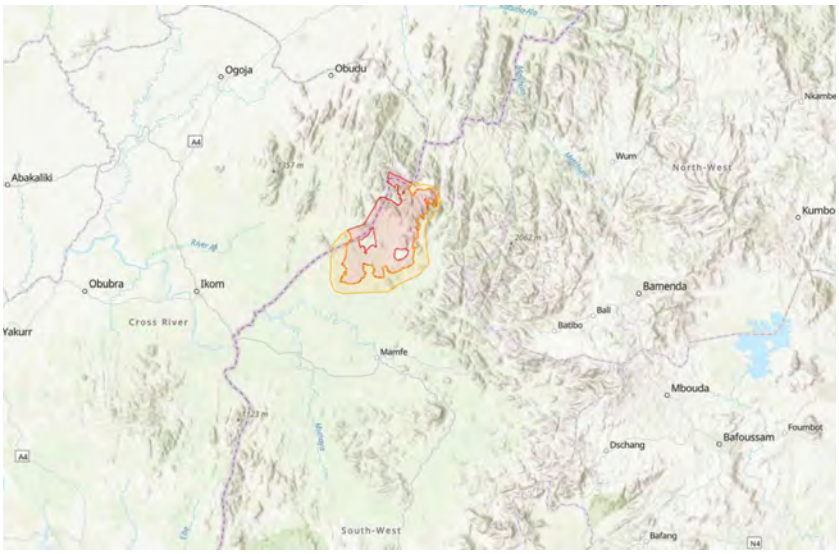
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – trend unknown |
| Mining and quarrying | Low | Past, likely to return |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |

## IPA

# Takamanda National Park

**International site name:** Takamanda National Park
**Site code:** CMNTIPA051
**Administrative region:** Southwest
**Assessed by:** Bruce Murphy, Jean Michel Onana, Terry Sunderland




**Latitude** (decimal degrees): 6.16000
**Altitude minimum:** 100
**Area** (km²): 1,000
**Longitude** (decimal degrees): 9.34000
**Altitude maximum:** 1,710
**IPA criteria met:** A(i)

## Site description

Takamanda was first gazetted in 1934 by the British colonial administration as a forest reserve to protect timber stocks and watersheds (Sunderland-Groves et al., 2003). It was upgraded to a national park in 2008, primarily due to the population of Cross-river gorillas (*Gorilla gorilla* ssp. *diehli*), and is administered through MINEF's Manyu division office in Mamfe. The park covers 67,599 ha but a buffer zone of around 2–5 km width surrounds most of the site, bringing the overall area demarcated here to around 1,000 km². Two large island enclaves around the villages of Kekpane and Obonyi 1 and Obonyi 3 are excluded from the national park. A further enclave around Matene is cut out of the boundary in the north-east, adjacent to the Nigerian border, and there is a further small enclave to the west of this.

Around 15,000 people have been estimated to live in the 43 villages within and surrounding the park, with the Anyang ethnic group predominant (Sunderland-Groves et al., 2003). Language, ethnicity and trade links the people closely to Nigerian villages across the border. The site has been historically isolated and difficult to access. A road from Mamfe to Akwaya has begun to change this, although it remains incomplete after more than 20 years.

## Botanical significance

Although Letouzey made some collections between Akwaya and Mamfe at the eastern perimeter of the site, Takamanda had received almost no botanical investigation until Duncan Thomas, Charles Doumenge, Benoit Satabie and colleagues made over 400 collections in 1987. A botanical study was produced for WWF by Etuge in 1998, which was followed by thorough vegetation surveys in 2000–2001 as a contribution to a biodiversity assessment of the site (Sunderland et al., 2003; Sunderland-Groves et al., 2003). These found the site to be exceptionally diverse, partly owing to the wide altitudinal range of intact forest. Intriguingly, the results also suggested the site had greater affinity with more distant forests than with nearer sites (Sunderland et al., 2003). Similarly, some of the species listed here, such as *Pachylobus igangana* and *Prioria balsamifera*, appear uncommon in Cameroon but are frequently recorded further south in Gabon.

The site has a number of globally threatened species, although several of these are timber species that are quite wide-ranging. It is likely that the site has still received too little botanical attention to reveal many of its rarer or endemic taxa. In particular, the attention of Orchidaceae and Rubiaceae experts would likely

increase the number of threatened species. However, the following taxa are notable: *Begonia stellata* (CR) is a site endemic with a single record near the village of Mbilishe (Sosef, 1994; Cheek, 2015c); *Talbotiella bakossiensis* (CR) has only otherwise been recorded from three other locations in Rumpi Hills and Kupe-Bakossi area; *Liparis goodyeroides* (CR) is one of rather few threatened orchids recorded; *Ardisia schlechteri* (CR) has been recorded and although the identification is unlikely the collection may still represent a different rare species of this difficult genus; *Xylopia monticola* (VU) was newly described recently (Johnson & Murray, 2018) and the Takamanda collections (Thomas et al., 4558, 7400) represent the most recent and only Cameroon records of the species, which is otherwise known only from eastern Nigeria; *Brachystegia kennedyi* (VU) has a similar distribution, only being known in Cameroon from a single plot record by Sunderland et al. (2003).

Several important taxa have been recorded from just outside the site, either in Nigeria in the Cross River National Park or between the eastern buffer zone and Mawne River Forest area. These include *Rhipidoglossum ochyrae* (EN), *Brachystephanus longiflorus* (VU), *Jollydora glandulosa* (VU), *Pyrenacantha longirostrata* (VU), *Pseudosabicea pedicellata* (VU) *Deinbollia maxima* (VU) and *Mussaenda epiphytica* (VU). The latter was described as common at the Obudu Cattle Ranch just over the border. *Tiliacora lehmbachii* (VU) is included in the checklist by Sunderland et al. (2003) but not in their provided records.

## Habitat and geology

The terrain varies between the rolling lowland forest of the south (100–400 m) and rugged mountains rising to 1,700 m in the north. The area is underlain by mainly metamorphic basement-complex rocks (gneiss, schist and quartzite), with overlying sediments giving rise to ferite, sedimentary and, in the south, alluvial soils (Sunderland-Groves et al., 2003). Ancient plutonic rocks are indicated along the Nigerian border (Thiéblemont et al., 2021).

Rivers flow predominantly southwards from the northern highlands of the reserve to ultimately join the Cross river. The Makone river flows south-west, meets the Manyu from the east and then joins the Munaya south of the national park. The Matene rises in the far north of the park before flowing east towards Mbilishe and Akwa to also join the Munaya. The Magbe flows east from Matene area into Nigeria (where it is known as the Oyi) and returns in the south to form part of the western boundary of the park before flowing into the Mamfe river.

There are no weather stations close to the national park and there is likely to be considerable variation from north to south, but the climate is essentially of the tropical monsoon type (Koppen Aw), with a single dry season from November to February. At Mamfe (126 m) to the south, Ikom (53 m) to the south-west, and Gakem (165 m) to the north-east, annual mean precipitation is 1,849, 2,583 and 1,966 mm respectively, with an average temperature of 25–26.5 °C (Weatherbase, 2022). At higher altitude (1,055 m) Wum, 60 km to the north-east, has 2,154 mm rain per year and an average temperature of 21 °C. Precipitation peaks in September (411 mm at Ikom), while at Mamfe there is <10 mm in December and January.

Most of the area is mapped by Letouzey (1982) as vegetation type 203, Guineo-Congolian North-Western Atlantic forest with few 'Caesalpinoideae' (now Detarioideae). In the north, submontane forest (117), alpine and savanna types are also present. Sunderland et al. (2003) discuss five different types of habitat: lowland forest, lowland ridge forest, mid-elevation forest, montane forest and high altitude grassland. The lowland forest which dominates the south is fairly homogenous, with *Afrostyrax*

**Takamanda Forest edge near Mbilishi.**
Photograph © T. Sunderland.

**High altitude grassland at Obudu, western border of Takamanda. Trees give way to grassland at about 1,500 m at Takamanda, lower than other sites in Cameroon.**
Photograph © T. Sunderland.

*kamerunensis* very abundant, while Irvingiaceae, Olacaceae, *Diospyros, Alstonia* and *Cylicodiscus* are also important taxa. However, large areas of this lowland forest are seasonally inundated, resulting in a distinct vegetation. The lowland ridge forest, with more frequent 'Caesalpinioideae' is also notably diverse and significant, with many large remaining trees forming a Cathedral-like structure with a sparse understory. Mid-elevation and montane forest are predictably less diverse but considered equally important because their species are more likely to be threatened. The grassland zone is noted to start at lower altitude (1,500 m) than at some other sites (Sunderland et al., 2003).

## Conservation issues

Although still relatively intact when assessed by Sunderland et al. (2003) and Slayback (2003), there were already indications of increased forest clearance around villages and particularly surrounding the site since the opening of the bridge at Mamfe in the late 1980s and the building of various unpaved roads and logging tracks. However, in the subsequent two decades the Mamfe-Akwaya road has remained uncompleted. The site has been upgraded to a national park and levels of forest loss appear relatively low, with 221 ha (0.4%) of humid primary forest reported lost between 2001 and 2020 (University of Maryland and WRI, 2022). Significant areas have been cleared in the north, around the enclosures and in the buffer zone. Loss of fertility in cultivated land continues to drive additional forest clearance (Unah, 2020).

The ongoing conflict in the region threatens the forest and also means there is little up-to-date information on the current condition of the site. Conservation work is stalled and there is great concern over likely disturbance and poaching of megafauna (Sunday, 2021). The vegetation may be less directly threatened but there are reports of refugees resorting to logging for income on the Nigerian side, while those hiding in forests may also be clearing fresh land for cultivation (Sunday, 2021). Furthermore, the elimination of charismatic wildlife would greatly diminish the chances of successfully protecting the remaining 'empty forest' (Redford, 1992), and the loss of megafaunal seed dispersers is possibly a latent catastrophe for some forest plant species.

The site borders the Cross River National Park and KBA, benefitting from an enlarged conservation zone and cross border cooperation; there is an aspiration for joint UNESCO World Heritage Site status (Sunday, 2021). Conservation agencies are supported by European funding. On the Cameroon

**Takamanda National Park.**
Photograph © T. Sunderland.

side, the site is part of a large Mone River Landscape scheme that includes Kagwene, Mawne River and Ejgham reserves, but there is a danger of these sites becoming disconnected (WCS Cameroon, 2021).

## Key ecosystem services

The forest is an important source of non-timber forest products as well as timber trees, Sunderland (2003).

Takamanda is part of a REDD/REDD+ pilot scheme designed to fund preservation of carbon sequestering forests (Burren et al., 2011; Ndobe & Mantzel, 2014).

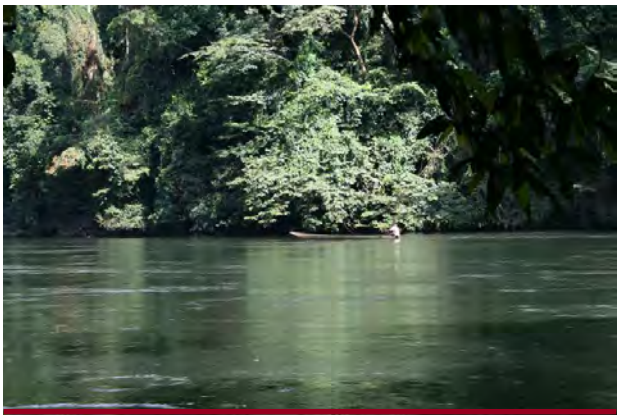
The northern part of the forest has particular importance for watershed protection and is designated a fragile ecological zone (Ndobe & Mantzel, 2014).

## Ecosystem service categories

**Provisioning** – Food
**Provisioning** – Raw materials
**Provisioning** – Fresh water
**Provisioning** – Medicinal resources
**Regulating** – Carbon sequestration and storage
**Habitat or supporting services** – Habitats for species

## IPA assessment rationale

Takamanda National Park qualifies as an IPA under criterion A(i) through numerous globally threatened species with significant populations at the site. It would also likely qualify under criterion C through its particularly rich lowland forest habitat and possibly under B(iii) as it appears to contain a high number of timber and other useful species.



**Lowland rainforest in Takamanda National Park. This habitat appears more diverse and less dominated by Detarioid tree species than at other sites such as Korup.**
Photograph © T. Sunderland.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | ✓ | | |
| Ancistrocladaceae | *Ancistrocladus le-testui* | VU | A(i) | | ✓ | | | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | | | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | ✓ | | |
| Annonaceae | *Uvariopsis vanderystii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | | | |
| Anopyxis | *Anopyxis klaineana* | VU | A(i) | | | ✓ | ✓ | |
| Begoniaceae | *Begonia stellata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Boraginaceae | *Cordia platythyrsa* | VU | A(i) | | | | ✓ | |
| Burseraceae | *Pachylobus igaganga* | VU | A(i) | | | ✓ | ✓ | |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | ✓ | | | |
| Celastraceae | *Salacia volubilis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia afzelii* | | A(i) | | | | ✓ | |
| Clusiaceae | *Garcinia kola* | VU | | | | | | |
| Detarioideae | *Afzelia africana* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Afzelia bipindensis* | VU | | | | | | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | ✓ | | |
| Detarioideae | *Brachystegia kennedyi* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | | | |
| Detarioideae | *Prioria balsamifera* | EN | A(i) | | | | ✓ | |
| Detarioideae | *Talbotiella bakossiensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | | | | | | |
| Euphorbiaceae | *Grossera major* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | | | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | | | ✓ | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | ✓ | | | |
| Melastomataceae | *Memecylon mamfeanum* | | | B(ii) | | | | |
| Meliaceae | *Leplaea cedrata* | VU | | | | | | |
| Meliaceae | *Leplaea thompsonii* | VU | | | | | | |
| Menispermaceae | *Tiliacora lehmbachii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Ochnaceae | *Lophira alata* | VU | | | | | | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | ✓ | | | |
| Orchidaceae | *Liparis goodyeroides* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum ochyrae* | EN | A(i) | B(ii) | | | | |
| Putranjivaceae | *Drypetes preussii* | VU | A(i) | | ✓ | | | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | | | |
| Rhizophoraceae | *Xylopia monticola* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Gaertnera letouzeyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha arcuata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | B(ii) | ✓ | | | |
| Rutaceae | *Vepris trifoliolata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Pterygota macrocarpa* | VU | | | | | | |
| Zingiberaceae | *Aframomum plicatum* | VU | A(i) | B(ii) | ✓ | ✓ | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Takamanda National Park | Protected/conservation area matches IPA |
| Key Biodiversity Area | Cross River National Park | Protected/conservation area is adjacent to IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Ongoing – increasing |
| Small-holder grazing, ranching or farming | unknown | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Increase in fire frequency/intensity | Medium | Ongoing – trend unknown |
| War, civil unrest and military exercises | High | Ongoing – trend unknown |

# Northwest Region

Reforestation with native species at Dom Community Forest, Northwest Region.
Photograph © ANCO.

## IPA

# Bali Ngemba Forest Reserve

**International site name:** Bali Ngemba Forest Reserve
**Site code:** CMNTIPA004
**Administrative region:** Northwest
**Assessed by:** Bruce Murphy, Martin Cheek, Kenneth Tah, Moses Njoya

**Latitude** (decimal degrees)**:** 5.82434
**Altitude minimum:** 1,300
**Area** (km²)**:** 22.5
**Longitude** (decimal degrees)**:** 10.09582
**Altitude maximum:** 2,200
**IPA criteria met:** A(i)

## Site description

The Bali Ngemba Forest Reserve is a small but extremely important patch of remaining forest in the Bamenda Highlands of Northwest Region, Cameroon. The Bamenda Highlands, part of the Cameroon Highlands which extend north from Bioko and Mt Cameroon following a geological fault line, are an upland area of high rainfall that was previously heavily forested but has been extensively converted to grassland and savannah. It is estimated that over 95% of original forest area of the Bamenda Highlands above 1,500 m has been lost (Cheek et al., 2000a).

The site is located on a scarp slope around 15 km south-west of the city of Bamenda (the third largest city in Cameroon) and 10 km south-east from the town of Bali. It is directly accessed by vehicular road from the village of Mantum, probably the main base for small-scale logging. Baba II lies to the north-east and Pinyin to the south. The latter is likely the base for cocoyam farming and other agriculture within the reserve (Harvey et al., 2004). The Baba II community forest and connecting territory are included here in addition to the Bali Ngemba Forest Reserve itself. Covering an altitudinal range from 1,300–2,200 m, the site contains submontane closed-canopy forest (with often degraded understory vegetation), heavily degraded montane forest, montane scrub and grassland, grassy inselberg areas, a Eucalyptus plantation and derived savanna and farm-fallow.

## Botanical significance

The significance of this small, imperfectly preserved fragment of forest is mainly in relation to the deforestation that has occurred in the rest of the Bamenda Highlands, formerly one of the richest plant areas in tropical Africa. In particular, Bali Ngemba is unique in preserving primary (albeit degraded) vegetation over a continuous altitudinal range from c. 1,300 m to over 2,000 m. While larger protected areas exist in the Bamenda Highlands for montane forest above 2,000 m (e.g. Kilum-Ijim), Bali Ngemba represents the largest and only officially protected block of submontane forest remaining (Harvey et al., 2004).

Prior to surveys from 2000 onwards by teams associated with RBG Kew and Herbier National du Cameroun, culminating in the 2004 Conservation Checklist (Harvey et al., 2004), Bali Ngemba was almost unknown to botanical science, having been neglected by the main collectors in the region. The bulk of pre-21st-century collecting, c. 50 specimens,

was performed by the Nigerian Ujor in 1951, including three specimens which 50 years later have been published as new species: *Allophylus ujori* (EN), *Vepris bali* (CR) and *Deinbollia oreophila*. Two of these are globally threatened, with *Vepris bali* likely extinct having not been seen since it was collected, despite targeted searches from 2001–2004. *Deinbollia oreophila* was provisionally assessed as Vulnerable by Cheek & Etuge (2009) but new records suggest it may no longer qualify as threatened, being found to be frequent and widespread. Another feared lost species, *Newtonia cameroonensis* (CR), has been successfully rediscovered at Bali Ngemba and used for forest restoration projects (Cheek et al., 2010).

The surveys carried out between 2000 and 2004 over four expeditions led to Harvey et al. (2004) listing 12 taxa as strictly endemic to Bali Ngemba, plus another 11 near-endemic taxa and 39 threatened Red Data species. Several of these taxa were unpublished at the time and some remain so. However, c. 50 threatened taxa are now recorded from the site (not all listed here), with seven of these endemic or near endemic, including *Allophylus ujori* (EN), *Vepris bali* (CR), *Polystachya anthoceros* (EN), *Clutia kamerunica* (EN), *Leptonychia kamerunensis* (VU) and *Magnistipula butayei* subsp. *balingembaensis* (provisionally CR, Onana & Cheek, 2010).

## Habitat and geology

The following is taken from Cheek's summary in Harvey et al. (2004):

> Bali Ngemba Forest Reserve is positioned facing west in a concave part of the steep scarp slope that connects the High Lava Plateau (1,500–2,100 m alt.) of the Bamenda Highlands with the low lava surface (900–1,200 m alt.) on which the former appears to rest (Hawkins & Brunt, 1965). These basalts and trachytes are of ancient volcanic origin (Courade, 1974). The Bamenda Highlands themselves are the most extensive of the mountainous areas, usually known as the Cameroon Highlands, that begin with the Atlantic Ocean islands of São Tomé, Príncipe, Annobon and Bioko and proceed NE in a band 50–100 km wide. These mountains have their origin in a geological fault and are formed largely of igneous material. Three main periods of volcanic activity and one of plutonic uplift have been reviewed by Courade (1974). The Bamenda Highlands were largely formed in the Tertiary, in the second of the three main periods of volcanic activity 'the middle white series'. Courade (1974) classifies the soils in the area of Bali as being ancient, ferralitic, and of volcanic origin, being of medium fertility (3rd class out of 4 possible classes). Tye (1986) refers to soils in the Bamenda Highlands area as being 'clayey', resulting in more permanent streams than some of the mountain areas of more recent origin in the Cameroon Highlands, such as Mt Kupe and Mwanenguba.
>
> Courade's (1974) rainfall map shows the area in which Bali Ngemba falls being somewhere between the 1 m and 2 m isohyets. However, rainfall data for a meteorological station at Bali, only 5 km W and at the same altitude as the lower part of Bali Ngemba (1,300 m alt.) gives an annual total of c. 2.25 m (Hawkins & Brunt, 1965). Most of this falls in the single long wet season in March–October inclusive, when 20 cm or more falls in each month, only 3–9 cm falling in each of the months from Nov. to Feb. when average max. monthly temperatures are 26.7°–27 °C, the coolest months being 21.8 °C and 22.6 °C. Average minimum monthly temperatures range from 11.1 °C to 14.4 °C. Temperatures at Bali and at Bali Ngemba are partly depressed by temperature inversion, cold air draining off the high lava plateau (Hawkins & Brunt, 1965).

As mentioned, Bali Ngemba contains a transition beginning at 1,300 m with submontane forest and extending through montane forest, scrub and grassland up to 2,200 m (Harvey et al., 2004). The submontane forest from 1,300–1,700 m is characterised by a

**Bali-Ngemba F.R. view from the forest looking north.**
Photograph © B. Pollard.

notable abundance of the large, deciduous canopy trees, *Pterygota mildbraedii*. Montane forest (1,900 m upwards) is rare and poorly surveyed, with forest cover lost to farming but apparently little evidence of *Sporobolus* grassland which typically succeeds degraded montane forest (Letouzey, 1985). *Podocarpus milanjianus* was collected in 1951 but has not recently been recorded since (Harvey et al., 2004). Scrub and grassland, which is considered partly natural, and a non-forest 'saxicole' grassland, vegetation also occurs at lower altitude on inselberg areas (Letouzey, 1985; Harvey et al., 2004). There are also areas of derived scrubland, farm fallow and *Eucalyptus* plantation.

## Conservation issues

Although the origins of the Bali Ngemba Forest Reserve are unclear and no official maps have been seen, it is thought to be a production reserve, gazetted for the commercial exploitation of timber probably sometime during the British mandate period (Harvey et al., 2004). Therefore, it has only limited protection and the survival of the forest in any form is probably largely due to the steep slopes, the use of the canopy trees for growing shade crops such as cocoyams, and other value to the local community.

As a forest reserve, there appears to be little tribal tradition protecting the forest as is the case elsewhere such as at Mt Kupe or Oku, nor the same community concern to protect water resources as there is at Dom (Harvey et al., 2004; Cheek et al., 2010). The forest is isolated and surrounded by farmland (largely *Coffea arabica*) which encroaches on all sides except the steepest sloping parts (BirdLife International, 2001f). There is a large *Eucalyptus* plantation within the reserve and small-scale logging continues; the vegetation understorey has been largely cleared for cultivation and the canopy forest has been mostly replaced by grass and shrubland above 2,000 m (Harvey et al. 2004). The site also lies within an area approved for quarrying exploration (MINFOF & WRI, 2021).

According to BirdLife International (2001f), the government forest agency (ONADEF) had recently become actively involved in the management of the reserve at that time, including creation of conservation areas and reforestation along watercourses. However, it is not known what became of these initiatives and Harvey et al., (2004) reported alarming levels of forest degradation over the period of their surveys between 2000–2004. The charity ANCO has been active in the area and is currently investigating the possibility of reforesting a corridor connecting the Baba 2 forest with the nearby Santa Mbei community forest. There is reportedly good community support for such reforestation (M. Njoya 2021, pers. comm., 23 September).

Despite repeated surveys of the small area, some species such as *Vepris bali* and *Podocarpus milanjianus* have not yet been rediscovered at the site after initially being collected and described in the early 1950s. Similarly, while BirdLife International (2001f) mentioned reports of Preuss's monkey (*Cercopithecus preussi*, EN) surviving at the site, it is not known if they still occur.

## Key ecosystem services

Plants within the reserve serve a variety of uses to the local community, including as timber, fuel, medicines and food.

The forest is also an Important Bird Area (BirdLife International, 2001f) and supports a variety of threatened bird species including *Tauraco bannermani* (EN), *Platysteira laticincta* (EN), *Malaconotus gladiator* (VU) and Phylloscopus herberti, as well as still possibly providing habitat for *Cercopithecus preussi* (EN). There is potential for ecotourism and educational activities (BirdLife International, 2001f), especially given the deforestation that has occurred to the rest of the Bamenda Highlands and the uniqueness of the forest altitudinal range preserved here.

Land within the reserve presumably drains into the Alatening river which serves the city of Bamenda, while the forest also helps prevent erosion of soils on the steep scarp slope as well as landslides, which are a serious concern along the Cameroon Volcanic Line (Mukenga et al., 2016).

***Eriocaulon asterioides*** **at Bali Ngemba. This pipewort species is restricted to threatened high-altitude basalt pavement habitats in the Bamenda Highlands and Mambilla plateau of Nigeria.**
Photograph © B. Pollard.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

The Bali Ngemba Forest Reserve qualifies as an IPA under criterion A(i) through occurrence of around 40 globally threatened taxa with nationally or globally significant populations. Several of these taxa have been collected in Cameroon only in the Bamenda Highlands, and Bali Ngemba is often the only site – or one of very few – where they may survive, especially for those occurring below 2,000m. Many of these taxa have also been collected in the past in Nigeria, often from the Mambilla Plateau, although there are few recent records and those populations have likely suffered extensive habitat loss also. Several other endemic or range-restricted taxa included by Harvey et al. (2004) have not been included here as they are still to be described.

Given the >95% loss of forest over 1,500 m in the Bamenda Highlands reported by Harvey et al. (2004) and the uniqueness of Bali Ngemba as a surviving remnant of submontane forest in the sub-1,900 (2,000) m zone – a vegetation type included in Letouzey's (1985) vegetation map as mapping unit 117 – the site is likely to qualify under also IPA criterion C.

***Lobelia columnaris*** **(VU). A montane species growing at 2,000–2,220 m asl.**

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | | ✓ | |
| Apocynaceae | *Epistemma decurrens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Pentarrhinum ledermannii* | VU | A(i) | | | | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | | | ✓ | |
| Asteraceae | *Crassocephalum bauchiense* | VU | A(i) | | ✓ | | | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | | ✓ | |
| Byttnerioideae | *Leptonychia kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Caesalpinioideae | *Newtonia camerunensis* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Campanulaceae | *Wahlenbergia ramosissima subsp. ramosissima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | | | ✓ | |
| Chrysobalanaceae | *Magnistipula butayei* subsp. *balingembaensis* | CR | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Clusiaceae | *Allanblackia gabonensis* | VU | A(i) | | ✓ | | ✓ | |
| Cyperaceae | *Bulbostylis densa* var. *cameroonensis* | VU | A(i) | | ✓ | | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Cyperaceae | *Scleria afroreflexa* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Dombeyoideae | *Dombeya ledermannii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Clutia kamerunica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Aeollanthus trifidus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Dissotis bamendae* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Melastomataceae | *Memecylon dasyanthum* | VU | A(i) | | | | ✓ | |
| Myrtaceae | *Eugenia gilgii* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Orchidaceae | *Bulbophyllum gravidum* | VU | A(i) | | | | ✓ | |
| Orchidaceae | *Bulbophyllum nigericum* | VU | A(i) | | ✓ | | ✓ | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | | | ✓ | |
| Orchidaceae | *Polystachya anthoceros* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Crotalaria ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Pavetta hookeriana* | VU | A(i) | B(ii) | | | ✓ | |
| Rubiaceae | *Phyllopentas ledermannii* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Psychotria moseskemei* | CR | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Tricalysia elmar* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris bali* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rutaceae | *Vepris onanae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Salicaceae | *Dovyalis cameroonensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Salicaceae | *Oncoba lophocarpa* | VU | A(i) | B(ii) | | | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus ujori* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia onanae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Scrophulariaceae | *Rhabdotosperma densifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Scrophulariaceae | *Rhabdotosperma ledermannii* | VU | A(i) | | ✓ | | ✓ | |
| Simaroubaceae | *Hannoa ferruginea* | VU | A(i) | | | | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (Production) | Bali Ngemba Forest Reserve | protected/conservation area matches IPA |
| Important Bird Area | Bali-Ngemba Forest Reserve | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | High | Ongoing – trend unknown |
| Logging & wood harvesting | Medium | Ongoing – trend unknown |

## IPA

# Dom Community Forest

**International site name:** Dom Community Forest
**Site code:** CMNTIPA006
**Administrative region:** Northwest
**Assessed by:** Bruce Murphy, Martin Cheek, Kenneth Tah, Moses Njoya

**Latitude** (decimal degrees)**:** 6.35472
**Altitude minimum:** 1,400
**Area** (km²)**:** 4.5
**Longitude** (decimal degrees)**:** 10.59889
**Altitude maximum:** 2,400
**IPA criteria met:** A(i)

## Site description

The proposed IPA site at Dom, Northwest Region, Cameroon, consists of three community forest patches totalling 452.7 ha of largely intact, mainly submontane forest between approximately 1,450 and 2,200 m asl. These patches are located within the remains of a larger forest in the Kejojang mountains, itself part of the Bamenda Highlands. The latter in turn are geologically part of the Cameroon Highlands, a chain of volcanic prominences stretching from the Atlantic islands of Annobon, São Tomé, Príncipe, and Bioko northward to Mt Cameroon, Mt Kupe, Mt Oku and beyond.

While the Bamenda Highlands and the Kejojang forest in particular have been extensively deforested, in part very recently, further valuable forest likely remains in the Kejojang mountains, particularly to the north-east of Dom Community Forest (Cheek et al., 2000a, 2010; Harvey et al., 2004; Baena et al., 2010). The latter are connected and encompassed by a wider zone of less intact vegetation where efforts at reforestation of interstitial corridors has been attempted by local people with the assistance of Bamenda-based NGO Apiculture and Nature Conservation Organisation (ANCO) (Cheek et al., 2010). Some of the threatened taxa listed here are known from such areas, especially that around Kejojang rock, and the proposed IPA area therefore incorporates a wider area than the community forests strictly defined. Further extension north-east to the forest associated with the village of Mbinon might also be warranted.

Dom is located in Noni subdivision, north-west of Kumbo. The administrative centre of Noni is at Nkor, where the divisional officer is based. The community of Dom consists of six settlements: Mbam, Nkale, Sanghere, Chaw, Nsusi and Kifume. The latter settlement (at c. 6°21'33'N, 10°35'34'E) is home to the Fon of Dom and was the base for the surveys which resulted in the data listed here. The three forest patches, from south to north, are Kowi, Nvui (Sagnere) and Nsusi (Sousi).

## Botanical significance

Despite the complete lack of botanical surveying and specimen collecting by scientists at Dom prior to the surveys performed at the instigation of ANCO by the HNC/RBG Kew team between 2005 and 2006, Dom is a rare and important remnant of montane and particularly submontane forest in the now largely denuded Bamenda Highlands. The latter, historically probably one of the most species-rich areas in tropical Africa, has experienced approximately 93% loss of forest above 1,500m (Harvey et al., 2004). In the more immediate

**The Kowi forest patch at Dom in the wet season, 2006.**
Photograph M. Cheek.

vicinity of Dom, the Kejodsang forest area is calculated to have been reduced by 50% from 2,247 ha to 1,242 ha between 1988 and 2003 (Cheek et al., 2010).

Twenty-six IUCN globally threatened species (plus three provisionally assessed as threatened) have been recorded from Dom in the very limited surveying that has taken place over three field expeditions and subsequent work by local collaborators (the montane forest element in particular has been very inadequately surveyed). Nine of these taxa are CR. Particularly notable are *Ardisia dom* (Cheek, 2010; Cheek, 2017b) and *Coleochlola domensis*, the only fully epiphytic Cyperaceae globally (Musaya et al., 2010; Cheek et al., 2017c) which are both believed to be endemic to the site. Six other threatened species are national endemics, while many others, such as *Dombeya ledermanni* (VU), *Oxyanthus okuensis* (CR) and *Psychotria moseskemei* (CR), are recorded only from the Bamenda Highlands or adjacent areas in Nigeria, such as the Mambilla plateau (Cheek et al., 2010).

Many species found at Dom have not been seen for decades at other recorded sites that have often suffered major forest loss. For example, *Antidesma pachybotryum* (CR, Lovell & Cheek, 2020b) has not been seen for 50 years except for its rediscovery at Dom, while *Newtonia cameroonensis* (CR), an important timber species believed to be lost at its historically recorded sites, was rediscovered at Bali Ngemba and Laikom and then found to be most abundant at Dom (Cheek et al., 2010).

The only relatively well protected area in the Bamenda Highlands is Kilum Ijim, and there only above 2,000 m (Cheek et al., 2000a). Only at Bali Ngemba is there otherwise some (limited) protection for submontane forest below 2,000 m (Harvey et al., 2004). However, it is notable that there are major differences in the suite of species at Dom compared with the apparently similar forest at Bali-Ngemba, likely due to species reaching their northern or southern latitudinal ranges. Dom's CR *Antidesma pachybotryum* (Euphorbiaceae) is one notable example of a species not found at Bali Ngemba.

## Habitat and geology

The forest at Dom is located above a steep escarpment that forms the boundary between a 'high lava plateau' of former montane forest, now largely derived grassland, and a lower lava surface, now vegetated mainly with savannah and shrub (Cheek et al., 2010). The high plateau continues to rise to the east and the site has a predominantly west-facing slope.

Dom is part of the Bamenda Highlands which is the largest part of the Cameroon Highlands, a series of mountains and hills following a geological fault connecting Bioko, Mt Cameroon, Mt Kupe and Mt Oku to the south and continuing north to the Mambilla plateau of Nigeria before turning eastwards. Although the Bamenda Highlands are apparently formed of Tertiary era basalts and trachytes (Courade, 1974), the Dom area is thought to lie on uplifted and exposed pre-Cambrian basement rock (Courade, 1974; Cheek, 2010). Soils of the Bamenda Highlands are moderately fertile volcanic soils – more clayey than elsewhere – enabling more permanent streams (Tye, 1986).

The site lies on the western side of the mountains and therefore experiences relatively high rainfall, falling largely in a single rainy season between April and October. Although local data is lacking, mean annual

totals from Kilum, Ijim and Bamenda to the south are around 2,200–2,400 mm (Forboseh et al., 2003; World Meteorological Organization, 2020). Mist is common. Mean maximum and minimum temperatures are 20–22 °C and 13–14 °C respectively, with some ground frost possible in narrow valleys at night (Cheek et al., 2010).

## Conservation issues

The submontane forest at Dom is predominantly found within three patches of community forest which are valued by local people and monitored also by ANCO. While community stewardship and the efforts of ANCO have been effective, some areas of cut and burnt forest and cultivation were seen by the surveying teams in 2005–6. Introduced *Coffea arabica* was also being grown in places as an understory crop within the forest. Spread of wildfire from the surrounding grassland and the roaming of grazing cattle are also potential problems, with some reforested areas suffering losses from these (Cheek et al., 2010).

While survival of the Dom forest patches looks promising due to the efforts of the local people and ANCO, the decline of the wider Kejodsam (Kejojang) forest has been rapid. Between 1987 and 1994, Mackay (1994) notes that the forest declined from c. 30 km² to c. 5 km² and a later BirdLife survey reported a further decline to c. 5 ha by 2000. However, since nearly 5 km² remains at Dom, the latter estimate at least was over-pessimistic. Cheek et al. (2010) estimates a 50% decline between 1988 and 2003, with an additional c. 8 km² remaining outside of the Dom enclaves.

The increasing isolation of the Dom forest patches may represent an impediment to the long-term survival of some species and associated wildlife. ANCO has undertaken work to improve or maintain corridors connecting the forest patches with each other and with the rest of the remaining Kejodsam forest (Cheek et al., 2010; pers. comm., K. Tah, 2020). There are also areas of non-native *Eucalyptus* within the Dom area which are being targeted for removal and replanting by the communities. Some important surveyed areas also lie outside of the community forests, including the area around Kejojang Rock, where several rare and threatened species were found. These areas are considered part of the potential IPA zone identified here. Conservation of additional forest area to the north would likely add considerably to the conservation value and long-term resilience of the forest.

Overall, Dom stands as a positive example of the community forest model for conservation and there may be much to learn from it given the high expectations and limited success of this model elsewhere.

**Forest interior at Dom with tree fern *Cyathea manniana*.**
Photograph Y. Harvey, 2006.

**One of the remaining forest patches at Dom.**
Photograph Y. Harvey, 2006.

**Evidence of recent forest clearance at Dom.**
Photograph Y. Harvey, 2006.

Local people raising native seedlings in a community nursery at Dom.

A nursery of native species including Critically Endangered *Newtonia camerunensis*, reared by local people for reintroduction at Dom.

ANCO and local villagers preparing to plant native community-reared seedlings into degraded forest at DOM.

The Fon of Dom planting a native seedling raised in a village nursery.

All photographs © ANCO

Local villagers restoring forest with native tree seedlings reared by the community with the assistance of ANCO.

## Key ecosystem services

The importance of the Dom forest to the local communities is indicated by their decision, taken after extensive consultation, to request the forest patches be given community forest status and by the active participation of local people in the management of the forest through, for example, assigning forest guards, nursing and planting native trees for reforestation and supporting surveys by botanical teams (Cheek et al., 2010).

Ethnobotanical data is limited but many names of plants in the forest have been recorded in the checklist of Cheek et al. (2010) along with their various uses for medicinal, food and other purposes. The forest is an important educational resource for efforts to conserve this traditional knowledge. The ANCO program has also encouraged the forest to be used for educational work targeting environmental study and sustainable agriculture. Rearing of native trees such as Critically Endangered *Newtonia camerunensis* and economically important and over-exploited *Prunus africana* helps create income for local peoples through NGO schemes to buy seedling trees and pay for planting (Mzeka, 2010; Tah, 2010). Sustainable bee-farming has been widely promoted and is also an important source of income.

It would appear that one of the main factors that spurred the local efforts to conserve the forest was an awareness of the impact of deforestation on local water supplies in the dry season. The divisional officer in Nkor was approached for assistance by representatives of 300 local women after land conversion in the north led to pipe silting and loss of dry season supply (Harvey, 2010). The six settlements at Dom are all dependent on the forest watershed and it should be noted that the local Noni word for the larger forest area, '*Kejojang*', means 'gives rain'.

***Dombeya ledermannii*** **(CR), a submontane-montane tree species.**
Photograph Y. Harvey, 2006.

## Ecosystem service categories

**Provisioning –** Fresh water
**Provisioning –** Medicinal resources
**Regulating –** Pollination
**Cultural –** Education
**Cultural –** Cultural heritage

## IPA assessment rationale

The Dom Community Forest meets the criteria for an IPA primarily through the presence of several globally threatened species with globally or nationally significant populations. In particular, *Ardisia dom* and *Coleochlola domensis*, both CR, are believed to be globally endemic to the forest. The largest population of *Newtonia camerunensis* (CR) globally also appears to be at Dom. In total, 25 globally threatened species (including nine CR) have been recorded from the site, 23 of which qualify under IPA criterion A(i).

The site, along with Bali Ngemba, would also very likely qualify under criterion C as a threatened habitat because of its rarity as a remaining piece of submontane Bamenda Highlands forest, since the latter have been almost comprehensively deforested within this altitudinal zone.

***Lobelia columnaris*** **(VU), a montane forest-edge species.**
Photograph Y. Harvey, 2006.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Apocynaceae | *Epistemma decurrens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | ✓ | | | |
| Asteraceae | *Crassocephalum bauchiense* | VU | A(i) | | | | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | | ✓ | |
| Caesalpinioideae | *Newtonia camerunensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | | | ✓ | |
| Cyperaceae | *Coleochloa domensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Dombeyoideae | *Dombeya ledermannii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Antidesma pachybotryum* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Myricaceae | *Morella arborea* | VU | A(i) | | ✓ | | ✓ | |
| Myrtaceae | *Eugenia gilgii* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Orchidaceae | *Bulbophyllum calvum* | VU | A(i) | | ✓ | | ✓ | |
| Orchidaceae | *Bulbostylis densa* var. *cameroonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria nigrescens* | VU | A(i) | | ✓ | ✓ | | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | ✓ | | | |
| Poaceae | *Panicum acrotrichum* | VU | A(i) | | | | ✓ | |
| Primulaceae | *Ardisia dom* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rosaceae | *Prunus africana* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Oxyanthus okuensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta hookeriana* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Psychotria moseskemei* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | | ✓ | |
| Sapindaceae | *Allophylus ujori* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia onanae* | EN | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Community conservation area | Dom Community Forest | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Past, likely to return |
| Nomadic grazing | Low | Ongoing – trend unknown |
| Invasive non-native/alien species/diseases | Low | Ongoing – declining |
| Increase in fire frequency/intensity | Low | Past, likely to return |
| War, civil unrest and military exercises | Unknown | Ongoing – trend unknown |
| Logging and wood harvesting | Low | Ongoing – declining |

## IPA

# Kom-Wum Forest Reserve

**International site name:** Kom-Wum Forest Reserve
**Site code:** CMNTIPA020
**Administrative region:** Northwest
**Assessed by:** Bruce Murphy, Martin Cheek, Kenneth Tah, Benedict Pollard.

**Latitude** (decimal degrees)**:** 6.26000
**Altitude minimum:** 570
**Area** (km²)**:** 117.0
**Longitude** (decimal degrees)**:** 10.11000
**Altitude maximum:** 1,650
**IPA criteria met:** A(i)

## Site description

The Kom-Wum Forest Reserve is a habitat of forested river valleys and steep, dissected hills in a relatively low altitude part of the Bamenda Highlands of Northwest Region, Cameroon. It lies on the eastern side of the N11 road running north-north-west between Bamenda and Wum along the river Menchum which flows approximately parallel to this road before continuing north-west to the Nigerian border and then joining the Katsina Ala river. Other rivers, including the Mentar, Mugom and Movum, all join the Menchum within the reserve. Chuo et al. (2017) also mention the Ivin, Nzele and Kimbi but these are unmarked and presumed to be alternative names.

The reserve was established in 1951 when it was part of the Southern Cameroons United Nations Trust Territory under British colonial administration. There were reforestation initiatives implemented by the National Forestry Fund but later neglected (Morgan, 2011). In 2013 the Cameroon government transferred the reserve to the councils of Fundong, Boyo division (80%) and Wum, Menchum division (20%) (Chuo et al., 2017). Documents specify the Fundong administered area as 8,029 ha. The total area of the forest reserve mapped by the Cameroon Forest Atlas is 117 km² (MINFOF & WRI, 2020). Seven neighbouring villages are mentioned in the agreement: Bu in Wum subdivision and Mentang, Baiso, Mughom, Mbengkas, Mbongkisu and Aboh in the Fundong subdivision (CTFC, 2013).

## Botanical significance

Kom-Wum is notable as the only site in Cameroon for *Brachystephanus oreacanthus* (VU) and globally for *Impatiens etugei* (Cheek, 2014c; Cheek et al., 2023). *Jollydora glandulosa* (VU) is known from two other sites in Cameroon, as well as the Obudu Plateau area in Nigeria, and *Stenandrium thomense* (EN) from three other Cameroon sites and one in São Tomé (Cheek and Onana, 2011). *Platycoryne megalorrhyncha* (provisionally EN) is only otherwise known from the Bamenda/Bamboutos area (Droissart et al., 2006). *Cylicomorpha solmsii* (NT) also has a significant population at Kom-Wum (Cheek, 2015d).

In addition to these and the other listed species, there are likely to be more threatened species present since there has been very little botanical surveying effort at the site. In particular, species from nearby locations could also potentially occur here, such as *Saxicolella marginalis* (CR) and *Dactyladenia johnstonei* (CR), both of which are known from nearby locations in Cameroon and over the border in Nigeria. The site is at much lower altitude than much of the Bamenda Highlands and

consequently features submontane and lowland forest that is uncommon in the area, highly threatened and seldom or not at all protected.

## Habitat and geology

The lower lava plateau, on which the major cities of Bamenda and Bali sit, lies in the submontane zone where remaining forest is rare or absent. Most of the Kom-Wum site is much lower than this, so the natural vegetation is largely lowland forest – according to the categories of Cheek (2004) – but extending into the submontane zone in the east of the site. However, the tops of the hills appear on satellite imagery to be mostly lacking vegetation and CTFC (2013) describe savannah vegetation on the summit.

There is no detailed geological information about the site itself but the Bamenda Highlands are part of the Cameroon Volcanic Line of highlands extending north-east from the Gulf of Guinea. Tertiary-era volcanic rocks sit above more ancient Basement Complex strata. The soils are described as mainly volcanic and sandy (CTFC, 2013), strongly leached, and ferralitic in places but mainly very fertile due to the high organic content, and therefore targeted for cultivation. However, this fertility is quickly lost and soils eroded due to the steep slopes. Landslides are common in the region (Zogning et al., 2007).

At nearby Bamenda (c. 1,250 m asl), average annual rainfall (1971–2020) is 2,620 mm. There is a single wet season peaking in July and August with over 400 mm monthly rainfall, and a dry season from November to February with <50 mm. Mean minimum daily temperatures range from 16.1 °C in April to 13.1 °C in December, and maxima from 26.8 °C in February to 22.1 °C in August (World Meteorological Organization, 2020).

## Conservation issues

The Bamenda Highlands is one of the most densely populated areas of Cameroon and most of the richly diverse primary forest has been lost to cultivation and pasture (Harvey et al., 2004). The population has apparently increased rapidly in and around the site in the last two decades, and Bamenda, the third-largest city in Cameroon with an estimated population 533,000 (United Nations, 2018), is less than 20 km away.

The Kom-Wum reserve has long been exploited as a production forest and efforts at reforestation have been limited (Morgan et al., 2011). Chuo et al. (2017) show evidence of areas within the forest cleared for cultivation of corn, bananas and cocoa as well as illegal logging and harvesting of other forest products, including bushmeat. The south-west and north are reported to be the worst affected. Forest is visibly absent on many of the peaks; at this altitude, this is likely to be anthropogenic.

It is unclear what has been the outcome from transferring the forest management to the local councils, although a management plan was reportedly drafted (CTFC, 2013). The transfer agreement specifies the forest can be used as a production forest within certain environmental guidelines and limitations, including the requirement for forest to be maintained or restored over 75% of the area. Chuo et al. (2017) suggest the area is too large for effective management and protection by the local authorities.

As one of the larger patches of remaining forest in the Bamenda Highlands, and with chimpanzees and other animals present, the site has potential for tourism and education (Chuo et al., 2017). Morgan et al. (2011) classed it as an 'exceptional priority site' for conservation action to protect the Nigeria-Cameroon chimpanzee. The steep forested slopes make up part of the Mentchum watershed, buffering heavy rains, preventing soil erosion and landslides, and maintaining water quality. Landslides and soil erosion are a typical concern in the region where land is cleared for forest (Zognig et al., 2007; Ngoufo, 1992).

Cultural taboos have probably hitherto helped protect the forest, and particularly the primates, but are declining in influence (Chuo & Angwafo, 2017). Ebua et al. (2017) report that conservation is unpopular amongst local people who resent being deprived of the fertile soils, bushmeat and other forest products. Negative attitudes towards conservation were particularly associated with limited lack of formal education.

The two parts of the forest reserve are non-contiguous and some important species may have been recorded from a little outside these borders. Consideration should be given to managing a larger continuous area of remaining forest as a conservation site.

**A river bordering the Kom-Wum Forest Reserve.**
Photograph © B. Pollard.

## Key ecosystem services

The site is an important focus for mammal conservation, supporting the Nigerian-Cameroon chimpanzee (*Pan troglodytes ellioti*, EN) as well as twelve other primates (including Preuss's monkey, *Allochrocebus preussi*, EN), white-bellied pangolin (*Phataginus tricuspis*, EN), red river hogs (*Potamochoerus porcus*), blue duiker (*Cephalophus monticola*), red duiker (*Cephalophus dorsalis*) and bushbuck (*Tragelaphus scriptus*). Birds have not been specifically surveyed at the site but Bannerman's turaco (*Tauraco bannermani*, EN), great blue turaco (*Corythaeola cristata*) and blackcasqued wattled hornbill (*Bycanistes subcylindricus*) are known to occur (Fotang, 2018; Fotang et al., 2021).

The forest is used by local communities for a variety of non-timber products (Chuo & Angwafo, 2017; Kah, 2015) and a number of important timber species are harvested.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

## IPA assessment rationale

Kom-Wum qualifies as an IPA under criterion A(i) on the basis of several globally threatened species for which it is an important site, particularly *Stenandrium thomense* (EN), *Brachystephanus oreacanthus* (VU), *Jollydora glandulosa* (VU) and *Platycoryne megalorrhyncha* (provisionally EN). The site could also qualify under criterion C as a representative of rare surviving lowland and submontane forest in the Bamenda Highlands. The site is also the type location of the newly published *Uvariopsis etugeana*, likely EN and known from one other site globally (Couvreur et al. 2022)

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Brachystephanus oreacanthus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Isoglossa dispersa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Justicia camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Stenandrium thomense* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens etugei* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Connaraceae | *Jollydora glandulosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Turraeanthus africana* | VU | A(i) | | | | | |
| Moraceae | *Dorstenia astyanactis* | VU | A(i) | | | ✓ | ✓ | |
| Orchidaceae | *Platycoryne megalorrhyncha* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (Production) | Kom-Wum Forest Reserve | Protected/conservation area matches IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | Unknown | Future – inferred threat |
| Soil erosion, sedimentation | High | Future – inferred threat |
| Avalanches/landslides | Medium | Future – inferred threat |
| Small-holder grazing, ranching or farming | Unknown | Ongoing – trend unknown |

## IPA

# Mbi Crater Lake

**International site name:** Mbi Crater Lake
**Local site name (if different):** Foleshele Lake
**Site code:** CMNTIPA017
**Administrative region:** Northwest
**Assessed by:** Bruce Murphy, Martin Cheek, Kenneth Tah, Benedict Pollard

**Latitude** (decimal degrees)**:** 6.08970
**Altitude minimum:** 1,470
**Area** (km²)**:** 32.5
**Longitude** (decimal degrees)**:** 10.34880
**Altitude maximum:** 2,245
**IPA criteria met:** A(i)

## Site description

The Mbi crater lake is located north-east of the city of Bamenda in Belo subdivision of Boyo division, Northwest Region, Cameroon. The lake is a faunal reserve surrounded by land owned by the private Elba ranch and Ndawara plantation. Beyond this, to the west, the Mbingo baptist church and hospital owns the Mbingo forest, an area of approximately 4 km. It is unclear where the boundary of the Mbingo forest and the Elba ranch is located but there is an extensive area of partially forested land between the hospital and the lake (BirdLife International, 2021g). To the north, a ridge of continuous high land also connects the site with Lake Oku and the Kilim Ijim reserve, although this bridge of land appears to be grassland and pasture, with buildings spreading up the slopes.

## Botanical significance

The Mbi crater itself harbours four globally threatened species, including the Critically Endangered tree *Eugenia gilgii* recorded from the narrow-wooded slopes forming the perimeter of the lake, and the Endangered 'Red Hot Poker' species, *Kniphofia reflexa* (EN), which occurs in abundance and has its largest global population at this small site (Cheek et al., 2000a). These species were recorded during a brief visit by botanists from the Cameroon National Herbarium, MINEF and RBG Kew; this is believed to be the only recorded botanical surveying effort at the lake. *Kniphofia reflexa* is endemic to Cameroon and is the only species of the genus to occur west of the Congo basin. It is only known from two or three other nearby sites where it is less abundant (Cheek et al., 2000a).

*Afrocarum imbricatum* (*Berula imbricata*) is recorded as the only known occurrence of the species in Cameroon (Cheek et al., 2000). *Polystachya bamendae* (EN) is recorded from high forest between the lake and Mbingo and is only known from one other collection 100 km away (Simo-Droissart et al., 2020). An unidentified *Gladiolus* sp. might also represent an additional undescribed globally threatened and locally endemic species (Cheek et al., 2000). More threatened species may well be present since only limited collecting has taken place at the site at a time when few species were flowering or fruiting (Cheek et al., 2000a). Globally threatened economic tree species such as *Khaya ivorensis, Prunus africana* and *Entandrophragma cylindricum* have also been recorded but their populations here are not significant enough to meet IPA criterion A(i).

The Cameroon botanist Martin Etuge who collected specimens from the lake (including *Justicia telloensis* and *Kniphofia reflexa*) and who helped discover and describe many new taxa from this area and elsewhere in the country sadly died at Mbingo hospital in 2020 after a struggle with cancer.

## Habitat and geology

The Bamenda Highlands, where the site is located, have a two-season monsoon climate with a distinct wet season between March and October when heavy rains come from the west. Average precipitation in nearby Bamenda, 1,000 m lower in altitude, is 2,145 mm per annum, with a peak in September of 383 mm (Climate-Data.org, 2020). Mean annual temperature at Bamenda is 21.5 °C, with monthly means varying only slightly between the peak at the beginning of the rainy season of 23 °C and a low of 20.5 °C at the height of the rains in August and September. However, at the altitude of the site itself temperatures do not exceed 18 °C and frost is possible although very rare (Suchel 1988, cited by Lezine et al., 2019). Mist is also common at this altitude (Lezine et al., 2019).

The crater lake is at approximately 2,015 m altitude, with the rim rising steeply to the level of the plateau at c. 2,200m to the west but only c. 15 m above the crater surface on the east side where the land subsequently drops away towards Lake Bamendjing and the Central Plateau.

In this area Tertiary volcanic basalts and trachytes overlay the pre-Cambrian Basement complex strata, with the land surface at this altitude formed from the high lava plateau (Cheek et al., 2000a). Soils of the high lava plateau are uniformly ferralitic clay soils, derived from Tertiary era rocks but with high organic content owing to the slow pace of decomposition at this altitude. However, the crater itself likely differs from surrounding soils. At nearby Bambili lake (at similar altitude), the lake sediment is entirely organic, with higher decomposed content in the upper meters (Lezine et al., 2019).

Water exits the crater on the east side through a swampy river, irrigating the neighbouring Ndawara ranch and tea estate. Agwafo et al. (2016) indicate several other streams flowing from around the lake in different directions but these must arise from the rim rather than within the crater itself.

**Mbi Crater Lake.**
Photograph M. Cheek.

The crater, which is completely flat and lacking trees or shrubs, appears to be partly permanent swamp and partly seasonally inundated grassland, vegetated by tussock forming sedges and grasses up to 0.8–1.5 m high, with *Afrocarum imbricatum* common and *Rhytachne rottboelloides* forming the largest tussocks (Agwafo et al., 2016; Cheek et al., 2000a). Other tussock species include *Fuirena stricta* subsp. *chlorocarpa*, *Xyris congensis* and *X. rehmannii*, while *Andropogon lacunosus*, *Scleria achtenii*, *Leersia hexandra*, *Sacciolepis chevalieri*, *Cyperus dichrostachys*, *Oldenlandia lancifolia*, *Polygonum* cf. *strigosum*, *Conyza clarenceana*, *Helichrysum forskahlii* and *Xyria capensis* are also present. A thin strip of forest on the escarpment surrounds most of the lake, thickest on the western side; this habitat is characterised by the montane woodland tree *Gnidia glauca* (BirdLife International, 2021g).

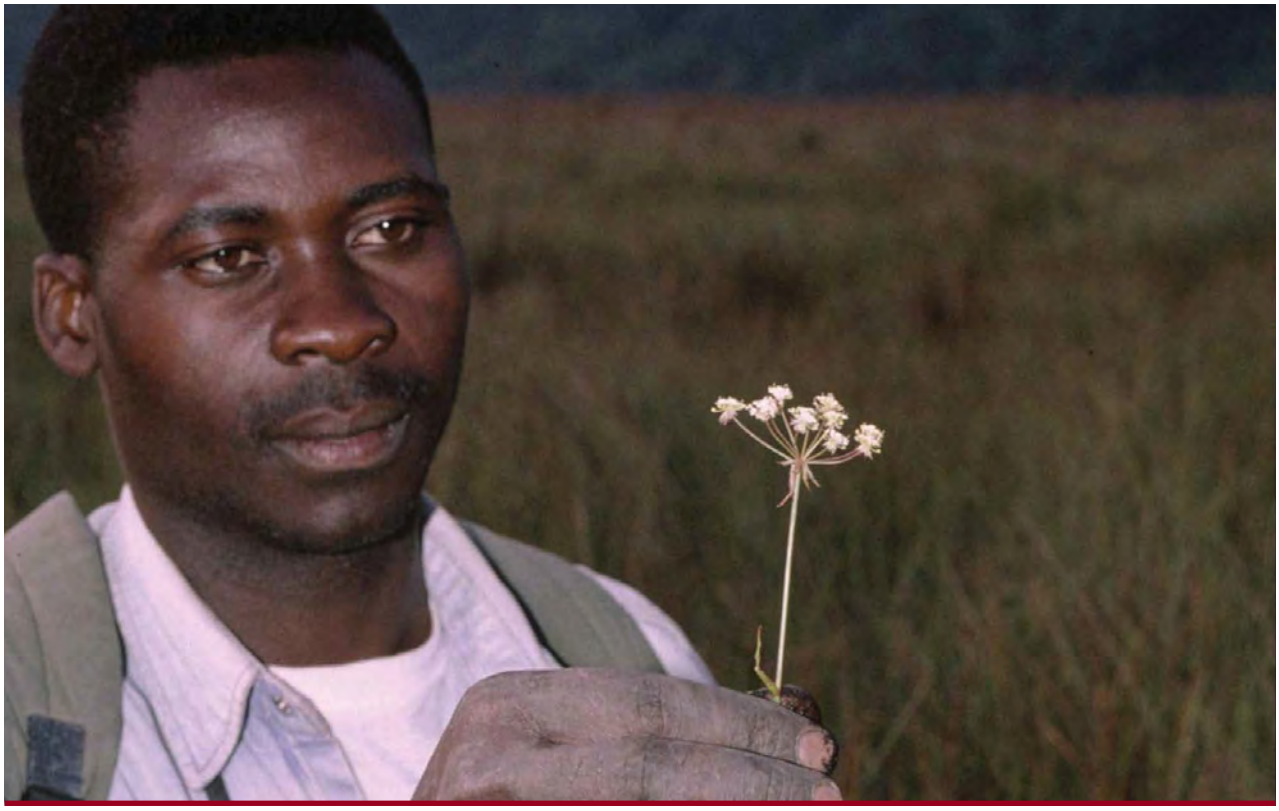
## Conservation issues

The crater lake is small at 370 ha (Topa et al., 2009) and isolated, surrounded by a large ranch. Grazing from the ranch appears to have partly encroached on the crater, which is managed as a faunal reserve ('Cratère de Mbi') but is difficult for local authorities to access (BirdLife International, 2021g). Trampling by livestock could also potentially threaten some species (Cheek et al., 2000a). The changed vegetation of the surrounding landscape could potentially affect the crater habitat by influencing the microclimate, and through pollution, sedimentation and nutrient leaching from the cultivated area (Angwafo et al., 2016).

The extent and regularity of inundation of this damp or partially flooded habitat is likely critical to the survival of some of the species. The only outlet from the crater flows through the ranch, which might seek to manage this flow for irrigation. Climate change could also lead to drying of the swamp habitat.

Discussions between various state and non-state actors regarding upgrading the conservation status of the site have been halted by the conflict in the region since 2016 (K. Tah 2021, pers. comm., 18 October).

The nearby Mbingo forest is included as an additional area of forest worth preserving together with the site. It is apparently owned by the Mbingo baptist church and hospital, which supports the forest's conservation but has limited power to achieve this. Cheek et al. (2000a) describe the Mbingo 'Back Valley' forest as the only block of remaining forest below 1,800 m approaching 1 km² in size in the Bamenda Highlands. The globally threatened *Pentarrhinum ledermannii* is recorded there (Cheek, 2014d). The owners of the ranch that surrounds the lake and separates the forest from it are also reportedly sympathetic to the conservation of the crater habitat (Cheek et al., 2000a). Corridors connecting the lake, the forest and the Kilum-Ijim protected area (with native tree planting where necessary) should be considered through collaboration with these parties and with local organisations such as ANCO and ERUDEF, which have successfully implemented reforestation schemes elsewhere.



***Berula imbricata (Afrocarum)*, a type of 'Water Parsnip', held by Clement Toh one of the collectors. Although not globally threatened, the species was previously unknown in Cameroon. *Berula repandum* also occurs in the Bamenda Highlands.**
Photograph M. Cheek.

## Key ecosystem services

The site is an Important Bird Area with 120 species recorded from limited visits (BirdLife International, 2021g) including *Tauraco bannermani* (EN) and *Platysteira laticincta* (EN). Other fauna include the blue duiker (*Cephalophus monticola*) and bushbuck (*Tragelaphus scriptus*), as well as several primates including chimpanzee (*Pan troglodytes*), which is globally endangered and extremely threatened if not extinct at the site due to loss of the surrounding habitat – before the conflict that started in 2016 – there were believed to be <5 individuals (K. Tah 2021, pers., comm. 18 October). During inundated periods, the lake potentially functions as a watering source for these fauna (Angwafo et al., 2016).

The swamp habitat also buffers seasonal rains and is the source of the outflowing stream which descends steeply to the Ndara tea plantation and community to the east and the much larger town of Babungo further below. It thus contributes to regular irrigation and protects against flooding and landslides, which are a major threat in this area (Zogning et al., 2007).

The depth of the crater swamp peat is not known but could potentially provide a valuable site for pollen coring as well as a carbon store. At the nearby lake Bambili (20 km southwest), cores from a similar altitude have been extracted dating back 90,000 years, providing valuable knowledge about vegetation change in the Cameroon Highlands (Lezine et al., 2019).

## Ecosystem service categories

**Provisioning –** Fresh water

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

The Mbi crater lake qualifies as a potential IPA under criterion A(i) due the abundant presence of the globally endangered *Kniphofia reflexa* and the occurrence of *Eugenia gilgi* (CR), *Justicia telloensis* (VU) and *Stachys pseudohumifusa* subsp. *saxeri. Afrocarum imbricatum* is also found at the site and nowhere else in Cameroon.

***Xyris capensis*, a highland swamp species in the Xyridaceae.**
Photograph B. Pollard, 2000.

***Kniphofia reflexa* (EN), a species of 'Red Hot Poker', and a far distant western outlier from the rest of the genus. It is known only from Mbi crater lake where it is most abundant and 2 or 3 nearby sites.**
Photograph M. Cheek.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Justicia telloensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apiaceae | *Berula imbricata* | | | | | | | |
| Apocynaceae | *Pentarrhinum ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Asphodelaceae | *Kniphofia reflexa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Stachys pseudohumifusa* subsp. *saxeri* | VU | A(i) | | ✓ | ✓ | | |
| Meliaceae | *Entandrophragma cylindricum* | VU | | | | | | |
| Meliaceae | *Khaya ivorensis* | VU | | | | | | |
| Myrtaceae | *Eugenia gilgii* | CR | A(i) | B(ii) | ✓ | | | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya bamendae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rosaceae | *Prunus africana* | VU | | | | | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Local/Regional Nature Reserve | Mbi Crater Faunal Reserve | Protected/conservation area matches IPA |
| Important Bird Area | Mbi Crater Faunal Reserve – Mbingo forest | Protected/conservation area matches IPA |
| Key Biodiversity Area | Mbi Crater Faunal Reserve – Mbingo forest | Protected/conservation area matches IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Agro-industry farming | Low | Future – inferred threat |
| Agro-industry grazing, ranching or farming | Medium | Ongoing – trend unknown |
| Abstraction of surface water | Low | Future – inferred threat |
| Soil erosion, sedimentation | Unknown | Future – inferred threat |
| Nutrient loads | Unknown | Future – inferred threat |
| Droughts | Unknown | Future – inferred threat |

## IPA

# Mt Oku and the Kilum-Ijim Forests

**International site name:** Mt Oku and the Kilum-Ijim forests
**Site code:** CMNTIPA037
**Administrative region:** Northwest
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana, Kenneth Tah

**Latitude** (decimal degrees)**:** 6.22000
**Altitude minimum:** 1,525
**Area** (km²)**:** 289.0
**Longitude** (decimal degrees)**:** 10.44000
**Altitude maximum:** 3,011
**IPA criteria met:** A(i)

## Site description

Rising to around 3,000 m, Mt Oku is the second highest peak in Cameroon. Situated along the Cameroon Volcanic Line 280 km north-east of Mt Cameroon and the Gulf of Guinea coast, and 175–150 km north-east of Mt Kupe and Mt Manenguba, it is part of the Bamenda Highlands, an area which has been intensively populated and largely deforested.

The proposed IPA is based on the Oku Ijim IBA (150 km²) which is similar to the core area surveyed by Cheek et al. (2000a), both having been based on the the Kilum-Ijim forest project areas (c. 200 km² Maisels et al., 2000) which approximately follows the 2,000 m contour line. However, the area has been extended here, bringing the total area up to 289 km². Communities surround the site, including the villages of Elak (where the headquarters of the Kilum Project was based), Oku and Jikijem to the north and north-east, Njinikom and Fundong to the south and west, Ibal to the south, and the suburbs of the larger town of Kumbo spreading from the east. Laikom, where the Fon of Kom's palace is sited, lies within the Ijim project area and within the proposed IPA zone at the western tip of the Ijim ridge. At the centre of the area at approximately 2,240 m lies Lake Oku, a large crater lake, around which a floral sanctuary of 10 km (including the lake) was designated in 2004.

## Botanical significance

Mt Oku and the Ijim ridge is one of a handful of key sites for afromontane and subalpine vegetation outside of East Africa (Cheek et al., 2000a; White, 1986). Cheek et al. (2000a) recorded 850 species within a zone similar to the IPA proposed here. While the flora has natural affinities with other sites along the Cameroon line (Mt Cameroon, the Bakossi mountains, Mt Kupe, Tchabal Mbabo), it is also notably different, peaking at higher altitude than all but Mt Cameroon and largely limited to the montane altitudinal band. Mt Cameroon and Mt Oku are the only two sites reaching sufficient altitude for Afro-alpine vegetation (above 2,800 m) but Letouzey (1985) showed forest extended higher at Oku (to 3,000 m) than at Mt Cameroon.

The site is the largest remaining and best-preserved part of the formerly forested Bamenda Highlands, which has lost c. 95% of its original forest cover above 1,500 m (Cheek et al., 2000a). Remaining submontane forest patches in this area include the

**Lake Oku, 2002. Forest vegetation extends right to the edge and overhangs the lake.**
Photograph M. Cheek, 2002.

forests of Dom and Bali Ngemba, both also proposed as IPAs but both much smaller in size and of lower altitudes. The previously important forest at Bafut Ngemba has been all but obliterated, with 99% of the canopy estimated to have been lost or replaced by *Eucalyptus*; a similar fate was suspected at Kejodsam (Cheek et al., 2000a).

The summit area of Mt Oku also features the highest known sphagnum bog in West Africa, at 2,900 m, surveyed in 1997 (Maisels et al., 2000), as well as other rare natural habitat types (Cheek et al., 2000a).

Around 50 globally threatened species are listed here, with nearly half estimated to have 10% or more of their global population at the site, an indication of the rarity of this habitat. Seven taxa are noted as narrowly endemic, including *Alchemilla fischeri* subsp. *camerunensis* (CR), which occurs only at the summit of Mt Oku itself, creating a silver carpet visible on satellite imagery. It is threatened by grazing and fire (Cheek et al., 2000a). Other notable taxa include the two separate subspecies of *Bafutia tenuicaulis*, a genus confined to the Bamenda Highlands area and named after the Bafut Ngemba reserve where it is likely extinct; subsp. *zapfackii* is considered endemic to the Oku IPA. *Newtonia camerunensis* (CR) was feared extinct until rediscovered here and at one other site (Dom). *Prunus africana* has been heavily impacted by collection but Oku remains an important site for this species.

The Oku-Ijim area is the sole location for *Scleria cheekii* (VU), although not all the records are quite within the IPA boundary (Bauters et al., 2018; Larridon et al., 2019). The same is true for *Ledermanniella keayi* (CR) (Diop, 2010). The site is one of only two locations where the medicinally important *Ternstroemia cameroonensis* (CR) has been recorded, although the collecting location was deforested and it has not been rediscovered at the site (Cheek et al., 2004). *Angraecopsis lisowskii* (EN) is only otherwise recorded from a few collections near Bamenda (Simo et al., 2018). *Crotalaria bamendae* is worthy of mention as it appears rare despite having a large range of occurrence extending to Angola and an IUCN status of Least Concern (Cheek, 2015e); if threatened at Oku then it might qualify as threatened. *Lobelia minutula* is otherwise only known from the mountains of the Rift Valley. *Saxicolella ijim* (provisionally CR, Onana & Cheek, 2011) is known only from a waterfall close to the edge of the TIPA site at 1300 m. *Saxicolella marginalis* (CR) is also recorded nearby but not within the IPA boundaries. *Polystachya anthoceros* (EN) is known from Bali Ngemba and Baba II forests and from Oku village where it was collected from a coffee plantation, epiphytic on a coffee plant. This location is outside the IPA proposed here. A second location in the area of Oku-Ijim is also indicated by Simo-Droissart et al. (2020) but the specimen was not located and also appears to be outside the boundary. *Astropanax hierniana* (VU) is recorded along the route from Belo to Oku (Keay & Lightbody, 28519) but it is unclear if it occurs within the IPA.

A further eight undescribed species are thought likely to be threatened (Cheek et al., 2000a), including apparently endemic *Xyris* and *Gladiolus* species, and an *Oncoba* sp. now also recorded at Bali Ngemba and which it is feared may be extinct at the Oku site.

## Habitat and geology

The Mt Oku massif is a Tertiary era stratovolcano complex, approximately 100 km in diameter, consisting of mainly trachyte and basalt lava overlying granite and migmatite basement rocks (Wooley, 2001). It consists of four individual

stratovolcanoes: Mt Oku itself – the highest, reaching over 3,000 m – Mt Nkambe to the north-east, Mt Babanki to the south-west and Mt Nyos, with its $CO_2$-emitting lake, to the north-west (Brunt, 2000; Konfora et al., 2007; Djukem et al., 2020).

Mt Oku itself shows three periods of volcanic activity: a lower series of trachyte and rhyolite plugs and flows from 24-22 Ma; a middle series from 18–14 Ma of basalt, trachyte and rhyolite lavas intercalated by pyroclastic flows; and an upper series of recent <1 Ma basalt, pyroclasts, scoria and other airfall material leaving volcanic craters and cones prominent in the remaining landscape (Konfora et al., 2007). There is no evidence of volcanic activity between 1 and 14 Ma. The Lake Oku crater originates from the recent series, the eruption leaving basalt lavas on the north flanks and rhyolitic and phonolitic flows to the south (Wooley, 2001). The peaks of Mt Oku, which can be steep and bare of vegetation, are mostly formed of middle series trachyte plugs (Konfora et al., 2007), while mafic rocks are generally hidden by deep lateritic soils and forest, but may in places form 'inhospitable cliffs' (Konfora et al., 2007).

Brunt (2000) describes the soils as humic ferralitic clay (mainly Gibbsite) with high organic content but low in nutrients due to intensive weathering. Soils are liable to become particularly infertile when the organic content is exhausted. Structurally, they are grainy in the upper layers, free draining and non-plastic when wet (Brunt, 2000). However, according to Djukem et al. (2020), the basalt and trachyte derived clay soils are highly plastic and very susceptible when wet to landslides.

The Bamenda Highlands have a two-season climate with a rainy season from April–May and September–November and a dry season in between (McLeod, 1987; Djukem et al., 2020). The montane landscape superimposes further climatic variation on this general pattern, leading Hawkins and Brunt (1965) to distinguish nine climatic zones for the Northwest Region, of which three are relevant to Mt Oku. The major part of the site fits the 'Cool and Misty' climate type (zone 7), with rainfall between 1,780-2,290 mm falling mainly between July and September. A rain shadow effect gives the eastern side lower precipitation, with c. 2,000 mm at Jakiri (McLeod, 1987) and 2,260 mm at Bamenda (World Meterological Organization, 2020) despite 400 m lower altitude at the latter. Forboseh et al. (2003) cite annual averages of 2,427 mm at Kilum on the north side and 2,242 mm at Ijim to the south. Mean maximum and minimum temperatures are 20–22° C and 13–14° C respectively, with November the coldest month and some ground frost occurring in narrow valleys at night. Humidity averages over 80% in July and August, with frequent mist cover. At the summit (zone 8, 'Cold, Very Cloudy and Misty'), mist is very common and solar insolation reduced, rainfall is estimated at about 3,050 mm and mean temperatures may drop as low as 9° C in some months. Climate zone 9 ('Variable') may also be applicable to escarpments where strong winds occur.

The site features mainly montane and upper montane forest. The upper montane forest is characterised by ten species which contribute 90% of the canopy and are also found at other high-altitude sites along the Cameroon Volcanic Line: *Astropanax (Schefflera) abyssinica, A. mannii, Prunus africana, Myrsine melanophloeos, Bersama abyssinica, Syzygium staudtii, Ixora foliosa, Carapa oreophila, Clausena anisata* and the bamboo *Oldeania (Arundinaria) alpina* (Cheek et al., 2000a; Cheek et al., 2021b). *Podocarpus latifolius* is mainly rare and localised and *Ficus* is absent (Cheek et al., 2000a). The understory is rich in herbs, with Acanthaceae prominent, and an interesting mass-flowering phenomenon noted by Cheek et al. (2000a). Several other important habitats are also found: Afroalpine, rock ridge and summit grassland (including *Alchemilla fischeri* subsp. *camerunensis*); *Hyparrhenia* grassland, which appears to replace montane forest after clearance; upper-montane *Sporobolus-africanus*-dominated grassland (which appears to replace burnt and trampled *Hyparrhenia* grassland); an unusual 'basalt pavement grassland' with grass and sedge species (*Loudetia simplex* and *Scleria cheekii),* annual herbs (including *Utricularia* spp.) and perennial geophytes;

**Ijim forest patch.**
Photograph M. Cheek, 1999.

**The summit area of Mt Oku features the highest known sphagnum bog in West Africa at 2,900 m asl.**

drier woodland and forest edge with fire resistant shrubs and herbs (including *Erica* spp., *Lasiosiphon [Gnidia]) glaucus*, *Dombeya ledermannii*, *Adenocarpus mannii* and *Maesa lanceolata*); swamp and riverine habitats including sphagnum communities, waterfalls and rapids; and Lake Oku itself.

## Conservation issues

Between 1963 and 1986 the forest at Kilum-Ijim was estimated to have been reduced by 50% due to conversion for farmland (Macleod, 1987; Maisels & Forboseh, 1999). This sparked involvement by BirdLife International (then ICBP) and, in collaboration with MINEF, the creation of the Kilum and Ijim forest projects, which have operated together since 1995 (BirdLife International, 2003). The projects aimed to prevent further forest loss and provide sustainable alternatives for local people (Maisels & Forboseh, 1999). In 2003 the projects were transferred to MINEF and the local communities (BirdLife International, 2003). GIS analysis of the period has shown that the most intense forest loss occurred between 1984 and 1988, with forest limits being largely preserved from the onset of the forest projects, and net forest recovery recorded after 1995 (Baena et al., 2010). Without the change in deforestation trajectory associated with the initiation of the forest project it is estimated, based on rates of loss in 1987, that the forest would have completely disappeared by 1998 (Baena et al., 2010). However, threats remain and more recent reports suggest the forest continues to deteriorate due to grazing, burning, edge effects, fuelwood cutting, bark harvesting and building (Forboseh et al., 2003; Doherty-Bone & Gvoždík, 2017; Maisels et al., 2001; Stewart, 2009).

Improvements to roads through the forest are likely to further increase pressure on the habitat (Doherty-Bone & Gvoždík, 2017). Grazing is a particular threat; it is not thought to be a traditional practice (Cheek et al., 2000a) and was halted within the forest after the onset of the forest project, but has subsequently resumed (Maisels et al., 2001). The extinction of natural seed dispersers (megafauna and birds) is an additional concern to the long-term survival of the plantlife (Maisels et al., 2001). The forest is also used fairly intensively for non-timber forest products. Harvesting of *Prunus africana* bark constitutes a major threat to one of the key montane forest species at the site, but efforts have been made to promote cultivation and sustainable management of *P. africana* amongst local communities (Stewart, 2009).

A small part of the site around the lake (10 km²) has been designated a national Plantlife Sanctuary (IUCN category IV). The rest of the site has no formal protection but is managed by local communities in collaboration with MINEF.

## Key ecosystem services

The site is an IBA and the main site for two bird species endemic to the Bamenda Highlands: *Tauraco bannermani* and *Platysteira laticincta* (both EN). It is also important for amphibians, with 50 species recorded from the Oku Massif and five (or possibly six) endemic to Mt Oku (Doherty-Bone & Gvoždík, 2017). These taxa have helped justify the site becoming part of the Alliance for Zero Extinction network (Key Biodiversity Areas Partnership, 2021d). Five small mammals are also apparently globally endemic, *Chrysochloris balsaci, Lemniscomys mittendorfi* (EN), *Hylomyscus grandis, Lophuromys dieterleni* and *Lamottemys okuensis* (EN), the latter is a unique genus which is apparently threatened by hunting and sold as 'Oku sardines' (Ingram, 2011).

The preservation of the montane forest is important for mitigating the risk of landslides, erosion and silting of freshwater supplies, especially given the high population density of the surrounding area, with 300,000 people estimated to live within a day's walk (Maisels et al., 2000; Djukem et al., 2020). Overall, 200,000 people have been estimated to depend on the forest for food, water, fuel and tourist income (Forboseh et al., 2003). *Prunus africana* bark is harvested for pharmaceutical purposes. The area is known for its extensive use of traditional medicines based on plants from the forest, with people travelling great distances to visit the area for treatment (Cheek et al., 2000). Beekeeping has successfully been encouraged as a sustainable source of income, while tourism is also important and has been embraced by local leaders (Doherty-Bone, 2015; Frits, 2017).

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

**Cultural –** Spiritual experience and sense of place

## IPA assessment rationale

Mt Oku and the Ijim Ridge qualifies as an IPA under criterion A(i) through the occurrence of numerous globally threatened species, several of which are narrowly endemic. It also qualifies under criterion B(ii) as one of the top-15 sites for restricted and nationally endemic species, with over 3% of the national total. In addition, it is likely that the site would also qualify under criterion C as one of the top national sites for montane forest, subalpine vegetation or montane sphagnum bog.

*Alchemill fischeri* subsp. *camerunensis* (CR), globally endemic to the summit region of Oku. It is prolific there but threatened by fire and grazing.

*Kniphofia reflexa*, a globally Endangered 'Red Hot Poker' species endemic (unique) to Kilum-Ijim and Mbi Crater.

*Coleus insignis*, a mass flowering species synchronous with three species of Acanthaceae.

Flowers of the Critically Endangered *Dovyalis cameroonensis*, a small tree growing next to Lake Oku.

Fruit of the Critically Endangered *Dovyalis cameroonensis*
Photograph M. Cheek, 2002.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Acanthopale decempedalis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Isoglossa nervosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apiaceae | *Afroligusticum townsendii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apiaceae | *Lefebvrea camerunensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Epistemma decurrens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Pentarrhinum ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | | | ✓ | |
| Asphodelaceae | *Kniphofia reflexa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Asteraceae | *Alchemilla fischeri* subsp. *camerunensis* | CR | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Asteraceae | *Bafutia tenuicaulis* var. *tenuicaulis* | | A(iv) | | ✓ | ✓ | ✓ | |
| Asteraceae | *Bafutia tenuicaulis* var. *zapfackiana* | | A(iii) | | ✓ | ✓ | ✓ | ✓ |
| Asteraceae | *Bidens mannii* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Asteraceae | *Crassocephalum bauchiense* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Asteraceae | *Senecio burtonii* | | A(iv) | B(ii) | | | | |
| Asteraceae | *Vernonia bamendae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Caesalpinioideae | *Newtonia camerunensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Campanulaceae | *Wahlenbergia ramosissima* subsp. *ramosissima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Caprifoliaceae | *Dipsacus narcisseanus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cyperaceae | *Scleria afroreflexa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cyperaceae | *Scleria cheekii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Dombeyoideae | *Dombeya ledermannii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Eriocaulaceae | *Eriocaulon asteroides* | | | | | | | |
| Eriocaulaceae | *Eriocaulon bamendae* | | | B(ii) | | | | |
| Eriocaulaceae | *Eriocaulon parvulum* | | | B(ii) | | | | ✓ |
| Gentianaceae | *Anthocleista scandens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Coleus insignis* | | | B(ii) | | | | |
| Lamiaceae | *Coleus maculosus* subsp. *lanatus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Stachys pseudohumifusa* subsp. *saxeri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loranthaceae | *Tapinanthus letouzeyi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Dissotis bamendae* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Myricaceae | *Morella arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia gilgii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecopsis lisowskii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum calvum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Disperis nitida* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Genyorchis macrantha* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria maitlandii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria microceras* | NT | | B(ii) | | | | |
| Orchidaceae | *Habenaria obovata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | ✓ | | ✓ | |
| Orchidaceae | *Liparis rosseelii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya anthoceros* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Orchidaceae | *Polystachya bamendae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya bicalcarata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya superposita* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Crotalaria ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Crotalaria mentiens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Indigofera patula* subsp. *okuensis* | VU | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Papilionoideae | *Millettia conraui* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Pentaphyllaceae | *Ternstroemia cameroonensis* | CR | A(i) | B(ii) | ✓ | | ✓ | |
| Poaceae | *Agrostis mannii* subsp. *mannii* | | A(iv) | | ✓ | ✓ | ✓ | |
| Poaceae | *Eragrostis camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Trisetopsis mannii* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella keayi* | CR | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella musciformis* | DD | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia bamendae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rosaceae | *Prunus africana* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Anthospermum asperuloides* | | | B(ii) | | | | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus okuensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta hookeriana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Phyllopentas ledermannii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria moseskemei* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Salicaceae | *Dovyalis cameroonensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia onanae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Scrophulariaceae | *Rhabdotosperma densifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Scrophulariaceae | *Rhabdotosperma ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| IV: Floral Sanctuary | Kilum-Ijim, Mont Oku | IPA encompasses protected/conservation area |
| Alliance for Zero Extinction Site | Mt Oku | IPA encompasses protected/conservation area |
| Important Bird Area | Mt Oku | IPA encompasses protected/conservation area |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | High | Ongoing – trend unknown |
| Development – tourism & recreation areas | Medium | Ongoing – trend unknown |
| Small-holder grazing, ranching or farming | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |
| Gathering terrestrial plants | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |

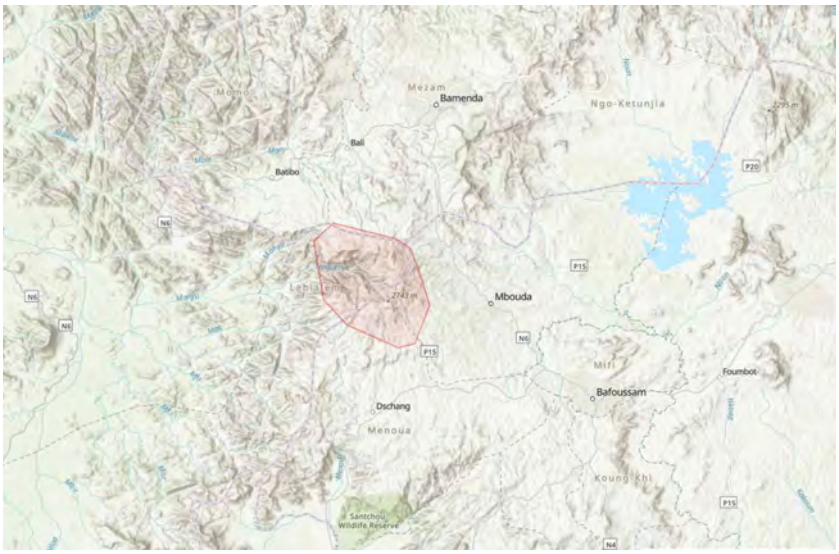
# West Region

Mt Bamboutos, the third highest peak in Cameroon reaching 2,700 m but heavily cultivated even at high altitudes.
Photograph 2021, © A. Tchassem.

## IPA

# Mt Bamboutos

**International site name:** Mt Bamboutos
**Site code:** CMNTIPA021
**Administrative region:** West
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana, Arnaud Tchassem




**Latitude** (decimal degrees)**:** 5.63700
**Altitude minimum:** 650
**Area** (km²)**:** 340.0
**Longitude** (decimal degrees)**:** 10.08700
**Altitude maximum:** 2,736
**IPA criteria met:** A(i)

## Site description

Mt Bamboutos is located at the junction of West, South-West and North-West regions, Cameroon. It is the third-highest point in the country after Mt Cameroon and Mt Oku, and like those peaks it is part of the Cameroon Volcanic Line, which extends north-west from the Gulf of Guinea and continues beyond Mt Bamboutos as the Bamenda Highlands. The area identified here lies within West and Southwest regions, with a huge caldera at the centre. To the north, south and east, the land slopes away gradually from the rim of the caldera forming a high plateau that is heavily populated and cultivated. The western side is much steeper and more forested, dropping rapidly 2.5 km in height to the valley below. The proposed area is a preliminary demarcation based on historical records of botanical significance. Further surveys and consultation will be required to demarcate an actual area where important taxa remain amidst the mostly degraded landscape.

## Botanical significance

Mt Bamboutos and the neighbouring plateau has been a focus for Western botanical collecting since the nineteenth century and there are many records of species which are now threatened with extinction. However, it is also one of the most populated areas of Cameroon and has been densely grazed and farmed with extensive loss of forest. Most of the historically recorded taxa were collected from areas that now have no forest remaining, only hedges and patches of trees and savannah (Cayet-Boisrobert, 2020). It is not known how many of these species survive in this fragmented habitat or in the remaining forested parts on the western side. The exceptionally rare Critically Endangered medicinal plant *Ternstroemia cameroonensis*, originally collected here by Letouzey, is currently thought only to survive at the border of this site and the Tofala Hills Wildlife Sanctuary, having apparently become extinct at Mt Oku (Cheek et al., 2017a). *Vepris montisbambutensis* (CR) is known only from the type collected here in 1974 and may be extinct (Whittaker & Cheek, 2021). *Clerodendrum singwanum* is known only from the Ledermann collections in 1908, probably lost in the Berlin herbarium fire. *Ctenium ledermannii* is a high-altitude grass sparsely recorded over a rather large area of Africa but mainly in the mountains of Cameroon. *Dissotis bambutorum* (NT) is another noteworthy, ecologically restricted species that does not quite qualify for threatened status or under IPA criteria.

**The summit of Mt Bamboutos reaching c. 2,700 m asl.**
Photograph © A. Tchassem.

## Habitat and geology

The upper slopes of Mt Bamboutos, constituting the area under consideration, are dominated by acidic volcanic rocks such as trachytes, phonolites, rhyolites and tuffs (Ngoufo, 1992). Soils are generally acidic but varied, with widespread lithosols and rankers, but also fertile soils rich in dark humus (Ngoufo, 1992). Although these highland soils have been worked for agriculture for far less time than the lower plateau, they are highly vulnerable to erosion and leaching due to the steep gradients, high precipitation and loss of vegetation (Ngoufo, 1992).

Precipitation varies considerably across the site due to altitude and the rain-shadow effect. Mean annual precipitation at Bamenda to the north was 2,260 mm between 1971 and 2000 (WMO, 2020) but at Dschang, south of the summit, it was 1,873 ±209 mm between 1910 and 2000 (Kengni et al., 2009). Both these stations are around 1,400 m below the summit of Mt Bamboutos. Kengni et al. (2009) recorded a total of 2,507 mm over 1 year (2002–3) at the Mélétan station (2,608 m asl). Precipitation is strongly seasonal, with the steep western slopes intercepting the humid Atlantic monsoon winds; 75% of annual precipitation occurs between June and October, and 50% between July and September (WMO, 2020; Ngoufo, 1992). November, December and January are the driest months, with virtually no rain falling in some areas in the east (Ngoufo, 1992). Mean temperatures vary relatively little at lower altitudes (e.g. Bamenda max 22.1–26.8 °C, min 13.1–16.7 °C) but even at 2,000 m asl morning temperatures may drop to zero °C in the dry cold months of November–February.

While probably originally forested, the high Bamboutos area has long borne the imprint of human civilisation. Colonial era maps suggest livestock grazing resulted in savanna of trees or shrubs as well as areas of grassland, with forest remaining only in valleys, steep slopes and along rivers (Ngoufo, 1992; Cayet-Boisrobert, 2020). However, since the 1970s increasing population pressure and impoverishment of soils in the piedmont area, as well as opportunities for cash crops suited to higher altitude, have led to cultivation and further loss of semi-natural vegetation even at high altitudes, with increased pressure on reduced area of grazing lands, increased fire, and soil erosion from cultivation of even steep slopes (Ngoufo, 1992; Tchassem et al., 2019).

## Conservation issues

There has been almost complete loss of forest on the northern and eastern slopes of Mt Bamboutos under intense agricultural and population pressure (Ngoufo, 1992; Cayet-Boisrobert, 2020; Tchassem et al., 2019). While it is possible that threatened tree species hang on in hedges or isolated clumps, the extent of development, with large settlements visible on the summit rim itself at 2,600 m, make conservation very challenging on this side of the mountain. The small Mt Bamboutos Forest Reserve was already fully degraded from forest to savanna vegetation by 1957 (Cayet-Boisrobert, 2020). Patches of forest are visible still on satellite imagery (Google Earth, 2020 – most recent images April 2020) and may represent small areas that could be considered a salvageable IPA, but ground truthing is rapidly required to assess these.

Fire, grazing, agricultural cultivation and soil erosion, including landslides, are the main conservation issues. Community conflicts arise as traditional livestock grazing and subsistence farming at high altitudes by mainly Fulani (Mbororo) peoples faces upwards pressure from Bamilike Mbouda groups growing a new, diverse range of garden cash crops such as carrots, cabbage and potatoes, as well as, at lower altitudes, palm oil and cocoa (Ngoufou, 1992; Tchassem et al., 2019; Toh et al., 2018). Cultivation of steep slopes, shortened fallowing, increased fire and loss of natural vegetation has resulted in rapid loss of previously fertile, humus-rich, high-altitude soils and major landslides. Even on the south-western slopes and within the caldera valley there is alarming loss of hitherto better-preserved forest with associated erosion and landslides (Toh et al., 2018).

Mt Bamboutos is also a major watershed. Habitat conversion and irrigation has resulted in the drying up of streams while pollution, sedimentation and nutrient enrichment also result from the intense agricultural use of the land (Ngoufo, 1992; Cayet-Boisrobert, 2020).

The NGO ERuDeF is active in the area and has instigated tree-planting, including native species such as *Prunus africana* which was eliminated through over-harvesting in the 1990s (Greenvision, 2020). The organisation also promotes more sustainable agricultural methods, hydrological conservation, sustainable income generation and habitat corridors (Cayet-Boisrobert, 2020). Restoration work and surveying is also being funded by ZSL EDGE, focused particularly on amphibians and reptiles, and by the International Tree Foundation (T. Doherty-Bone 2022, pers. comm., 4 Jan). Tree-planting with native species including *Prunus africana* in patches of remaining scrub has apparently been welcomed by locals (A. Tchassem 2023, pers. comm., 8 March).

## Key ecosystem services

Over 80,000 people are estimated to be dependent on the watershed, as well as two major hydroelectric plants (Cayet-Boisrobert, 2020). Natural vegetation plays a crucial role in protecting watersheds, reducing soil erosion and sedimentation, and protecting against landslides such as that which killed 23 people and 700 livestock in 2003. Habitat restoration has been advocated for these reasons (Ayonghe & Ntasin, 2008)

The area was considered a very important area for birds although these are now probably limited largely to the western part which is also important habitat for various mammals, including gorillas and chimpanzees (Tchassem et al., 2018; International Tree Foundation, 2020; Nkembi et al., 2006).

Forests, where they still exist, also provide various products including medicines to local people (Focho et al., 2009; Tchassem et al., 2018).

## Ecosystem service categories

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Regulating –** Pollination

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

Mt Bamboutos potentially qualifies as an IPA on the basis of past collections of multiple threatened species. However, it is not known which of these still survive in the area. If they do, it is likely to be so in the western part and the caldera, or perhaps in remnant hedges and forest fragments. Herbaceous species are more likely to survive in grassland and scrubby areas on the eastern side. The high-altitude habitat is rare in Cameroon but may be too degraded to qualify under criterion C.

**Reforestation efforts on Mt Bamboutos with scrubby surviving forest in a gully behind.**
Photograph © A. Tchassem.

**Arnaud Tchassem planting threatened native species *Prunus africana* on the steep slopes of Mt Bamboutos.**
Photograph © A. Tchassem.

**The summit of Mt Bamboutos reaching c. 2,700 m asl.**
Photograph © A. Tchassem.

**On Mt Bamboutos even very steep slopes have been deforested and converted to farmland, making them susceptible to erosion and dangerous landslides.**
Photograph © T. Doherty-Bone.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Isoglossa nervosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apiaceae | *Afroligusticum townsendii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apiaceae | *Lefebvrea camerunensis* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | | | |
| Asteraceae | *Bidens mannii* | VU | A(i) | B(ii) | ✓ | | | |
| Asteraceae | *Vernonia bamendae* | VU | A(i) | | | | | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | ✓ | | ✓ | |
| Caprifoliaceae | *Dipsacus narcisseanus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Clutia kamerunica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Phyllanthus caligatus* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Aeollanthus trifidus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Clerodendrum singwanum* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lamiaceae | *Coleus maculosus* subsp. *lanatus* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Stachys pseudohumifusa* subsp. *saxeri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Dissotis bamendae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Myricaceae | *Morella arborea* | VU | A(i) | | ✓ | ✓ | | |
| Myrtaceae | *Eugenia gilgii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Platycoryne megalorrhyncha* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Pentaphyllaceae | *Ternstroemia cameroonensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Andropogon pusillus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Eragrostis camerunensis* | VU | A(i) | | ✓ | | ✓ | |
| Rosaceae | *Prunus africana* | VU | | | | | | |
| Rubiaceae | *Anthospermum asperuloides* | | | B(ii) | | | | |
| Rubiaceae | *Phyllopentas ledermannii* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Rutaceae | *Vepris montisbambutensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Scrophulariaceae | *Rhabdotosperma densifolia* | VU | A(i) | | ✓ | | ✓ | |
| Scrophulariaceae | *Rhabdotosperma ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Thymelaeaceae | *Gnidia bambutana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

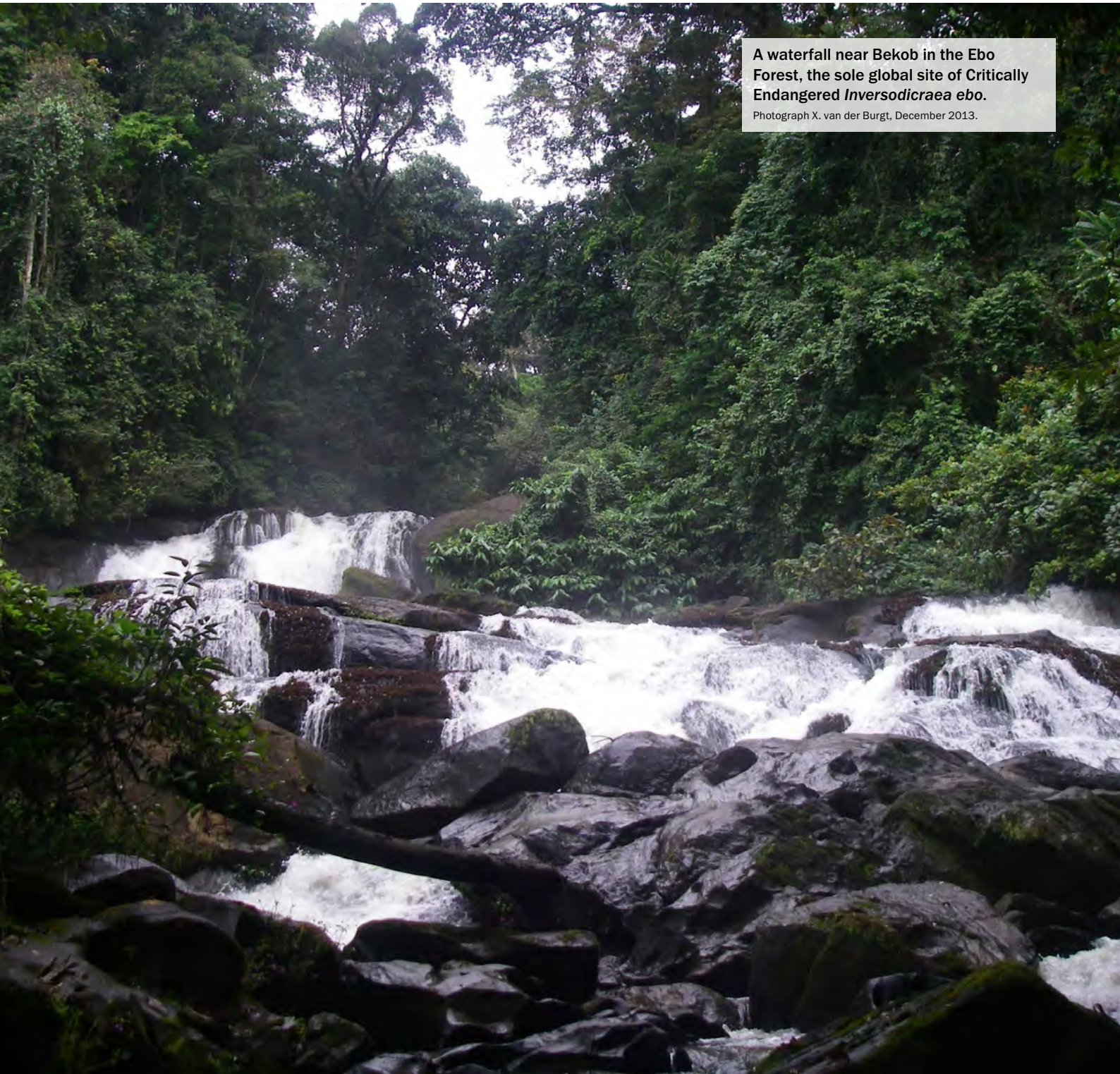
## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (Production) | Mt Bamboutos Forest Reserve | IPA encompasses protected/conservation area |
| Important Bird Area | Bamboutos Mountains | Protected/conservation area overlaps with IPA |
| Key Biodiversity Area | Bamboutos Mountains | Protected/conservation area overlaps with IPA |
| Alliance for Zero Extinction Site | Bamboutos Mountains | Protected/conservation area overlaps with IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – housing and urban areas | Medium | Ongoing – increasing |
| Small-holder farming | High | Ongoing – increasing |
| Shifting agriculture | High | Ongoing – increasing |
| Small-holder grazing, ranching or farming | High | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Gathering terrestrial plants | Low | Past, likely to return |
| Increase in fire frequency/intensity | Medium | Ongoing – trend unknown |
| Abstraction of ground water | Medium | Ongoing – increasing |
| Soil erosion, sedimentation | Medium | Ongoing – increasing |
| Avalanches/landslides | High | Ongoing – increasing |
| Herbicides and pesticides | Medium | Ongoing – trend unknown |

# Littoral Region

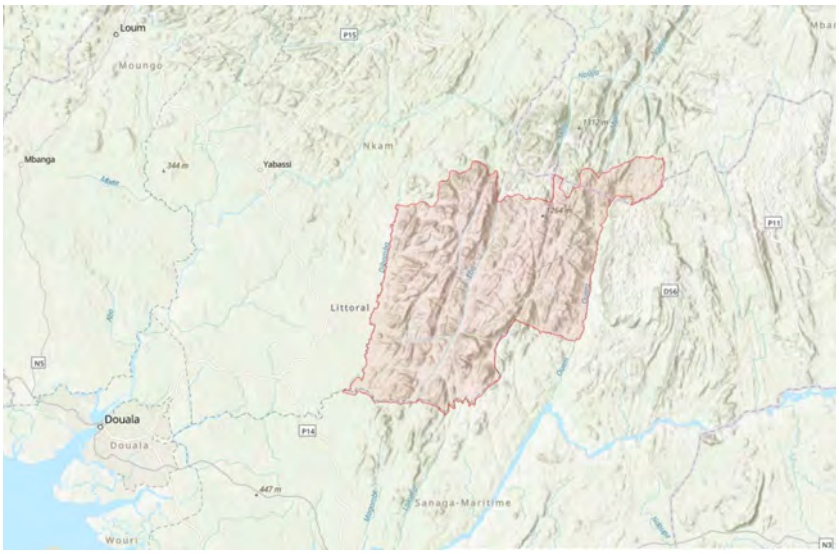


A waterfall near Bekob in the Ebo Forest, the sole global site of Critically Endangered *Inversodicraea ebo*.
Photograph X. van der Burgt, December 2013.

## IPA

# Ebo Forest

**International site name:** Ebo Forest
**Site code:** CMNTIPA003
**Administrative region:** Littoral
**Assessed by:** Bruce Murphy, Martin Cheek, Xander van der Burgt, Ekwoge Abwe, Bethan Morgan




**Latitude** (decimal degrees)**:** 4.30970
**Altitude minimum:** 130
**Area** (km²)**:** 1,423.0
**Longitude** (decimal degrees)**:** 10.31670
**Altitude maximum:** 1,115
**IPA criteria met:** A(i)

## Site description

The Ebo forest in Littoral Region, Cameroon, covers c. 1,400 km² of evergreen lowland and submontane cloud forest along numerous low, parallel ridges between the Wouri and Sanaga rivers approximately 100 km from the coast. The suggested IPA site corresponds to the former proposed national park and is centred around the confluence of the two branches of the Ebo river at approximately 4.3097 N, 10.3167 E. From there, the river flows SSW, bisecting the site. Small villages surround the Ebo forest, populated by the Banen and Bassa peoples, and until the late 1950s and early 1960s there were several inhabited villages within the forest (Abwe & Morgan, 2008).

The Ebo Forest Research Project (EFRP) has been working in the forest and with communities surrounding it since the important discovery in 2002 of a lowland gorilla population in the forest. This population, possibly a unique subspecies, is isolated from other populations of both the Cross-river gorilla (*Gorilla gorilla diehli*) and western gorilla (*Gorilla gorilla gorilla*) (Oates et al., 2003; Morgan, Wild and Ekobo, 2003). The forest also harbours many other rare mammals, including one of the largest global surviving populations of both the drill – a Critically Endangered, range-restricted primate – and the rarest chimpanzee subspecies, *Pan troglodytes ellioti* (Morgan et al., 2013). The latter is uniquely known amongst chimpanzees to use tools for both termite fishing and nut-cracking (Abwe and Morgan, 2008). The forest is one of few classed as 'Exceptional Priority' for Nigeria-Cameroon chimpanzees by the IUCN-endorsed conservation action plan for the subspecies (Morgan et al., 2011). It also constitutes nearly 50% of the Yabassi Key Biodiversity Area (BirdLife International, 2021h).

Botanically, the forest was hardly known until surveys in the early 21st century found it to be one of the richest and largest surviving intact areas of lowland and submontane forest in tropical Africa, harbouring many globally threatened and nationally endemic plant species (Cheek et al., 2018c). These surveys have also revealed several species new to science.

## Botanical significance

Although located in the biologically important zone between the Cross and Sanaga rivers, which contains the highest plant species diversity per degree-square in tropical Africa (Barthlott et al., 1999), the botanical significance of the Ebo forest has only become apparent to scientists in the 21st century. Collections

were made by the botanists Leouzey and Leeuwenberg in the Yabassi-Yingui area in the 20th century but Ebo was almost completely unsurveyed for plants until 2004 when surveys were undertaken by RBG Kew and Herbier National du Cameroun, resulting in 2,590 herbarium specimens. These collections suggest that diversity and endemism are particularly high. So far, surveying efforts have resulted in the publication of seventeen new species to science discovered at Ebo, ranging from herbs and shrubs to canopy trees. Nine of these *Ardisia ebo* (Cheek & Xanthos, 2012), *Palisota ebo* (Cheek et al., 2018c), *Inversodicraea ebo* (Cheek et al., 2017b), *Kupeantha ebo* (Cheek et al., 2018b), *Crateranthus cameroonensis* (Prance & Jongkind, 2015), *Pseudohydrosme ebo* (Cheek et al., 2021c), *Uvariopsis dicaprio* (Gosline et al., 2022), *Kupeantha yabassi* (Alvarez-Aguirre et al., 2021) and *Impatiens banen* (Cheek et al., 2023) are narrowly endemic to Ebo while two others have a slightly larger range but have also been named after the site: *Gilbertiodendron ebo* (van der Burgt et al., 2015) and *Talbotiella ebo* (Mackinder et al., 2010). Further new species to science remain to be published in the genera: *Ardisia, Begonia, Chassalia, Cola, Justicia, Ledermanniella, Mitriostigma, Pavetta, Psychotria, Rhaptopetalum and Zenkerella* (M. Cheek pers. comm., 2020). Many of these species are also so far endemic to Ebo or its immediate neighbourhood. Overall, the area is known to contain over 100 globally threatened species from the official IUCN Red List as well as several others that are Near Threatened, or provisionally threatened but awaiting formal IUCN assessment. In total, over 1,000 species have already been recorded at Ebo, which is one tenth of the total Cameroon flora (Onana, 2011).

The proposed area is important for both lowland evergreen moist tropical forest, containing species ranging from the spectacular and globally endemic herb *Pseudohydrosme ebo* to the giant, Endangered timber tree *Microberlinia bisulcata*, as well as submontane cloud forest featuring rare endemics such as *Uvariopsis dicaprio* and *Kupeantha ebo* (Cheek et al., 2018b, 2021; Gosline et al., 2022). In addition, small areas of deciduous forest occur on igneous outcrops, featuring species such as *Ochna calodendron,* which is of traditional significance to local people. Important waterfall communities also exist within the area, such as that containing the globally endemic *Inversodicraea ebo* from one of the most threatened plant families in Africa (Cheek et al., 2017b). These rare plants are likely to be particularly affected by any incursions in the forest area because of their sensitivity to water turbidity which can be caused by increased surface run-off associated with forest clearance.

**The Ebo forest seen from an inselberg on Gashaka Hill.**
Photograph X. van der Burgt.

Nearly all plant collecting has been in two small areas around the Bekob and Njuma camps; the rest of the site has hardly been explored botanically and likely contains much else that is worthy of scientific research. However, a Rapid Botanical Survey was ongoing in November 2022 with collections to be made across the whole site.

## Habitat and geology

The forest lies on ancient highly weathered basement complex rocks, with some ferralitic areas in the lower, flatter southern part (Cheek et al., 2018c). The topology consists of numerous low, parallel ridges running SSW-NNE, parallel with the Cameroon Volcanic Line. Altitude ranges from c. 130 to 1,115 m, with the south flatter and lower than the northern part. There is a wet season from March until November with >100 mm precipitation. Rainfall has been measured at Bekob and Njuma within the proposed area at 2,336 and 3,135 mm p.a. respectively between 2010 and 2016 (Cheek et al., 2018c). Mean annual temperature is 25–28 °C (Whytock et al., 2021). The Ebo river flows south through the site into the Dibamba river which joins the Cameroon estuary at Douala.

The Ebo forest is a major part of the largest intact forest landscape in the important Cross-Sanaga-Bioko coastal forest ecoregion (Popatov et al., 2017; Grantham et al., 2020ab; Whytock et al., 2021). As well as the predominant evergreen, closed-canopy lowland forest and submontane forest with *Podocarpus latifolius*, there are also areas of semi-deciduous woodland on inselbergs and waterfall communities. According to Letouzey's (1985) categorisation, the site consists mainly of variations on dense humid Atlantic Littoral forest (type 247), Atlantic Biafran forest (types 228, 235) and Atlantic Northwest forest with semi-deciduous elements (type 205), as well as some submontane forest (type 117). Varying abundances of 'caesalpinioid' legume species and the presence of *Sacoglottis gabonensis* are used to define these variations.

## Conservation issues

The Ministry of Forestry and Wildlife (MINFOF) started the process of gazettement of this forest as a national park in 2006 following work by WWF, Cameroon. The process had stalled, partly due to objections from local communities wary of losing traditional rights to the forest, when in March 2020 decrees (signed in February, 2020) were unexpectedly revealed announcing that the area of the proposed national park would instead be brought under two Forest Management Units (FMU) to be commercially exploited for timber. This would have seriously increased the danger to the majority of threatened plant species and made the continued long-term survival of the important faunal populations untenable. The surprise development was also opposed by local villagers, this time in coalition with a range of local and international conservation organisations, resulting in the government revoking

***Pseudohydrosme ebo*. A new and endemic Critically Endangered species globally unique to Ebo forest.**
Photograph X. van der Burgt.

**A Large *Liana* in the Ebo Forest near Njuma.**
Photograph X. van der Burgt, 2015.

the concessions in August 2020 (Alberts, 2020; Cheek et al., 2021c). The ultimate status of the forest remains undecided but conservation agencies have now forged a close working alliance with local villagers and are keenly aware that traditional access and use of the forest should be a key component of conservation plans (Mfossa et al., 2018; Gaworecki, 2020; Truscott, 2021).

Despite the suspension of plans for direct exploitation, the site remains threatened by encroachment. To the north lies a large forestry concession (FMU 00-004) while logging roads in the southern part of the forest give access to illicit logging and bushmeat hunting. A major 123,000 ha palm oil plantation has also been established on the western fringe of the forest by the Cameroonian company Azur/Greenfil, which, it is feared, will lead to an increase in encroachments into the forest for bushmeat and logging as well as forming a dispersal boundary for forest populations (Mowbray, 2017; Earthsight, 2018; Orozco & Salber, 2019).

Non-industrial cultivation is actually the main source of palm oil in the region and is a further local threat through insidious and ongoing forest fragmentation (Nkongho et al., 2014; Mahmoud et al., 2019). A study of Ebo and the wider Littoral region reported a 57% increase in fragmentation of natural forest between 1975 and 2017 (Mahmoud et al., 2019). Future expansion of cultivation into the Ebo forest area can also be envisaged if timber extraction does proceed in and around the forest, since logging and road building has been shown to be a facilitator of further land clearance (Mahmoud et al., 2019). The conservation of the forest is also threatened by mining permits covering the south-eastern part, amounting to around a third of the area (Mahmoud et al., 2019).

## Key ecosystem services

The Ebo forest provides crucial habitat to several Endangered primates listed as Class A under the Cameroon Wildlife Law of 1994, as well as a great diversity of other fauna and flora (Abwe & Morgan, 2008; BirdLife International, 2021h; Cheek et al., 2018c; Whytock et al., 2021). The forest is an important internationally recognised centre of academic research for students and scientists at the University of Douala and the EFRP supported by the San Diego Zoo Wildlife Alliance (SDZWA).

The people of over 40 local communities are reliant on the forest for medicines and food, as well as timber, wood and freshwater. It also has great cultural and spiritual importance since many of the older people in these communities grew up in villages within the forest before these were abandoned, and the grave-sites of elders buried in the forest are still visited (Murphy, 2020). Leaders of these communities have asserted the importance of this cultural heritage through the legally recognised association of traditional chiefs, *Association des Chefs Traditionnels Riverains de La Forêt d'Ebo* (ACTRIFE) (Mfossa et al., 2017). The forest has also been estimated to have a total carbon stock of 35-million

**An inselberg on Gashaka Hill, with many shrubs of the rare near endemic *Nothodissotis barteri*, Melastomataceae.**
Photograph X. van der Burgt.

***Uvariopsis dicaprio*, a globally endemic, Critically Endangered species newly described from Ebo Forest.**
Photograph X. van der Burgt, 2008.

tonnes (GFW, 2020). Many species of scientific and economic importance are also found within the forest, including timber trees such as *Diospyros crassiflora,* which provides African ebony used for musical instruments, and *Rungia congoensis,* which has been shown to have anti-inflammatory and anti-oxidant properties (Kapepula et al., 2019).

## Ecosystem service categories

**Provisioning –** Food
**Provisioning –** Raw materials
**Provisioning –** Medicinal resources
**Regulating –** Carbon sequestration and storage
**Habitat or supporting services –** Habitats for species
**Cultural –** Spiritual experience and sense of place
**Cultural –** Cultural heritage

## IPA assessment rationale

The Ebo forest qualifies as an IPA under criterion A on the basis of nationally significant populations of globally threatened species. Although it has only recently and incompletely been surveyed, over 100 globally threatened IUCN Red List species have been recorded at the site, representing over 10% of the Cameroon total. Nine species are strictly endemic to the site.

The site also qualifies under criterion B for the exceptional botanical diversity of the site, with c. 5% of the national list of range-restricted and nationally endemic species. Over 1,000 species (c. 10% of the Cameroonian flora) have been recorded from the area. The site is also known to contain many species of social, cultural and economic significance utilised by local peoples. Therefore, it is likely to qualify under criterion B(iii) when a national list is collated. Finally, the site may also qualify under criterion C as one of the country's best examples of evergreen coastal/ Biafran lowland rainforest.

**The rocky Njuma river in the dry season.**
Photograph X. van der Burgt, December 2019.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Asystasia lindauiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Chlamydocardia subrhomboidea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Mendoncia camerounensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Acanthaceae | *Thunbergia cuanzensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Whitfieldia preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma macrophyllum* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Annonaceae | *Piptostigma submontanum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis dicaprio* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Annonaceae | *Uvariopsis submontana* | EN | A(i) | B(ii) | ✓ | | | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia africana* | VU | A(i) | | ✓ | | ✓ | |
| Apocynaceae | *Landolphia maxima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Secamone letouzeana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Pseudohydrosme ebo* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Araceae | *Rhaphidophora pusilla* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araliaceae | *Astropanax mannii* | VU | A(i) | | ✓ | | | |
| Aristolochiaceae | *Aristolochia preussii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens banen* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Balsaminaceae | *Impatiens frithii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Boraginaceae | *Hoplestigma pierreanum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia fungiformis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Scaphopetalum paxii* | | | B(ii) | | | | |
| Celastraceae | *Salacia nigra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Thyrsosalacia pararacemosa* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Clusiaceae | *Allanblackia gabonensis* | VU | A(i) | | ✓ | | | |
| Commelinaceae | *Floscopa mannii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Palisota ebo* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Costaceae | *Costus kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Momordica enneaphylla* | VU | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | | | |
| Detarioideae | *Anthonotha xanderi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Berlinia korupensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Daniellia oblonga* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron ebo* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron newberyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Guibourtia pellegriniana* | EN | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Hymenostegia brachyura* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia talbotii* | CR | A(i) | | ✓ | ✓ | | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Leonardoxa africana* subsp. *rumpiensis* | | A(iv) | | ✓ | | ✓ | |
| Detarioideae | *Microberlinia bisulcata* | EN | A(i) | | ✓ | | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Detarioideae | *Plagiosiphon discifer* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella ebo* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Dichapetalaceae | *Dichapetalum korupinum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Hamilcoa zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Grewioideae | *Microcos magnifica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lamiaceae | *Vitex lokundjensis* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Lecythidaceae | *Crateranthus cameroonensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lecythidaceae | *Rhaptopetalum breteleri* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum sessilifolium* | EN | A(i) | B(ii) | ✓ | ✓ | | |
| Linaceae | *Hugonia micans* | VU | A(i) | | | ✓ | ✓ | |
| Loranthaceae | *Tapinanthus preussii* | VU | A(i) | | ✓ | ✓ | | |
| Melastomataceae | *Nothodissotis barteri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Leplaea thompsonii* | VU | A(i) | | | | ✓ | |
| Moraceae | *Dorstenia prorepens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Ochnaceae | *Ochna calodendron* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum alinae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum calvum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum platybulbum* | VU | A(i) | | ✓ | | ✓ | |
| Orchidaceae | *Bulbophyllum porphyrostachys* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | | | |
| Orchidaceae | *Eggelingia gabonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Peridiscaceae | *Medusandra mpomiana* | | | B(ii) | | | | |
| Phyllanthaceae | *Phyllanthus caesiifolius* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus nyale* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea ebo* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Primulaceae | *Ardisia ebo* | CR | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Putranjivaceae | *Drypetes preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Aulacocalyx camerooniana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Belonophora ongensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera laxissima* | | | B(ii) | | | | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Chassalia simplex* | | | B(ii) | | | | |
| Rubiaceae | *Coffea leonimontana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Coffea montekupensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Eumachia obanensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis rammelooana* | VU | A(i) | B(ii) | | | ✓ | |
| Rubiaceae | *Kupeantha ebo* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Kupeantha yabassi* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Mitriostigma cameroonense (ined.)* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha divaricata* | VU | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | ✓ | | |
| Rubiaceae | *Psychotria arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria darwiniana* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | | ✓ | | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Psychotria geophylax* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria lanceifolia* | VU | A(i) | | | ✓ | | |
| Rubiaceae | *Psychotria njumei* | EN | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Sabicea medusula* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea rufa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea xanthotricha* | EN | A(i) | | ✓ | ✓ | | |
| Rubiaceae | *Tricalysia vadensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Trichostachys petiolata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Neolemonniera batesii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola letouzeyana* | | | B(ii) | | | | |
| Sterculioideae | *Pterygota macrocarpa* | VU | | | | | ✓ | |
| Thymelaeaceae | *Dicranolepis polygaloides* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Urticaceae | *Myrianthus fosi* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Violaceae | *Rinorea thomasii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Vitaceae | *Vitex yaundensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Yabassi Important Bird Area | Protected/conservation area overlaps with IPA |
| Key Biodiversity Area | Yabassi Key Biodiversity Area | Protected/conservation area overlaps with IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Agro-industry farming | Medium | Ongoing – increasing |
| Small-holder plantations | Medium | Ongoing – increasing |
| Mining & quarrying | Medium | Ongoing – trend unknown |
| Logging & wood harvesting | High | Future – planned activity |
| Shifting agriculture | Low | Ongoing – trend unknown |

# IPA
# Mt Nlonako

**International site name:** Mt Nlonako
**Site code:** CMNTIPA018
**Administrative region:** Littoral
**Assessed by:** Bruce Murphy

**Latitude** (decimal degrees)**:** 4.91000
**Altitude minimum:** 150
**Area** (km²)**:** 661.0
**Longitude** (decimal degrees)**:** 9.95000
**Altitude maximum:** 1,807
**IPA criteria met:** A(i)

## Site description

Mt Nlonako is part of the Cameroon line of volcanic uplands which stretch inland from the bay of Biafra in a north-east direction. These mountains constitute some of the few areas in tropical Africa north of the equator that exceed 1,000 m in altitude, apart from the more extensive uplands of the rift valley and Ethiopian Highlands. In White's (1983) phytogeographical scheme they are part of the Afromontane archipelago-like centre of endemism. Mt Nlonako itself is on the eastern side of this chain, with the summit approximately 15 km south-east of the eastern summit of the better known Mt Mwanenguba. Between these two mountains runs the major Douala-Baffoussam N5 road, along which are several large urban areas, including, at the foot of Mt Nlonako, the city of Nkongsamba that has a population of c.100,000 at the 2005 census, estimated to have risen to 117,000 in 2020 (United Nations, 2018).

The area here proposed as an IPA approximately matches the Mt Nlonako IBA but includes a little more of the degraded western and southern slopes of Nlonako where important plant species may still survive amongst secondary forest. The southern border follows the Nkebe river and the site extends east of the peak as far as the Nkam river to incorporate a large area of little-populated, undulating lowland forest. Therefore, the site also mostly overlaps FMU 07-004 except that the FMU does not include the upper slopes of Mt Nlonako itself. Beyond the eastern boundary lies the Yabassi Key Biodiversity Area incorporating Nkondjock and Yingui council forests (former Makombe forest) and then the Ebo forest.

## Botanical significance

The site is significant both for its montane and submontane forest and for the large tracts of relatively intact lowland rainforest with semi-deciduous elements (BirdLife International, 2021h). There has been little botanical surveying, especially on the eastern side. The different rock and soil types and reportedly less humid conditions (see below) may produce a somewhat unique flora compared with other nearby mountains. A large number of globally threatened species are found at the site as well as many timber species and medicinal plants utilised by the local population.

Five threatened species of the genus *Begonia* are recorded, suggesting the area may have been part of a Pleistocene refuge, as has been suggested for amphibians (Hermann et al., 2005a). *Cola lomensis* has only ever been recorded here. Further botanical collecting is urgently needed, especially of the montane summit vegetation and eastern forest.

The rare rheophyte *Ledermanniella thalloidea* (EN) is included here as collections, including the type, have been made from nearby towns, although it is unknown if from Mt Nlonako. *Crudia letouzeyi* (VU) has been collected in the vicinity of Balondo close to the proposed southern border.

## Habitat and geology

Although Gartlan (1989) describes Mt Nlonako as part of the elevated gneiss and granite Precambrian basement complex, more recent research (Kamgang et al., 2020; Pouclet et al., 2014) suggests it is an igneous (90% syenite) intrusion of probable Eocene age, while the forest to the east lies on Neoproterozoic basement complex rocks. Minor amounts of extrusive rock (rhyolites and basalts) also occur. As an intrusive formation it differs from its more recent, extrusive neighbour Mt Manengouba, and from Mt Kupe, which may derive from a horst but is capped by basalt (Pouclet et al., 2014). The slopes are steep, especially on the western face, but also much eroded; a large crater-like culvert is found near the summit, opening to the eastern slopes which descend more gradually. Pedologically coarse gravels, very acid sands and laterites are dominant (Gartlan, 1989). Soils in the lowland forest in the eastern part are unreported but are likely to be more typical laterites over basement complex rocks.

Rainfall at Nkongsamba (882 m asl) averaged 2,762 mm per year over a 34-year period (Amiet 1975, cited by Hermann et al., 2005a). The tropical monsoon climate has a single – summer – wet season, peaking between July and September, with up to 482 mm of rain per month. The winter dry season between December and February has less than 50 mm per month. At the summit of Mt Nlonako itself, annual rainfall was 3,000 mm. Mean annual temperature was 20 °C at the summit and 26 °C at Nkongsamba (Gartlan, 1989; Valet et al., 1985, cited by Sainge et al., 2018).

Although lying less than 150 km from the Bight of Biafra coast and therefore within White's (1983) Guineo-Congolian lowland rainforest, Mt Nlonako's altitude puts it in the Afromontane zone. Letouzey's (1965) map of Cameroon locates Mt Nlonako in a submontane-montane vegetation zone, with the eastern hinterland in the Biafran forest zone. The eastern forest is drier and less humid, with less epiphytic vegetation than that at equivalent altitude in the Bakossi-Kupe-Manengouba area (Hermann et al., 2005a; BirdLife International, 2021i).

## Conservation issues

There has been severe degradation to the northern slopes (facing Nkongsamba) up to at least 1,000 m asl due to agriculture, logging and over-exploitation of medicinal plants. However, Nembot & Tchanou (1998) suggested that the steep slopes, relatively infertile soils and lack of access had generally limited damage to much of the mountain. Hermann et al. (2005a) reported forest destruction on the western and northern slopes up to about 1,100m, while in the east and south, the forest was much less impacted. However, some coffee cultivation also occurs on the southern slopes, and tracks were present on the eastern slopes too, with much logging in places (Hermann et al., 2005a). Small villages such as Eyimbe have cultivated land on the eastern flanks and expansion of coffee farms has almost cut off the montane vegetation from the forest below (BirdLife International, 2021i). The high cuvette is vegetated largely by bracken and grass. Global Forest Watch estimates 0.4% tree-cover loss since 2000, equivalent to 6.79 kt of $CO_2$ emission per year (Global Forest Watch, 2020).

Efforts to gain protected status for the site have been frustrated and the current status of Mt Nlonako is uncertain. The whole area was marked on the 2018 Cameroon Forest Estate map (MINFOF & WRI, 2018) as a (non-protected) forest reserve but on the 2020 map Mt Nlonako itself has been removed from the unit, which is now designated as Forest Management Unit 07-004, contracted to SCIEB, with a management plan in process (MINFOF & WRI, 2020; Open Timber Portal, 2021). It was proposed in 1994 as a protected forest reserve, and WWF (2020b) refer to Mt Nlonako as a 'protected faunal reserve' but this does not appear to have been implemented. The Cameroon NGO ERUDEF continues to push for gazettement (Ndimuh & Niba, 2018; Greenvision News, 2018), supported by research suggesting it has the richest amphibian fauna in Africa, with 93 species (Hermann et al., 2005a). It is one of the best sites for the giant goliath frog (*Conraua goliath*, EN) as well as other globally threatened species such as *Werneria mertensiana* (CR) and *Petropedetes perreti* (EN). It is also rich in reptiles (89 species), and birds (267 species) (Hermann et al., 2005b; Ndiumuh & Niba, 2018).

To the east of the site, Makombe forest, part of the Yabassi Key Biodiversity Area, is apparently being developed as a large palm oil plantation concession granted to a Cameroonian company, Greenfil, part of Nana Bouba's business empire (Orozco & Salber, 2019). There appears to be much secrecy about the project and the future of this area and other huge tracts of largely intact forest in Littoral Region, including Ebo forest and FMU 00-004, to the north-east remain unclear and insecure (Morgan et al., 2011). Bakaka Forest Reserve adjoins Nlonako to the south and is another site which should be managed to maintain habitat connectivity with Mont Nlonako.

## Key ecosystem services

Landslides are a serious threat in parts of Cameroon and the very steep deforested western and northern slopes directly above the growing city of Nkongsamba are a threat to life (Zogning et al., 2007). Images posted online appear to show scars on the mountain from a major landslide which apparently took place

on 16 June 2009 (Fons, 2019, **https://goo.gl/maps/wkqonkS6tdSwBWnp7**). The remaining forest on the mountain provides a crucial ecosystem service by limiting this danger and preventing soil erosion and silting of rivers.

Although a relatively small catchment, the mountain is the source of the rivers Mungo, Wouri and Dibombari (Greenvision News, 2018). Protecting the remaining forest and reforesting the lower slopes should therefore be considered priorities.

The forest reportedly is considerably exploited for many forest products, including medicinal plants (Greenvision News, 2018). Many timber species are also known, several of which such as *Lophira alata, Afzelia bipindensis*, *Baillonella toxisperma* and *Entandrophragma* spp. are considered globally threatened but are widespread enough not to be included here under IPA criterion A or B(ii).

With good road access to Doaula and northern cities, as well as immediate proximity to Nkongsamba, the site has great tourist potential owing to the dramatic topology and large area of intact rainforest. Charismatic species such as the world's largest frog are found here but bushmeat hunting is a major threat to this and other species (Ndimuh & Niba, 2018).

The site provides habitat for a remarkable diversity of animal species. Herrmann et al. (2005a, 2005b) found it to be the most species-rich single locality in Africa for both amphibians and reptiles, especially snakes, for which it was suggested to be possibly the most species-rich site in the world. The continued presence of forest elephants, drill, gorillas, chimpanzees, other large mammals and many bird species was also reported by these and other authors (Morgan et al., 2011; BirdLife, 2021i). The protection of the eastern Nlonako forest and its connection with Ebo forest and the other large tracts of forests constituting the Yabassi Bird Area (FMU 00-004, Yingui, Nkondjock, Makenene, Ndikinimeki and Yabassi council forests and several patches of community forest) are likely to be crucial for the long-term survival of these populations.

## Ecosystem service categories

**Provisioning** – Food

**Provisioning** – Raw materials

**Provisioning** – Fresh water

**Provisioning** – Medicinal resources

**Regulating** – Carbon sequestration and storage

**Regulating** – Erosion prevention and maintenance of soil fertility

**Habitat or supporting services** – Habitats for species

**Cultural** – Tourism

## IPA assessment rationale

Mt Nlonako qualifies as an IPA under criterion A(i) due to the presence of a large number of globally threatened species. The extent of surveying so far does not yet provide sufficient data concerning national endemics and range-restricted species for it to qualify under criterion B(ii). The site may potentially also qualify as a reservoir of useful species under criterion B(iii) and under criterion C as an important site for nationally threatened submontane forest and moist lowland forest.

***Begonia pseudoviola*** **(EN) is one of the threatened species recorded at Mt Nlonako.**
Photograph X. van der Burgt.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | ✓ | | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | ✓ | | |
| Araceae | *Amorphophallus preussii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | ✓ | ✓ | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Aristolochiaceae | *Aristolochia goldieana* | VU | A(i) | | | ✓ | ✓ | |
| Begoniaceae | *Begonia adpressa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia oxyanthera* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia pelargoniiflora* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia preussii* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia pseudoviola* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Bombacoideae | *Rhodognaphalon brevicuspe* | VU | A(i) | | | | ✓ | |
| Celastraceae | *Thyrsosalacia racemosa* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | | |
| Commelinaceae | *Palisota flagelliflora* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Connaraceae | *Jollydora glandulosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Costaceae | *Costus kupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia talbotii* | CR | A(i) | | ✓ | ✓ | | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | | | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | | | |
| Lecythidaceae | *Crateranthus talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Napoleonaea egertonii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos gnetifolia* | VU | A(i) | | | ✓ | ✓ | |
| Marantaceae | *Sarcophrynium villosum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Triclisia macrophylla* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia fernandopoana* | VU | A(i) | | | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella thalloidea* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia koupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rosaceae | *Prunus africana* | VU | | | | | ✓ | |
| Rubiaceae | *Calochone acuminata* | VU | A(i) | | ✓ | ✓ | | |
| Sterculioideae | *Cola lomensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sterculioideae | *Cola megalophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Pterygota macrocarpa* | VU | A(i) | | | ✓ | ✓ | |
| Zingiberaceae | *Aframomum kamerunicum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (Production) | FMU 07-004 | Protected/conservation area overlaps with IPA |
| Important Bird Area | Mont Nlonako IBA | Protected/conservation area matches IPA |
| Key Biodiversity Area | Mont Nlonako IBA | Protected/conservation area matches IPA |

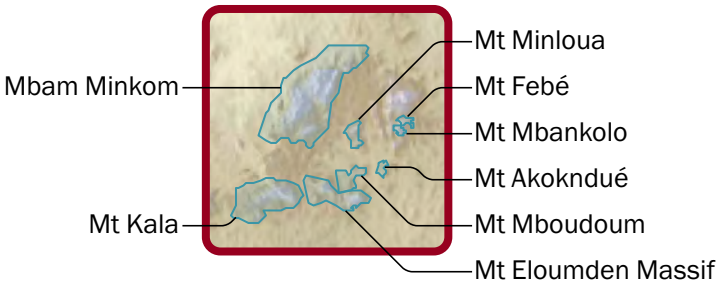
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | High | Ongoing – trend unknown |
| Gathering terrestrial plants | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | High | Ongoing – increasing |
| Avalanches/landslides | Medium | Past, likely to return |

# Centre Region

The view over Yaoundé from Mt Akokndoue, looking towards Mt Eloumden and Mt Kala.
Photograph December 2022.

# Yaoundé sites
## General summary




## Description and botanical significance

In and around Cameroon's capital city, particularly on the western side, are a number of steep hills or inselbergs where natural vegetation persists to a varying degree and many rare and globally unique and threatened species have been recorded. In the following sections, individual sites have been selected as IPAs based on pinpointed species records. However, dating back to Zenker and Staudt's 1890–94 herbarium collections, many rare species have been recorded that can be traced only to Yaoundé generally or to the Nkolbisson area. Subsequent collecting has recorded additional rare or conservation-important species from the inselberg hills, including rediscovery of many but not all of the species detected earlier by Zenker and Staudt. These forested inselbergs provide a flora differing from the lower surrounding areas. Like several cities, Yaoundé is sometimes referred to as having 'seven hills' (Tiafack & Mbon, 2017), although many more peaks can in fact be identified. The Nkolbisson area has been a particular locus for collecting, partly due to proximity with the centre of Yaoundé and ease of access as it is located about 8 km west of Yaoundé on the old road to Douala. Some of these collections, particularly a number made in the early 1960s by W.J.J.O. de Wilde & de Wilde Duyfjes and colleagues in the 1960s, have also not yet been precisely located within this area. The list below details potential IPA-triggering species recorded from Yaoundé but not yet known from any of the recognised IPA sites.

## Habitat and geology

The hills around Yaoundé rise from the South Cameroon Plateau between the Sanaga fault and the north-thrusting Congo craton. They are formed from ancient surface erosion which has exposed high-grade plutonic metamorphic rocks, mainly granulites and migmatites also referred to as embrichite gneiss (Achoundong, 1985), derived from sedimentary and igneous protoliths and apparently dating from around 600 mya (Nzenti et al., 1988; Tchouatcha et al., 2018; Timoléon et al., 2012).

Precipitation in Yaoundé is 1,605 mm per annum, falling in a bimodal pattern with a small (March–June) and greater (September–November) wet season interspersed with a drier period (July–August) and a second more severe dry period in December–February when mean monthly rainfall drops below the relatively flat mean monthly temperature curve (range 22.8–25.47 °C) on a Walter-Leith type chart (Simo et al.,2009; Bissaya et al., 2014; Noumi, 2015). This is below the level of rainfall normally thought necessary to sustain evergreen tropical forest (Cheek et al., 2011), although the level may be higher on the summits due to orographic precipitation including from cloud condensation (Madiapevo et al., 2014; Simo et al., 2009).

The original forest at the foot of the hills, where altitudes are in the range 700–750 m asl, was semi-deciduous (Achoundong 1985, 1996; Kuete 1977, 1990) but has been heavily degraded where it has not been totally cleared. The hills themselves rise usually several hundred meters, mainly in the range 900–1200 m asl. The steep slopes are covered in both submontane (cloud) forest and with a variety of inselberg micro-habitats including open bare-rock vegetation with extremely specialised plant communities. These inselberg communities include herbaceous plants that are adapted to periods of desiccation; for example, *Tricarpelema africanum, Microdracoides squamosa* and *Afrotrilepis pilosa*. The submontane forest includes indicator species from the Cameroon Highlands; for example, *Santiria trimera*, *Cylicomorpha solmsii, Allanblackia gabonensis, Garcinia* and *Cola* species. Both major habitat types contain numerous species globally restricted to the Yaoundé hills. No one hill contains all the threatened and globally unique species. Some species are restricted to a single hill, while others occur on only two or three.

## Conservation issues

Yaoundé was the second-largest city in Cameroon at the last census but has been estimated to be growing at over 5% per year. It is now estimated to have the largest population in the country and is predicted to

reach 5.7 million by 2030 (United Nations, 2018). All of the western hills and areas of vegetation have been more or less seriously degraded due to small-scale agriculture, suburban spread and extraction of firewood and timber. Intense population pressure has increased demand on natural areas (undeveloped land) for fuelwood, cultivation and building, with 'urban front' advancement on steep slopes and marshy areas (Nkwemoh et al., 2017; Tiafack & Mbon, 2017; Nkwemoh, & Tchindjang, 2018). The sites are also targeted for large and small-scale quarrying of their granite-type rocks (used for concrete and road construction), notably at Mt Minloua and Mt Eloumden.

A program of tree-planting has been initiated in Yaoundé in the 21st century, including the planting of *Eucalyptus* trees, with the aim of drying up marshy areas and for flood and landslide protection (Nkwemoh et al., 2017). However, such wetland areas may be important for some species and the conservation of natural vegetation, limiting of settlement on slopes and perhaps planting fast-growing native species where reforestation is desirable might be better options because of the invasive, flammable and allelopathic traits of *Eucalpytus*.

Despite the considerable degradation of Yaoundé's natural habitats, for those plant species endemic to or with significant populations in the area, preserving a network of these inselberg sites may be the best hope for their survival. Collectively, these sites also likely qualify under criterion C as a threatened habitat. Several sites on the western side of the city, such as Mt Mbokdoum, Mt Eloumden and Mt Kala, could be connected to form a continuous forest habitat. Walking routes with educational signs could be developed around the hills to help promote local interest in preserving the city's biodiversity.

Although not included here, the Nkolondom massif (incorporating Mt Yéyé) in the north of the city may also qualify as an IPA. A short visit by the authors in December 2022 revealed several species important for conservation but also considerable degradation, with cultivation up to the summit area. Better forest appeared to survive on some lesser peaks and slopes of the same massif.

The surviving habitats of the Yaoundé hills remains incompletely surveyed for plants. New species to science are slowly being discovered to this day. Much work remains to re-find sites for some of the species known only from unlocalised historic specimens (which may prove to be extinct due to previous habitat clearance) and also to complete the inventory of surviving species. There is no doubt that additional globally unique plant species currently unknown to science will be found if this is done before the hills are further cleared and the species become extinct. Only when species are known to science can they be officially Red Listed and the likelihood of them being conserved for future generations improved.

## Key ecosystem services

The hills of Yaoundé have a high risk of landslides partly due to steep terrain and impervious clay beneath permeable laterite soil and human actions that cause gullying (Zogning et al., 2007; Mukenga et al., 2016). Such events have claimed many lives and caused extensive damage in Yaoundé. Flooding is also a danger due to the dramatic rise in unplanned settlements and deforestation of slopes and naturally flood-prone areas such as swamps (Tiafack & Mbon, 2017). Preservation of existing forest and primary vegetation is important to preventing landslide disasters and flash flooding through binding soils and buffering rainfall, especially since the base of many hill sites are densely settled in places (Lachenaud et al., 2013; Mukenga et al., 2017).

In a rapidly growing metropolitan area these scenic hill sites are also an important recreational and educational resource for the growing population, improving quality of life and adding to the prestige and aesthetic appeal of the city; the survival of rare species, many globally unique to Yaoundé, and primary vegetation greatly increases their value. They provide convenient fieldwork sites for students at Yaoundé's schools and universities and, for other urban residents, a potential connection to the country's rich biodiversity.

Yaoundé's hills provide habitat for many bird species, including *Picathartes oreas* (VU) which survives in the Mbam Minkom – Kala IBA. Survival and restoration of natural vegetation on the smaller, more degraded, hills could help support populations of such species that are increasingly dependent on the Mbam Minkom hills.

## Ecosystem service categories

**Regulating –** Moderation of extreme events

**Regulating –** Erosion prevention and maintenance of soil fertility

**Regulating –** Local climate and air quality

**Regulating –** Carbon sequestration and storage

**Habitat or supporting services –** Habitats for species

**Habitat or supporting services –** Maintenance of genetic diversity

**Cultural –** Recreation and mental and physical health

**Cultural –** Tourism

**Cultural –** Aesthetic appreciation and inspiration for culture, art and design

**Cultural –** Education

**Cultural –** Cultural heritage

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

## Potential priority species not included for specific Yaoundé sites

| Family | Taxon | IUCN |
|---|---|---|
| Acanthaceae | *Crossandra obanensis* | EN |
| Acanthaceae | *Dicliptera alternans* | VU |
| Acanthaceae | *Justicia orbicularis* | VU |
| Annonaceae | *Uvariodendron giganteum* | VU |
| Apocynaceae | *Brachystelma omissum* | VU |
| Apocynaceae | *Landolphia flavidiflora* | VU |
| Apocynaceae | *Secamone letouzeana* | VU |
| Asparagaceae | *Chlorophytum staudtii* | EN |
| Bignoniaceae | *Stereospermum zenkeri* | CR |
| Boraginaceae | *Cordia stenoloba* | EN |
| Byttnerioideae | *Leptonychia subtomentosa* | EN |
| Caesalpinioideae | *Entada camerunensis* | |
| Celastraceae | *Crossopetalum serrulatum* | VU |
| Celastraceae | *Pristimera staudtii* | |
| Celastraceae | *Simirestis staudtii* | CR |
| Commelinaceae | *Tricarpelema africanum* | |
| Compositae | *Mikaniopsis vitalba* | VU |
| Cucurbitaceae | *Momordica camerounensis* | EN |
| Dichapetalaceae | *Dichapetalum reticulatum* | VU |
| Dioscoreaceae | *Dioscorea claessensii* | DD |
| Euphorbiaceae | *Macaranga paxii* | VU |
| Lamiaceae | *Vitex yaundensis* | CR |
| Lauraceae | *Beilschmiedia grandifolia* | VU |
| Loganiaceae | *Strychnos gnetifolia* | VU |
| Loranthaceae | *Agelanthus dichrous* | VU |
| Menispermaceae | *Albertisia glabra* | VU |
| Papilionoideae | *Pterocarpus zenkeri* | EN |
| Rubiaceae | *Coffea heterocalyx* | CR |
| Rubiaceae | *Hymenocoleus glaber* | VU |
| Rubiaceae | *Rytigynia dasyothamnus* | |
| Sapindaceae | *Allophylus oyemensis* | EN |
| Violaceae | *Rinorea sinuata* | |
| Vitaceae | *Cyphostemma camerounense* | EN |
| Zingiberaceae | *Renealmia laxa* | |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – housing and urban areas | High | Ongoing – increasing |
| Shifting agriculture | High | Ongoing – increasing |
| Small-holder farming | High | Ongoing – increasing |
| Mining and quarrying | High | Future – inferred threat |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| Avalanches/landslides | Medium | Future – inferred threat |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |

## IPA

# Yaoundé site: **Mbam Minkom Hills**

**International Site Name:** Mbam Minkom Hills
**Site code:** CMNTIPA008
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Xander van der Burgt, Vincent Droissart, Bonaventure Sonké, Murielle Simo-Droissart, Roger Fotso, Oliver Lachenaud, Gaston Achoundong

**Latitude** (decimal degrees)**:** 3.96150
**Altitude minimum:** 650
**Area** (km²)**:** 86.0
**Longitude** (decimal degrees)**:** 11.39150
**Altitude maximum:** 1,295
**IPA criteria met:** A(i)

## Site description

The Mbam Minkom Hills are a series of steep prominences located around 15 km north-west of the centre of Yaoundé, the capital city of Cameroon. Rising to 1,295 m, the highest point in Centre Region, they represent the highest and largest of the several granulite (metamorphic) inselberg areas in and around the west of the city. Unlike most of the other prominences, much of their vegetation is intact, at least in the submontane altitudinal zone (>900 m). The lower slopes at the perimeter of the area are more degraded by cultivation with farmland and farm fallow.

## Botanical significance

Despite their proximity to Yaoundé, the Mbam Minkom Hills have revealed many threatened and rare species of interest. It is the largest and most intact of the Yaoundé sites and the best hope for conserving some of the species endemic to the Yaoundé area, including historically recorded taxa that have yet to be collected from the site itself. It may represent the only global location for Critically Endangered *Coffea fotsoana*, a potentially important coffee wild relative. *Aristolochia preussii* is another Critically Endangered taxon recorded here. *Talbotiella breteleri* (EN) is endemic to the Yaoundé sites and only survives perilously or not at all at the other two sites. Simo et al. (2009) have described the orchid flora of the site but there have been relatively few other surveying efforts. Mbam Minkom is the only known Cameroon location for *Polystachya carnosa* and *Polystachya kubalae*. Additional rare recorded orchid species such as *Kylicanthe cornuata* have yet to be formally assessed.

## Habitat and geology

Relative to other montane areas such as the Cameroon Highlands, the Mbam Minkom and other Yaoundé hills may exhibit a Massenerhebung (mountain mass elevation) effect due to their relative isolation from other large mountains, potentially resulting in plants having lower altitudinal tolerances and high-altitude species occurring at lower altitudes than elsewhere (Noumi, 2015).

The vegetation consists of remaining areas of lowland forest much degraded by cultivation, relatively intact submontane forest at 800–1,300 m, and 'inselberg' areas characterised by sparse vegetation tolerant of heat and water deficit such as *Microdracoides squamosus* (Droissart et al., 2006; Onana & Cheek, 2011). 'Mbam Minkom' means 'rocky domes' in the Ewondo language and the steep topology leaves substantial areas of exposed rock. Forest is semi-deciduous on the lower, eastern

slopes but evergreen on the summit. There are many rivers and streams beneath the canopy, often forming steep gullies.

## Conservation issues

The proximity of the Mbam Minkom Hills to the capital city presents various conservation challenges and opportunities. Most of the other hills and areas of vegetation on the western side of the city have been seriously degraded or lost due to small-scale agriculture, suburban spread, hotel development, extraction of timber, and quarrying. These are all threats to Mbam Minkom as the city enlarges and develops (Nkwemoh et al., 2017, 2018).

Noumi (2015) reports that much forest has been destroyed by small-scale agriculture around the edges and on the lower slopes of the Mbam Minkom area but that the interior is largely intact. The western side, which is steeper and has higher rainfall, is less degraded, even though it drops to lower altitudes of around 650 m (Simo et al., 2009). Awa et al. (2009) report the threats to be agriculture, logging and settlement within the forest.

The beauty of the landscape is very striking to visitors and there is potential for increased tourism. However, Awa (2009) reports that a tourism drive led to deforestation of important trees and loss of nesting sites to harvest timber for huts at the summit. Unfortunately, these huts were poorly sited and by 2009 were dilapidated (O. Lachenaud, 2021, pers. comm., 29 June). Outcomes such as this highlight the importance of integrating biodiversity education and management into well-managed ecotourism development.

The area demarcated here is narrowly separated from other proposed IPAs (Mt Kala, Eloumden and Mt Minloua). There is potential to integrate these sites and create a much more effective conservation area.

## Key ecosystem services

The forested Mbam Minkom watersheds supply fresh water to the large nearby population (Awa et al., 2007). The forest also helps prevent landslides, which have claimed lives and caused much devastation in parts of Cameroon. Mbam Minkom is particularly susceptible to mass movement and potential landslides (Zogning et al., 2007; Bissaya, 2014).

Mbam Minkom forms the major part of a Key Bird Area and is considered a stronghold for *Picathartes oreas*, with rocky outcrops of the steep slopes and watercourses providing rare suitable habitat where dense forest cover remains (Awa et al., 2009). Deforestation has severely impacted nesting in parts of the site. The presence of primate populations including the western lowland gorilla (*Gorilla gorilla gorilla*) was also reported (Awa et al., 2009) although it is not known if these still persist. Chimpanzees (*Pan troglodytes*) have been recently confirmed to still occur at the site (R. Fotso 2021, pers. comm., 9 June).

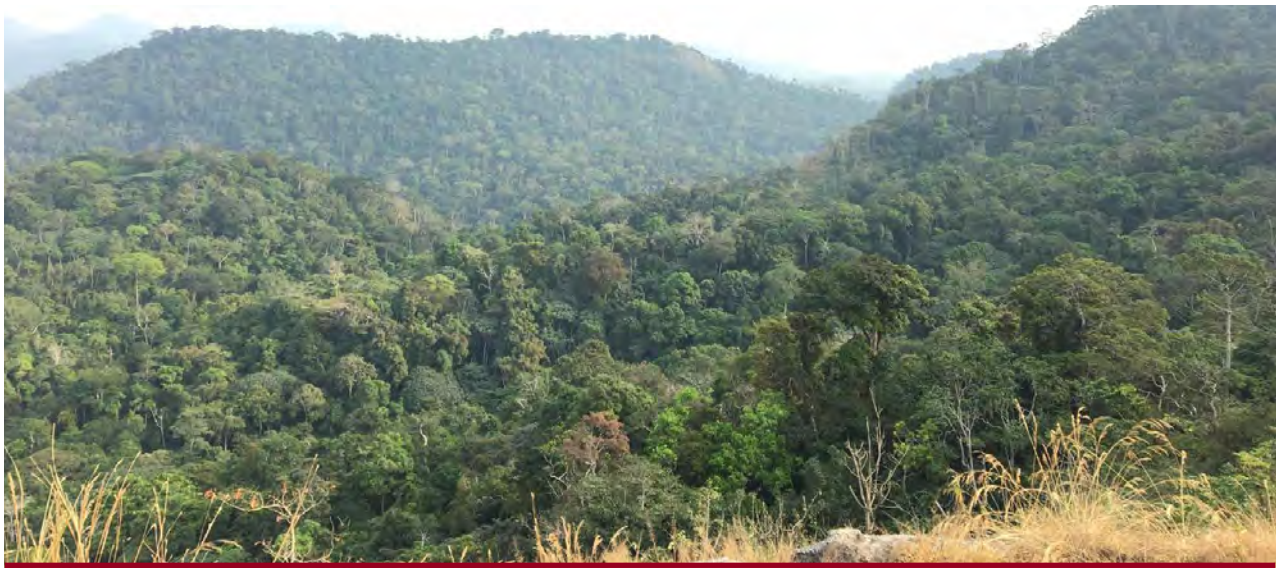
So close to Yaoundé, the site is important for traditional forest products, although care must be taken to avoid over-exploitation, particularly of timber. It is also of importance for air quality, leisure activity and biodiversity education.

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

The Mbam Minkom Hills qualifies as an IPA under criterion A(i) through the presence of around 25 globally threatened species with significant populations at the site. Given the high number of threatened Orchidaceae, one of the few groups for which the site has been well surveyed, it seems very likely that there are more threatened taxa from other plant families yet to be recorded.



**Forested hills of Mbam Minkom.**
Photograph A. Grail, 2018.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Crossandra obanensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | ✓ | | |
| Annonaceae | *Monodora zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia preussii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella breteleri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Pterorhachis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum egertonii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Orchidaceae | *Cheirostylis divina* var. *ochyrae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Kylicanthe bueae* | EN | A(i) | | ✓ | ✓ | | |
| Orchidaceae | *Polystachya albescens* subsp. *poyphylla* | | A(iv) | | ✓ | | | |
| Orchidaceae | *Polystachya carnosa* | | A(iII) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya kornasiana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya kubalae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia koupensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera laxissima* | | | B(ii) | ✓ | | | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Chassalia manningii* ined. | | A(iii) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Coffea fotsoana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Mussaenda epiphytica* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus doucetii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria satabiei* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria senterrei* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria sycophylla* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria villicarpa* subsp. *villicarpa* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea laxa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola hypochrysea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola letouzeyana* | | | B(ii) | | | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Mbam Minkom-Mt Kala IBA | Protected/conservation area encompasses IPA |

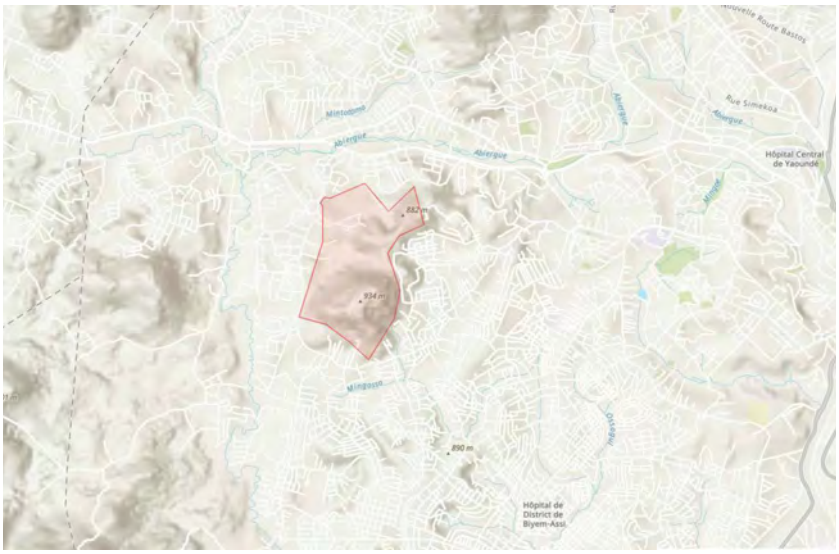
## Threats

See the Yaoundé general summary above.

## IPA

# Yaoundé site: **Mt Akokndoué**

**International Site Name:** Mt Akokndoué
**Local Site Name (if different):** Akok Ndoé
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Martin Cheek, Olivier Lachenaud, Gaston Achoundong, Jean Michel Onana




**Latitude** (decimal degrees)**:** 3.85700
**Altitude minimum:** 750
**Area** (km²)**:** 1.6
**Longitude** (decimal degrees)**:** 11.46540
**Altitude maximum:** 967
**IPA criteria met:** A(i)

## Site description

Mt Akokndoué (Akok Ndoe) and the associated ridge leading to the Mvog-Betsi summit a short distance to the north-east, is a partially forested prominence located in the Nkolbisson area of west Yaoundé, immediately west of the Institute of Agricultural Research for Development (IRAD) and associated buildings. It is part of a chain of c. 1,000 m inselbergs in and around the western part of Yaoundé, the capital of Cameroon.

## Botanical significance

Notable amongst the globally threatened species at this site are *Psychotria yaoundensis* (CR), which is endemic to Yaoundé, *Pristimera bilhongii* and *P. breteleri* (both CR) which are both narrowly endemic to the Nkolbisson area. *Pterorachis zenkeri* (VU), first described from Zenker and Staudt's 'Yaunde station' collections, has also been subsequently recorded here as well as at a few other sites, including the neighbouring inselbergs of Mt Minloua and Mt Fébé. *Callichilia monopodialis* (VU) and *Commelina zenkeri* (EN) are other threatened species recorded at this site.

## Habitat and geology

See the Yaoundé general summary above.

## Conservation issues

The vegetation has been considerably degraded by logging and cultivation. Dense settlements cover the lower slopes and have spread high up the flanks in places. Buildings are visible on satellite imaging to the top of the connected north-east ridge at c. 885 m. A brief recent field visit to the site confirmed extensive degradation, logging and market gardens close to the summit, but also the continued presence of interesting species in the flank forests and on the rock summit plateau.

## Key ecosystem services

See the Yaoundé general summary above.

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

Mt Akokndoué qualifies as an IPA under criterion A(i) through the presence of several globally threatened species which have been recorded here and are known from very few other sites. While the considerably degraded nature of the site is noted and the continued presence of some of these taxa would need to be confirmed, populations at other potential sites are also at risk.

## Priority species (IPA criteria A and B)

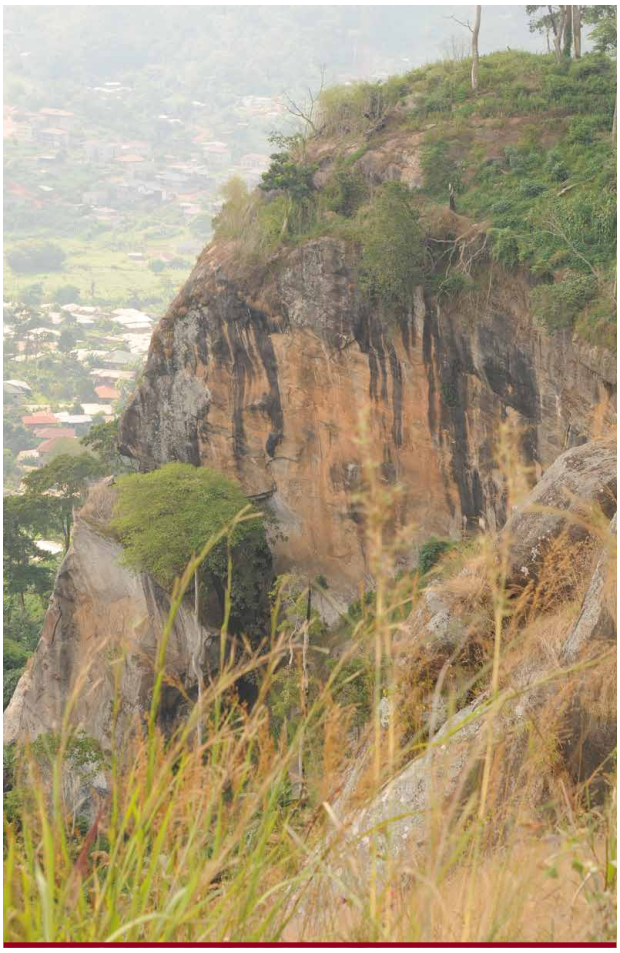
| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Apocynaceae | *Callichilia monopodialis* | VU | A(i) | B(ii) | ✓ | | | |
| Celastraceae | *Pristimera biholongii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Celastraceae | *Pristimera breteleri* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Commelinaceae | *Commelina zenkeri* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Pterorhachis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus doucetii* | VU | A(i) | B(ii) | ✓ | | | |
| Rubiaceae | *Psychotria yaoundensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

## Threats

See the Yaoundé general summary above.



**Steep cliffs of Mt Akokndoué.**
Photograph December 2022.

**A species of Melastomataceae on the rocky summit of Mt Akokndoué.**
Photograph December 2022.

## IPA

# Yaoundé site: **Mt Mbokdoum**

**International Site Name:** Mbokdoum Hill
**Local Site Name (if different):** Mbekoum
**Site code:** CMNTIPA014
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Martin Cheek, Olivier Lachenaud, Gaston Achoundong, Jean Michel Onana

**Latitude** (decimal degrees)**:** 3.85720
**Altitude minimum:** 700
**Area** (km²)**:** 6.7
**Longitude** (decimal degrees)**:** 11.44430
**Altitude maximum:** 950
**IPA criteria met:** A(i)

## Site description

Mt Mbokdoum (Mbogdoumy, Mbekoum) is a steep-sided inselberg, one of the 'seven hills' of Yaoundé (Tiafack & Mbon, 2017), rising to around 1,000 m and part of a larger group of mountains which form a natural barrier on the western side of the city. Included in the proposed IPA perimeter is the unnamed hill to the south-east (895 m) and the low-lying riverine zone in between. The site is close to the N'kolbisson neighbourhood where IRAD and other scientific institutes are based, and it is adjacent to the Mt Eloumden proposed IPA which in turn extends west almost to the Mt Kala proposed IPA.

## Botanical significance

The site is significant for three Critically Endangered species that have been recorded there, two of which are endemic to the Yaoundé inselbergs. *Multidentia saxicola* has only been recorded from here, another site north of N'kolbisson, possibly Mont Minloua, and one location in DRC. *Psychotria yaoundensis* is only otherwise recorded from neighbouring Mt Akokndoué and from Mt Eloumden 3 km to the south (Lachenaud et al., 2013). *Coffea* sp. 'Nkolbisson' is an undescribed, morphologically distinct taxon known only from this record and other non-specific 'Nkolbisson' locations. Treated as *Coffea heterocalyx*, which might otherwise be extinct, it was demonstrated to be distinct from *Coffea canephora* ('Robusta' coffee) by a recent molecular study (Davis et al., 2020). Being apparently the closest 'wild relative' of *C. canephora*, it is of potential economic importance as a possible source of useful genetic traits; conserving it in the wild should therefore be a priority.

## Habitat and geology

Mt Mbokdoum is especially steep sided on its north-east and southern faces, with outcrops of bare rock. There is low-lying marshy habitat between Mbokdoum and the hill to the south-west.

## Conservation issues

The vegetation has been considerably degraded by logging and cultivation. Settlements surround the Mboukdoum hill and have crept up the lower slopes on all sides but are especially dense to the north where they reach up to 850 m. The site appears to be privately owned and botanists visiting it encountered surveyors demarcating the boundary (O. Lachenaud 2021, pers. comm., 29 June). On the other hill, a road and sparse buildings ascend to nearly the summit. There is also evidence of cultivation on the lower slopes.

## Key ecosystem services

*Picathartes oreas* (VU) used to occur here. Although it is not known if this is still the case, Mbokdoum is one of several sites which, with restoration, could serve as satellites to Mbam Minkom and help protect and enlarge the Yaoundé populations of this rare bird and other fauna.

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

Mt Mbokdoum qualifies as a potential IPA under criterion A(i) due to the presence of three globally threatened (all CR) species known only from here and one or two other sites. Other globally threatened species recorded from 'N'kolbisson' may also occur here.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Coffea sp. 'nkolbisson' Charr et al.,* | | | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Multidentia saxicola* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria sycophylla* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria yaoundensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

## Threats

See the Yaoundé general summary above.

## IPA

# Yaoundé site: **Mt Mbankolo**

**International Site Name:** Mont Mbankolo
**Site code:** CMNTIPA023
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Martin Cheek, Gaston Achoundong, Jean Michel Onana

**Latitude** (decimal degrees)**:** 3.90593
**Altitude minimum:** 840
**Area** (km²)**:** 1.25
**Longitude** (decimal degrees)**:** 11.48379
**Altitude maximum:** 1,076
**IPA criteria met:** A(i)

## Site description

Mt Mbankolo is one of the 'seven hills' of Yaoundé, the capital of Cameroon. These hills are part of a larger group of Yaoundé mountains fringing the western side of the city. Mt Mbankolo is north-west of the city centre, next to Mt Febe, and also close to the Presidential Palace. The site rises to over 1,000 m.

## Botanical significance

Two globally endangered species are known from Mt Mbankolo and it is possible that other taxa collected from neighbouring hills may also occur here.

## Habitat and geology

See the Yaoundé general summary above.

## Conservation issues

The vegetation of Mt Mbankolo can be seen from satellite images to have been degraded by cultivation, fire and logging, with subsequent soil erosion. Up to c. 830 m Mbankolo is densely settled around much of its perimeter, and buildings and cultivation can also be seen much higher on parts of the mountain. Several cell phone or radio masts are present on the summit with associated service roads.

## Key ecosystem services

See the Yaoundé general summary above.

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

Mt Mbankolo qualifies as a potential IPA under criterion A(i) due to the presence of at least two globally threatened species, *Craterostigma yaundense* and *Eragrostis raynaliana*. Both of these are known from very few other locations and are also thought to be scarce and threatened at those sites. *Craterostigma yaundense* is endemic to Cameroon.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Linderniaceae | *Craterostigma yaundense* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Eragrostis raynaliana* | EN | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

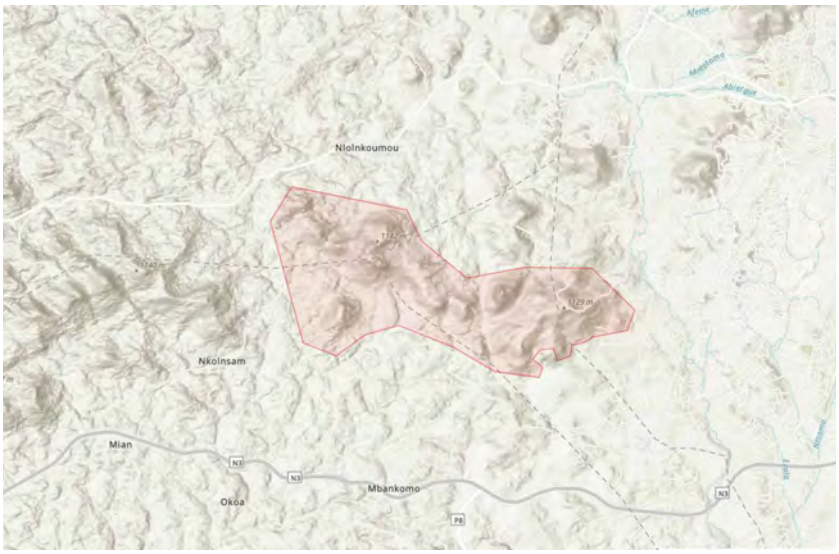
## Threats

See the Yaoundé general summary above.

## IPA

# Yaoundé site: **Mt Eloumden Massif**

**International Site Name:** Mt Eloumden Massif
**Site code:** CMNTIPA010
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Bonaventure Sonké, Vincent Droissart, Martin Cheek, Gaston Achoundong, Jean Michel Onana




**Latitude** (decimal degrees)**:** 3.82830
**Altitude minimum:** 750
**Area** (km²)**:** 19.0
**Longitude** (decimal degrees)**:** 11.43880
**Altitude maximum:** 1,142
**IPA criteria met:** A(i)

## Site description

Mt Eloumden and the associated peaks of Mt Zokye, Mt Ekanga and Nkol Ngoaékélé are located about 10 km west of central Yaoundé. Together with the Mt Kala massif further west, they extend in an east-west orientation, forming the southernmost of the various hills reaching over 1,000 m that dominate the western approach to the capital. Mt Zokye, Mt Ekanga and Nkol Ngoaékélé continue the Eloumden massif to the west and should arguably be included in the IPA designation since intact vegetation appears to persist. This chain comprises an area of approximately 10 km². A wider valley and road with settlements separates it from Mt Kala.

## Botanical significance

Several globally threatened taxa have been recorded specifically at Eloumden, including *Pterorhachis zenkeri* (VU) which was first recorded from Yaoundé in 1894. *Psychotria yaoundensis* (CR) has only been recorded from this site and two other nearby hills in Yaoundé (Lachenaud et al., 2013; Lovell & Cheek, 2021a). *Anisotes zenkeri* (EN) is also recorded and known only from Yaoundé and one other site also in Centre Region.

## Habitat and geology

See the Yaoundé summary above.

## Conservation issues

The site does not have protected status. Quarries are evident on the southern faces of Mt Eloumden and Mt Zokye. Elsewhere in Yaoundé, a larger quarry has destroyed much of the north-east summit of Mt Minloa.

The lower flanks show clear signs of settlement and cultivation up to about 900 m, particularly on the eastern side nearer to Yaoundé where it is feared there may be very little original vegetation surviving.

As well as potentially forming part of a network of inselberg sites around Yaoundé, the adjacent proposed IPAs of Mt Kala, Mt Eloumden and Mt Mbokdoum offer a potential for a large connected habitat.

## Key ecosystem services

See the Yaoundé summary above.

## Ecosystem service categories

See the Yaoundé summary above.

## IPA assessment rationale

Mt Eloumden qualifies as an IPA on the basis of several records of globally threatened species that are known from few other sites and are mostly nationally endemic. These include *Eugenia kameruniana* (CR), *Psychotria yaoundensis* (CR), *Pterorhachis zenkeri* (VU), *Anisotes zenkeri* (VU) and *Crossopetalum serrulatum* (VU). *Psychotria yaoundensis* is known only from Yaoundé and *Anisotes zenkeri* only from Centre Region. *Aristolochia ceropegioides* (VU) is recorded from Nkol Ngoaékélé, which is included as part of this IPA.

***Pterorhachis zenkeri* (VU) on Mt Eloumden.**
Photograph M. Cheek, 1997.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Anisotes zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Callichilia monopodialis* | VU | A(i) | B(ii) | ✓ | | | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | ✓ | | ✓ | |
| Caricaceae | *Cylicomorpha solmsii* | NT | | | | | | |
| Celastraceae | *Crossopetalum serrulatum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Pterorhachis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia kameruniana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus doucetii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria yaoundensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Mbam Minkom-Kala IBA | Protected/conservation area encompasses IPA |
| Key Biodiversity Area | Mbam Minkom-Kala IBA | Protected/conservation area encompasses IPA |

## Threats

See the Yaoundé general summary above.

## IPA

# Yaoundé site: **Mt Febé**

**International Site Name:** Mt Febé
**Site code:** CMNTIPA013
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Xander van der Burgt, Martin Cheek, Gaston Achoundong, Jean Michel Onana

**Latitude** (decimal degrees)**:** 3.88780
**Altitude minimum:** 770
**Area** (km²)**:** 1.55
**Longitude** (decimal degrees)**:** 11.47760
**Altitude maximum:** 1,047
**IPA criteria met:** A(i)

## Site Description

Mt Febé is a 1,000 m high inselberg located on the north-west fringes of Yaoundé and approximately 3 km due west of the Presidential Palace. It is the site of a large upmarket hotel with grounds and golf course and there is little natural vegetation on the south and west slopes except towards the summit. However, there appears to be remaining forest on the steep north slopes, which is partially continuous with the forested Nkolondom hill and associated topology to the north. The site here suggested also includes a strip of forest extending southwards on the eastern side.

## Botanical significance

*Pterorhachis zenkeri* (VU), originally collected from 'Yaundé station' in the 1890s, was recollected at Mt Febé in the 1960s along with other threatened species, *Justicia camerunensis* (VU), *Tricalysia atherura* (VU), *Diaphananthe sanfordiana* (EN), *Drypetes molunduana* (VU) and *Talbotiella breteleri* (CR). The latter species is thought to be endemic to Yaoundé, having been recorded from two or three of the city's inselberg sites including Mt Febé. *Agelanthus dichorus* (VU) is recorded from Yaoundé along the road to Mt Febe at c. 700 m (Breteler F.J.).

## Habitat and geology

See the Yaoundé general summary above.

## Conservation issues

Much of the hill has been developed into a luxury hotel and golf course and access to the summit area is apparently out of bounds for non-residents/ the general public (Explor xplore, 2020). Urban development has covered the lower flanks.

Sustainable management of remaining important species could be implemented in the grounds of the hotel and golf course, enhancing the interest and aesthetic appeal of the site. Walking routes with educational signs could be developed around the hill to help promote local interest in preserving the city's biodiversity.

## Key ecosystem services

See the Yaoundé general summary above.

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

Several globally threatened species have been recorded at the site. If any of these remain then the site would potentially qualify under criterion A(i). In particular, it would certainly qualify as one of the five best national sites for *Talbotiella breteleri* (CR), as this taxon is known from less than five sites, all in the Yaoundé area.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Justicia camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Talbotiella breteleri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Drypetes molunduana* | VU | A(i) | | ✓ | | | |
| Meliaceae | *Pterorhachis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Menispermaceae | *Penianthus camerounensis* | | | B(ii) | | | | |
| Orchidaceae | *Diaphananthe sanfordiana* | DD | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Leptoderris macrothyrsa* | EN | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Ixora batesii* | EN | A(i) | B(ii) | | | ✓ | |
| Rubiaceae | *Psychotria sycophylla* | | | B(ii) | | | | |
| Rubiaceae | *Tricalysia atherura* | VU | A(i) | | ✓ | | | |

## Protected areas and other conservation designations

None.

## Threats

See the Yaoundé general summary above.

## IPA

# Yaoundé site: **Mt Kala**

**International Site Name:** Mt Kala
**Local Site Name (if different):** Nkol Nlong
**Site code:** CMNTIPA009
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Xander van der Burgt, Bonaventure Sonké, Vincent Droissart, Gaston Achoundong, Jean Michel Onana, Eric Ngansop

**Latitude** (decimal degrees)**:** 3.83480
**Altitude minimum:** 1,137
**Area** (km²)**:** 10.0
**Longitude** (decimal degrees)**:** 11.35000
**Altitude maximum:** 750
**IPA criteria met:** A(i)

## Site description

Mont Kala is an east-west oriented ridge approximately 7 km long and located about 20 km west of Yaoundé. It is part of the chain of prominences located between the main N3 and N3A roads running into Yaoundé from the west that form the southern section of the steep topography flanking the western side of Yaoundé. The ridge is mostly around 900–950 m high with several summits rising to over 1,000 m.

## Botanical significance

Mt Kala is one of the least degraded of Yaoundé's forested inselbergs due probably to its greater distance from the centre of the city. Two species of *Afrothismia* are currently considered globally endemic to the site. *Pavetta bidentata* var. *sessilifolia* is also considered endemic to Mt Kala and the Kombing area 30 km to the south-west. *Disperis aphylla* (VU) appears to be only recorded in Cameroon from this site. *Gastrodia africana* is a very rare and little-understood species which was apparently collected at Mt Kala in 1968 (although the specimen appears to be missing) and from one or two other locations. Other species such as *Callichila monopodialis* (VU), *Tricalysia amplexicaulis* (provisionally VU, Onana & Cheek, 2011), *T. atherura* (VU) and *Culcasia sanagensis* (VU) are mainly known from here and other hills in the Yaoundé area. Several globally threatened but widespread timber species are also recorded and included in the table below, although they do not contribute to the IPA criteria considered.

## Habitat and geology

Madiapevo et al. (2017) describe the Kala summit forest as diverse and having affinities with other West African submontane forest but with high representation of Clusiaceae and *Cola*. Common species include *Allanblackia gabonensis, Tabernaemontana crassa, Santiria trimera, Coelocaryon preussii, Pycnanthus angolensis, Cola attiensis* var. *bodardii* and *Aulacocalyx jasminiflora*.

## Conservation issues

Mt Kala is one of the furthest inselberg sites from the centre but has not escaped habitat loss at all altitudinal levels. Clearance for agriculture and logging has particularly impacted the slopes up to 1,000 m, with cleared areas easily visible on satellite imaging. A road has been bulldozed from the base of the site as far as the rock cliff and land is being sold off (R. Fotso 2021, pers. comm., 9 June).

The site is included in the Mbam Minkom-Mt Kala Important Bird Area (BirdLife International, 2021j) and in 2009 Mt Kala was considered the only other remaining nesting site in the Yaoundé area for *Picathartes oreas* (VU) other than the larger Mbam Minkom massif (Awa et al., 2009).

A short fieldtrip by the authors in November 2022 revealed remaining good quality habitat on the steep slopes and cliffs. The lower slopes are much degraded by cultivation.

## Key ecosystem services

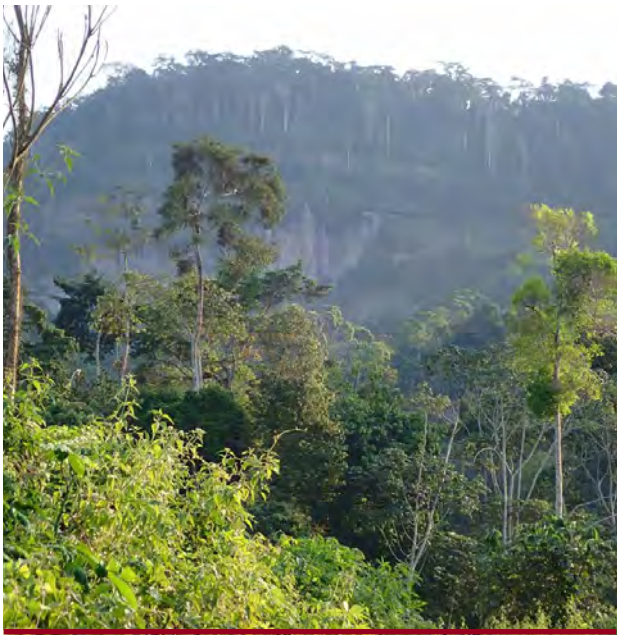
The site provides habitat to threatened bird species such as *Picathartes oreas* (VU).

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

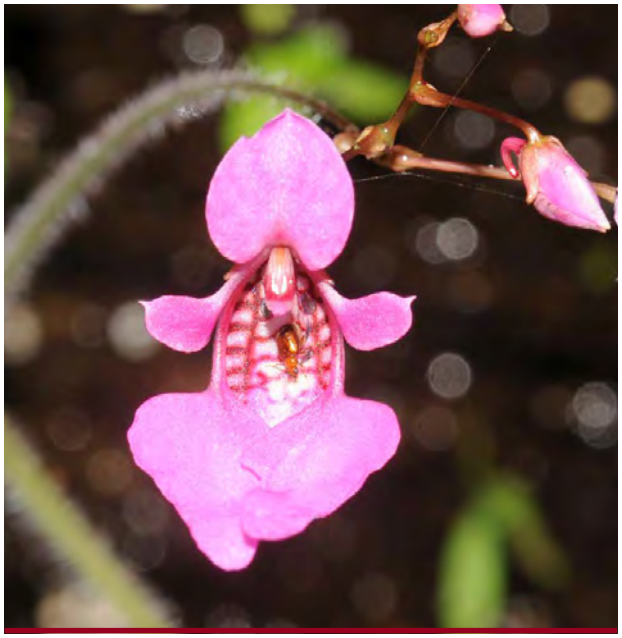
Mt Kala qualifies as an IPA on the basis of several globally threatened species which are present here and at few other locations, including some that are endemic to the site or the wider Yaoundé area.



**Mt Kala: remaining forest and steep cliffs.**

**Rocky cliffs provide interesting habitat in the Mt Kala forests.**

**Eric Ngansop of the National Herbarium of Cameroon investigates a potential new species of *Impatiens* on the rock faces at Mt Kala.**



**A possibly new species of *Impatiens* growing at Mt Kala.**

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Apocynaceae | *Callichilia monopodialis* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Araceae | *Culcasia sanagensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia amietii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Burmanniaceae | *Afrothismia pusilla* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Clusiaceae | *Allanblackia gabonensis* | VU | A(i) | | ✓ | | | |
| Clusiaceae | *Garcinia kola* | VU | | | | | | |
| Detarioideae | *Loesenera talbotii* | VU | A(i) | | ✓ | | ✓ | |
| Detarioideae | *Prioria joveri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | | | | | | |
| Euphorbiaceae | *Crotonogyne impedita* | CR | A(i) | | ✓ | | ✓ | |
| Euphorbiaceae | *Drypetes molunduana* | VU | A(i) | | ✓ | | | |
| Meliaceae | *Entandrophragma cylindricum* | VU | | | | | | |
| Meliaceae | *Entandrophragma utile* | VU | | | | | | |
| Meliaceae | *Khaya anthotheca* | VU | | | | | | |
| Orchidaceae | *Disperis aphylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Gastrodia africana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus doucetii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta bidentata* var. *sessifolia* | | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria sycophylla* | | | B(ii) | | | | |
| Rubiaceae | *Tricalysia atherura* | VU | A(i) | | ✓ | | ✓ | |
| Sterculioideae | *Pterygota macrocarpa* | VU | | | | | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Mbam Minkom-Kala IBA | Protected/conservation area encompasses IPA |
| Key Biodiversity Area | Mbam Minkom-Kala IBA | Protected/conservation area encompasses IPA |

## Threats

See the Yaoundé general summary above.

## IPA

# Yaoundé site: **Mt Minloua**

**International Site Name:** Mt Minloua
**Local Site Name (if different):** Montagne de Mouche
**Site code:** CMNTIPA012
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Xander van der Burgt, Martin Cheek, Gaston Achoundong, Jean Michel Onana

**Latitude** (decimal degrees): 3.88610
**Altitude minimum:** 720
**Area** (km²): 4.36
**Longitude** (decimal degrees): 11.43490
**Altitude maximum:** 967
**IPA criteria met:** A(i)

## Site description

Mt Minloua is located on the western side of Yaoundé, north-west of the N'kolbisson district and north-east of the Afeme river and Mefou dam and reservoir. It is part of a chain of c. 1,000 m inselbergs in and around the western part of Yaoundé. The site includes three summits above 900 m connected by ridges. North-east of the demarcated area, the mountain has been destroyed by quarrying up to around 925 m asl. It is unclear from available maps what name is given to the peak rising to around 960 m located at dd 3.9038 North,11.4344 East but this is also included here.

## Botanical significance

Notable amongst the globally threatened species at this site are *Pterorachis zenkeri* (VU), first described from Zenker and Staudt's 'Yaundé station' collections and subsequently recorded here as well as at a few other sites mainly in the Yaoundé area, including the neighbouring inselbergs of Mt Akondoué and Mt Febé (Onana & Cheek, 2011). *Anisotes zenkeri* (EN) was similarly rediscovered at Mt Minloa and is also known from Mt Eloumden and other unlocated Yaoundé locations as well as one other site in Centre Region (Cheek, 2014e). *Talbotiella breteleri* (EN) is also endemic to the Yaoundé area, recorded from Mbam Minkom and Mt Febé as well as this site.

*Scleria sheilae* (CR, Cheek et al., 2018e) is considered globally endemic to Mt Minloa itself. *Eragrostis raynaliana* (EN) is known from three collections in the 'N'kolbisson' area, one of which is identified as this site, 'la colline Minlo', as well as nearby Mt Mbankolo and two other sites outside of Yaoundé (Cheek & Lovell, 2020c). Although not yet on the global Red List, *Tricarpelema africanum* is known from very few sites in Cameroon but is recorded from Mt Minloa and nearby Mbam Minkom.

## Habitat and geology

See the Yaoundé general summary above.

## Conservation issues

Successive satellite imaging reveals gradual encroachment of buildings and farms up the flanks of these hills, sometimes to the summits. In addition, mountain-top quarrying has destroyed the north-eastern part of the hill and is likely to expand into the designated site if not prevented.

A large dam and reservoir to the immediate south and west of the site has flooded lower lying valleys. It is not known what species may have been lost or survived from naturally marshy habitat in this area.

## Key ecosystem services

See the Yaoundé general summary above.

## Ecosystem service categories

See the Yaoundé general summary above.

## IPA assessment rationale

Mt Minloa qualififes as an IPA under criterion A(i) due to the presence of several globally threatened species recorded from this site and with few other known locations. In particular, *Scleria sheilae* (CR) is known only from this site globally, while *Talbotiella breteleri* (CR) is otherwise recorded only from a few equally threatened Yaoundé sites.

**A large part of Mt Minloa has been destroyed by quarrying but the collecting site of *Talbotiella breteleri* is believed to be unaffected.**
Photograph A. Grall, December 2018.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Anisotes zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cyperaceae | *Scleria sheilae* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Detarioideae | *Talbotiella breteleri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Pterorhachis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Eragrostis raynaliana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricarpelema africanum* | | | | | | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Important Bird Area | Mbam Minkom-Mt Kala IBA | Protected/conservation area encompasses IPA |

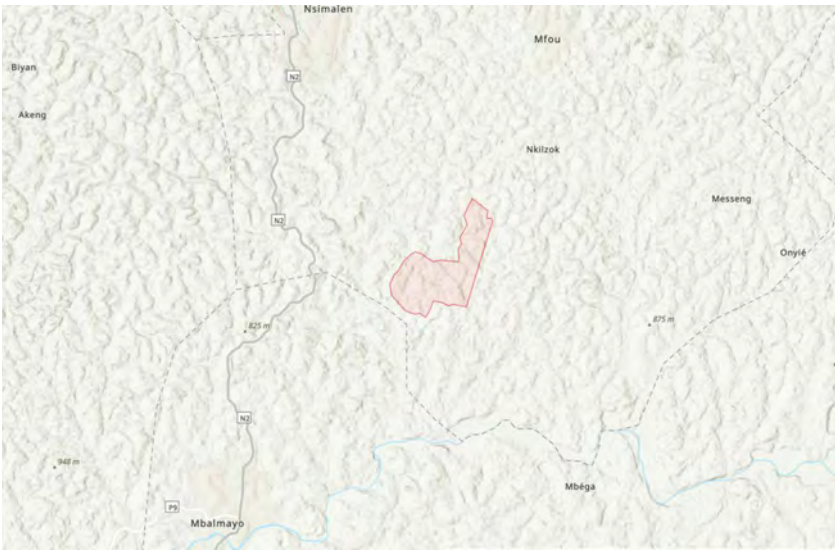
## Threats

See the Yaoundé general summary above.

## IPA

# Mefou Proposed National Park

**International Site Name:** Mefou Proposed National Park
**Local Site Name (if different):** Mefou Primate Sanctuary
**Site code:** CMNTIPA005
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Martin Cheek, Eric Ngansop




**Latitude** (decimal degrees): 3.62608
**Altitude minimum:** 600
**Area** (km²): 11.0
**Longitude** (decimal degrees): 11.58130
**Altitude maximum:** 750
**IPA criteria met:** A(i)

## Site description

The proposed Mefou National Park is an 11 km² patch of forest about 25 km south of Yaoundé. Since 1996, a primate rescue centre has operated at the site which was provided to the British NGO Ape Action Africa (AAA – formerly the Cameroon Wildlife Aid Fund) by the Ministry of Forestry and Wildlife. It is a refuge for chimpanzees, gorillas and other primates orphaned by the bushmeat and pet trade, and provides a wildlife education centre and visitor attraction within 45 minutes of the capital city. The centre employs over 50 staff, mostly from local villages. Botanically, the site is also a rare surviving patch of remaining lowland forest in the Yaoundé area (Centre Region). It harbours a good diversity of species including many that are nationally and globally threatened. The site is reached from the main N2 road between Yaoundé and Mbalmayo, via the turning to the east towards the village of Ekali II, across the river Mefou and south to the park headquarters at Ndanan I. It is located close to Yaoundé Nsimalen International Airport and approximately equidistant from the larger towns of Mbalmayo and M'fou (not to be confused with Mefou, the suburb of Yaoundé).

The park is bordered to the west and east by two branches of the river Mefou which converge to form also the southern boundary before flowing south to join the Nyong river. The western half, where the main entrance is located, has been better surveyed than the eastern part which extends northwards. The forest is predominantly semi-deciduous, logged and degraded lowland forest with patches of cultivation and primate enclosures. In addition, there is largely intact evergreen gallery forest dominated by *Gilbertiodendron dewevrei*, as well as inundated areas with swamp grassland.

## Botanical significance

Prior to the surveys between 2002 and 2006 by botanists from the National Herbarium of Cameroon and RBG Kew, which contributed to the publication of the Mefou Conservation Checklist (Cheek et al., 2011), there had apparently been no surveys of the proposed national park location. However, there has been some historical collection in the more general Yaoundé area by some of the major Western botanical collectors in Cameroon (Cheek et al., 2011). The site represents one of very few pieces of remaining forest in the Yaounde area and is therefore a refuge for characteristic taxa and habitat types.

Letouzey (1985) mapped the wider area as degraded semi-deciduous forest, and numerous indicator species of this forest type are recorded for Mefou

in Cheek et al. (2011) from their surveys or logging records. Canopy species of semi-deciduous trees from the Ulmaceae (Celtis, now Cannabaceae) and Malvaceae s.l. families are notable, particularly the genera *Celtis, Sterculia* and *Triplochiton*. While none of these are globally threatened, they represent valuable timber trees. The understory of this type of forest, which appears to differ considerably from evergreen forest, features some globally rare and threatened taxa such as the Mefou flagship species *Phyllanthus kidna* (CR), which is so far endemic to the site and is phylogenetically distant to other species in the region (Challen et al., 2011; Cheek & Rokni, 2017b). *Rhaphidophora bogneri* (CR) may also be globally endemic to the site as it is considered possibly extinct at the only other recorded location (Cheek & Lovell, 2021d). Taxa such as these may previously have been more widespread in the Yaoundé region and are now preserved at Mefou. *Pogostemon micangensis* (VU), although wide-ranging as far as central Angola, is also very infrequently recorded with only two to three collections besides Mefou (Cheek & Rokni, 2017b).

The spectacular leopard orchid (*Ansellia africana*, VU) is also recorded here and although widespread in Africa has few recorded collections in Cameroon. Some interesting taxa that were provisionally assessed as threatened by Onana & Cheek (2011) have not made it to the IUCN Red List but are listed below without contributing to the IPA criteria. These include *Pauridiantha* (Poecilocalyx) *setiflora*, which remains rarely recorded in Cameroon.

**Gilbertiodendron Forest at Mefou.**
Photograph Y. Harvey.

Areas of evergreen gallery forest in the park are substantially intact compared with the semi-deciduous forest and include several threatened species. This forest is dominated by the canopy tree, *Gilbertiodendron dewevrei*, and the Mefou site is an important educational example of Detarioid monodominance in tropical African forests (Letouzey, 1985; Cheek et al., 2011). The evergreen forest at Mefou is of interest also for the occurrence at lower altitude of several species usually found in submontane forest, while other coastal taxa are at higher altitude here. Furthermore, according to the 'Nyong Congo hypothesis', the Nyong river into which the Mefou drains, may have been previously connected to the Congo drainage basin, which would help explain the distribution of some species in these areas (Cheek et al., 2001, 2011). The finding by Challen et al. (2011) that the endemic *Phyllanthus kidna* is not closely related to other West African taxa is a further intriguing result. These patterns make the forest of particular interest and worthy of greater botanical research.

Overall, the forest is significant for the surprising number of taxa that are globally endangered, as well as many plants of social, economic or cultural importance, particularly timber trees. Cheek et al. (2011) reported 12 species new to science found at Mefou between 2002 and 2006. While not all have yet been described and most are known or assumed to also occur elsewhere, this illustrates the importance of the site as a representative of the under-examined and largely lost forests of the wider area.

## Habitat and geology

Mefou lies within the South Cameroon Plateau, an area of slightly elevated rolling topography (600–900 m asl) covering most of Cameroon south of the Adamaoua mountains and east of the Cameroon Highlands. The plateau is underlain by mainly metamorphic rocks, although these are in places overlain by sedimentary deposits and intruded by igneous formations, as well as typically covered by deep lateritic soils. The area south of Yaoundé encompassing the site features a complex of pre-Cambrian migmatities (crystaline acidic rocks) hidden beneath deep, red ferralitic soils, while white sand is revealed in exposed river beds (Cheek et al., 2011).

Annual rainfall of 1,529 mm per annum is lower than that typically estimated to support evergreen forest except along river margins (Cheek et al., 2011). The equatorial climate has two wet seasons: the long wet season (September–December) peaks in October, with 288 mm of rainfall; the second, shorter, wet season peaks in May. During the wet seasons, extensive areas alongside the rivers are inundated, while riverbeds may be exposed during the dry seasons. Cheek et al. (2011) note that the rivers appear to fill from water flowing back upstream from the Nyong. Temperature fluctuates little, around an annual mean of 24 °C.

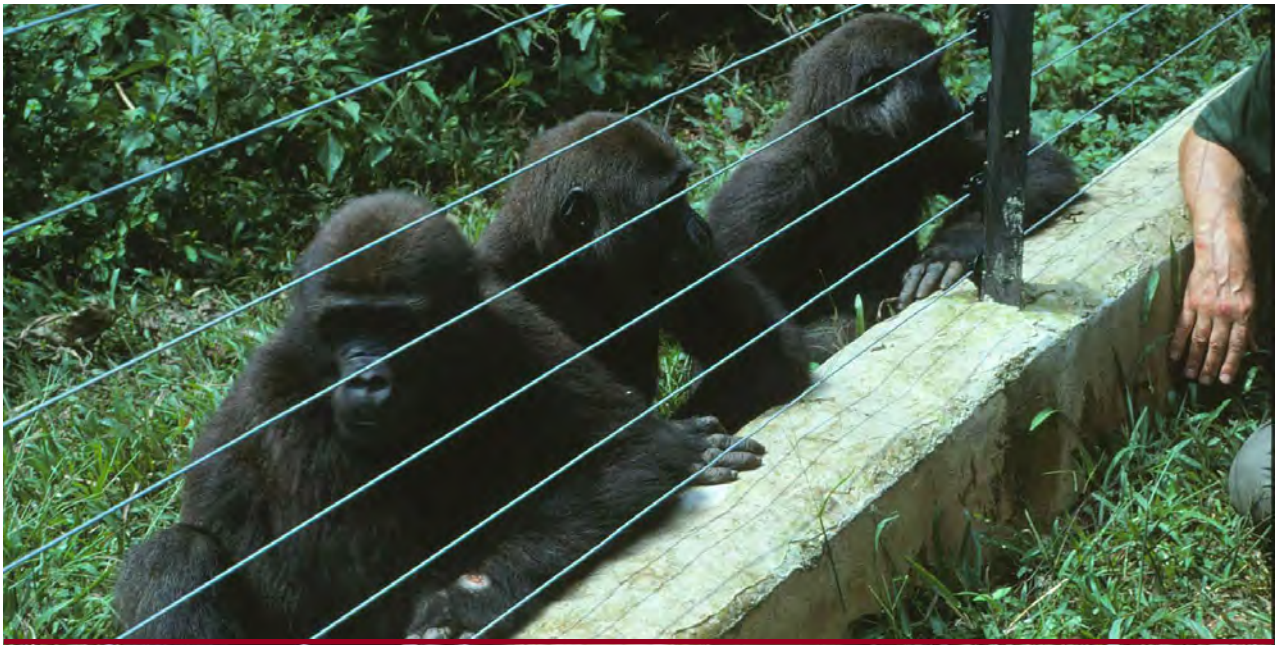
Three main habitat types are discussed by Cheek et al. (2011). Degraded, semi-deciduous Sterculiaceae-Ulmaceae forest (type 169 of Letouzey, 1985) dominates the area with several species of the genus *Celtis*,and other indicators of semi-deciduous forest such as *Triplochiton scleroxylon* featuring in the canopy layer (Cheek et al., 2011). However, evergreen *Gilbertiodendron dewevrei* is frequent and largely intact in wide bands along the rivers. These types may combine as a mixed evergreen and semi-deciduous mosaic (Letouzey's types 170 and 171) although degradation of the deciduous forest makes it hard to interpret the natural structure. The riverine evergreen forest is often inundated for weeks or months to about 2 m in depth. Open swamp grassland and river-edge vegetation constitutes a third category in Cheek et al.'s (2011) checklist, partially matching Letouzey's (1985) periodically inundated grassland (type 181) but *Raphia* swamp and river-edge and floating herb species are also present.

## Conservation issues

The semi-deciduous parts of the forest have been heavily degraded by selective logging and agriculture (Cheek et al., 2011). The evergreen parts are described as largely intact, although some of the valuable timber species also occur in this habitat. Logging is not presently believed to occur within the park and logging trails are becoming overgrown, which helps to prevent secondary clearance for agriculture. Several timber species known from historical logging records to have been extracted from the site were not collected by the botanical surveys, suggesting they may now be rare. Some timber species, such as *Diospyros crassiflora*, the source of West African ebony, are also very slow-growing and large trees will not return for many years.

Small-holder agriculture continues in parts of the park and, during the period 2002–2006 when surveys were carried out, some extensive plots were cleared in the semi-deciduous forest and in areas of *Raphia* swamp. Of the two main crops, cocoa (*Theobroma cacao*) is grown in the cleared understory under the shade of the forest canopy, while cassava (*Manihot esculenta*) requires complete forest clearance. This activity was believed to be in decline at the time but it is a concern that clearance continued despite the involvement of MINEF in the national park process. The 2002 survey team reported that delays in compensation for locals may have contributed to continued clearance of land as well as hunting and even sabotage of AAA property, although they document that an army presence subsequently halted this (Cheek et al., 2011). Many introduced species associated with cultivation are reported from the site but none are thought to present a conservation problem (Cheek et al., 2011). The wild fauna of the park has fared less well than the flora and little of it remains. It is not known to what extent the bushmeat trade is an ongoing problem at the site.

The use of the park for primate rehabilitation, while generally of great benefit to the preservation of the flora, may also present some conflicts which will need to be managed. Cheek et al. (2011) report that plants of the threatened species *Trichalysia amplexicaulis* (VU) where discovered at a location destined for a chimpanzee enclosure and had to be moved. More generally the authors comment that pristine sites unfortunately tend to be cleared for enclosures rather than areas already cleared for farmland. An increase in tourist visitors to the park would also bring potential conservation challenges that will have to be managed.



**Young gorillas in the Mefou Primate Sanctuary.**
Photography Y. Harvey, October 2002.

## Key ecosystem services

Many of the species recorded have social, economic and cultural uses associated with them. Particularly notable are several species of timber trees, many of which are globally threatened but do not contribute to IPA criterion A (Cheek et al., 2011). Other uses include medicines and foods, while the nationally endemic *Aulotandra kamerunensis* has horticultural potential as an ornamental plant (Cheek & Onana, 2011). Relatively little is recorded, however, about the extent to which local people actually utilise or rely on these species.

The site provides an important service by supporting primates orphaned by the bushmeat and pet industries, as well as employing over 50 people, most of whom are local (AAA, 2020). In addition, agricultural produce is purchased from local farmers to feed the animals. The site also has value as a tourist attraction and educational service given the proximity to Yaoundé, the presence of the primates and the botanical diversity and significance of the forest.

## Ecosystem service categories

**Provisioning** – Food

**Provisioning** – Raw materials

**Provisioning** – Fresh water

**Provisioning** – Medicinal resources

**Habitat or supporting services** – Habitats for species

**Cultural** – Tourism

**Cultural** – Education

## IPA assessment rationale

Mefou qualifies as a potential IPA under criterion A(i) through the presence of numerous globally threatened species which have significant populations at the site. In particular, *Phyllanthus kidna* appears to be globally endemic to this site and not closely related to other species in the region. As a rare fragment of a particular local variety of lowland mixed forest, it might potentially also qualify under criterion C.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Ancistrocladaceae | *Ancistrocladus le-testui* | VU | A(i) | | ✓ | | ✓ | |
| Apoycnaceae | *Dictyophleba setosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Culcasia sanagensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araceae | *Rhaphidophora bogneri* | CR | | | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | | | ✓ | |
| Asparagaceae | *Dracaena viridiflora* | VU | A(i) | | ✓ | | ✓ | |
| Bignoniaceae | *Fernandoa ferdinandi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Leptonychia subtomentosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Campanulaceae | *Lobelia gilletii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Floscopa mannii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Momordica camerounensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Momordica enneaphylla* | VU | A(i) | | ✓ | | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | | | | | | |
| Euphorbiaceae | *Pseudagrostistachys africana* subsp. *africana* | | A(i) | | | | ✓ | |
| Lamiaceae | *Pogostemon micangensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Entandrophragma cylindricum* | VU | | | | | | |
| Meliaceae | *Entandrophragma utile* | VU | | | | | | |
| Meliaceae | *Heckeldora ledermannii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Khaya ivorensis* | VU | | | | | | |
| Meliaceae | *Leplaea cedrata* | VU | | | | | | |
| Meliaceae | *Trichilia zewaldae* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Menispermaceae | *Platytinospora buchholzii* var. *macrophylla* | | A(iii) | | ✓ | ✓ | ✓ | |
| Ochnaceae | *Lophira alata* | VU | | | | | | |
| Orchidaceae | *Ansellia africana* | VU | A(i) | | | | ✓ | |
| Orchidaceae | *Corymborkis minima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus kidna* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Bertiera adamsii* | | A(i) | | | | ✓ | |
| Rubiaceae | *Chassalia manningii ined.* | | A(iii) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Morinda mefou* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha (Poecilocalyx) setiflora* | | | | | | | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Rubiaceae | *Psychotria sycophylla* | | | B(ii) | | | | |
| Sapotaceae | *Baillonella toxisperma* | VU | | | | | | |
| Sterculioideae | *Cola letouzeyana* | NT | | B(ii) | | | | |
| Sterculioideae | *Sterculia oblonga* | VU | | | | | | |
| Vitaceae | *Cyphostemma camerounense* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aulotandra kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Proposed National Park | Mefou Proposed National Park | Protected/conservation area matches IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – tourism and recreation areas | Low | Ongoing – trend unknown |
| Shifting agriculture | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Past, not likely to return |

## IPA

# Ototomo Forest Reserve

**International Site Name:** Ototomo Forest Reserve
**Local Site Name (if different):** Réserve Forestière d'Ototomo
**Site code:** CMNTIPA022
**Administrative region:** Centre
**Assessed by:** Bruce Murphy, Martin Cheek, Vincent Droissart

**Latitude** (decimal degrees)**:** 3.67550
**Altitude minimum:** 690
**Area** (km²)**:** 45.0
**Longitude** (decimal degrees)**:** 11.29130
**Altitude maximum:** 914
**IPA criteria met:** A(i)

## Site Description

The Ototomo Forest Reserve is a production forest reserve and was first gazetted in 1929 by the French colonial authorities. It is located approximately 30 km south-east of Yaoundé and covers around 45 km² (Jum and Oyono, 2005; but 2,950 ha according to Sassen and Jum, 2007) of undulating moist tropical forest between 700 and 900 m asl. An initial buffer zone was quickly lost to cocoa plantation in the first half of the twentieth century and now a new buffer zone has been established allowing farming within the reserve area (Jum et al., 2009). This may explain the discrepancy between the area of 45 km² indicated by Jum and Oyono (2005) and that of c. 30 km² indicated on maps and cited by Sassen and Jum (2007).

## Botanical significance

Although classed as a production reserve and considerably degraded, the site represents one of very few remaining forest areas in the Yaoundé region with any officially recognised protected status. Botanical collections dating back to the 1930s indicate several globally threatened species, including the Critically Endangered *Monanthotaxis couvreuri* and *Stereospermum zenkeri*, both now considered narrowly endemic to the site. The latter is one of the species collected in the 1890s by Zenker and Staudt from 'Yaunde station' and has only been otherwise collected (Tsoungui, 101042) from 'Chantier Coron', apparently in downtown Yaoundé, where it is very unlikely to survive. It has apparently not been collected at any of the inselberg sites around Yaoundé where some other Zenker and Staudt species have been rediscovered.

*Eugenia kameruniana* (CR) may be endemic to the Yaoundé region as it is considered likely to be extinct at the other recorded sites of Bipindi and Mt Cameroon (Onana & Cheek, 2011). *Ardisia ototomensis* (EN) is either endemic or known from three other locations including Mbam Minkom, depending on delimitation, while *Callichilia monopodialis* (VU) is known from the Yaoundé region and four or five other locations in South and Centre regions. *Leptonychia subtomentosa* (EN) is only known from Yaoundé (Onana & Cheek, 2011; Cheek, 2014f, 2017e).

In addition, a number of globally threatened, economically important species are known from the site. These species have mainly been assessed under IUCN criterion A (population decline) and therefore typically may not qualify as a site under IPA criterion A(i) but could still be of botanical significance, particularly close to the capital.

## Habitat and geology

There is little specific information on the geology of Ototomo but it lies within the South Cameroon Plateau, an area of slightly elevated rolling topography covering most of Cameroon south of the Adamaoua mountains and east of the Cameroon Highlands (Cheek et al., 2011). The plateau is covered by deep lateritic soils underlain by mainly metamorphic rocks, although these are in places overlain by sedimentary deposits and intruded by igneous formations. A complex of Precambrian migmatites is indicated by geological maps for this region south of Yaoundé. White sand is often revealed in river beds but it is not known if this is the case at Ototomo. The soils are described as ferralitic and chemically poor at Ototomo (Segalen, 1967, cited in Sassen & Jum, 2007). Altitude varies between around 600 and 900 m, with some exposed rocky outcrops. Valleys between are narrow, with inundated rivers and swampy ground.

Annual temperature is 23–24 °C, with little fluctuation around this mean. Annual rainfall is 1,450–1,750 mm (Sassen and Jum, 2007), which is below the level usually considered to support evergreen forest (Cheek et al., 2011). There are two wet seasons: one peaking in May and a longer one peaking in October. The vegetation in the area has been characterised as mainly semi-deciduous with a patchwork of degraded and partially intact forest but with evergreen *Gilbertiodendron dewevrei* along rivers and some mixed evergreen semi-deciduous areas (Letouzey 1968, 1985; Cheek et al., 2011). However, most of the vegetation outside of the reserve is now heavily degraded (Sassen and Jum, 2007).

## Conservation issues

The site was established as a production forest reserve supplying timber and has mainly been managed as such; there has been intense harvesting of large timber trees, both legal and illegal. Over the years, various regeneration efforts have been initiated in an attempt to put the reserve on a more sustainable basis, with a management plan first published in 1999 (Jum et al., 2009). This divided the forest into production, regeneration and conservation areas covering 1,575, 516 and 796 ha respectively, plus an area for wood gathering by local peoples.

The reserve has apparently long lacked legitimacy in the eyes of local people and has been encroached for cultivation (Sassen & Jum, 2007). In particular, a border zone was quickly encroached in the 1930s and 1940s for cocoa production and has now been replaced with a new border zone permitting cultivation of the interior zone (Jum et al., 2009). The forest is also used by local peoples for food, medicines, spices, building materials and other purposes. According to Jum and Oyono (2005), the management plan was not based on substantive collaboration with local peoples, although there was some consultation.

Population increase in the area has put pressure on the site and the dense forest within the reserve was reported to have decreased by 45% between 1960 and 2000, with farmland increasing by 60% (Oyono et al., 2005).

There are very few protected sites in the Yaoundé area but nearby the proposed Mefou National Park (30 km east) provides a potentially replicable model for combining tourism, education and conservation in proximity to the capital (Cheek et al., 2011). There may be administrative as well as conservation benefits in linking these sites, as well as the Mbalmayo Forest Reserve c. 30 km south-east and the inselberg sites on the western fringes of Yaoundé. Wildlife corridors connecting these sites would be particularly desirable given their small size.

## Key ecosystem services

The site is used by local peoples for medicines, food, wood and building materials (Jum & Oyono, 2005). Several threatened timber species occur. As at nearby proposed Mefou National Park, proximity to Yaoundé means that education and tourist activities could potentially provide alternative livelihoods for local populations that currently put pressure on the site through cultivation and extraction (Cheek et al., 2011).

Chimpanzees were reported still to occur in 2005 (Sassen & Jum, 2007) and the site likely supports other valuable wildlife.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Medicinal resources

**Regulating –** Local climate and air quality

**Habitat or supporting services –** Habitats for species

**Cultural –** Recreation and mental and physical health

**Cultural –** Tourism

**Cultural –** Education

## IPA assessment rationale

Ototomo forest reserve qualifies as a potential IPA under criterion A(i) on the basis of several globally threatened species which occur here and at few or no other sites.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Annonaceae | *Monanthotaxis couvreurii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Apocynaceae | *Callichilia monopodialis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Bignoniaceae | *Stereospermum zenkeri* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Byttnerioideae | *Leptonychia subtomentosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia kameruniana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia ototomensis* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Pterygota bequaertii* | VU | | | | | | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Forest Reserve (Production) | Réserve Forestière d'Ototomo | Protected/conservation area matches IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Logging and wood harvesting | High | Ongoing – trend unknown |
| Small-holder farming | High | Ongoing – trend unknown |

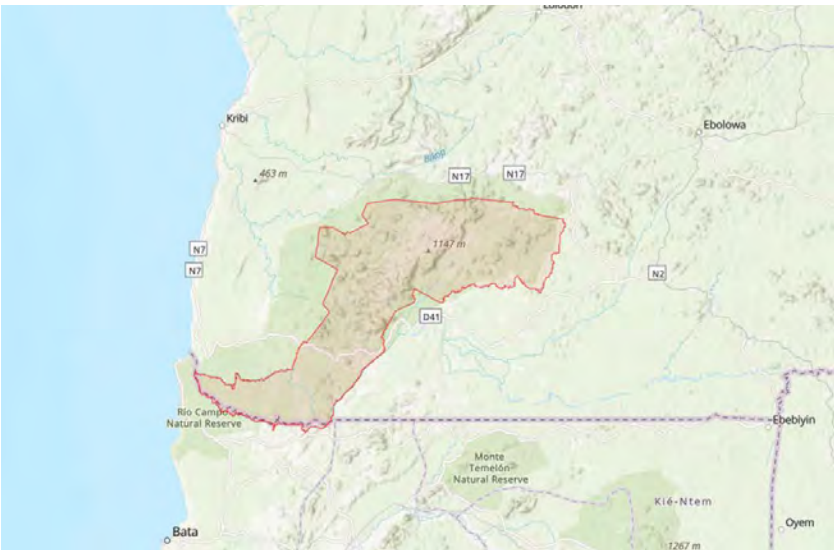
# South Region

The Ntem river at Dipikar.
Photograph X. van der Burgt, March 2016.

## IPA

# Campo Ma'an National Park

**International site name:** Campo Ma'an National Park
**Site code:** CMNTIPA025
**Administrative region:** South
**Assessed by:** Bruce Murphy, Xander van der Burgt, Jean Michel Onana




**Latitude** (decimal degrees)**:** 2.43600
**Altitude minimum:** 0
**Area** (km²)**:** 2,640.6
**Longitude** (decimal degrees)**:** 10.26590
**Altitude maximum:** 1,097
**IPA criteria met:** A(i)

## Site description

The Campo Ma'an National Park, established in January 2000, is one of Cameroon's largest protected areas, encompassing 264,000 ha of evergreen and mixed semi-deciduous tropical forest in the Ntem Valley and Ocean subdivisions of Cameroon's South Region (UNESCO, 2018). Extending eastwards inland from the coast at Campo between the rivers Bongala and Ntem, the park then curves north and east again, forming a dog-leg shape 15–30 km wide and 115 km long. The northern border lies a few km from the Kribi-Akom II-Ebolowa N17 road. To the south, the park is partly adjacent to the international border and Equatorial Guinea's Reserva Natural de Rio Campo, while further east lies the RAMSAR wetland site Partie Camerounaise du Fleuve Ntem in the swampy area where the Mvila and Ntem rivers combine to form a network of channels known as the Boucles du Ntem (Idriss, 2012).

From mangroves and coastal evergreen forest near the coast, the forest follows a ridge of low mountains up to 1,100 m in height and transitions to drier forest with a greater semi-deciduous element in the eastern parts. Created partly in mitigation of the Kribi-Chad pipeline project, the forest is part of a much larger Operation Technical Unit (UTO), with several large FMUs and plantations forming a peripheral zone incorporated in the management plan (WWF, 2018; UNESCO, 2018).

## Botanical significance

Research by Tchouto (2004) has revealed a high number of globally threatened species in the Campo Ma'an area. Many of these occur within the national park boundaries, occupying several different habitats, including submontane forest, swamp forest, lowland evergreen tropical forest, waterfalls and rapids. A number of highly threatened species in the Podostemaceae are known from the rapids of the Bongala and Ntem rivers forming the boundary, although other species known only from the Memve'ele Falls are outside the park.

Several threatened species are listed by Tchouto (2004) for which specimen data from the national park has not been located (for example, *Acridocarpus camerunensis*). Where no other evidence exists that these occur within the national park area, the taxa have not been included here. However, when a location inside the boundary (such as Dipikar island) is indicated in table 5.6 (Tchouto, 2004) then the taxon has been provisionally included even if no

specimen has been found. A number of species are also included from collections just outside the border, particularly in the areas of Zingui and Akom II, as these are strongly suspected to also occur within the park. *Amphimas tessmannii* (EN) is included based on the type-specimen collected near Campo, although apparently just over the border in Rio Muni.

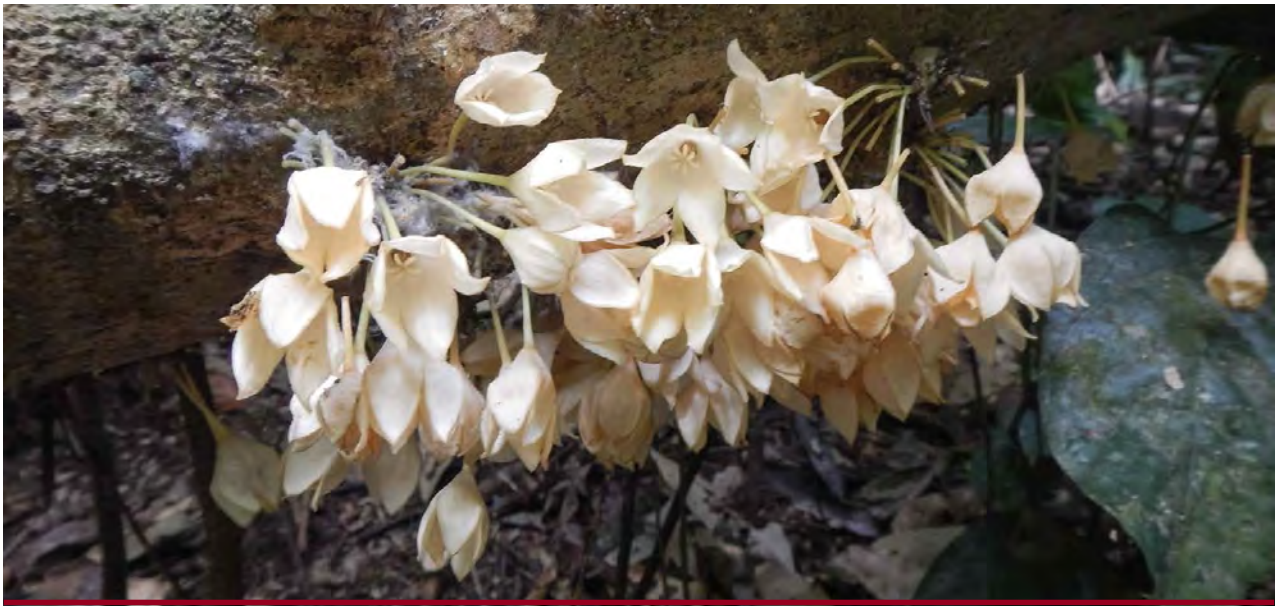
The site is important as a major area of largely intact tropical lowland forest as well as a representative of other important vegetation types, including mangroves, swamp forest and submontane forest, all of which contribute to the overall botanical diversity of c. 1,500 species. This number is approximately equal to that of the Dja Faunal Reserve which occupies double the area (UNESCO, 2018). Tchouto (2004) records a greater total of 2,227 taxa from the wider Campo Ma'an TOU area. The Campo Ma'an area was likely to have been a refugial zone for plant species during the drier climate conditions of the Pleistocene, resulting in a high level of endemicity (Tchouto et al., 2009). For example, ten species of *Begonia*, a potential refugial bioindicator genus (Sosef 1994, 1996), are recorded within the national park, while over 114 national endemics and 29 local endemics were recorded from the wider TOU (Tchouto, 2004). Many of these endemics are now recorded more widely, particularly because of greater collecting in Gabon and Equatorial Guinea, and proximity to the national border may in fact limit the number of national endemics compared with other sites in Cameroon. However, several species occur towards the northern limit of their geographical range and are therefore nationally rare or unknown elsewhere in Cameroon, even if they are more widely known to the south. Eight species are here considered to be narrowly endemic to the park itself (*Inversodicraea kamerunica*, *Tapura tchoutii, Triceratorhynchus sonkéanus, Cola nana, Cola subglaucescens* and *Ardisia letouzeyi*), but several more are likely limited to the larger TOU area.

Tchouto (2004) refers to unpublished research indicating 112 timber species and 249 non-timber forest product (NTFP) species are found within the TOU. While many timber species are on the global Red List, many of these assessments are out of date and based on IUCN criterion A, suggesting they do not qualify under IPA criterion A(i). However, Campo Ma'an may qualify as one of the overall best sites for useful species (criterion B[iii]).

## Habitat and geology

The site lies predominantly on Precambrian metamorphic basement rocks, which produce low nutrient, acidic soils (Tchouto, 2004). Also found are Cretaceous sedimentary near the coast in the Campo basin and migmatites and granites in the hillier terrain inland. Soils are mainly ferrasols and acrisols, strongly weathered, deep and clayey, but sandier in the coastal and riverine areas. Altitude ranges from sea level at the coast to around 1,100 m in the hills further east.

The climate has two wet and two dry seasons, with rainfall of 2,800 mm at Campo (2,950 at Kribi) reducing inland to 1,670 mm in the Nyabessan/Ma'an area, probably due partly to a rain-shadow effect (Tchouto, 2004). This climate gradient results in an increase in semi-deciduous vegetation further east, although extensive swamp areas are also found. Many rivers flow through the site (Ntem, Lobe, Bongala, Biwome, Ndjo'o, Mvila and Nye'ete), often with rocky beds that support rare rheophytic plants (Cheek et al., 2017b; Kuetegue et al., 2019). Even at the coast, the four-season climate distinguishes this area of Cameroon from the higher rainfall Cross-Sanaga area to the north (White, 1983).



***Cola elegans*** **(VU).**
Photograph X. van der Burgt, 2016.

In the broad classification of White (1983), Campo Ma'an lies within the Lower Guinea part of the Guineo-Congolian region of endemism and within vegetation type 1a – wetter types of lowland rainforest. Olson et al.'s (2001) scheme places it within a large band of Atlantic Coastal Equatorial Forest which extends south from the Sanaga river and is distinguished from the wetter Cross-Sanaga-Bioko coastal forests region. The northern border of South Region roughly follows the Nyong river, which may have acted as a biogeographical barrier in the past and has also likely contributed, together with the larger and closely parallel Sanaga river, to a somewhat different forest type in this region (Cheek et al., 2001; Oates et al., 2004).

Letouzey (1985) made finer discriminations in vegetation type, categorising the site area as mainly Atlantic Biafran forest rich in Caesalpinoideae (type 228) but with several subtypes characterised by the abundance of a few indicator species, particularly *Sacoglottis gabonensis* and *Calpocalyx heitzii*. Tchouto's (2004) multivariate analysis of plot data distinguishes ten vegetation types in the TOU area, with type 1 (lowland evergreen forest rich in Caesalpinaceae) dominating most of the park area (65% according to UNESCO, 2018). This is a continuous canopy, three-tier rainforest with emergents and buttresses, found on moderate hills and slopes, and dominated by c. 70 species of trees in the (former) Caesalpinoideae subfamily, several of which are gregarious. Much smaller areas of other types are also present. Type 2, (a variant of type 1 with abundant *S. gabonensis* and *C. heitzii*) is found in the Dipikar area, and closer to Campo there is an Atlantic variant with more coastal elements.

In the eastern part of the park, type 7 is found, which mixes more semi-deciduous elements but is still dominated by evergreen species and retains a largely closed canopy. In the north-west part of the park, near Zingui, there is a tiny area of type 3 which features coastal elements including *Sacoglottis gabonensis*, and which has been largely cleared for palm oil plantation outside the park but extends to Mt Elephant, Massif des Mamelles and Lobe. Submontane forest (type 9) is found on hilltops above 800 m and contributes a large proportion of species.

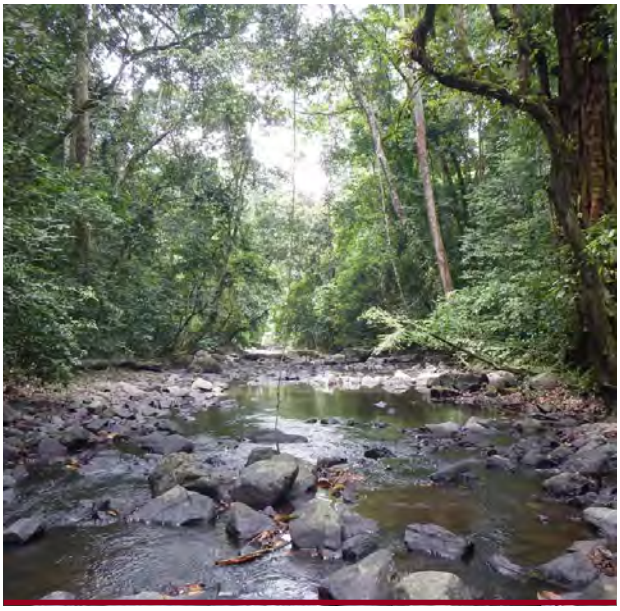
Around rivers some mangroves (type 11) are found nearer the coast and in other parts there is swamp forest (type 10), although much of the latter is outside the park area in the RAMSAR wetland around Ma'an. Near Ebianemeyong, Tchouto (2004) also distinguishes an additional zone of the more subjectively defined Okoume forest (type 12), an open forest dominated by the important timber species *Aucoumea klaineana* which has spread from plantations such as Kienke and may not be native to the national park area or to Cameroon (pers. comm., X. van der Burgt and J. M. Onana, 2021).

## Conservation issues

Campo Ma'an National Park benefits from both its protected status and its positioning in an area of Cameroon that has historically been hard to access and little disturbed. However, despite having the highest level of formal protection, serious threats remain to the site's biodiversity and recent development in the region has increased access to the forest, reducing the isolation which has preserved it up to now.

National park status was awarded partly to balance the negative biodiversity impact of the Kribi-Chad pipeline project (WWF, 2018). Tchouto (2004) indicated that it remained a 'paper park' only and that forests in the area faced a number of threats including large- and small-scale agriculture, logging and hunting.

***Bikinia letestui*, measured at 52 m tall in Campo Ma'an.**
Photograph X. van der Burgt, 2016.



**A river in Campo Ma'an National Park.**
Photograph X. van der Burgt, 2016.

Sunderland et al. (1997) suggest the forest was largely undisturbed until the 1960s but since that time logging concessions have changed its character in the Campo area of the park and in the other concessions surrounding the park boundary.

The interior region remains more intact (UNESCO, 2018), with populations of elephants, gorillas and chimpanzees considered stable when last evaluated (Nzoo Dongmo et al., 2015). However, WWF (2018) has more recently expressed concern that the park needs saving from a variety of developments which together are likely to increase population and activity in the area. These include the pipeline project, the Memve'ele hydroelectric dam, the Kribi deep seaport complex, rubber and oil palm projects (particularly in former well-managed FMU areas (Nforngwa, 2019) and a proposed railway link from Mbalam to Kribi. Previously, the population outside of the major population centres of Ebolowa, Kribi and Campo has been very low (Sunderland et al., 1997) but major population growth is predicted in the region from these developments. Net migration was reported at 14% in 2010, exceeding annual population growth (Ajonina et al., 2010). Logging trails already allow bushmeat hunters to penetrate deep into the forest and threaten to open the park up to small-scale agriculture, which could be hard to prevent (WWF, 2018). Bushmeat consumption has been calculated at 1,206 t/day, or 200g per person/day within the TOU (Ajonina et al., 2010).

Loss of the buffer zone of selectively logged FMUs to palm oil plantation is probably the major threat as this isolates the park genetically and brings in migrant labour, with associated pressure for food from hunting and agriculture, while increasing access to the park itself. Expansion of agriculture from Akom II and other settlements along the road north of the park is also likely to progress into the park unless prevented. Because of the many important species known from just north of the park border, it is highly recommended that the c. 5 km band between the border and the Kribi-Ebolowa road, from Zingui to Akom II, is treated with high conservation concern as a buffer region, and that these species are actively searched for within the park boundaries.

The unique character of the forest in the Campo region, which harbours vegetation and species unknown to other parts of the national park (Sunderland et al., 1997; Tchouto, 2004), is particularly threatened by proximity to coastal development. The Memve'ele dam project, as well as bringing the same problems of access and disturbance, also seems likely to render extinct several populations of rheophytic plants at rapids on the Ntem river, most of which are globally restricted to this river (Cheek et al., 2017b; Kuetegue et al., 2019).

From a positive perspective, the presence of healthy populations of gorillas and other large mammals, as well as waterfalls, beaches and other natural scenery, boosts the chance of conservation action and ecotourism (Walter et al., 2022). The second management plan emphasised ecotourism and other sustainable income generation to improve local livelihoods. As well as the natural riches, Walter et al. (2021) considers the local population's openness to tourist development as an asset. However, these researchers also found that the local population did not consider ecotourism to be improving their livelihoods. Development of ecotourism is considered to be held back by poor roads and other infrastructural challenges (Forje et al., 2020) but these obstacles also mitigate threats to the park. Conversely, development associated with the Kribi port and other projects boosts the potential for tourist access but also brings threats.

As discussed further below, the park is also a key component of Cameroon's Red++ carbon strategy (CARN, 2020).

## Key ecosystem services

The site provides important habitat for a very diverse fauna with 80 large–medium mammal species, including 20 species of primate, 200 birds (plus another hundred from the buffer zone), 122 reptile species, and 80 amphibians (BirdLife International, 2021k). At least 23 resident mammals are globally threatened, including elephants (*Loxodonta africana cyclotis*), gorillas (*Gorilla gorilla gorilla*), leopards (*Panthera pardus*) and giant pangolins (*Manis gigantea*).

As a large area of intact rainforest in the tropical zone, Campo Ma'an is a major carbon sink. It forms a crucial part of Cameroon's proposed Emission Reduction Program, developed as a first step towards Cameroon's REDD+ strategy (CARN, 2020). The Emission Reduction Program is focussed on southern Cameroon, covering an area estimated to constitute 1.725 Gt carbon from total above and below ground biomass, amounting to 37% of the national total. Based on the percentage area, the Campo Ma'an National Park share would be 49 Mt.

Numerous plants found within the national park have been recorded as having uses to local peoples. Sunderland et al. (1997) report 43 economic species, amounting to 30% of the total species within the Campo forest part of the national park, while Tchouto (2004) refers to unpublished research indicating 250 taxa within the TOU area.

The park contributes a large watershed and the intact forest is important to maintaining the water quality of the several major rivers flowing towards the populated coastal area, as well as buffering the effect of seasonal rains and mitigating damage from flooding (Ajonina et al., 2010). The mangrove forest areas near Campo are also important in this respect, with global sea levels rising.

## Ecosystem service categories

**Provisioning** – Raw materials
**Provisioning** – Fresh water
**Provisioning** – Medicinal resources
**Regulating** – Carbon sequestration and storage
**Regulating Services** – Moderation of extreme events
**Habitat or supporting services** – Habitats for species
**Cultural Services** – Tourism

## IPA assessment rationale

Important populations of over 120 globally threatened species occur at Campo Ma'an, therefore the site easily qualifies as an IPA under criterion A(i). It also qualifies under criterion B(ii) as the site with the third highest number of nationally endemic and range-restricted species (around 7% of the national total). In addition, the large numbers of reported timber trees and non-timber forest products mean that the site would be very likely to qualify under criterion B(iii) as one of the 15 richest sites nationally for socially, economically, or culturally useful species. Furthermore, the site would likely qualify under criterion C due to the diversity and importance of the lowland rainforest habitats it contains; in particular, the large, intact area of lowland evergreen rainforest rich in Caesalpinoideae, and the unique variant (Tchouto's type 2) with *Calpocalyx heitzii* and *Sacoglottis gabonensis* found in the Isle of Dipikar region.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Afrofittonia silvestris* | VU | A(i) | | ✓ | | ✓ | |
| Acanthaceae | *Dischistocalyx champluvieranus* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Justicia gigantophylla* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Rungia caespitosa* | | | B(ii) | | | | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Stenandrium thomense* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | ✓ | ✓ | |
| Anacardiaceae | *Trichoscypha hallei* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Duguetia dilabens* | EN | A(i) | B(ii) | ✓ | | ✓ | |
| Annonaceae | *Mischogyne gabonensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Monanthotaxis elegans* | | | B(ii) | | | | |
| Annonaceae | *Piptostigma macrophyllum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Piptostigma oyemense* | VU | A(i) | | | ✓ | ✓ | |
| Annonaceae | *Uvariodendron giganteum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis korupensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis submontana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis vanderystii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia mildbraedii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Dictyophleba setosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Landolphia flavidiflora* | | | B(ii) | | | | |
| Apocynaceae | *Malouetia barbata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Petchia africana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Tabernaemontana hallei* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Araceae | *Culcasia bosii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Araceae | *Culcasia linearifolia* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Asparagaceae | *Chlorophytum petrophilum* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Asparagaceae | *Dracaena viridiflora* | VU | A(i) | | | | ✓ | |
| Balsaminaceae | *Impatiens akomensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Balsaminaceae | *Impatiens gongolana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia mbangaensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia microsperma* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia zenkeriana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Boraginaceae | *Hoplestigma pierreanum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burseraceae | *Aucoumea klaineana* | VU | A(i) | | | | ✓ | |
| Burseraceae | *Pachylobus buettneri* | VU | A(i) | | | | ✓ | |
| Byttnerioideae | *Scaphopetalum riparium* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Byttnerioideae | *Scaphopetalum stipulosum* | | | B(ii) | | | | |
| Caesalpinioideae | *Calpocalyx heitzii* | VU | A(i) | | | ✓ | ✓ | |
| Celastraceae | *Pristimera luteoviridis* var. *kribiana* | | A(iv) | | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | | |
| Convolvulaceae | *Neuropeltis laxiflora* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Cyperaceae | *Mapania africana* subsp. *filipes* | | A(iii) | | ✓ | ✓ | ✓ | |
| Cyperaceae | *Mapania raynaliana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia bipindensis* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Aphanocalyx hedinii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Copaifera religiosa* | VU | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Englerodendron graciliflorum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron klainei* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron pachyanthum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Guibourtia tessmannii* | EN | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Englerodendron leptorrhachis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Prioria joveri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Dialioideae | *Dialium latifolium* | DD | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Dichapetalaceae | *Tapura tchoutii* | | | B(ii) | | | | |
| Ebenaceae | *Diospyros alboflavescens* | EN | A(i) | | | ✓ | ✓ | |
| Euphorbiaceae | *Crotonogyne impedita* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Crotonogyne zenkeri* | VU | A(i) | | ✓ | | ✓ | |
| Lauraceae | *Beilschmiedia cinnamomea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia cuspidata* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia klainei* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia wilczekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Linaceae | *Hugonia micans* | VU | | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos gnetifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos mimfiensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | | | ✓ | |
| Loranthaceae | *Tapinanthus preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Malpighiaceae | *Acridocarpus camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Marantaceae | *Sarcophrynium villosum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Amphiblemma letouzeyi* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Calvoa stenophylla* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon alipes* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon fugax* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Meliaceae | *Entandrophragma candollei* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Entandrophragma cylindricum* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Entandrophragma utile* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Heckeldora leptotricha* | | | B(ii) | | | | |
| Meliaceae | *Khaya anthotheca* | VU | A(i) | B(iii) | | | | |
| Meliaceae | *Khaya ivorensis* | VU | A(i) | | | | | |
| Menispermaceae | *Albertisia capituliflora* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Albertisia glabra* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Penianthus camerounensis* | | | B(ii) | | | | |
| Metteniusaceae | *Rhaphiostylis subsessilifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia dorstenioides* | | | B(ii) | | | | |
| Moraceae | *Dorstenia involuta* | | | B(ii) | | | | |
| Ochnaceae | *Lophira alata* | VU | A(i) | | | | ✓ | |
| Ochnaceae | *Testulea gabonensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidacaeae | *Diaphananthe spiralis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Ancistrorhynchus crystalensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Ancistrorhynchus tenuicaulis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum angustum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum curvipes* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum alinae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum coriscense* | | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum platybulbum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum sanfordii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Diaphananthe sarcorhynchoides* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria batesii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis hallei* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Nephrangis bertauxiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya batkoi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya laurentii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya lejolyana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Triceratorhynchus sonkéanus* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Papillionoideae | *Amphimas tessmannii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papillionoideae | *Ormocarpum klainei* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Inversodicraea ntemensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea tchoutoi* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea xanderi* | | | B(ii) | | | | |
| Podostemaceae | *Ledermanniella bifurcata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella linearifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Primulaceae | *Ardisia ebolowensis* | | | B(ii) | | | | |
| Primulaceae | *Ardisia letouzeyi* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Putranjivaceae | *Drypetes preussii* | VU | A(i) | | ✓ | | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes tessmanniana* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Cassipourea alternifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Cassipourea zenkeri* | | | B(ii) | | | | |
| Rubiaceae | *Aulacocalyx cameroonianа* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Aulacocalyx mapiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera heterophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera laxissima* | | | B(ii) | | | | |
| Rubiaceae | *Bertiera rosseeliana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Coffea mapiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis rammelooana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora euosmia* | | | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora synactica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha divaricata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta kribiensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta muiriana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta renidens* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pseudosabicea batesii* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Psychotria arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Psychotria droissartii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria lanceifolia* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Psychotria njumei* | EN | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Psychotria podocarpa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria satabiei* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria senterrei* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria sonkéana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria torrenticola* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria villicarpa* subsp. *villicarpa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea apocynacea* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Sabicea medusula* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea rufa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sericanthe lowryana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia achoundongiana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia vadensis* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Rutaceae | *Vepris araliopsioides* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris lecomteana* | VU | A(i) | | ✓ | | ✓ | |
| Sapindaceae | *Chytranthus micranthus* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia macroura* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia maxima* | VU | A(i) | | | ✓ | ✓ | |
| Sapindaceae | *Deinbollia mezilii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia pycnophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Sapindaceae | *Deinbollia saligna* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | A(i) | | | | ✓ | |
| Sapotaceae | *Gluema ivorensis* | VU | A(i) | | | ✓ | ✓ | |
| Sapotaceae | *Neolemonniera batesii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Tieghemella africana* | EN | A(i) | | | | ✓ | |
| Sterculioideae | *Cola elegans* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola fibrillosa* | | | B(ii) | | | | |
| Sterculioideae | *Cola hypochrysea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola letouzeyana* | NT | | B(ii) | | | | |
| Sterculioideae | *Cola nana* | | A(iii) | B(iii) | ✓ | ✓ | ✓ | ✓ |
| Sterculioideae | *Cola subglaucescens* | | A(iii) | B(iii) | ✓ | ✓ | ✓ | ✓ |
| Sterculioideae | *Pterygota bequaertii* | VU | A(i) | | | | ✓ | |
| Sterculioideae | *Sterculia oblonga* | VU | | | | | ✓ | |
| Violaceae | *Allexis cauliflora* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Violaceae | *Allexis zygomorpha* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea dewildei* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea dewitii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea umbricola* | | | B(ii) | | | | |
| Zingiberaceae | *Aulotandra kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Campo Ma'an National Park | Protected/conservation area matches IPA |
| Important Bird Area | Campo Ma'an Complex IBA | Protected/conservation area encompasses IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – commercial and industrial areas | Medium | Ongoing – increasing |
| Shifting agriculture | Low | Ongoing – increasing |
| Agro-industry farming | High | Ongoing – increasing |
| Oil and gas drilling | Medium | Ongoing – stable |
| Mining and quarrying | Low | Ongoing – trend unknown |
| Roads and railroads | Medium | Future – planned activity |
| Hunting and collecting terrestrial animals | Medium | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Renewable energy | High | Ongoing – trend unknown |
| Dams and water management/use – Large dams | High | Ongoing – trend unknown |

# IPA
# Lobé Falls

**International site name:** Lobé Falls
**Site code:** CMNTIPA016
**Administrative region:** South
**Assessed by:** Bruce Murphy, Martin Cheek, Eric Ngansop

**Latitude** (decimal degrees): 2.88100
**Altitude minimum:**
**Area** (km²): 3.3
**Longitude** (decimal degrees): 9.89760
**Altitude maximum:** 25
**IPA criteria met:** A(i)

## Site description

Lobé Falls is a natural beauty spot and tourist attraction located on the Atlantic coast in Cameroon's South Region, a few km south of the port town of Kribi. It is one of the few major waterfalls in the world that fall directly into the ocean and has been proposed as a UNESCO world heritage site (UNESCO World Heritage Centre, 2020). The waterfalls and cascades are fed by the river Lobé, which originates in Campo Ma'an National Park. The proposed area designated here is bounded to the east by the N7 coastal road, to the south by the bridge where the N7 crosses the river Lobé, to the west by the local road which branches from the N7 just south-west of the bridge, and to the north by the ocean. Within this area the river, which flows broadly and smoothly at the bridge, branches to cascade around small forested islands in multiple channels before reaching the main falls at the edge of the sea.

## Botanical significance

The proposed site hosts several endemic species of Critically Endangered rheophytic plants in the family Podostemaceae (Cheek et al., 2017b; Kuetegue et al., 2019). Species in this family are restricted to waterfalls and rapids in fast-flowing clear water and depend on seasonal variation in water levels for flowering and fruiting (Cheek et al., 2017b; Schenk et al., 2015). Lobé constitues the most diverse site in Africa, and possibly globally, for these plants, with ten species present, of which seven are globally threatened (Cheek et al., 2017b). The remaining three (*Inversodicraea ledermannii, Dicraeanthus africanus* and *Tristicha trifaria*) have also been provisionally assessed as nationally threatened (Kuetegue et al., 2019). An additional rheophytic species, *Ixora euosmia,* in the coffee family is also potentially globally and nationally threatened (Kuetegue et al., 2019).

Other threatened species such as *Psychotria kribiensis, Allexis cauliflora* (VU), *Malouetia barbata* (EN) and *Calpocalyx heitzii* (VU) are recorded from the Lobe river margins near to the mouth but it is not known whether they definitely occur within the narrow area proposed here as the IPA. Likewise, *Dichapetalum oliganthum* (VU) is recorded several times from a few km south of Kribi which would put it within the Lobe Falls area. *Cassipourea dinklagei* (EN) is also recorded from Bwambe and Grand Batanga, very close to the site.

**The waterfalls at Lobé fall directly into the sea.**
Photograph X. van der Burgt, 2005.

## Habitat and geology

Climate data from nearby Kribi indicates a tropical monsoon climate (Kloeppen climate classification A) with annual precipitation of 2,870 mm per year, around 20% less than that of Douala, which is located on a coastal estuary 125 km to the north (World Meterological Organization, 2021). Precipitation comes mainly from the south-west on the monsoon winds that are typical in the mornings, while drier trade winds from the north-west blow in the afternoons (Corriol et al., 2008). The dry season runs between November/December and February, and although precipitation and temperature drops slightly in July there is not a proper second dry season between the peaks of precipitation in May and September as there is in much of inland Cameroon. Average annual temperature is around 25 °C and monthly average maxima peak in the dry season around 32 °C, with minima dropping to around 22.6 °C in July (World Meterological Organization, 2021).

Water level in the Lobé river and other streams does, however, follow a four-season pattern, with two highwater periods due to greater seasonal precipitation inland (Corriol et al., 2008). This results in two potential flowering and fruiting seasons for the rheophytic species found here, in contrast to other sites such as the rapids on the Sanaga river at Edea 100 km to the north (Schenk et al., 2015).

Geologically, the area lies within the South Cameroon Plateau. More locally, the geological strata are known as the 'Ntem complex', which is dominated by Precambrian basement-complex formations. These metasedimentary, foliated, crystaline rocks include gneisses, pyroxenes and schists (Idriss, 2012; Nkoungou et al., 2012; Corriol et al., 2008). Soils are predominantly acidic, yellow ferralites with low organic content, low fertility and low exchange capacity because of aluminum and iron hydroxides (Corriol et al., 2008).

## Conservation issues

The most immediate threat to the cited plant species of the Lobé falls is probably direct erosion and physical damage to the vegetation by large volumes of visitors (Kuetegue et al., 2019; Cheek et al., 2017b). Tourism will probably continue to increase at the site and increased numbers will likely bring further indirect impacts in the form of pollution or sedimentation of the water from nearby development (Tchindjang & Etoga, 2014). However, the site also faces a range of other threats, and well-managed, sustainable tourism is also probably the best opportunity to conserve the site and its flora.

Typically, the main threat to rheophytic species in Africa is the development of hydro-electric power stations (Cheek et al., 2017b; Schenk et al., 2015)

which disrupt water levels or flood habitat. It is likely that the tourist industry at Lobé will save the river from hydro development at the site itself. The rheophytic flora is, however, vulnerable to the impact of habitat change, development or interference with flow within the watershed, because these plants are adapted to clear, aerated water and consistent seasonal variation in water level (Cheek et al., 2017b).

There are also potential threats from loss of nearby forest to coastal development, clearance of mangrove swamp and extraction of beach sand, which could expose the falls to pollution, flooding and increased coastal erosion (Corriol, 2008; Tchindjang & Etoga, 2014). The site is closely sandwiched between major infrastructure developments to the north and south. To the north, the Chad-Cameroon pipeline terminates at Ébomé just 2.5 km up the coast where the bay was excavated and reefs dynamited during development (Enns & Sneyd, 2020). There have been several reported oil leaks and local fish stocks and diversity have reportedly declined (Enns & Sneyd, 2020). To the south, the 26,000 ha Kribi deep sea port development extends 30 km down the coast from Grand Batanga which is located less than 4 km south of the Lobé falls. The project, which will clear large areas of coastal forest, plans to create a residential city accommodating an expected 300,000 new residents and to serve as a major regional hub for increased mining and other industrial development (Louis Berger, 2020; Romain et al., 2017). Associated with the project, a major roadway, reported to be a 'four-lane motorway' (Tchindjang & Etoga, 2014), is under construction from north of Kribi to Lolabé, with the section crossing the Lolabé river visibly underway on Google Earth imagery from 2 September 2017 (accessed 6 October 2020; see also **OpenStreetMap.org** for the planned road route). Major rail connections are also planned (Tchindjang & Etoga, 2014). The construction work, increased population pressure and shipping trade severely threaten the waterfall floral communities.

There are also extensive industrial palm oil and rubber plantations (SOCAPALM and HEVECAM) covering almost the entire coastal hinterland between the mouth of the Lobé and Campo Ma'an National Park, an area which constitutes a large proportion of the river's watershed (Tchindjang & Etoga, 2014; Googe Earth and OpenStreetMap viewed 6 October 2020). The impact of these plantations on the river quality at Lobé Falls is not known but they date back to colonial times and, to remain productive given the typically poor soils in the area, may need increasing inputs of fertiliser, which would potentially leach into the river system (Tchindjang & Etoga, 2014; Corriol et al., 2008).

## Key ecosystem services

Lobé Falls is very important to the burgeoning tourist industry at Kribi which is Cameroon's main beach-holiday location (Tchindjang & Etoga, 2014). It was proposed as a UNESCO World Heritage Site in 2006 on the basis of its cultural and natural importance (UNESCO World Heritage Centre, 2020). Apart from its aesthetic merits, the site has geographical significance as one of few locations in the world where waterfalls cascade directly into the ocean. Culturally, the falls have symbolic importance to local people: the three major ethnic groups, Batanga, Maabi and indigenous forest peoples, all have cultural and religious rites based on the site as a spiritual place of purification, sacrifice or healing (UNESCO, 2020; Tchindjang & Etoga, 2014).

## Ecosystem service categories

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

**Cultural –** Aesthetic appreciation and inspiration for culture, art and design

**Cultural –** Spiritual experience and sense of place

**Cultural –** Cultural heritage

## IPA assessment rationale

Lobé Falls qualifies as a potential IPA based on the presence of several globally threatened species of rheophytic plant in the family Podostemaceae which depend on waterfall habitats. The site has the highest diversity of this family in Cameroon, with ten species; three of these are narrowly endemic to the site and at high risk of extinction, while most of the others are threatened and range restricted. The site is also likely to qualify as a valuable waterfall habitat under criterion C.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Apocynaceae | *Malouetia barbata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Caesalpinioideae | *Calpocalyx heitzii* | VU | A(i) | | | | ✓ | |
| Dichapetalaceae | *Dichapetalum oliganthum* | VU | A(i) | B(ii) | | | ✓ | |
| Phyllanthaceae | *Phyllanthus kelleanus* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea bosii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Inversodicraea eladii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Ledermanniella batangensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Ledermanniella bifurcata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella linearifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella pusilla* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella variabilis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Cassipourea dinklagei* | EN | A(i) | B(ii) | | | ✓ | |
| Rubiaceae | *Ixora euosmia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria kribiensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Allexis cauliflora* | VU | A(i) | | | | | |

## Protected areas and other conservation designations

None.

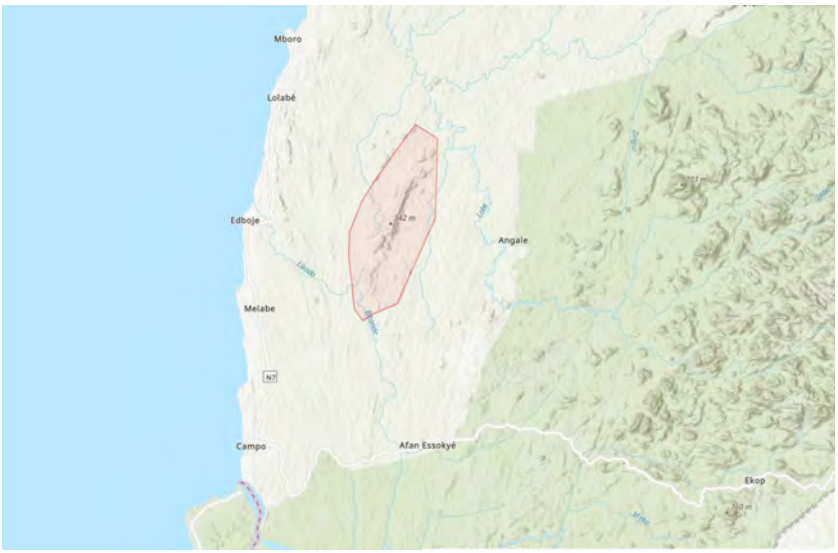
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – tourism and recreation areas | High | Ongoing – increasing |
| Mining and quarrying | Low | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Soil erosion, sedimentation | Medium | Future – inferred threat |
| Dams and water management/use | Low | Future – inferred threat |
| Storms and flooding | Medium | Ongoing – increasing |
| Oil spills | Medium | Past, likely to return |
| Residential and commercial development | Medium | Ongoing – increasing |

## IPA

# Massif des Mamelles

**International site name:** Massif des Mamelles
**Site code:** CMNTIPA026
**Administrative region:** South
**Assessed by:** Bruce Murphy, Jean Michel Onana




**Latitude** (decimal degrees)**:** 2.56760
**Altitude minimum:** 50
**Area** (km²)**:** 93.0
**Longitude** (decimal degrees)**:** 9.94870
**Altitude maximum:** 328
**IPA criteria met:** A(i)

## Site description

The Massif des Mamelles is a low ridge of forested hills, approximately 15 km long and 2 km wide, running NNE-SSW parallel to the coast, which is 12 km away. The nearest town is Ebodje, on the N7 coastal road between Campo and Kribi. Three peaks are named on the map, from north to south: Mont Puku, Mont Mbimba and Mont Die Buster (Openstreetmap, 2022; results from Geonames). The hills interrupt the low plain between the sea and Campo Ma'an National Park 25 km to the east. Mt Elephant (475 m) lies approximately 20 km to the north, while to the south the low plain stretches across the border and well into Equatorial Guinea.

## Botanical significance

The site is relatively little known but was noted in the work of Tchouto (2004) on the Campo Ma'an area as a botanical hotspot and key site for rare and range-restricted taxa. While some of the taxa are also recorded from within the Campo Ma'an National Park, others are not, such as *Psychotria campoensis* (CR), known from just one other location south of Ebolowa, and *Afrotrewia kamerunica* (Cheek & Lovell, 2020a). Some taxa are also shared with Mt Elephant. Both sites represent a vegetation type categorised by Tchouto (2004), following Letouzey (1986), as 'Caesalpsa' vegetation type 3 ('Lowland evergreen forest rich in Caesalpinioideae, with *Sacoglottis gabonensis* and other coastal indicators'). The site was actually explored for several days in September 1862 by Richard Francis Burton, but no observations or specimens were recorded (Letouzey, 1968b).

Among the significant species listed for the site, there are several mentioned by Tchouto (2004), such as *Monanthotaxis elegans, Gilbertiodendron pachyanthum* and *Monodora zenkeri*, for which specimen numbers are not available. Other taxa, such as *Cassipourea alternifolia, Pauridiantha multiflora, Cola hypochrysea* and *Culcasia bosii* have been included here although they occur a little distance from the main hills, while other rare or threatened taxa that are recorded imprecisely from nearby (such *as Ochthocosmus calothyrsus*) have not been included but should be searched for at the site.

## Habitat and geology

South Cameroon lies on the northern edge of the Congo craton in a zone where Archean rocks became reactivated in the Proterozoic eon to form the metasedimentary and meta-igneous Ntem complex,

which is in turn subdivided by age into the Ntem, Nyong and Ayna units (Teutsong et al., 2020). Within the Nyong unit, which consists of paleoproterozoic (c. 2089–2050 Ma) gneisses and amphibolites, the Massif des Mamelles is a greenstone belt containing banded iron formations (Moudioh et al., 2020). To the west, it is bordered by an eastward thrusting coastal band which extends down from the neo-proterozoic Yaoundé group zone bordering the Congo craton to the north. The iron ores at the site predominantly consist of martite, goethite and quartz, with lesser amounts of magnetite, hematite, kaolinite, and halloysite (Teutsong et al., 2020). Tchouto (2004) reports xanthic ferrasols, ferralic cambisols and ferric acrisols around the Massif. Teutsong (2020) describes the 'loose horizon' as dark brown, lumpy sandy-clay and also reports low phosphorous content in the geological profile, although it is unclear if this influences soil phosphate levels.

The vegetation of the site is little reported. Tchouto's (2004) multivariate analysis categorises the local forest as the Caesalpsa vegetation type 3 ('Lowland evergreen forest rich in Caesalpinioideae, with *Sacoglottis gabonensis* and other coastal indicators'), which is more or less absent from the national park area and differs from the dominant Caesalp evergreen forest in much of the park by the abundance of *Sacoglottis gabonensis* and other coastal indicators. However, it is unclear if the hills themselves are continuous with this type and to what extent their height, exposure and soil characteristics are responsible for a locally unique flora.

## Conservation issues

The site was one of the first iron ore reserves to be identified in the southern Cameroon iron ore corridor but has yet to be exploited (Ngoran et al., 2016; Teutsong et al., 2020). However, recent increased demand for steel has led to greater iron prospecting in Cameroon (Ngoran et al., 2016). Teutsong et al. (2020) suggest that the Mamelles reserves are of mainly medium grade ore with acceptable contaminant levels and that further investigation is justified. Approximately 350 Mt of ore at a mean composition of 30% Fe are reported for the site by Nkoumbou et al. (2017).

Proximity to the deep sea Kribi port is a major factor contributing to the potential exploitation of these reserves compared with richer reserves further east that require major new transport infrastructure (Teutsong et al., 2020). The Cameroon company SteelCam was reported recently to have hired a French consultancy in relation to the site (Africa Intelligence, 2019). At nearby Lobé, SinoSteel has been widely reported as investing US$660 million in the 35% ores. Although no extraction had taken place by 2017 (Nguepjouo, 2017), the Chinese-funded deep seaport at Kribi is now operational, providing a nearby export route (Yingwu, 2019).

In addition to the direct threat of mining at the site, the area is under threat from development and population growth associated with the port development. The forests outside of the Campo

***Heinsia crinita*** **is used for its edible leaves.**
Photograph M. Cheek, 1997

Ma'an National Park, towards the coast, were already more disturbed (Tchouto, 2004) and huge rubber and palm oil (Hevecam and SocaPalm) plantations have cleared most of the area north of the site up to the Kribi-Ebolowa road. To the south, the forest although considerably altered from its natural state was relatively well managed as a logging concession (FMU 09-025) by the Dutch firm Wijma between 2005 and 2016 (Nforngwa, 2019). This is now to be developed as a major palm oil plantation by a little-known company, Camvert, with almost the whole area of 60,000 hectares between the national park and the coast scheduled for clearance (Nforngwa, 2019). Because the Mamelles site lies in a notch in the north edge of this block, this development will isolate it on three sites from other natural habitat while exposing it to clearance for small-scale logging and agriculture.

Further surveying of this small site should be performed to verify the state of the habitat and what taxa still occur. This should be an urgent priority given the imminent threats faced from mining, palm-oil clearance and coastal development.

## Key ecosystem services

The forest between the coast and Campo Ma'an is of great value as a buffer zone for the national park, enlarging overall habitat for many species and providing corridors enabling gene flow between populations, as well as unique habitat not found in the national park. If most of this zone is lost to agro-industrial plantations and coastal development as planned (Nforngwa, 2019) then remaining sites such as the Massif des Mamelles would become especially important.

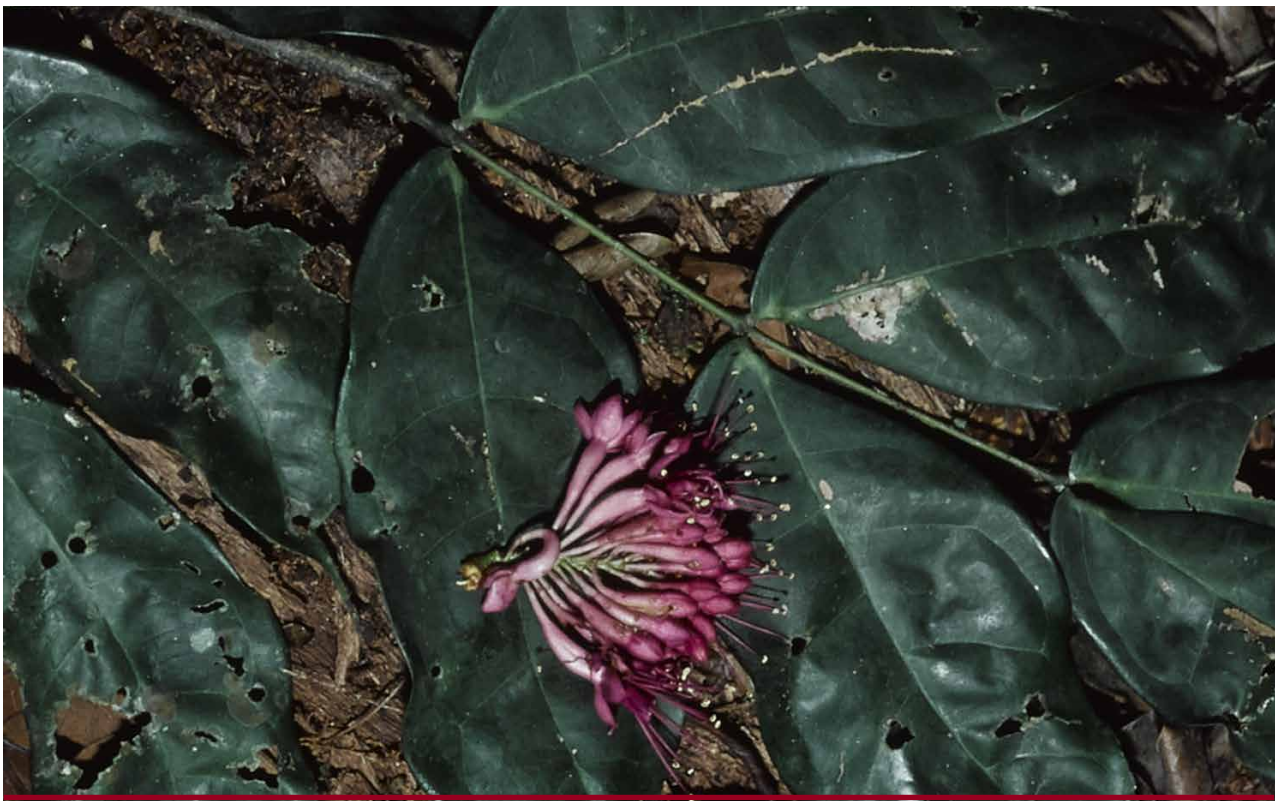
Landslides are a common danger associated with steep topography in Cameroon (Zogning et al., 2007). Maintenance of forest cover on hills such as these is generally advisable to limit this danger and associated flooding (Forbes & Broadhead, 2013), although it is not known if this is a significant concern at the site.

## Ecosystem service categories

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

The site qualifies as a potential IPA under criterion A(i) due to the presence of globally threatened species such as *Psychotria campoensis* (CR), *Afrotrewia kamerunica* (EN), *Rhaphiostylis ovatifolia (*EN), *Deinbollia mezilii* and *Culcasia bosii* (all EN), which are known from very few other sites. A *Costus* sp. nov. seemingly unique to the site awaits publication (Cheek 2023 pers. obs.) The site might also qualify under criterion C for the particular variety of coastal forest in this area, particularly as much of it is being lost to rapid development.



***Leonardoxa africana*** **is an indicator of caesalp forest type.**

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Annonaceae | *Monanthotaxis elegans* | | | B(ii) | | | | |
| Annonaceae | *Uvariopsis vanderystii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Araceae | *Culcasia bosii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia zenkeriana* | VU | A(i) | B(ii) | ✓ | | ✓ | |
| Detarioideae | *Gilbertiodendron klainei* | VU | A(i) | | ✓ | | ✓ | |
| Detarioideae | *Gilbertiodendron pachyanthum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Englerodendron leptorrhachis* | CR | A(i) | | ✓ | | | |
| Dichapetalaceae | *Dichapetalum oliganthum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Afrotrewia kamerunica* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Metteniusaceae | *Rhaphiostylis ovatifolia* | EN | A(i) | B(ii) | ✓ | | | |
| Rhizophoraceae | *Cassipourea alternifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis rammelooana* | VU | A(i) | B(ii) | ✓ | | | |
| Rubiaceae | *Hymenocoleus glaber* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Psychotria arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria campoensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria lanceifolia* | VU | A(i) | | ✓ | | | |
| Sapindaceae | *Deinbollia mezilii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola hypochrysea* | EN | A(i) | | ✓ | | ✓ | |
| Violaceae | *Rinorea umbricola* | | | B(ii) | | | | |

## Protected areas and other conservation designations

None.

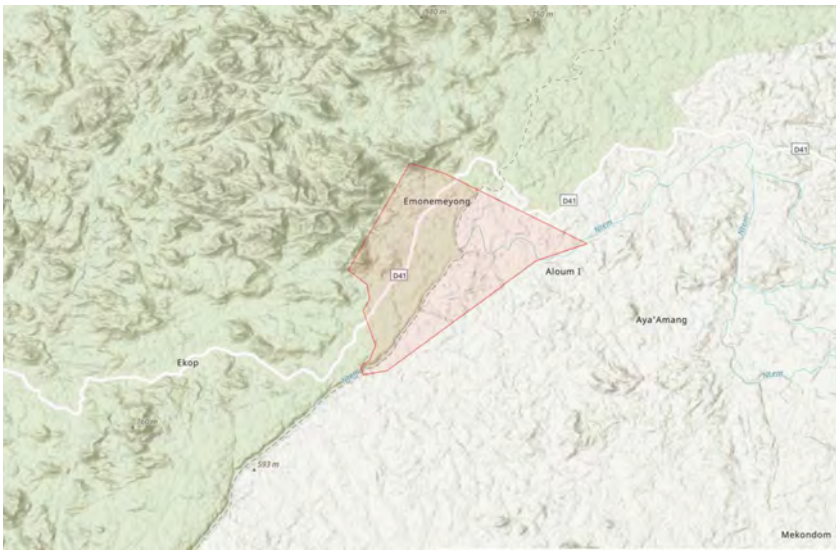
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Agro-industry farming | High | Ongoing – increasing |
| Shifting agriculture | Unknown | Ongoing – trend unknown |
| Roads and railroads | Medium | Ongoing – increasing |
| Mining and quarrying | High | Future – planned activity |

## IPA

# Memv'ele Falls

**International site name:** Memv'ele falls
**Site code:** CMNTIPA015
**Administrative region:** South
**Assessed by:** Bruce Murphy, Martin Cheek, Xander van der Burgt, Eric Ngansop




**Latitude** (decimal degrees): 2.40410
**Altitude minimum:** 380
**Area** (km²): 30.0
**Longitude** (decimal degrees): 10.37810
**Altitude maximum:** 450
**IPA criteria met:** A(i)

## Site description

The Memv'ele falls at Nyabessan in Cameroon's South Region is located on the Ntem river, approximately 60 km east of the coastal town of Campo and close to the border of both Equatorial Guinea and Gabon. It lies immediately to the south of the Campo Ma'an National Park. The Memv'ele falls is the site of a large hydroelectric project on the Ntem river which flows through a narrow gorge in this area downstream from the confluence of a network of backwater channels (Boucles du Ntem) that branch South of Ma'an as the Mvila and Ntem tributaries meet.

## Botanical significance

The site lies within a relatively sparsely populated area with remaining valuable forest habitat. The falls themselves are significant for the presence of several important rheophytic species, including Critically Endangered local endemics *Inversodicraea tchoutoi, I. ntemensis, I. achoundongii, I. senei*, *Virectaria salicoides* and *Psychotria torrenticola*. These species are narrowly endemic to a small area of the Ntem although some of them also occur a little further downstream as well as at Memv'ele itself. The site has the greatest species diversity for the genus *Inversodicraea* globally (Cheek et al., 2020c) and at least ten species of Podostemaceae have been recorded from the Ntem river (Schenk et al., 2015).

Growing close to the falls but not in the river itself, the rare tree *Xylopia calva* (EN) has also been collected at one of only three known global locations (Johnson & Murray, 2018). *Ixora euosmia* and *Ixora inundata* have also been recorded here. A collection of the genus *Cola* (Ngansop 327) from the site is thought to represent an undescribed new species and the surrounding forest is thought likely to contain further rare species, although it has been previously logged (X. van der Burgt 2020, pers. comm., 29 September).

The larger area incorporating Memv'ele has been described as a refuge for plant species during quaternary glaciations when humid forest contracted in Central Africa (Idriss, 2012). A total of 1,471 species of vascular plants were recorded from nearby Campo Ma'an by Tchouto et al. (2006a), with 114 national endemics (Tchouto et al., 2006b). To the south and incorporating Memv'ele, the RAMSAR site Partie Camerounaise du fleuve Ntem is also botanically important.

## Habitat and geology

The Ntem river flows westwards to the Atlantic between the Ntem massif of Campo Ma'an to the north and the mountains of Equatorial Guinea to the South. Geologically, the area lies within the South Cameroon Plateau and is dominated by Precambrian

metasedimentary basement complex rocks such as gneisses, migmatites and schists (Idriss, 2012; Nkoungou et al., 2012).

At the site of the falls themselves, the solid outcroppings are granitic gneiss (Nkoungou et al., 2012). These hard rocks give the river its black colour due to the low silt content. The rocks might be some kind of conglomerate since loose material appears to become consolidated into the bed of the river channels (X. van der Burgt 2020, pers. comm., 29 September).

Soils in the area are predominantly acidic, ferralitic and lateritic and can be deep but are shallow on steep slopes; they have good physical properties but low nutrient content (Idriss, 2012).

The topography rises to around 1,000 m on either side of the valley and is very steep in places. After the Boucles du Ntem, where there are multiple backwater channels and marshy areas, the river enters a gorge at Nyabessan as it cuts through hills blocking the valley to the west. Here at the spectacular Memv'ele falls themselves the energy of the concentrated and rapidly descending river with a catchment area of 26,350 $km_2$ has been exploited through a hydro-power station (Chen & Landry, 2016).

Average annual temperature in the region varies little, around 25 °C. Annual rainfall at Nyabessan is 1,670 mm, considerably less than at Campo on the coast where there is 2,800 mm (Tchoutou et al., 2006a,b). The climate pattern is bimodal, with a dry season between July and August and a longer one between December and February (Schenk et al., 2015; Cheek et al., 2020c). However, due to the extensive buffer provided by the marshy area of upstream river loops, seasonal variation in waterflow is less than at some sites, enabling the use of a run-of-the-river style hydro station with limited reservoir capacity (Chen and Landry, 2016).

The forest in this area is at the interface between Atlantic Biafran forest rich in 'Caesalpinioid' legume species – type 228 in Letouzey (1985) – and two forms of mixed forest varyingly dominated by either Atlantic evergreen or semi-deciduous elements – types 233 and 166.

## Conservation issues

The Memv'ele falls is the site of a major 200 MW hydro-electric project which is close to completion (Chen & Landry, 2016). At the main falls, a 20 m high earthfill dam, 1.5 miles long, has been built which will create a 19-million $m^3$ reservoir, flooding the villages of Nyabessan and Alem and an area of the Campo Ma'an National Park, according to Chen and Landry (2016). As well as destroying the main waterfalls or channelling water away from them, the project will flood rocky channels above the falls and disrupt water levels downstream where other populations of some of the Critically Endangered species are also found (Cheek et al., 2020c; Schenk et al., 2015). Seasonal fluctuation in water levels is crucial to the reproductive cycle of the rheophytic Podostemaceae species which flower and fruit during drier periods when water levels drop (Schenk et al., 2015; Cheek et al., 2017b), and therefore the dam severely threatens all populations of these species at the site or downstream.

In addition to the impact of the dam itself, the construction of roads and transmission infrastructure, as well as the influx of migrant labour, will impact an

**The Memv'ele Falls host several rare or endemic rheophytic species that only occur at waterfalls and rapids.**
Photograph X. van der Burgt, November 2016.

area which was previously sparsely populated and hard to access (Carrière et al., 1999). Typical threats such as logging and habitat clearance for cultivation are likely to increase (Idriss, 2012). These issues, in addition to construction directly associated with the hydro-power project, also threaten rheophytic species through increased pollution and water turbidity. Podostemaceae in particular normally require clear water and their growth and reproduction may be impaired by silt (Cheek et al., 2015c, 2020c).

The site is closely adjacent to two conservation areas, the protected Campo Ma'an National Park to the north and the Partie Camerounaise du fleuve Ntem to the south, a RAMSAR wetland of international significance, one of only seven in Cameroon (Idriss, 2012). The latter incorporates the Memv'ele falls site along with a larger upstream area and a further, smaller area is designated as a 'Forêt de protection reserve' – Ma'an/Boucles du Ntem (WDPA ID 146,629; 12,083 ha). A large logging concession (FMU 09-024) lies to the south.

## Key ecosystem services

The river Ntem is an important habitat for fish biodiversity with 249 species recorded, including two endemics. Fishing is also relied upon by local people for food and income (Idriss, 2012; Dounais et al., 2016). The local forest area supports 80 species of large and medium sized mammals, including elephants and 13 threatened primates such as the Critically Endangered western lowland gorilla (*Gorilla gorilla gorilla*).

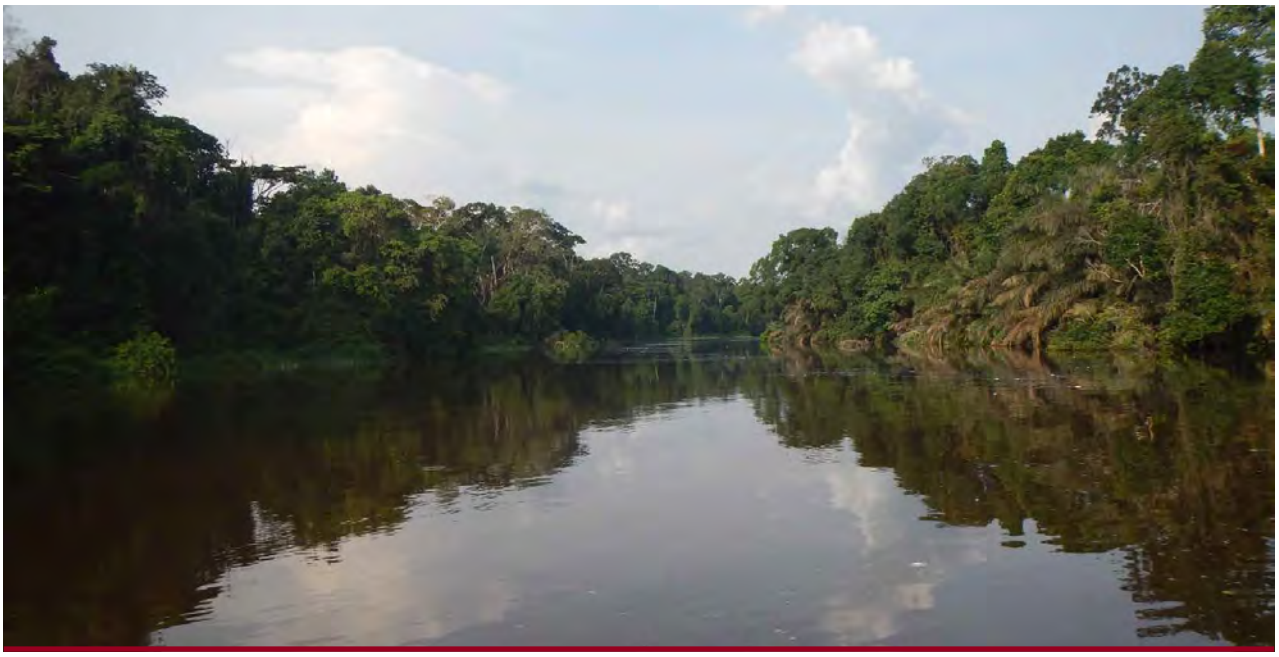
The falls were described by Schenk (2015) as the main tourist attraction in the region, while the nearby national park is also a lure to visitors. This has the potential to encourage conservation of the natural environment and to provide alternative employment and income. While the hydro project has already likely partly destroyed this habitat, it also brings improved access for ecotourism and conservation. The potential for tourism would be enhanced by efforts to mitigate the impact of the hydro project on the natural landscape and organisms, and to discover further sites for the endemic rheophytic species, while encouraging conservation of the surrounding forest. The Ebianemeyong tourist camp ('*Site ecotouristique et communautaire des chutes de Memv'ele*') has been built near the falls, partly financed by the European Union.

## Ecosystem service categories

**Provisioning –** Food
**Provisioning –** Raw materials
**Provisioning –** Fresh water
**Provisioning –** Medicinal resources
**Habitat or supporting services –** Habitats for species
**Cultural –** Tourism

## IPA assessment rationale

The site qualifies as an IPA under criterion A(i) due to the presence of several globally threatened species, particularly members of the genus *Inversodicraea*, which are narrowly endemic to the site alone or also occur at a few nearby parts of the river system, which are also threatened by the hydro-power project. It might also qualify under criterion C for its waterfall habitats, although these may be too impacted by the hydro-electric project. The site might also be treated together with the 'Partie Camerounaise du fleuve Ntem' and 'Forêt de protection reserve Ma'an/Boucles du Ntem' as a wetland habitat, but little plant data is available for these adjacent areas.



**The Ntem river near the Memv'ele Falls.**
Photograph X. van der Burgt, November 2016.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Annonaceae | *Xylopia calva* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Begoniaceae | *Begonia microsperma* | VU | A(i) | | ✓ | ✓ | | |
| Detarioideae | *Englerodendron graciliflorum* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Guibourtia tessmannii* | EN | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Detarioideae | *Oddoniodendron gambanum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis hallei* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Thecacoris lancifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea achoundongii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Inversodicraea ntemensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Inversodicraea senei* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Podostemaceae | *Inversodicraea tchoutoi* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella bifurcata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Podostemaceae | *Macropodiella heteromorpha* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Psychotria torrenticola* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Virectaria salicoides* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Simaroubaceae | *Nothospondias staudtii* | VU | A(i) | | | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Campo Ma'an National Park | Protected/conservation area overlaps with IPA |
| Ramsar | Partie Camerounaise du fleuve Ntem | Protected/conservation area encompasses IPA |

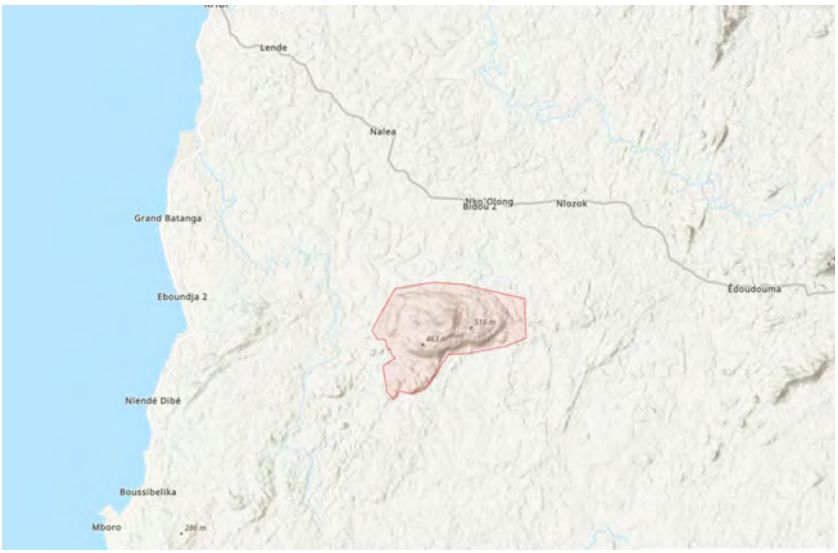
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Low | Ongoing – trend unknown |
| Roads and railroads | Medium | Ongoing – increasing |
| Soil erosion, sedimentation | High | Future – inferred threat |
| Nutrient loads | High | Future – inferred threat |
| Renewable energy | High | Ongoing – stable |
| Dams and water management/use – large dams | High | Ongoing – stable |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |

## IPA

# Mt Elephant

**International site name:** Mt Elephant
**Local site name (if different):** Mont de l'Eléphant
**Site code:** CMNTIPA002
**Administrative region:** South
**Assessed by:** Bruce Murphy, Xander van der Burgt




**Latitude** (decimal degrees)**:** 2.80000
**Altitude minimum:** 50
**Area** (km²)**:** 23.0
**Longitude** (decimal degrees)**:** 10.00000
**Altitude maximum:** 480
**IPA criteria met:** A(i)

## Site description

Mt Elephant is a 480 m hill in Ocean division of Cameroon's South Region, 11 km from the coast, south-east of Kribi. The slopes are gradual on the north, east and west sides, but on the south side there is a long vertical rock wall about 50 m high. The area demarcated here covers 23 km², encompassing the hilly terrain, but it is feared much of this area may already have been lost.

## Botanical significance

The site is part of the African Atlantic coastal forest, a vegetation type rich in rare and endemic species (Letouzey 1968, 1986). Forest in this area is particularly rich in tree species in the Leguminosae subfamily Detarioideae. *Begonia montis-elephantis* (CR; Wilde, 2002) and *Mitriostigma monocaule* (CR; Sonké et al., 2009) are endemic, and *Hypolytrum unispicatum* (EN; Sosef & Simpson, 2005) is near-endemic to the vertical rock wall at the south side of the hill (but also known from a single site in Equatorial Guinea). These species are highly threatened because forest fires lit by farmers and oil palm plantation staff are advancing closer in the forest strip at the base of the vertical rock wall. In September 2017, the fires had advanced to 50 m from the base of the cliff. When these fires reach the base of the cliff, the trees will die and the environment will become generally too sunny for these three shade-loving species. *Begonia montis-elephantis* may therefore soon become extinct. Three attempts have been made to collect seeds of these species for seed-banking – in February 2016, November 2016 and October 2017 – but without success.

The type of *Didelotia ledermannii* was collected here in 1908; the species has only been possibly collected once since then, at nearby Kribi. *Rhaphiostylis elegans* (EN) and *Rhaphiostylis subsessilifolia* (EN) are only recorded from two or three other nearby sites. *Allexis obanensis* (EN), *Habenaria phantasma* (EN), *Vangueriella zenkeri* (EN) and *Vangueriella letestui* (EN) are also very rare. Several species reach the northern limit of their distribution in this region and are therefore nationally rare, such as *Gilbertiodendron scutatum* (VU), which has only been recorded in Cameroon at this site. *Kylicanthe cornuata, Polystachya riomuniensis* and *Begonia scapigera* subsp. *scapigera* are other noteworthy taxa that have yet to be assessed for the IUCN Red List but which have been provisionally considered threatened (Onana & Cheek, 2011; Lachenaud et al., 2013; Descourviéres et al., 2018).

A photograph taken from the quarry on top of the south-facing rock wall near the summit of Mt Elephant, August 1997. The rainforest is still present, although logging has taken place. In the distance, the forest has been cleared already.
Photograph X. van der Burgt.

A photograph taken from the quarry on top of the south-facing rock wall near the summit of Mt Elephant, November 2016. The rainforest is nearly completely converted to oil palm plantations.
Photograph X. van der Burgt.

## Habitat and geology

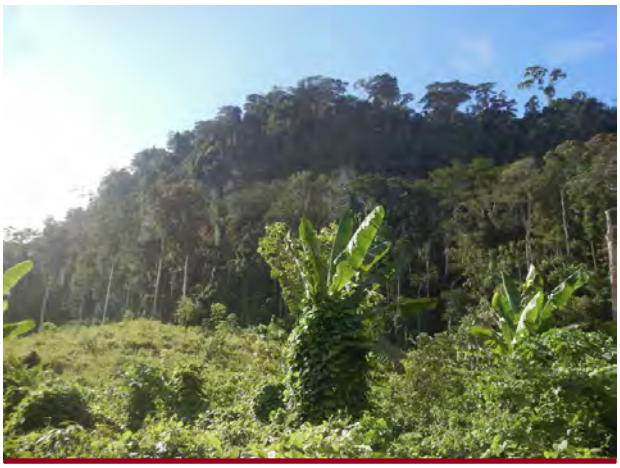
Mt Elephant lies at the northern edge of the ancient Congo craton, at the border of the paleo-proterozoic Nyong unit (part of the Ntem complex) and a north-west oriented, south-east thrusting tongue of the neoproterozoic Yaoundé group. These are metasedimentary and meta-igneous rocks, predominantly gneiss, amphibolite, biotite, quartzite and micaschists (Nzenti et al., 2016; Teutsong et al., 2020).

More detailed mapping appears to show Mt Elephant as a small intrusion of meta-syenite bordering an area of Biotite-hornblende gneiss and TTG (Moudiouh et al., 2020). Personal observation suggests the bedrock is of some kind of light-coloured layered stone, which is being quarried by hand in two quarries at the top of the cliff. The stone is carried to the roadside and sold in nearby villages and cities in Cameroon. The slabs are cut into egg-shaped plates which are used to grind food. Irregularly shaped pieces are used to cover floors and walls (X.M. van der Burgt, pers. obs.; see accompanying photograph).

Soils in this area are mapped as haplic ferralsols (Yerrima & Ranst, 2005) but may vary locally on the raised terrain.

The climate is equatorial with c. 2,900 mm of rain per year at Kribi and a main dry season between late November and February but with all months receiving c. 60 mm or more (Tchouto, 2004; WMO, 2021). At Kribi there is only a slight reduction in precipitation in July rather than a distinct second dry season. Average annual temperature is around 25 °C, with monthly maxima ranging from 32.8 °C in February to 27.7 °C in August. Minima are more constant, ranging between 22.5 and 23.9 °C.

The area is part of the Lower Guinea subregion of the Guineo-Congolian region (White, 1986), and habitat includes lowland coastal rainforest, rich in Detaroid legumes, and a vertical, partially vegetated rock wall.



**Mt Elephant cliff forest from below.**
Photograph X. van der Burgt, October 2017.

However, there is little rainforest remaining and the area is largely surrounded by palm oil plantation and other cultivated land.

## Conservation issues

The whole area in and around Mt Elephant is currently listed as an 'Agro-industrial area' by the Cameroon government, implying that it will all be converted to agricultural land. To the south, a very large oil palm plantation was set up recently and there is no more forest left there. To the east, medium sized farms were set up recently and the forest is all but gone, although this area is designated as Nyete community forest – a production forest reserve. In September 2017 there was still closed forest on the slopes and summit of the mountain; this has been subject to some logging in the past. This forest is also heavily hunted, greatly reducing the populations of edible animals. At the time of writing (2023), the forest may already have been completely destroyed, or this may happen soon.

## Key ecosystem services

Mt Elephant provides habitat for numerous animal species but populations of many of these have greatly declined because of hunting. The hill provides water to nearby villages and the remaining rainforest acts as a store of carbon.

## Ecosystem service categories

**Provisioning –** Raw materials

**Provisioning –** Fresh water

**Habitat or supporting services –** Habitats for species

**Mt Elephant is acutely threatened by encroaching oil palm cultivation.**
Photograph X. van der Burgt, 2016.

***Begonia montis-elephantis*** **a globally endemic, Critically Endangered species confined to the steep Mt Elephant cliffs and facing imminent extinction as the forest is cleared.**

Photograph X. van der Burgt, February 2016.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Annonaceae | *Duguetia dilabens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Isolona pleurocarpa* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis vanderystii* | VU | A(i) | | ✓ | | | |
| Asparagaceae | *Dracaena viridiflora* | VU | A(i) | | ✓ | | | |
| Begoniaceae | *Begonia montis-elephantis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Byttnerioideae | *Scaphopetalum riparium* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Floscopa mannii* | EN | A(i) | | ✓ | | | |
| Cyperaceae | *Hypolytrum unispicatum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia africana* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Copaifera religiosa* | VU | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Didelotia ledermannii* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Eurypetalum unijugum* | VU | A(i) | B(ii) | ✓ | | | |
| Detarioideae | *Gilbertiodendron klainei* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron scutatum* | VU | A(i) | | | ✓ | ✓ | |
| Detarioideae | *Guibourtia tessmannii* | EN | A(i) | | | | ✓ | |
| Detarioideae | *Hymenostegia talbotii* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Hymenostegia viridiflora* | VU | A(i) | B(ii) | ✓ | ✓ | | |
| Detarioideae | *Englerodendron leptorrhachis* | CR | A(i) | | ✓ | | ✓ | |
| Dichapetalaceae | *Dichapetalum oliganthum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Crotonogyne zenkeri* | VU | A(i) | | ✓ | | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Lamiaceae | *Vitex lokundjensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos gnetifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos staudtii* | VU | A(i) | | ✓ | | ✓ | |
| Melastomataceae | *Memecylon candidum* | VU | A(i) | | ✓ | | | |
| Meliaceae | *Heckeldora leptotricha* | | | B(ii) | | | | |
| Menispermaceae | *Albertisia capituliflora* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Metteniusaceae | *Rhaphiostylis elegans* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Metteniusaceae | *Rhaphiostylis subsessilifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia involuta* | | | B(ii) | | | | |
| Orchidaceae | *Ancistrorhynchus tenuicaulis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum angustum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum alinae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria phantasma* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera rosseeliana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis rammelooana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Mitriostigma monocaule* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Sabicea medusula* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Vangueriella letestui* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Vangueriella zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia maxima* | VU | A(i) | | ✓ | | | |
| Sapotaceae | *Tieghemella africana* | EN | A(i) | | | ✓ | ✓ | |
| Sterculioideae | *Cola brevipes* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola letouzeyana* | NT | | B(ii) | | | | |
| Violaceae | *Allexis obanensis* | EN | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

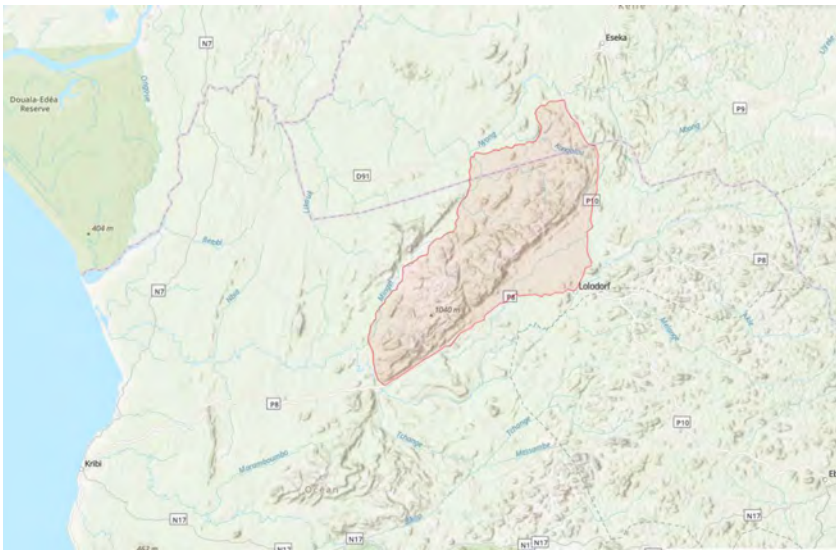
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – increasing |
| Agro-industry farming | High | Ongoing – increasing |
| Increase in fire frequency/intensity | High | Ongoing – increasing |
| Mining and quarrying | Low | Ongoing – stable |
| Hunting and collecting terrestrial animals | High | Ongoing – stable |
| Gathering terrestrial plants | Medium | Ongoing – stable |
| Logging and wood harvesting | High | Ongoing – trend unknown |

## IPA

# Ngovayang Massif

**International site name:** Ngovayang Massif
**Site code:** CMNTIPA001
**Administrative region:** South
**Assessed by:** Xander van der Burgt, Bruce Murphy, Bonaventure Sonké, Murielle Simo-Droissart, Vincent Droissart




**Latitude** (decimal degrees)**:** 3.25000
**Altitude minimum:** 100
**Area** (km²)**:** 1,035
**Longitude** (decimal degrees)**:** 10.50000
**Altitude maximum:** 1,110
**IPA criteria met:** A(i)

## Site description

The Ngovayang Massif Area (NMA) in South Region, Cameroon, is a north-east–south-west angled ridge of lowland and sub-montane rainforest c. 50–100 km from the Atlantic coast (Droissart et al., 2019). It lies south of the Sanaga river, near the transition between the Lower Guinea and Congolian forest zones in the Atlantic Coastal Equatorial Forests ecoregion (Olson et al., 2001). Areas of primary forest likely occur in inaccessible parts of the range and areas of submontane forest are found on the summit area of the main ridge. The lowlands and lower slopes have been degraded by logging and slash-and-burn agriculture, but are often succeeded by regrowth and secondary forest. Several communities are located along the Bipindi-Lolodorf road along the southern edge of the massif and along other perimeter roads. The massif itself has a smaller human-presence although Bagyeli forest hunter-gatherers make temporary camps throughout the forest (Gonmadje et al., 2011).

## Botanical significance

The Ngovayang forests have some of the highest species richness and endemism of all Central African forests (Gonmadje et al., 2011; Droissart et al., 2019). Topography, high precipitation and permanence of forest cover during periods of drier climate may help explain this richness (Gonmadje et al., 2011). A particular richness in Leguminosae-Detarioideae likely indicates that the area has remained under forest cover during the past ice ages.

The NMA has been shown to be important for its exceptional plant diversity (> 20% of the total flora of Cameroon), its concentration of many threatened and/or restricted range species (ten taxa are strict endemics of the massif), and for its threatened habitats, for example, the submontane vegetation above c. 750 m elevation (Droissart et al., 2019). The Ngovayang massif represents the third richest documented area for Cameroon (Droissart et al., 2019) after Mt Cameroon National Park (2,435 plant species – Cable & Cheek, 1998) and the Kupe, Mwanenguba and Bakossi mountains (2,412 plant species, Cheek et al., 2004). Taxa strictly endemic to the Ngovayang massif include: *Monanthotaxis dielsiana, Pyrenacantha grandifolia Dischistocalyx rivularis, Phyllanthus aspersus, Globulostylis leniochlamys, Psychotria conica* subsp. *ngovayangensis*, *P. retrorsipilis, P. villicarpa* subsp. *sessilis* and *Sabicea trigemina* (all seven species are Rubiaceae – Droissart et al., 2019). *Eremospatha barendii* (Palmae) is also endemic to an area just south of the site.

At least six other species are new to science and most of these may also be endemic to Ngovayang when formally described (Droissart et al., 2019; Burgt unpubl. data). Over 120 species listed here are published on the IUCN Red List as globally threatened. Recent botanising has particularly focussed on Rubiaceae, Orchidaceae and Begoniaceae. However, many species listed here are recorded only from collections by Zenker over 100 years ago in the region of Bipindi (Droissart et al., 2019). These cannot be precisely located and it is possible that some will have been collected from outside the Ngovayang massif and may not occur there. Furthermore, several species collected in the lowland around Bipindi may have become extinct, as this area has been cleared for development.

## Habitat and geology

The massif lies towards the northern end of the Congo craton and belongs to the Nyong unit, part of the Ntem complex. The Nyong unit consists of Archean and Paleoproterozoic meta-sedimentary, meta-volcanic and intrusive rocks, with gneiss, migmatite, quartzite and schists common, together with greenstone belts, iron formations and some ultramafics (Gonmadje et al., 2011; Paterne et al., 2019). These formations have been strongly influenced by the eburnean orogeny 2050 Ma (Paterne et al., 2019). Xanthic ferralsols are dominant (Gonmadje et al., 2011; Droissart et al., 2019).

Average annual rainfall is about 2,000 mm. There are four seasons with the main dry season between December and February and a short dry period from July to August. Mean annual temperature is 25 °C and average minima and maxima are 23.4 °C and 32.5 °C respectively (Gonmadje et al., 2011; Paterne et al., 2019). However, the mountainous topology produces a range of localised microclimates. Together with geological variation, this creates the potential for numerous niches, resulting in high diversity and endemicity (Gonmadje et al., 2011). The remaining intact habitat is evergreen moist lowland forest dominated by 'Caesalpiniaceae' (now Detarioideae) and submontane forest, Letouzey's (1985) types 228 and 117. The lower slopes are more degraded forest. Geologically and phytogeographically the site appears to be at the meeting point of two zones. However, phytologically, Lower Guinea taxa appear to dominate over Congolian elements (Gonmadje et al., 2011).

## Conservation issues

The rapid expansion of human activities in South Cameroon threatens the exceptional biodiversity of the Ngovayang massif. The site does not at present appear to have any legal conservation status (Droissart et al., 2019). Most of the area is designated as production forest, with the Bipindi-Lolodorf Council Forest (478 km$^{2)}$ covering the central ridge and FMU 00-002 (115 km$^2$) encompassing the north-western part (MINFOF & WRI, 2021). Several community forests border these areas.

The lowland forests have been extensively logged in many parts of the massif, particularly in the north, although there are indications that companies have been moving to more sustainable management of

**Ngovayang summit ridge.**
Photograph X. van der Burgt, December 2019.

the forests (Gonmadje et al., 2011). As elsewhere in Africa, after the logging companies leave, the logging roads provide access to hunters and farmers, thus resulting in further degradation of the forest.

Hunting is widespread in the region (Gonmadje et al., 2011), with the catch being sold in villages but also in the main cities of Cameroon. Important forest seed dispersers, such as elephants, have become rare in the region, which may reduce the population density of those plant species depending on these animals for their seed dispersal.

There exists a threat of deforestation by farmers and commercial agricultural companies (Gonmadje et al., 2011). Local villagers in the area clear small patches of forest for slash-and-burn farming; individuals living in the nearby cities buy larger areas of forest and clear these for the cultivation of cash crops to be sold within Cameroon; commercial agricultural companies may buy large areas of forest for transformation into plantations of crops such as plantains, oil palm and rubber, to be sold nationally and internationally.

Mining is arguably the highest priority threat to the site. Prospecting has revealed one of the largest magnetite iron ore deposits in Central Africa. Investigations have also shown that the predominantly magnetite-gneiss ore is of sufficient grade and mass for potential economic exploitation (Droissart et al., 2019). Unfortunately, open-cast iron mining is considered one of the worst extraction processes for surface impact and it would appear that the highest concentrations of ore are located in the higher altitude areas where the forest is more intact (Droissart et al., 2019).

Mining companies have also been attracted to gold deposits which appear to be more concentrated in the lowland south-eastern area (Droissart et al., 2019). Uranium has also been prospected and sand is quarried from the Lokundje river (Paterne et al., 2019). The NMA is subject to three exploration permits (EP) covering 2,972 km²: EP 144 covers the main part of the NMA; EP 195 is located in the north and north-eastern part of NMA; and EP 221 in the south-east (Droissart et al., 2019). Jindal Steel and Power took over control of operations from the Legend Mining company in 2014 for of $17.5M (Droissart et al., 2019).

A management plan involving in situ and ex situ conservation actions is urgently needed to reduce the potential threats of future mining activities (Droissart et al., 2019).

**Small stream in primary forest in the Ngovayang Massif, north of village Ngovayang II.**
Photograph X. van der Burgt, December 2019.

## Key ecosystem services

Local people rely on the forest to meet many of their basic needs (Gonmadje et al., 2011). The site contains a dense hydrographic network of upland streams and constitutes a major catchment area for the Lokundje river (Paterne et al., 2019). The many villages at the foot of the massif, as well as larger communities of Bipindi and Lolodorf, likely rely on these watercourses for fresh water and fish. Surveying of streams for mineral deposits indicates the potential for pollution of these sources (Paterne et al., 2019). Existing forests also likely help protect lowland communities from erosion, landslides and flash-flooding, which are common in Cameroon.

## Ecosystem service categories

**Provisioning** – Food
**Provisioning** – Raw materials
**Provisioning** – Fresh water
**Provisioning** – Medicinal resources
**Regulating** – Moderation of extreme events

***Plagiosiphon* sp. nov. (Detarioideae, Leguminosae) from Ngovayang.**
Photograph X. van der Burgt, December 2019.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Dischistocalyx rivularis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Acanthaceae | *Justicia gigantophylla* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Pseuderanthemum dispermum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Rungia caespitosa* | | | B(ii) | | | | |
| Acanthaceae | *Staurogyne bicolor* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Acanthaceae | *Whitfieldia preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Ancistrocladaceae | *Ancistrocladus le-testui* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvaria buchholzii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Boutiquea platypetala* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Hexalobus bussei* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Isolona pleurocarpa* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Monanthotaxis dielsiana* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Annonaceae | *Monanthotaxis elegans* | | | B(ii) | | | | |
| Annonaceae | *Piptostigma longepilosum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Uvariopsis zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia calva* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Baissea ochrantha* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Callichilia monopodialis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Landolphia flavidiflora* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Apocynaceae | *Landolphia maxima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Pleioceras zenkeri* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Araceae | *Culcasia bosii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Arecaceae | *Eremospatha barendii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Asparagaceae | *Chlorophytum petrophilum* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Boraginaceae | *Hoplestigma pierreanum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Burmanniaceae | *Afrothismia winkleri* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Caesalpinioideae | *Calpocalyx atlanticus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Celastraceae | *Campylostemon mitophorum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Loeseneriella camerunica* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia lucida* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Celastraceae | *Salacia volubilis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Dactyladenia cinerea* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | | |
| Combretaceae | *Combretum echirense* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Aneilema silvaticum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Connaraceae | *Cnestis macrophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Convolvulaceae | *Calycobolus micranthus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Convolvulaceae | *Neuropeltis eladii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Momordica enneaphylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia pachyloba* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Aphanocalyx hedinii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Eurypetalum unijugum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron pachyanthum* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Gilbertiodendron zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Detarioideae | *Hymenostegia brachyura* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Englerodendron leptorrhachis* | CR | A(i) | | ✓ | | ✓ | |
| Detarioideae | *Plagiosiphon discifer* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Dichapetalaceae | *Dichapetalum reticulatum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros alboflavescens* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | A(i) | | | | ✓ | |
| Euphorbiaceae | *Crotonogyne impedita* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Crotonogyne zenkeri* | VU | A(i) | | ✓ | | ✓ | |
| Euphorbiaceae | *Erythrococca patula* | | | B(ii) | | | | |
| Euphorbiaceae | *Grossera major* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Euphorbiaceae | *Hamilcoa zenkeri* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Icacinaceae | *Pyrenacantha grandifolia* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lamiaceae | *Clerodendrum anomalum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lamiaceae | *Vitex lokundjensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia cinnamomea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia fruticosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia grandifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia klainei* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia kostermansiana* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lauraceae | *Beilschmiedia myrciifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia nitida* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia papyracea* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Lauraceae | *Beilschmiedia sessilifolia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Lauraceae | *Beilschmiedia staudtii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia wilczekii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Lecythidaceae | *Rhaptopetalum sessilifolium* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Linaceae | *Hugonia micans* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos gnetifolia* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos mimfiensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loganiaceae | *Strychnos zenkeri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loranthaceae | *Agelanthus glaucoviridis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Loranthaceae | *Helixanthera periclymenoides* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Loranthaceae | *Tapinanthus preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Marantaceae | *Sarcophrynium villosum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Amphiblemma soyauxii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Melastomataceae | *Memecylon candidum* | VU | A(i) | | ✓ | | ✓ | |
| Melastomataceae | *Memecylon simulans* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Tristemma camerunense* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Entandrophragma candollei* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Heckeldora leptotricha* | | | B(ii) | | | | |
| Meliaceae | *Khaya ivorensis* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Trichilia zewaldae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Albertisia capituliflora* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Menispermaceae | *Tiliacora odorata* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Metteniusaceae | *Rhaphiostylis elegans* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Moraceae | *Dorstenia prorepens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia staudtii* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Ochnaceae | *Lophira alata* | VU | A(i) | | | | ✓ | |
| Orchidacaeae | *Diaphananthe garayana* | | A(iv) | | ✓ | ✓ | ✓ | |
| Orchidacaeae | *Diaphananthe spiralis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Afropectinariella pungens* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Ancistrorhynchus tenuicaulis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Angraecum angustum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum alinae* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum dolabriforme* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum platybulbum* | | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum porphyrostachys* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum teretifolium* | VU | A(i) | B(ii) | ✓ | | | |
| Orchidaceae | *Diaphananthe dorotheae* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Eggelingia gabonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Gastrodia africana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Liparis hallei* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Orestias micrantha* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya batkoi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya lejolyana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Polystachya stodolnyi* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum montealenense* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus aspersus* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Phyllanthaceae | *Phyllanthus dusenii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Podostemaceae | *Ledermanniella thalloidea* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes magnistipula* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes staudtii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Cassipourea dinklagei* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Cassipourea zenkeri* | | | B(ii) | | | | |
| Rubiaceae | *Aulacocalyx mapiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Belonophora ongensis* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Belonophora talbotii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera heterophylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Bertiera laxissima* | | | B(ii) | | | | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Coffea mapiana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Colletoecema magna* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Corynanthe brachythyrsus* | EX | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Gaertnera letouzeyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Globulostylis leniochlamys* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Globulostylis rammelooana* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora batesii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Ixora synactica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Kupeantha spathulata* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Massularia stevartiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Morinda mefou* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Oxyanthus doucetii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha arcuata* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pauridiantha divaricata* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta kribiensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta renidens* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta robusta* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pseudosabicea batesii* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Psychotria arborea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria basicordata* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria camerunensis* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Psychotria conica* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Psychotria droissartii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria lanceifolia* | VU | A(i) | | ✓ | | ✓ | |
| Rubiaceae | *Psychotria marantifolia* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria minimicalyx* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria retrorsipilis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Psychotria satabiei* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria senterrei* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria villicarpa* subsp. *sessilis* | EN | A(i) | | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Sabicea apocynacea* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea laxa* | VU | A(i) | | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Sabicea medusula* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea rufa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea trigemina* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Sabicea xanthotricha* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sericanthe lowryana* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia atherura* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia ferorum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Tricalysia vadensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Vangueriella letestui* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Vangueriella zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapindaceae | *Allophylus zenkeri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Deinbollia pycnophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sapindaceae | *Placodiscus angustifolius* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | A(i) | | | | ✓ | |
| Sapotaceae | *Manilkara zenkeri* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Neolemonniera batesii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola gilgiana* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sterculioideae | *Cola hypochrysea* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola letouzeyana* | NT | | B(ii) | | | | |
| Sterculioideae | *Cola sulcata* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Thymelaeaceae | *Dicranolepis polygaloides* | VU | A(i) | B(ii) | ✓ | | | |
| Violaceae | *Rinorea amietii* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea ebolowensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Violaceae | *Rinorea microglossa* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Zingiberaceae | *Aulotandra kamerunensis* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – increasing |
| Agro-industry farming | High | Future – inferred threat |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Mining and quarrying | High | Future – planned activity |

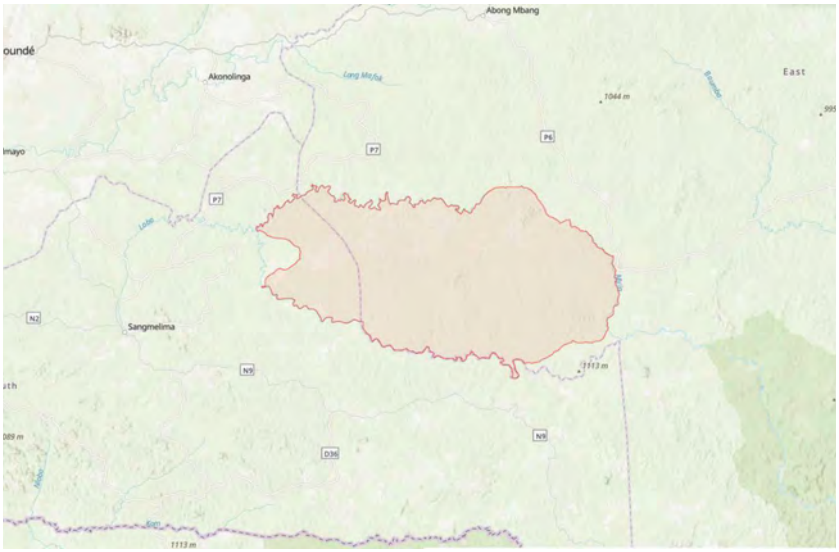
# East Region

**Inselberg with grassland in the Dja forest.**
Photograph X. van der Burgt, December 2018.

## IPA

# Dja Faunal Reserve

**International site name:** Dja Faunal Reserve
**Site code:** CMNTIPA038
**Administrative region:** East and South
**Assessed by:** Bruce Murphy, Xander van der Burgt, Jean Lagarde Betti




**Latitude** (decimal degrees): 3.00000
**Altitude minimum:** 550
**Area** (km²): 6278.0
**Longitude** (decimal degrees): 13.00000
**Altitude maximum:** 810
**IPA criteria met:** A(i)

## Site description

The Dja Faunal Reserve is the largest protected area in Cameroon. It is located in a sparsely populated area in southern Cameroon, straddling the boundary between East Region (Haut-Nyong division) and South Region (Dja-et-Lobo division), approximately 300 km east of Kribi on the Atlantic coast and 60 km from the southern border with Gabon and Republic of Congo. It is bordered by the settlements of Bengbis in the north-west and Lomie in the east, with Sangmélima 50 km to the south-west, Yaoundé 120 km north-west and Abong-Mbang 60 km to the north. To the south and east a huge area of relatively undisturbed forest features several other Cameroon protected areas and the transboundary TRIDOM and Sangha Trinational zones.

Dja was designated a hunting reserve in 1950, before becoming a wildlife reserve in 1973. In 1981 UNESCO designated it a Biosphere Reserve and in 1987 a World Heritage Site. The Biosphere reserve was extended in 2020 and now incorporates a total of 1,328,097 ha, including a transition zone of 740,000 ha.

The boundaries of the IPA proposed here match those of the KBA, which include the buffer zone of the Dja Faunal Reserve, increasing the area from 526,000 ha to 627,797 (KBA Partnership, 2021c). This approximately matches the 623,619 ha under the original 1973 designation (Forestry Act Ordinance 73/18, cited by IUCN & UNEP-WCMC, 2012).

A population of c. 4,000 (UNESCO, 2019) nomadic Baka forest people live within the reserve in accordance with laws valuing their cultural heritage, while populations on the borders of the reserve, estimated at 40,000, include the Banjoué to the north, Nzimé to the east, Mbulu to the west and Fang-Nzaman to the south, as well as other nomadic Baka and Kaka groups (UNESCO, 2021; Betti, 2004a; MINFOF & IUCN, 2015).

## Botanical significance

Established as a faunal reserve, Dja also represents a botanically important area encompassing a very large area of well-protected Guineo-Congolian lowland evergreen and semi-deciduous forest. Just how important it might be for plant diversity or endemicity is hard to judge given the relatively low level of botanical collecting in most of the area, excepting for the families Orchidaceae and Rubiaceae, which have been well studied at Dja. However, a reasonable

number of globally threatened species are listed here, while 312 identified tree species (dbh >= 10 cm) have been recorded from a plot study of nine transects (5 x 5,000 m, total area 22.5 ha) with another 60 morphospecies unidentified (Sonké & Couvreur, 2014). Herbaceous plants are probably less known, although the orchid flora is considered to be noteworthy (UNESCO, 2021).

Amongst the threatened taxa, the reserve is particularly important for *Sabicea cruciata* (CR), *Sabicea cameroonensis* (EN), *Bulbopyllum fayi* (VU), *Diaphananthe sarcorhynchoides* (VU), *Drypetes tessmanniana* (CR), *Staurogyne pseudocapitata* (EN), *Homalium ogoouense* (VU) and *Calycobolus micranthus* (VU). Several rare and threatened species are also known from collections made a short distance outside the boundaries, particularly those made a century ago by the missionary G.L. Bates from an area near Bitye, close to the Dja river and a few km south-east of the reserve, such as *Ixora batesii* (CR), *Dalbergia nervosa* (EN), *Agelanthus dichorus* (VU) and *Telfairia batesii* (EN). The latter, a very rare Cameroon endemic, was also collected from the Nkout ridge (another important site), just south of Dja, and there are unconfirmed reports that the species might also occur within the reserve (Cheek & Lovell, 2020f). *Synsepalum batesii* (CR) is known from only a single collection in 1921 (Bates, 1742) from Bitye, *Pavetta robusta* (EN) and *Pavetta cellulosa* (VU) from a few additional locations, and *Psychotria lanceifolia* (VU), although officially threatened, is now known to be quite widespread (Onana & Cheek, 2011). None of these are recorded within the reserve itself. *Pachylobus (Dacryodes) igaganga* (VU), very rarely recorded in Cameroon, is known from a plot-record on the fringes of the reserve near Lomie. *Pavetta laxa* (CR) is known only from a single collection (Letouzey 4581) near Mekomo, 8 km south-west from the confluence of the Dja and Lobe rivers. Although this puts it at least 7 km from the nearest boundary of the western buffer zone and around 20 km from the boundary of the strict reserve, rediscovery within the reserve may be the best hope for this species as the collection site is close to a rubber plantation and is being encroached by slash-and-burn agriculture, possibly exacerbated by a service road to the nearby Mekin hydroelectric dam (Cheek, 2017f).

## Habitat and geology

Dja has a four-season climate, with the major wet season between September and December (with average monthly rainfall peaking in October at 268 mm), and a lesser wet season between March and June. Rainfall is considerably lower than along the Cameroon Volcanic Line, averaging 1,570 mm, with a monthly average of only 18 mm in December and

**Open grassland on inselberg in the Dja forest.**
Photgraph X. van der Burgt, December 2018.

January. Temperature varies relatively little seasonally, around a mean of 23.3° C (at 640 m), with mean monthly maxima and minima in August, the coolest month, of 27° and 18° C respectively and of 30° and 19° in April, the hottest month. Humidity remains high all year (IUCN & UNEP-WCMC, 2012; Peh et al., 2011).

Geologically the site is part of the South Cameroon Plateau, resting on Precambrian metamorphic basement rocks of the Mbalmayo-Bengbis and Dja series, mainly schists, gneisses and quartzites (IUCN-UNESCO, 2012; Yerima & Van Ranst, 2005). The topography rises slightly to an east-west ridge in the centre and is characterised by numerous small, dome-like hills with a network of shallow valleys in between, visible on satellite imagery. A fault-line running along the southern border results in steeper valleys and cliffs in the south, with rapids and waterfalls along the rivers (IUCN-UNESCO, 2012). Soils are Haplic ferralsols of kaolinite clay with iron and aluminium sesquioxides, red (on the higher areas) to yellow and brown, porous and with good physical structure but very weathered and low in all nutrients, especially phosphate (Yerima & Van Ranst, 2005; Peh et al., 2011; IUCN & UNEP-WCMC, 2012). After initial forest clearance for agriculture, organic content and nutrients may be quickly and suddenly depleted. Valley areas may be hydromorphic and swampy (Sonké, 2004).

The Dja reserve is a large site featuring relatively little geological and edaphic variation or altitudinal range, although having an undulating topology and areas of forest on terra firma, swamp forest and seasonally inundated forest (Manel et al., 2014). Letouzey (1985) characterises most of the reserve as 'Dja forests on wet and dry ground and valleys with *Uapaca paludosa*' (type 187). The forest canopy is typically 30–40 m high with emergents (mainly *Baillonella toxisperma*) up to 60 m (MINFOF & IUCN, 2015). Towards the north-west, greater semi-deciduous elements are mapped, although the evergreen forest is still considered dominant (type 190); prairies on chlorite schists (201) are scattered in the western half and there are degraded areas towards the edges. Sonké & Couvreur (2014) distinguish two types of hydromorphic forest: swamp forest in valley bottoms and periodically flooded forest. Degraded or secondary forest areas are common towards the perimeter and are notably lacking in Meliaceae (IUCN & UN, 2012).

Areas of *Gilbertiodendron dewevrei* monodominant forest are also important (Letouzey, 1985; Sonké, 2004; Djuikouo et al., 2010, 2014), occurring on flood-prone alluvial soils according to some sources (IUCN & UN, 2012), although Peh et al. (2011) found them to not correspond to physical or chemical soil characteristics.

Despite the relatively homogenous physical environment and moderate rainfall, diversity appears to be high (Djuikouo et al., 2010). Letouzey (1968) considered the Dja forest to be a melting pot between the Biafran Atlantic forest and the semi-deciduous forest further north. Hardy and Sonké (2004) and Manel (2014) found that much of the distributional pattern of diversity accorded with a neutral model of limited dispersion, although habitat heterogeneity also played a part.

## Conservation issues

The original 1987 UNESCO inscription describes the 526,000 ha as one the best-protected rainforests in Africa, of 'unique pristine condition', 90% 'intact' and 'undisturbed'. The site is managed by MINFOF through the Dja Conservation Service (UNESCO, 2021b) with a variety of international NGOs involved in supporting conservation, including WWF and ZSL. Conservation concern is primarily centred on the decline of large faunal populations (UNESCO, 2019). In 2005, numbers of both gorillas and chimpanzees were each estimated at c. 4,000 (approximately the same as the resident human population within the core reserve) and elephants numbered 1,150 (IUCN & UNEP-WCMC, 2012). However, a 2018 faunal survey estimated numbers of elephants at only 219, gorillas at 1,258 and chimpanzees at 2,313. This is a 50% decline since 2015 for elephants, following an 84% decline from 1995–2015 (MINFOF & IUCN, 2015), although the severity of these declines may have been partly due to previously inflated figures and methodological differences (Bruce et al., 2018). The UNESCO (2019) report describes the reserve as in a 'very fragile situation', with numbers of elephants, gorillas and chimpanzees 'very low', and warns of 'local extinction' of elephants if the decline is not reversed.

While the plant biodiversity within the strict reserve faces less direct threat, the decline of large fauna through hunting and poaching would likely lead to reduction in conservation effort and funding, as well as affecting plant populations through loss of vital natural seed dispersers (for example, *Autranella congolensis*; Hills, 2021). The river Dja provides natural protection for the forest around much of the site border; c. 4,000 forest-dwelling Baka people resident within the reserve itself are permitted to hunt but not practice agriculture (UNESCO, 2021). However, there is agricultural encroachment of the forest inside the river perimeter and within the reserve in the north-west around Bengbis, as well as around various settlements along the road running within the northern buffer zone and in the east around Lomie (KBA partnership, 2021c; Google Earth, 2021; IUCN & UNEP-WCMC, 2012). The KBA summary reports a slow but significant deterioration due to small-scale agriculture and agro-industry (KBA partnership, 2021c). Much of the Biosphere reserve area outside the strict reserve is demarcated for timber extraction as Forest Management Units (FMUs), risking isolation of plant and animal populations from the wider forests landscape

(Betti, 2004b; KBA Partnership, 2021c). Plans to declassify 1,000 ha of the Bengbis community forest are considered likely to exacerbate deforestation of the periphery (UNESCO, 2019). Implementation of a buffer zone is urged, with activities limited by conservation principles (UNESCO, 2019). The well-preserved condition of the forest owes much to the hitherto isolated and sparsely populated nature of the wider area. Although the TRIDOM scheme and the Biosphere reserve offer some protection for the peripheral area, development, including resurfacing and construction of new roads and bridges, threatens the integrity of this zone (UNESCO, 2019).

The site is largely surrounded by exploratory mining concessions, with active exploitation granted in the east for cobalt, manganese and nickel, but apparently not yet commenced. Calcareous rocks under the Dja river on the south-east border raise the prospect of cement production (IUCN & UNEP-WCMC, 2012); diamond, gold and iron mining are also possible in the south and south-east (MINFOF & IUCN, 2015).

On the western border, the Mékin dam and SUDCAM rubber and palm oil plantations bring increased infrastructure, population and development pressures (MINFOF & IUCN, 2015). The Mékin dam has already flooded part of the site and impacted water quality of the Dja river (UNESCO, 2019). Further to the east, the planned rail link from the Kribi deep seaport to the Mballam iron ore mine deep within the isolated forests 80 km south of Dja threatens to transform the TRIDOM area (IUCN & UNEP-WCMC, 2012; Betti, 2004b).

Conflicts between conservationists or forest wardens and Baka forest people who live off the forest are a prominent issue in central Africa. Dja Faunal Reserve should not be confused with the nearby proposed Messok Dja National Park in Republic of Congo where abuses of Baka people by WWF agents have been reported and conservation is viewed with suspicion or hostility. However, Gallois et al. (2020) report some clashes with rangers over destructive harvesting by Baka of *Irvingia* trees within the reserve. Devastation of faunal populations is mainly due to groups outside the reserve using modern hunting methods to harvest ivory and bushmeat for the Yaoundé market, and operating from logging concession areas at the periphery (IUCN & UNEP-WCMC, 2012).

A management plan, initially drawn up in 2003, was approved in 2007 and launched in 2008 (UNESCO, 2009), but subsequent yearly reports have repeatedly drawn attention to the 'lack of entire approval and implementation' (e.g. UNESCO, 2019). Although the Cameroon forest law stipulates a management plan should be updated every five years, there has been no revision of the 2008 plan which was drafted five years earlier and is therefore already outdated in some respects. A lack of sufficient scientific, qualitative and quantitative data in the

**River Dja.**
Photograph A. Grall, 2018.

management plan is argued to limit the feasibility of stipulated aims for participatory conservation in such a vast reserve (J.L. Betti 2021, pers. comm., 9 August).

Forest degradation has also been exacerbated by the departure of the ECOFAC project and a failure to implement significant local development projects as a tool for both improving local communities and reducing pressure on forest resources (J.L. Betti 2021, pers. comm., 9 August).

## Key ecosystem services

The site is one of the main bastions in Cameroon for large fauna such as gorillas, chimpanzees, elephants and leopards, as well as over 100 other mammal species (Bruce et al., 2018; IUCN & UNEP-WCMC, 2012; MINFOF & IUCN, 2015). It is also an IBA with over 320 bird species recorded.

The forest is important for NTFPs harvested by the hunter-gatherer Baka population and also other neighbouring communities, including the Badjoué, Bulu, Fang, Nzaman, Zimé and Kaka (Epanda et al., 2020). These groups have depended for generations on plants and animals harvested in forest ecosystems. The Baka residents of the reserve live in relatively traditional ways and represent a cultural history and knowledge of 10,000–20,000 years (IUCN & UNEP-WCMC, 2012). Since the 1950s, a number of Baka groups have become settled following missionary and state programs (Billong Fils et al., 2020). Although such peoples still rely on hunting and gathering to meet their basic needs, knowledge of traditional uses are at risk of dying out. Dja is an important area where such traditional knowledge is preserved. Ethnobotanical surveys among all ethnic groups in the Dja reserve and its immediate boundaries revealed the usage of 376 medicinal plants from 308 genera in the treatment of 81 ailments (Betti, 2001); 100 edible wild plants were used as food or spices (Betti et al., 1999; see also Billong Fils et al., 2020). Further studies have confirmed usage at Dja of at least 102 species from 97 genera by the Baka people (Betti, 2004a), with 80 species used to treat malaria alone (Betti, 2001; 2004a), 44 species for treating erectile dysfunction (Nana Afiong et al., 2022) and 45 species used to treat jaundice (Betti et al., 2009). For many plants used by Baka people, evidence of bioactive compounds has been confirmed in relation to the ailments cited (Betti, 2001). Populations of many timber species are also recorded, indicating that the site represents an important genetic reserve against over-harvesting of such species elsewhere (Sonké & Couvreur, 2014).

***Craterostigma yaundense* (VU) near Somalomo, north-western Dja.**
Photograph X. van der Burgt, December 2018.

The reserve is an important catchment area for the Dja river, which is a tributary of the Congo via the Sangha.

Although ecotourism has potential for providing sustainable development around the reserve, it is at a low level; expanding the scale without infrastructural development endangering the reserve is likely to be challenging. However, the reputation for ethnobotanical knowledge and traditional healers also raises the potential for enhancing ecotourism through ethno-medical tourism and food tourism (J.L. Betti 2021, pers. comm., 9 August).

## Ecosystem service categories

**Provisioning –** Food
**Provisioning –** Raw materials
**Provisioning –** Fresh water
**Provisioning –** Medicinal resources
**Regulating –** Carbon sequestration and storage
**Habitat or supporting services –** Habitats for species
**Cultural –** Tourism
**Cultural –** Cultural heritage

## IPA assessment rationale

The Dja Faunal Reserve qualifies as an IPA on the basis of several globally threatened plant species, particularly *Telfairia batesii* (EN), which is recorded only from two locations in the vicinity of Dja and unconfirmed reports from the reserve itself, and *Sabicea cruciata* (CR), which is recorded from only a single other site in Equatorial Guinea. *Bulbophyllum fayi* (VU), *Cyclantheropsis occidentalis* (EN), *Drypetes tessmanniana* (CR), *Homalium hypolasium* (EN) and *Sabicea cameroonensis* (EN) are also notable. In addition, the site would likely qualify under criterion B(iii) as one of the best sites for timber, medicinal and other useful species, and under criterion C(iii) as one of the best sites for evergreen lowland forests (or Letouzey's 'Dja Forest' type).

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Staurogyne pseudocapitata* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | | ✓ | |
| Anacardiaceae | *Trichoscypha eugong* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Ancistrocladaceae | *Ancistrocladus le-testui* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Burseraceae | *Pachylobus buettneri* | VU | A(i) | | | | ✓ | |
| Burseraceae | *Pachylobus igaganga* | VU | A(i) | | | ✓ | ✓ | |
| Celastraceae | *Salacia lenticellosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Chrysobalanaceae | *Magnistipula cuneatifolia* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Clusiaceae | *Garcinia staudtii* | VU | A(i) | | ✓ | | | |
| Convolvulaceae | *Calycobolus micranthus* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Cyclantheropsis occidentalis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Momordica enneaphylla* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Cucurbitaceae | *Telfairia batesii* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Detarioideae | *Prioria joveri* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | A(i) | | | | ✓ | |
| Euphorbiaceae | *Macaranga paxii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Linderniaceae | *Craterostigma yaundense* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Loranthaceae | *Agelanthus dichrous* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loranthaceae | *Tapinanthus preussii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Marantaceae | *Marantochloa mildbraedii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Marantaceae | *Sarcophrynium villosum* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum fayi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Diaphananthe gabonensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Diaphananthe sarcorhynchoides* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Habenaria stenochila* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Rhipidoglossum ochyrae* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Vanilla ochyrae* | | | B(ii) | | | | |
| Papilionoideae | *Amphimas tessmannii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Dalbergia nervosa* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Millettia laurentii* | EN | A(i) | | | ✓ | ✓ | |
| Poaceae | *Loudetia furtiva* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes celastrinea* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Putranjivaceae | *Drypetes tessmanniana* | CR | A(i) | | ✓ | ✓ | ✓ | |
| Rhizophoraceae | *Anopyxis klaineana* | VU | A(i) | | | | ✓ | |
| Rubiaceae | *Calycosiphonia macrochlamys* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Coffea anthonyi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Massularia stevartiana* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta cellulosa* | VU | A(ii) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Pavetta laxa* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Pavetta robusta* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria densinervia* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria lanceifolia* | VU | A(i) | | ✓ | | | |
| Rubiaceae | *Psychotria ingentifolia* | | | B(ii) | | | | |
| Rubiaceae | *Psychotria senterrei* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Sabicea cameroonensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Sabicea cruciata* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Salicaceae | *Homalium hypolasium* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Salicaceae | *Homalium ogoouense* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Autranella congolensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Baillonella toxisperma* | VU | A(i) | | | | ✓ | |
| Sapotaceae | *Manilkara kribensis* | DD | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Sapotaceae | *Synsepalum batesii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sterculioideae | *Cola mahoundensis* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Pterygota bequaertii* | VU | A(i) | | | | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| IV: Wildlife Sanctuary | Dja Faunal Reserve | IPA encompasses protected/conservation area |
| Key Biodiversity Area | Dja Faunal Reserve | Protected/conservation area matches IPA |
| Important Bird Area | Dja Faunal Reserve | Protected/conservation area matches IPA |
| UNESCO World Heritage Site | Dja Faunal Reserve | IPA encompasses protected/conservation area |
| Regional trans-border conservation area | TRIDOM (Tri-National Dja-Odzala-Minkébé forest) | Protected/conservation area encompasses IPA |
| UNESCO Biosphere Site | Dja Biosphere Reserve | Protected/conservation area encompasses IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Low | Ongoing – increasing |
| Agro-industry farming | Medium | Ongoing – increasing |
| Hunting and collecting terrestrial animals | High | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – increasing |
| Dams and water management/use – large dams | Medium | Ongoing – stable |
| Mining and quarrying | Low | Future – inferred threat |

## IPA

# Lobéké National Park

**International site name:** Lobéké National Park
**Site code:** CMNTIPA049
**Administrative region:** East
**Assessed by:** Bruce Murphy, David Harris

**Latitude** (decimal degrees)**:** 2.29740
**Altitude minimum:** 350
**Area** (km²)**:** 2,164.0
**Longitude** (decimal degrees)**:** 15.85970
**Altitude maximum:** 650
**IPA criteria met:** A(i)

## Site Description

Lobéké National Park is one of several protected areas in an extensively forested part of Central Africa where the borders of Cameroon, Central African Republic and Republic of Congo meet. This largely intact forest zone is of major importance for remaining megafaunal populations. The predominantly semi-deciduous (or semi-evergreen) forest habitat has been more sparsely surveyed but is probably less rich in plant species or endemics than the littoral or submontane forests of other parts of Cameroon. However, it is unrivalled in Cameroon in extent and lack of disturbance. Lobéké National Park is one part that has been more thoroughly surveyed, although the report of Harris (1999), relied upon here, does not cover quite the same area as the national park as it is now designated. Because there is limited data for this region, the site is perhaps best seen as an example of a much larger habitat rather than as a site that is of greater botanical significance than the surrounding forest and other nearby protected areas, such as Boumba Bek.

## Botanical significance

Over 760 species of vascular plant have been recorded, of which over 350 are trees (Harris, 1999). Several of these are globally threatened or have a restricted range. *Okoubaka aubrevillei* (EN), the 'Death Tree', is a widespread but very rare and highly threatened semi-parasitic tree with great cultural significance. It is threatened by unsustainable harvesting of its bark for traditional medicine, although there is no scientific evidence of its value. Lobéké may represent one of the best sites in Cameroon and globally for its survival (Harris, 1999; Borokini et al., 2015). *Beilschmiedia congolana* (EN) is another species with a large range but very few (five) collections and only known in Cameroon from Lobéké. *Afraegle asso* (EN) and *Balsamocitrus camerunensis* (DD but VU in Onana & Cheek, 2011) are other notable species for which Lobéké is an important site.

Several species reach the northern or western limit of their distribution in southern Cameroon and although most are not globally rare or threatened, they are little known in Cameroon outside Lobéké. These include *Irvingia smithii* (LC), *Isolona pilosa* (VU), *Bulbophyllum fayi* (VU), *Xylopia gilbertii* (VU), *Xylopia flamignii, Xylopia letestui*, *Colletoecema dewevrei, Strombosia nigropunctata, Millettia comosa, Macaranga saccifera* and *Buchnerodendron speciosum* (Harris, 1999). Similarly, species such *as Deinbollia laurentii* (NT) and *Manilkara pellegriniana* are not globally threatened but rare in Cameroon because of being confined to seasonally flooded habitats (Harris, 1999).

Should threats to this relatively undisturbed area continue to increase then some of these species could become threatened.

A large number of threatened timber species are recorded from the site. *Pericopsis elata* (EN) is a valuable timber tree driven to virtual extinction in West Africa. It is apparently reproducing successfully at Lobéké but is little recorded elsewhere in Cameroon (Harris, 1999). The site is likely to be one of the best national sites for other timber species, such as *Antrocaryon micraster* (VU) and *Anopyxis klaineana* (VU). Lobéké and surrounding forests may also represent some of the best sites in Cameroon or tropical Africa for large, mature individuals of species that are widely logged for timber, such as *Triplochiton scleroxylon* and *Entandrophragma cylindricum*, and which may be of particular importance for biodiversity, forest health and indigenous societies (Harris et al., 2021; Harris & Wortley, 2008).

As well as the predominant semi-deciduous forest on terra firma, Lobéké contains nationally important patches of *Gilbertiodendron dewevrei* mono-dominant forest and various types of inundated, riverine and swamp forest, particularly the 'Bais' – saline, sedge-dominated forest clearings frequented by megafauna (Harris, 1999).

## Habitat and geology

Lobéké has a four-season tropical monsoon climate (Koppen classification: Am). The main dry season is between December and February, followed by a wet season between March and early June, a short dry season in late June and July, and a second wet season from August to November. Peak precipitation is in October with 226 mm. An average of 1,595 mm of rain is recorded per annum and the average temperature is 25.6 °C. Humidity varies little across the year around an average of 81%. Average high temperatures peak at 32 °C in March and April at the beginning of the first wet season and drop to 29 °C in July and August before the second rainy season. Average lows are consistent at 20–21 °C across all months (Weatherbase, 2022c).

The site lies over the northern edge of the Congo craton, with metasedimentary pelites and quartzites prominent as well as sandstones and an igneous doloritic band in the south-eastern part (BFGM, 2016). Soils are predominantly haplic ferralsols, with some gleyed soils and haplic acrisols (Yerima & Van Ranst, 2005). Harris (1999) reports a bright red, clayey, slippery soil, referred to as 'Boma' by local Baka people who consider it fertile for bananas. It naturally supports forest rich in *Triplochiton scleroxylon* and *Terminalia superba* but other soil types on terra firma have a higher tree diversity.

The canopy in terra firma areas is typically around 40 m. It is usually rather open with a variable understory, sometimes of dense Marantaceae-Zingiberaceae thicket or a low, closed subcanopy at 6–8 m dominated by Ebenaceae and Annonaceae trees (BirdLife International, 2022a). The forest has similarities with Dja Faunal Reserve but is closest to that in the neighbouring Dzangha-Sangha National Park in CAR (Harris, 1999; Harris, 2002).

Based on evidence from Annonaceae, Lobéké may be more species-rich due to the presence of Atlantic species at the limit of their range (Harris, 1999). It is predominantly semi-evergreen (or semi-deciduous) humid forest which Letouzey (1985) maps as three related types: 'semi-deciduous with Sterculiaceae and Ulmaceae' (160), 'mixed, semi-deciduous and evergreen forests of Dja, with a predominance of semi-deciduous forest elements.' (164), and 'mixed, evergreen forests of Dja and semi-deciduous forests with a predominance of Dja elements (190)'. Harris (1999) was unable to detect consistent difference between these variations. More distinct are the patches of *Gilbertiodendron dewevrei* monodominant forest (Letouzey's type 189) which are uncommon in Cameroon. Also notable are the large, sedge-dominated forest clearings known locally as 'Bais'. These appear to occur mainly where the water table is high and the soil is rich in mineral salts, which attract animals that help deter woody vegetation (Harris, 1999; BirdLife International, 2022a).

Swamp forest (Letouzey's type 11), often dominated by *Raphia laurentii* and *Phoenix reclinata*, is also a major constituent, representing 10% according to Harris (1999) or 40% under the categorisation of Yuh et al. (2019). Seasonally inundated forest (Letouzey's type 195) occurs along the river Sangha and is characterised by *Guibourtia demeusei*, *Uapaca heudelotii* and other specialist species, and apparently features a high density of vines (Gentry, 1991; Harris, 1999).

## Conservation issues

Lobéké National Park is part of the Sangha Trinational, a cross-border conservation zone and since 2012 a UNESCO World Heritage Site encompassing three national parks across an area of 746,309 with an additional buffer zone of 1,787,950 ha (IUCN & UNEP-WCMC, 2012). The complex is managed by WWF, GIZ and WCS Cameroon, and funded by COMIFAC. The Sangha Trinational and buffer zone are in turn part of a much larger Sangha Trinational Landscape (4,393,600 ha), which encompasses the entire corner of Cameroon east of the Yokadouma-Salapoumbé-Mouloundou P4 road. West of this road corridor lies a second enormous (141,000 km) trinational area, the Dja-Odzala-Minkébé (TRIDOM) Landscape, involving cooperation between the governments of Cameroon, Gabon and Republic of Congo (CBFP, 2006).

Harris (1999) indicated that impacts on the forest were low but that this could change rapidly, particularly through anticipated timber extraction

and accompanying migration of workers. According to UNESCO (2021c), the forest is still well preserved, with an annual rate of vegetation loss of 0.03%. Yuh et al. (2019) reported a 1.44% reduction in dense forest and a slight increase in swampy forest for the park in the period 2001–2014. They deduced that 95% of the area has never been logged, although it is unclear if they consider pre-2001 logging, since Harris (1999) reports some areas as having been logged two or three times. Timber extraction does take place (Harris, 1999) and the surrounding forest management units, although legally certified and showing low levels of forest change (Yuh et al., 2019), do not promote biodiversity preservation (UNESCO, 2021c).

The remaining unlogged, old growth areas with giant trees are vulnerable and a powerful lure. Various projects in the wider area are likely to increase pressure by attracting migrant workers and increasing access, including the Chollet dam project at Molondou, the Mballam iron ore mining project and associated railway line, a proposed road through the national park along the Sangha and a projected Ouesso-Bangui-Ndjamena road (PIDA, 2019; Mongabay, 2021). Mining exploration permits were issued for the southern buffer zone (MINFOF & WRI, 2021) but UNESCO (2021c) report that these have not been renewed. Artisanal mining for diamonds and gold are a cause of concern within the park and also attract people to the area (UNESCO, 2021c).

Yuh et al. (2019, 2020) reported some decline in gorilla and chimpanzee nest encounters but concluded that the site was still extensively used by both species. While Gorillas also made much use of the neighbouring FMUs, chimpanzees were more restricted to forest within the national park, apparently indicating the better-quality forest at the site. Poaching remains a major problem in the area with potentially huge but largely unknown impacts on the regeneration of plant species and structure of the forest should key animal dispersers such as forest elephants continue to slide towards extinction.

Treatment of Baka peoples in this region have raised concerns about the implementation of national parks and efforts to preserve intact forests. Hunting and gathering rights were granted within a restricted part of the park under a specific agreement with the Baka, as an exception to typical national park laws (Usongo & Nkanje, 2004). However, concerns have been raised that Baka are marginalised and losing out to other stakeholders, including sport hunting operations (Nelson, 2003). Rights and participation of indigenous groups in the conservation and management of the site have been reaffirmed by UNESCO and should be seen as fundamental and complementary to preventing forest degradation by an influx of miners, loggers, hunters and farmers.

## Key ecosystem services

The forest holds important populations of many timber species (Harris, 1999), while local communities rely on the forest for a wide variety of non-timber products for trade or household consumption. Forest products contributed 44% of household income across five studied villages (Tieguhong & Nkamgnia, 2012). The forest also has cultural significance; for example, sacred sites are used by the Baka for pilgrimages and Jengi initiation ceremonies during forest festivals (Usongo & Nzooh, 2010).

The site is of great importance as a habitat for various large and threatened fauna, with some of the highest densities in the world for rainforest large mammals, which include gorillas, chimpanzees and forest elephants (Harris, 1999; Yuh et al., 2019). Elephant populations were reported to be relatively stable in the park itself but declining in the wider area and over the long term due to poaching (WWF, 2019). A national military response was reported in December 2021 after a number of elephants were killed by poachers in the area (Kindzeka, 2021). Crop damage by elephants and subsequent conflicts with villagers are also a problem. The site is an IBA and KBA with 170 avian species recorded, including the grey parrot (*Psittacus erithacus*), which suffers very heavy poaching within the site (BirdLife International, 2022a).

The national park is estimated to have a total above and below ground carbon stock of >55 Mt (DOPA, 2021).

There is high ecotourist potential and commercial hunting is already established, but the isolation which is essential to the site's value will also tend to limit tourism.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Medicinal resources

**Regulating –** Carbon sequestration and storage

**Habitat or supporting services –** Habitats for species

**Cultural –** Tourism

## IPA assessment rationale

Lobeké National Park qualifies under IPA criterion A(i) due to important populations of globally threatened species such as *Okoubaka aubrevillei* (EN), *Beilschmiedia congolana* (EN) and *Afraegle asso* (EN). However, it may have greater significance for its habitat types under criterion C, or useful species under criterion B(iii), when these aspects are more fully assessed. Although some evidence exists (Yuh et al., 2019, 2020) of the superior habitat within the national park compared with the surrounding area, further justifying the area as an IPA, it is as part of a much larger, intact landscape that it has most value.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Anacardiaceae | *Antrocaryon micraster* | VU | A(i) | | | | ✓ | |
| Ancistrocladaceaee | *Ancistrocladus le-testui* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Isolona pilosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Annonaceae | *Xylopia gilbertii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Aristolochiaceae | *Aristolochia ceropegioides* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Bignoniaceae | *Fernandoa ferdinandi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Commelinaceae | *Palisota brachythyrsa* | | | | | | | |
| Detarioideae | *Afzelia bipindensis* | VU | A(i) | | | | ✓ | |
| Dombeyoideae | *Nesogordonia papaverifera* | VU | A(i) | | | ✓ | ✓ | |
| Ebenaceae | *Diospyros crassiflora* | VU | A(i) | | | | ✓ | |
| Euphorbiaceae | *Drypetes molunduana* | VU | A(i) | | ✓ | | | |
| Lauraceae | *Beilschmiedia congolana* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Loranthaceae | *Agelanthus dichrous* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Marantaceae | *Marantochloa mildbraedii* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Entandrophragma candollei* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Entandrophragma cylindricum* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Leplaea thompsonii* | VU | A(i) | | | | ✓ | |
| Ochnaceae | *Lophira alata* | VU | | | | | | |
| Ochnaceae | *Ochna calodendron* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Orchidaceae | *Bulbophyllum fayi* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Millettia laurentii* | EN | A(i) | | | | ✓ | |
| Papilionoideae | *Pericopsis elata* | EN | A(i) | | | ✓ | ✓ | |
| Rhizophoraceae | *Anopyxis klaineana* | VU | A(i) | | | | ✓ | |
| Rutaceae | *Afraegle asso* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Rutaceae | *Balsamocitrus camerunensis* | DD | | | ✓ | ✓ | ✓ | |
| Santalaceae | *Okoubaka aubrevillei* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Autranella congolensis* | EN | A(i) | | | ✓ | ✓ | |
| Sapotaceae | *Synsepalum laurentii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Cola brevipes* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sterculioideae | *Pterygota bequaertii* | VU | A(i) | | ✓ | | ✓ | |
| Sterculioideae | *Sterculia oblonga* | VU | A(i) | | | | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| UNESCO World Heritage Site | Sangha Trinational | Protected/conservation area encompasses IPA |
| Trans-Frontier Conservation Area (core zone) | Sangha Trinational | Protected/conservation area encompasses IPA |
| National Park | Dzanga-Ndoki National Park (CAF) | Protected/conservation area is adjacent to IPA |
| Important Bird Area | Lobéké National Park | |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | Medium | Future – inferred threat |
| Mining and quarrying | Medium | Future – inferred threat |
| Hunting and collecting terrestrial animals | High | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Roads and railroads | High | Future – planned activity |

Important Plant Areas (IPAs)

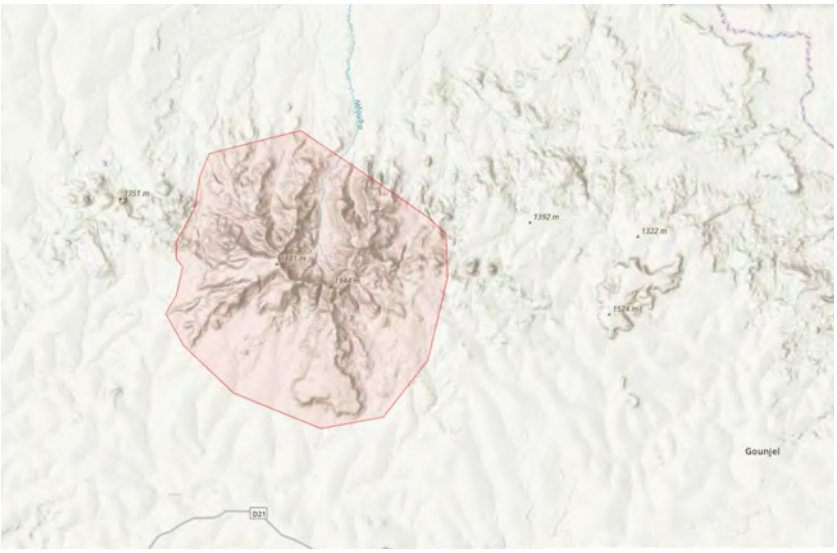
# Adamaoua Region

Mt Ngang-Ha. rises above the Adamaoua plateau.
Photograph © V. Droissart.

## IPA

# Mt Ngang-Ha

**International site name:** Mount Ngang-Ha
**Local site name (if different):** Tchabal Ngangha, Mont Ngao-Ha, Gangha Gebirge, Mont Gangha, Mont Ganhoua, Mont de Ganga
**Site code:** CMNTIPA044
**Administrative region:** Adamaoua
**Assessed by:** Bruce Murphy, Vincent Droissart




**Latitude** (decimal degrees)**:** 7.35910
**Altitude minimum:** 1,200
**Area** (km²)**:** 128.0
**Longitude** (decimal degrees)**:** 14.00260
**Altitude maximum:** 1,950
**IPA criteria met:** A(i)

## Site description

Mt Ngang-Ha is an inactive strato-volcano rising to nearly 2,000 m above the Adamaoua plateau. It lies 45 km east of Ngaoundéré in the Adamaoua Region. A road runs as far as the settlements of Ndigou and Ngang-Ha at the western foot of the mountain. The mountain area designated here encompasses approximately 100 km² from where it starts to rise up from the more gradually sloping 1,000–1,300 m plain. To the east and south-east, the terrain slopes away less abruptly. The site is mainly covered in sparsely wooded savanna, with ribbons of descending gallery forest. The summit rim ('Doïtaïa Mounts') features very steep, rocky terrain enclosing on south, east and west sides a 3 km wide caldera which opens to the north. Volcanic plugs are also prominent at the base of the mountain on both east and west sides.

## Botanical significance

The site is significant for *Antherotoma clandestina* (EN), only otherwise recorded from Mt Vokre, and *Trifolium gillettianum* (EN), which is known only from the type-specimens collected somewhere in the area, probably on the southern or eastern slopes. *Cassipourea adamauensis* has yet to be evaluated but is only recorded from this site. *Crotalaria mentiens* (EN) is only otherwise known from two sites in the Bamenda Highlands. *Platycoryne alinae* (EN) is known only from one other collection at nearby Tello Falls. *Dolichos reptans* (EN) is also very rare, known only from five other collections, all but one from the Adamaoua plateau. *Hypoxis suffruticosa* (VU) is only known in Cameroon from this site – a few nearby collections and records in the area of Tchabal Mbabo. *Humularia ledermannii* is assessed as DD but is only known from four nearby locations with no recent collections. *Hygrophila mediatrix* grows nearby at Mare de Tourningal and at Tello Falls and could also occur at this site in lower lying, marshy areas.

Mt Ngang-Ha is also the type-location of *Phaulopsis symmetrica*, which is not IUCN assessed but known from only a few other locations extending to the Bamenda Highlands and Mambilla plateau in Nigeria. *Podocarpus latifolius* also occurs here; it is rare in Cameroon and the Adamaoua population is apparently part of a genetic phylogroup limited to Cameroon (Migliore et al., 2020). *Otiophora villicaulis* is another species not considered globally threatened but apart from one other nearby collection in Adamaoua is only otherwise recorded over 2,000 km away in East Africa, Zambia and southern DRC. *Pachycarpus medusonema* (EN) has been recorded at locations east, west and south of Ngang-Ha and therefore may also occur.

Although many of these species have not been recorded since the 1960s, a number of collections were made at the site in 2011, including *Podocarpus latifolius, Otiophora villicaulis, Crotalaria mentiens* (EN), *Pavetta lasioclada* (VU) and *Dissotis longisetosa* (NT) in 'well-preserved mountain forests (due to very rugged topography)' (V. Droissart, pers. comm., 7 July 2020).

## Habitat and geology

Mt Ngang-Ha is a large, Miocene–Pliocene, intra-plate stratovolcano sitting on top of the Precambrian basement rocks of the uplifted Adamaoua plateau. The surface rocks are 87% basalts, while brescias, phonolites and trachytes are also prominent (Nono et al., 1994). The terrain is often very steep, with gallery forest in narrow gorges.

There is a two-season savannah climate (Kppen type Aw). At Ngaoundere (1,114 m), annual precipitation is 1,511 mm, which falls almost entirely in a wet season that runs from late March to the end of October, peaking in August with 270 mm. Average monthly temperatures (21–23 °C) vary little across the year, while average monthly lows vary from 12 to 17 °C and monthly maxima are 25–31 °C (Weatherbase, 2022a).

The predominantly savanna vegetation is presumably strongly influenced by anthropic effects, namely nomadic Fulani grazing and seasonal burning (Larison et al., 2000). On Letouzey's (1982) maps it is predominantly type 128 (more or less grazed and inhabited submontane meadows and fallows with gallery forests), while the higher parts from 1,600 m are type 113 (*Sporolobus africanus* montane pasture with gallery forests).

## Conservation issues

Grazing, wood gathering and burning are the primary threats to the key taxa (Larison et al., 2000; Cheek 2015ab; IUCN SSC Amphibian Specialist Group, 2019; NASA FIRMS, 2022). Forest is largely confined to narrow valleys; however, the rugged terrain has preserved these patches of forest better than might otherwise be expected. There is little sign of inhabitation or cultivation of the slopes, although a large network of farms can be seen on the flatter land around Nidigou and some of the threatened species, including the endemic *Trifolium gillettianum,* occur at low enough altitudes to be potentially affected. The trampling and muddying of watercourses are also threats to some species (Cheek 2015f,g).

**Mt Ngang-ha.**
Photograph © Vincent Droissart

The site is designated a KBA and Zero Extinction Alliance status based on the trigger species *Astylosternus nganhanus* (KBA Partnership, 2022; AZE, 2022). However, there is no official protection or obvious conservation involvement. Violence and kidnapping associated with the Boko Haram movement as well as the Central African Republic civil war has made the site a security risk and is likely to limit involvement by conservation agents (V. Droissart, pers. comm., 7 July 2020).

**Mt Ngang-ha.**
Photograph © Vincent Droissart

## Key ecosystem services

The gallery forests provide habitat for the Critically Endangered and narrowly endemic Mt Ngang-Ha night frog (*Astylosternus nganhanus*; IUCN SSC Amphibian Specialist Group, 2019). The forested gorges also likely contribute to buffering rains and maintaining water quality for the villages lower down the slopes. The spectacular volcanic terrain makes the site a visitor attraction and, together with the nearby Tello Falls, Vina Falls and Lake Tison, part of a potential tourist route for those drawn to Benoué or Mbere Valley national parks.

## Ecosystem service categories

**Provisioning** – Fresh water

**Regulating Services** – Moderation of extreme events

**Habitat or supporting services** – Habitats for species

**Cultural Services** – Tourism

## IPA assessment rationale

The site qualifies as an IPA under criterion A(i) through the presence of several globally threatened taxa that occur at few other sites.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Hygrophila mediatrix* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Phaulopsis symmetrica* | NT | | B(ii) | | | | |
| Apocynaceae | *Pachycarpus medusonema* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Campanulaceae | *Wahlenbergia ramosissima* subsp. *ramosissima* | VU | A(i) | | ✓ | | | |
| Hypoxidaceae | *Hypoxis suffruticosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Loranthaceae | *Globimetula oreophila* | | | | | | | |
| Melastomataceae | *Antherotoma clandestina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Melastomataceae | *Dissotis longisetosa* | NT | | | | | | |
| Orchidaceae | *Platycoryne alinae* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Crotalaria mentiens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Dolichos reptans* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Humularia ledermannii* | DD | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Trifolium gillettianum* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Polygalaceae | *Polygala tenuicaulis* var. *tayloriana* | NT | | | | | | |
| Rhizophoraceae | *Cassipourea adamauensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Pavetta lasioclada* | VU | A(i) | | | ✓ | ✓ | |

## Protected areas and other conservation designations

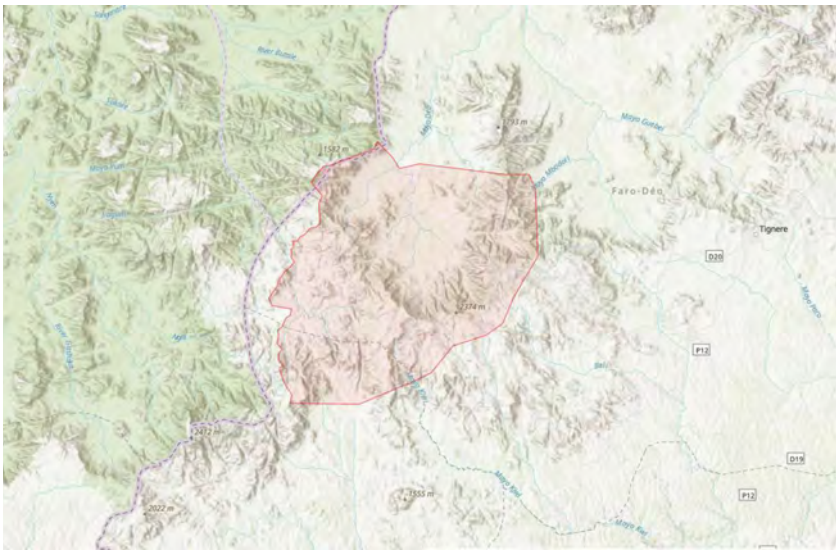
| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| Key Biodiversity Area | Mt Ngang-Ha | Protected/conservation area overlaps with IPA |
| Alliance for Zero Extinction Site | Mt Ngang-Ha | Protected/conservation area overlaps with IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | Low | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Nomadic grazing | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |
| War, civil unrest and military exercises | Unknown | Ongoing – trend unknown |

# IPA
# Tchabal Mbabo

**International site name:** Tchabal Mbabo
**Site code:** CMNTIPA034
**Administrative region:** Adamaoua
**Assessed by:** Bruce Murphy, Leonard Usungo, Jean Michel Onana




**Latitude** (decimal degrees)**:** 7.31000
**Altitude minimum:** 600
**Area** (km²)**:** 1,650.0
**Longitude** (decimal degrees)**:** 11.97000
**Altitude maximum:** 2,374
**IPA criteria met:** A(i)

## Site description

Located directly across the border from Nigeria's Gashaka Gumti National Park, Tchabal Mbabo in Adamaoua Region, Cameroon, is part of a UNDP-GEF promoted transnational conservation hotspot at the northern end of the Cameroon Highlands ecoregion. Rising from c. 600 m to nearly 2,400 m, it is the highest point in the three northern regions of the country and an outlier to the main Cameroon Afromontane forests to the south. A steep, north-west facing escarpment crescent includes a transition from lowland savanna and gallery forest to montane forest and grassland. The proposed IPA covers around 165,000 ha and, like the provisionally proposed national park boundary, follows the national border in the east, extending to Dodeo in the north and Sambolabo in the south. To the east, however, it extends further to incorporate the whole escarpment, including the important forest of the upper slopes, along with an additional area of the plateau, which could provide a buffer zone.

## Botanical significance

Tchabal Mbabo, one of few sites above 2,000 m in West or Central Africa, is a northern outpost of Afromontane and submontane forest amidst the drier, anthropic, savanna vegetation of northern Cameroon. As such, it contains northerly populations of species found across the Cameroon Highlands but forming communities with a northern variation (Chapman, 2004). When surveyed by Thomas & Thomas (1996) and Chapman (2004) it contained an important, relatively intact, transition across lowland submontane and montane vegetation zones. These authors also commented on the rare high-altitude *Hyparrhenia* savanna community. Two Critically Endangered species (*Ledermanniella monandra* and *Beilschmiedia congestiflora*) are narrowly endemic to the site, although not collected in recent times, while *Craterosiphon montanum* occurs at only one other site in Gabon (Onana & Cheek, 2011; Cheek & Lovell, 2020d; Lovell & Cheek, 2021a). The first, a waterfall-specific Podostemaceae can be recognized on current molecular data as the monotypic genus *Monandriella* (Schenk et al., 2015).

*Mimusops dodensis* (CR) is named after Dodéo at the northern edge of the site and is known only from records of two collections by Ledermann in 1911, assumed to be lost in the 1943 bombing of the Berlin herbarium. The species may be extinct (Cheek et al., 2021d). In addition, *Ficus oresbia*

(EN), otherwise known only from Mt Mbapit in West Region, Cameroon, has also been recorded here (Onana & Cheek, 2011). Several other globally threatened species occur, such *as Eugenia gilgii* (CR) and *Dombeya ledermannii* (CR), and the site is the only Cameroon location *of Ledermanniella aloides* (VU; Diop, 2010b). *Impatiens smetsiana* has recently been described as narrowly endemic to the site and provisionally assessed as threatened (Lachenaud et al., 2013; Janssens et al., 2022). The economically important *Prunus africana* (VU) is naturally common here but much impacted by destructive harvesting of its bark (Chapman, 2004).

## Habitat and geology

Tchabal Mbabo can be seen as the north-eastern termination of the Cameroon Highlands (Green, 2005). Situated at the intersection of the Cameroon Volcanic Line and the Adamaoua plateau, recent dating of this huge volcanic formation to at least two eruptions in the Oligocene-Eocene suggests Tchabal Mbabo is better understood as part of the former structure (Fagny et al., 2016). Lavas show a range of silica enrichment from (ultra)mafic basanite and basalts through to trachyandesites, trachytes and rhyolites, with the more felsic rocks apparently from the earlier eruptive period (Fagny et al., 2016). These lie on top of uplifted gneissic and granitic Proterozoic basement rocks (Green, 2005; Fagny et al., 2016). Soils in the area are predominantly ferralsols and acrisols, acidic with limited fertility (Yerima & Van Ranst, 2005; Green, 2005). More fertile soils are found on lower slopes and around riverbeds (Green, 2005).

The site includes two important watersheds, feeding the Benoué river from the north face of the escarpment and the Sanaga from two tributaries to the south (Green, 2005).

The plateau is cool and windy, with 1,700 cm of rain per annum. There is a two-season climate but the plateau has a less severe dry season due to rain and mist (Green, 2005). Annual mean temperature is 18 °C on the plateau with a daily amplitude of 13–15° (Thomas & Thomas, 1996). Monthly means are generally around 22 °C but peak up to 33 °C in April–May (Green, 2005).

The steep north-facing slopes shelter the northern-most montane cloud forest in Cameroon, while the southern slopes and plateau are grassland and savanna with remnants of gallery forest and deciduous forest. Further downslope, the northern forest also transitions into savanna that extends towards Faro National Park (Thomas & Thomas, 1996; Chapman, 2004).

**Tchabal Mbabo.**
Photograph © CWCS/TETU Emmanuel, 2021.

## Conservation issues

The Gashaka Gumti-Tchabal Mbabo Transboundary Conservation Project (GGTM) was a UNDP-GEF project implemented by BirdLife International and the Nigerian Conservation Foundation (Green, 2005). Gashaka Gumti has been a national park since 1991 and was previously a game reserve (Green, 2005). However, on the Cameroon side of the border, Tchabal Mbabo has no protection status. Efforts to establish a national park stalled but have been taken up again by the Wildlife Conservation Society (WCS) Cameroon (Usongo, 2020). The currently proposed boundary omits some of the most botanically important and potentially threatened upper slopes of the north and west facing escarpment forest, as well as areas of plateau gallery forest, rare grassland communities and forest ecotone identified by Chapman (2004) and Thomas & Thomas (1996). Preserving the entire escarpment and a protective buffer zone of the plateau grassland would seem to be necessary to maintain the botanical value of this site, but this may be difficult to reconcile with other land-use claims.

The main threats are grazing, burning, shifting cultivation, fuelwood extraction and destructive harvesting of *Prunus africana* bark (Chapman, 2004; Green, 2005). Approximately 10,000–20,000 head of cattle are herded across the northern face of the escarpment twice a year, migrating from the lowlands in the wet season and back again in the drier season. Generally, only the highlands are permanently occupied by pastoralists due to Tsetse fly (Green & Tchinlé, 2004). Green & Tchinlé (2004) urge conservation efforts to accommodate Mboro transhumance practices rather than restricting access, with management of migratory routes proposed to limit habitat degradation. Suspicion about conservation plans may explain the stalling of previous conservation efforts in this area.

Wind and cold keeps cattle pests away on the plateau and have traditionally limited cultivation. However, new cultivars now make cultivation more possible (Green, 2005). Together with restrictions on land use and changing cultural norms, these are leading to increasingly settled agropastoralism, with cultivation of cleared land and permanent high stocking rates, replacing traditional migratory pastoral land-use patterns that have previously mitigated impacts on natural habitats (Green, 2005). This creates a positive feedback loop of less available grazing land, more intensive, permanent grazing, increased fire frequency to revitalise pasture, and consequent increased dominance of fire-resistant and unpalatable *Sporobolus africanus* and *Pteridium aquilinum* (Chapman, 2004; Green, 2005). Although the north-facing montane forests are naturally better protected by steep slopes than the south-facing gallery forests (Herrmann et al., 2007), important montane forest on the north-facing slopes was already beginning to be lost over 15 years ago to deliberate burning for pasture (Green, 2005).

Fuelwood over-harvesting is also a problem around villages and along migration routes, particularly threatening gallery forests on the plateau and extending to the escarpment forests (Chapman, 2004; Green, 2005). Some *Eucalyptus* has been planted in response but native species are likely to be a better solution (Chapman, 2004).

Although it is unlikely to be in serious danger of global extinction because of its widespread distribution (Onana & Cheek, 2011), destructive harvesting of *Prunus africana* (VU) is also a major local threat because this tree was formerly an abundant element of the montane forest here. Efforts to promote sustainable harvesting and replanting could alleviate this problem, although Green & Tchinlé (2004) advise caution and consultation due to pastoralist suspicion that tree planting on the plateau will spread Tstese fly to higher altitudes.

The Faro National Park lies 70 km to the north and preservation of a connecting wildlife corridor with this site is important for many migratory animal species (Smith & McNiven, 1993). Climate change is likely to increase the importance of these migratory routes to higher ground as the region becomes more arid. The adjacent protected area across the Nigerian border also adds considerably to the conservation value of this site by effectively forming a much larger, continuous habitat.

## Key ecosystem services

The Benoué river, flowing north, and the Sanaga flowing south have important sources at Tchabal Mbabo. Protection of these drainage basins and the natural vegetation clothing them is of importance to ensuring clean reliable water supplies to the region (Green, 2005).

The site harbours a great many animal species of conservation importance, including leopards (*Panthera pardus*), golden cat (*Caracal aurata*, VU), 294 bird species including half of those endemic to the Cameroon Highlands, 34 reptiles and 77 butterflies (Smith & McNiven, 1993; Green, 2005; Hermann et al., 2007; BirdLife International, 2021l). African wild dog (*Lycaon pictus*, EN) has recently been reported at Tchabal Mbabo according to locals (Usongo, 2020) despite having been considered extinct in Cameroon (Woodroffe & Sillero-Zubiri, 2020). The site is also an important seasonal migratory route for many species.

*Prunus africana* (VU), a valuable economic species, is naturally common in the montane forest.

Green & Tchinlé (2004) suggest that the cultural heritage of the Mboro herdsman has touristic value and should be preserved.

## Ecosystem service categories

**Provisioning** – Raw materials

**Provisioning** – Fresh water

**Provisioning** – Medicinal resources

**Regulating** – Erosion prevention and maintenance of soil fertility

**Habitat or supporting services** – Habitats for species

**Cultural** – Tourism

**Cultural** – Cultural Heritage

## IPA assessment rationale

Tchabal Mbabo qualifies as a potential IPA under criterion A(i) due to the presence of several globally threatened and nationally rare taxa, including two Critically Endangered site endemics, *Ledermanniella* (*Monandriella*) *monandra* and *Beilschmiedia congestiflora* and the narrow endemic *Impatiens smetsiana.* It may also qualify for its montane and submontane forests, rare in this region of Cameroon.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Brachystephanus giganteus* | VU | A(i) | | ✓ | | | |
| Acanthaceae | *Isoglossa nervosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apiaceae | *Lefebvrea angustisecta* | NT | | | | | | |
| Apiaceae | *Pimpinella ledermannii* subsp. *ledermannii* | | | | | | | |
| Asteraceae | *Helichrysum cameroonense* | NT | | | | | | |
| Asteraceae | *Vernonia bamendae* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Apocynaceae | *Epistemma decurrens* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Balsaminaceae | *Impatiens sakeriana* | VU | A(i) | | ✓ | | | |
| Balsaminaceae | *Impatiens smetsiana* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Campanulaceae | *Lobelia columnaris* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Campanulaceae | *Wahlenbergia ramosissima* subsp. *ramosissima* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Detarioideae | *Afzelia africana* | VU | A(i) | | | | ✓ | |
| Dombeyoideae | *Dombeya ledermannii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Hypoxidaceae | *Hypoxis suffruticosa* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Lauraceae | *Beilschmiedia congestiflora* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Melastomataceae | *Dissotis bambutorum* | NT | | | | | | |
| Meliaceae | *Khaya grandifoliola* | VU | A(i) | | | | ✓ | |
| Meliaceae | *Khaya senegalensis* | VU | A(i) | | | | ✓ | |
| Moraceae | *Ficus oresbia* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Myrtaceae | *Eugenia gilgii* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Humularia ledermannii* | DD | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Millettia conraui* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Pterocarpus erinaceus* | EN | A(i) | | | ✓ | ✓ | |
| Poaceae | *Andropogon pusillus* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Poaceae | *Panicum acrotrichum* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella aloides* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Podostemaceae | *Ledermanniella monandra* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rosaceae | *Prunus africana* | VU | | | | | ✓ | |
| Rubiaceae | *Chassalia laikomensis* | CR | A(i) | | ✓ | | | |
| Rubiaceae | *Ixora foliosa* | VU | A(i) | | ✓ | | | |

*Priority species (IPA criteria A and B)*

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Rubiaceae | *Oxyanthus okuensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Rubiaceae | *Psychotria moseskemei* | CR | A(i) | | ✓ | | ✓ | |
| Sapindaceae | *Allophylus bullatus* | VU | A(i) | | ✓ | | | |
| Sapotaceae | *Mimusops dodensis* | CR | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Sapotaceae | *Vitellaria paradoxa* | VU | A(i) | | | | ✓ | |
| Scrophulariaceae | *Rhabdotosperma ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Thymelaeaceae | *Craterosiphon montanum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Thymelaeaceae | *Gnidia bambutana* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Gashaka Gumti National Park (Nigeria) | Protected/conservation area is adjacent to IPA |
| Important Bird Area | Tchabal-Mbabo IBA | Protected/conservation area overlaps with IPA |
| Key Biodiversity Area | Tchabal-Mbabo KBA | Protected/conservation area overlaps with IPA |

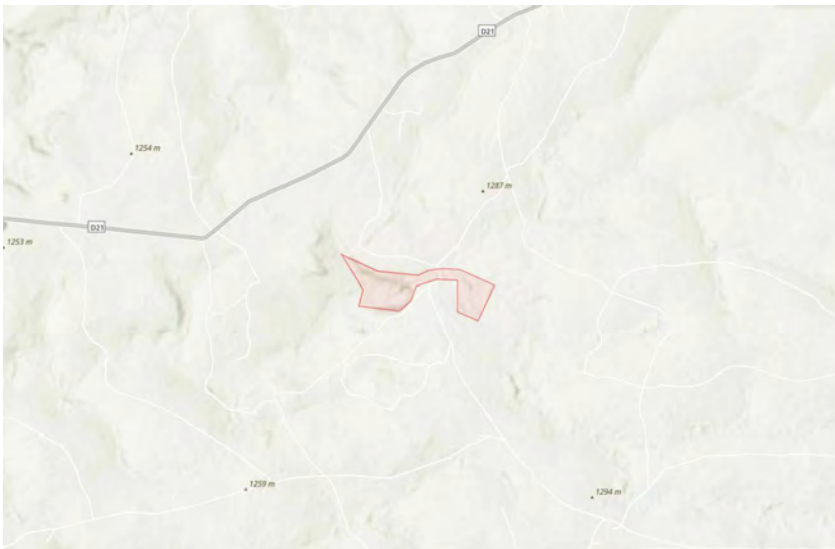
## Threats

| Threat | Severity | Timing |
|---|---|---|
| Shifting agriculture | High | Ongoing – increasing |
| Nomadic grazing | High | Ongoing – increasing |
| Gathering terrestrial plants | High | Ongoing – trend unknown |
| Soil erosion, sedimentation | Medium | Future – inferred threat |
| Nutrient loads | Medium | Future – inferred threat |
| Increase in fire frequency/intensity | High | Ongoing – increasing |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |

## IPA

# Tello Falls

**International site name:** Tello Falls
**Site code:** CMNTIPA019
**Administrative region:** Adamaoua
**Assessed by:** Bruce Murphy, Martin Cheek, Jean Michel Onana




**Latitude** (decimal degrees)**:** 7.22960
**Altitude minimum:** 1,210
**Area** (km²)**:** 0.5
**Longitude** (decimal degrees)**:** 13.94200
**Altitude maximum:** 1,250
**IPA criteria met:** A(i)

## Site description

Tello Falls is a small riverine habitat surrounding some spectacular waterfalls on the Tello river in Vina department, Adamaoua Region, Cameroon. It is about 2 km south of the D21 Ngaoundere-Mbang road, approximately 40 km east of Ngaoundere. The falls occur where the river valley descends abruptly by approximately 50 m and the water drops freely off a wide stone table 10–15 m thick to a small lake below. Beneath the table and behind the curtain of falling water a large cavern has been carved out. Hygrophilic vegetation clings to the stone table, cave edge and banks of the river and lake.

## Botanical significance

Although there is little information on the site and few recent botanical collections, seven globally threatened species have been recorded, four of which are assessed as Endangered and three as Vulnerable. Four of these species are national endemics and *Stonesia ghoguei* is narrowly endemic to the site itself (Cheek, 2018b). *Justicia telloensis* (EN) and *Platycoryne alinae* are recorded at just one other location globally. Apart from a doubtful record at Bandounga (Cheek & Lovell, 2021c), *Phyllanthus caligatus* is also known from just one other site in the Bamboutos mountains which have been very heavily de-vegetated since the only collection 85 years ago; therefore, this species is likely now endemic to Tello Falls. *Digitaria adamaouensis* (EN) is recorded from only two other nearby locations in Adamaoua Region and one location in West Region (Cheek & Lovel, 2020b).

Only one of the taxa listed here (*Stonesia ghoguei*) is included in Kuetegue et al.'s (2019) checklist of the rheophytic species of Cameroon but it is possible that further rheophytes may occur since the site has not been thoroughly surveyed. *Phyllanthus caligatus* is the only other species which is known to behave as a rheophyte in the spray of the falls themselves. *Justicia telloensis, Digitaria adamaouensis, Hygrophila mediatrix* (EN) all grow in swampy or inundated habitats (Cheek 2014g,h; Cheek & Lovell, 2020b) while *Sericanthe raynaliorum* (VU) is a shrub of gallery forest. Is not known exactly how close to the waterfalls some collections of these species were made and, for this reason, the area demarcated here is somewhat arbitrarily drawn. Further surveying or local knowledge is required to demarcate the boundary of the site more precisely. Other species known from Adamaoua Region but not known from the site should be searched for and if

possible included, such as *Eriosema raynaliorum* (not officially threatened but known from only a very small area nearby), *Cyphostemma leucotrichum*, *Vernonia chapmanii* and *Hypoxis suffruticosa* (VU) and *Trifolium gillettianum* (CR). The latter species is known only from a single collection at an unknown location recorded as '40km from Ngoundere towards Belel', which puts it very close to Tello Falls (Cheek, 2015f).

## Habitat and geology

Tello Falls cut through the Adamaoua plateau, a horst structure bordered to the north and south by the Adamaoua and Djerem-Mbam faults (Nkaouandou et al., 2008). The latter faults are part of the Central African Shear Zone which trends at 70° ENE-WSW, tangential to the 30° trending Cameroon Volcanic Line (Nkaouandou et al., 2008). Much of the plateau is overlain by alkaline basalts of recent (Miocene-Pliocene) to Cretaceous age, with much older basement complex rocks exposed to the north and south-west of Ngaoundere. Amongst the basalts, there are multiple trachyte and phonolite plugs (Apollinaire et al., 2017; Nkaouandrou et al., 2008; Marechal and Vincent, 1971). Cretaceous sandstones fill the Mbere and Djerem basins to the south-east and south-west (Apollinaire et al., 2017). Soil maps indicate rhodic ferralsols are prevalent in this area (Jones et al., 2013). However, localised data on the site itself is limited. Lebrun (1968) describes '*marécage temporaire sur basalte*' ('temporary swamp on basalt') above the falls. Pfeiffer et al. (2009) report *Stonesia ghoguei* growing in the waterfall itself on 'gneissic rock'.

The Adamaoua Region is broadly categorised as savannah (Letouzey, 1968) but it has been much affected by humans and has also changed considerably in response to climate within the Holocene epoch (Lebamba et al., 2016). Annual precipitation at nearby Ngaoundere (1,104 m) is 1,518 mm with six months exceeding 100 mm, monsoonal rains peaking in July and August, and a single dry season with virtually no rain between November and February. Mean daily temperatures vary relatively little around the annual mean of 21 °C, peaking at the beginning of the wet season in March at 23.4 °C. Mean monthly temperatures do not fall below 10 °C (Zepner et al., 2020).

Shrubs and trees surround the falls and line the rivers, with grass and savannah elsewhere. The river Tello flows towards Ngaoundere and joins the Djerem river, which eventually joins the Sanaga.

## Conservation issues

The natural vegetation of Adamaoua has been extensively changed by centuries of human activity (Lebamba et al., 2016). Although not the most heavily populated region in Cameroon, the population has grown dramatically in the nearby city of Ngaoundere since the 1960s, resulting in agricultural pressure, loss of fertility and conversion of forestry reserves or pastoral lands with resulting loss of semi-natural vegetation (Bell, 2007; Bouba, 2012). Although there are signs of agriculture in the vicinity of the waterfall site, and Bouba (2012) suggests soils nearby may be more fertile and valued for agriculture than in some other local areas, pastoralism appears to be the greater threat. Adamaoua is the main cattle rearing area in Cameroon, with 70% pasture land; increasing stocking rates have raised concern since the early 1980s (Tchotsoua et al., 1999). The area suffers from soil erosion due to gullying from cattle tracks, loss of vegetation and heavy seasonal rains (Tchotsoua & Moussa, 2005). Danger to the site itself appears to be acute with thousands of cattle watering at the site daily, degrading the vegetation through trampling, water pollution and overgrazing (Cheek, 2018b). Fuelwood is also increasingly intensively collected, threatening all woody vegetation in the area (Bouba, 2012).

Tourism is also a threat at the falls (Cheek, 2018b) but if well managed may also be the best hope for preserving the flora as part of this scenic site.

***Justicia telloensis*** **is a straggling herb which inhabits swamps. It is known only from the Tello Falls and Mbi crater lake in the Bamenda Highlands.**
Photograph M. Cheek, 1998.

## Key ecosystem services

Natural vegetation along the rivers and at the falls is important in preventing gullying, soil erosion and silting of rivers when strong seasonal rains come (Tchoutsoua & Moussa, 2005).

Although not documented, it is quite likely that the site may have spiritual or cultural significance to local peoples. The waterfalls are also an important tourist attraction (Cheek, 2018b).

## Ecosystem service categories

**Provisioning** – Fresh water

**Regulating Services** – Moderation of extreme events

**Regulating Services** – Erosion prevention and maintenance of soil fertility

## IPA assesssment rationale

Important populations of seven globally threatened species are recorded at the site. Four of these are also national endemics and *Stonesia ghoguei* is unique to the site itself. Therefore, the site qualifies as an IPA under criterion A(i).

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Hygrophila mediatrix* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Acanthaceae | *Justicia telloensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Orchidaceae | *Platycoryne alinae* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Trifolium gillettianum* | CR | A(i) | B(ii) | ✓ | ✓ | | |
| Phyllanthaceae | *Phyllanthus caligatus* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Phyllanthaceae | *Phyllanthus discolaciniatus* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | |
| Poaceae | *Digitaria adamaouensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Podostemaceae | *Stonesia ghoguei* | VU | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Rubiaceae | *Sericanthe raynaliorum* | VU | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | Medium | Ongoing – trend unknown |
| Livestock farming and ranching | High | Ongoing – increasing |
| Tourism and recreation areas | Low | Ongoing – trend unknown |
| Logging and wood harvesting | High | Ongoing – increasing |

# North Region

The Mt Vokré massif rises steeply around the town of Poli.
Photograph © A.P.M. van der Zon, 1982.

## IPA

# Mt Vokré

**International site name:** Mt Vokré
**Local site name (if different):** Hoséré Vokré, Monts de Poli
**Site code:** CMNTIPA046
**Administrative region:** North
**Assessed by:** Bruce Murphy, Gilbert Todou, Jean Michel Onana

**Latitude** (decimal degrees)**:** 8.34000
**Altitude minimum:** 500
**Area** (km²)**:** 962.0
**Longitude** (decimal degrees)**:** 13.25000
**Altitude maximum:** 1,940
**IPA criteria met:** A(i)

## Site Description

Mt Vokré in North Region, Cameroon, is a horseshoe-shaped mountain ridge reaching nearly 2,000 m. It lies 100 km south of Garoua, a few km south of the town of Poli, and between Faro and Benoué national parks which are of predominantly low altitude. As well as the summit, several additional peaks in the range are named, including Hosere Kogo and Hosere Mango. To the north-west, narrowly separated by a 300-400 m valley a related peak, Hosere Gode rises to 1,600 m and is also included here. A smaller separated peak, Hosere Poli, also rises to nearly 1,000 m on the eastern edge of Poli itself but is excluded. To the east, the range forms a plateau which slopes away gradually. The proposed boundary is tentative and surveying is required to indicate what parts retain conservation value.

## Botanical significance

These mountains have seen a fairly high number of collections compared with elsewhere in the North, Far North and Adamaoua regions, but there are no recent records of the more notable taxa. G. Fotius, J & A Raynal, H Jaques-Felix, C. Geerling and A.P.M Van der Zon are responsible for most of the collecting and important records which date from the 1960s–1980s. A large number of non-vouchered observations by Le Bourgeois in 1990 and colleagues in 2003 do not appear to have returned rare or threatened taxa.

*Antherotoma clandestina* (EN) is endemic to Cameroon and only recorded at one other site, nearby Mt Ngang-ha, while *Ledermanniella raynaliorum* (EN) is only otherwise recorded from a single site in Nigeria (Cheek, 2015g; Cheek & Lovell, 2021b). *Rhynchosia ambacensis* subsp. *cameroonensis* (provisionally EN, Onana & Cheek, 2011) is also very rare. The site is one of only three locations globally for *Vepris oubanguensis* (EN, Lovell & Cheek, 2021e). Other recorded taxa such as *Wahlenbergia ramosissima* subsp. *ramosissima* and *Panicum acrotrichum*, are somewhat more widely recorded but still assessed as Vulnerable. Mt Vokré is also notable for hosting outlier populations of taxa otherwise limited to the Northwest and Southwest regions of Cameroon, such as *Crotalaria ledermannii* (VU) – a national endemic – and *Podocarpus milanjianus*. The remarkable orchid *Ansellia africana* (VU), although widespread in Africa, has rarely been scientifically recorded in Cameroon but twice collected at this site. It is threatened by horticultural and ethnobotanical collecting (Crook, 2013). *Echinops mildbraedii* is

provisionally assessed as NT by Onana & Cheek (2011). *Thesium equisetoides* (NE) also has a large range across Africa but is very sparsely recorded and is only known in Cameroon from this site. Taxa are recorded from nearby Hosere Godé, including *Eugenia poliensis, Cyphostemma leucotrichum* (provisionally EN), *Globimetula oreophila* (VU in Onana & Cheek 2011, though now more widely recorded), *Dombeya ledermannii* (CR), *Vernonia chapmannii* (provisionally VU) and *Vitex bogalensis* (NE).

## Habitat and geology

Mt Vokré is in the Central African Fold Belt region, a zone between the Congo craton, the West African craton and the Chad basin. The mountains are formed of Neoproterozoic granitoids, uplifted as a horst-like structure and surrounded by metabasalts and micaschists (Kouske et al., 2012; Abate Essi et al., 2017; Thiéblemont et al., 2021). Many large granite boulders, forming deep crevices, are exposed at the summit area and found in gallery forest at slightly lower altitudes (Bauer et al., 2006). One of only two known Cameroon uranium deposits (the Kitongo occurrence) is known from the north-western margin and occupies an area of c. 1.8 km by c. 1.3 km (Kouske et al., 2012). The higher altitude areas are characterised by leptosols, with gleyic luvisols and planosols in the lower areas to the west and ferric luvisols and regosols to the east (Yerrima & Van Ranst, 2005; Letouzey, 1985).

Average annual precipitation at Poli (478 m) is 1,352 mm. There is a single wet season (Koppen type: Aw) running from mid March to the end of October and peaking in August (275 mm, humidity 80%). Very little rain (<=5 mm) falls from November to February. Average annual temperature is 24 °C, with January being the coolest month (average 21.4 °C) and temperatures peaking in April (average 27.6 °C) as the rains build (WeatherBase, 2022b).

Letouzey (1985) maps the main ridge as vegetation type 119, a strongly degraded submontane forest of Guineo-Congolian type, sometimes colonised by thorny trees. The highest region is mapped as type 113, mountain pastures with *Sporolobus africanus* and forest galleries, and at this altitude Letouzey comments on similarity with the rest of the Cameroon Volcanic Line of mountains. Lower slopes consist of mainly type 66, 'Mid-Sudanian wooded savannas with *Isoberlinia doka*, sometimes degraded, on rocky soils; sometimes stands of *Isoberlinia doka* as open dry forests', although a considerable area at lower altitude is uncategorised, perhaps indicating anthropic degradation. Groves of *Borassus aethiopum* are cultivated around Poli and Hosére Godé. The main forest trees are *Syzigium guineensis* and *Phoenix reclinata* (Larison et al., 1996; Bauer et al., 2006).

## Conservation issues

The area has a high population-density and impacts on the natural habitat have been described as 'extremely high' (Larrison et al., 2000). Forest is largely limited to narrow gallery forests in valleys and gorges, with dry wooded savanna in between. The summit area appears largely bare. It is assumed that forest cover was formerly much more complete although perhaps not reaching the highest regions. Grazing is likely to be the main cause of degradation (Cheek, 2015e). Pastoral villages and cattle grazing

**The Mt Vokré massif rises steeply around the town of Poli.**
Photograph © A.P.M. van der Zon, 1982.

are reported on the plateau itself, with streams used for watering livestock. There is also cultivation of the lower slopes and even the plateau. Fire is not mentioned but is probably used to rejuvenate grazing land, and fuelwood gathering is likely a further impact. Numerous fire alerts are indicated over the latest month (prior to 18 March 2022) by infrared satellite imaging using a 375 m pixel size (NASA FIRMS, 2022). Gallery forests are targeted for both grazing, particularly in the dry season, and for cultivation because of the moister soils (Bauer et al., 2006). One of the globally threatened and near endemic species *Ledermannia raynaliorum* is a rheophytic species from waterfalls and rapids and likely to be susceptible to impacts on these streams (Cheek & Lovell, 2021b).

Hidden crevices between the large granite boulders may shelter surviving populations of important species.

The Kitongo uranium deposit is thought to contain up to 13,000 tonnes of ore material but is of low value (IAEA, 2009). Drilling in 2010 by Mega Uranium Ltd revealed nothing of economic significance. Further drilling in 2011 was deferred and does not appear to have resumed (KPMG, 2014). A large area, extending through Benoué National Park, remains under various mining permits (MINFOF & WRI, 2020).

## Key ecosystem services

*Vepris oubanguensis* is widely used as a remedy for asthma and coughs. Phytochemical research has isolated novel chemical compounds from samples of this species collected on Mt Vokré (Ayafor et al., 1982, 1986). Other medicinal and edible species are recorded and are likely to be utilised by local people.

**A mountain village in the Mt Vokré massif near Poli.**
Photograph © A.P.M. van der Zon, 1982.

The remaining gallery forest protects the streams and rivers that provide fresh water to local communities, including Poli. Denser forest may have previously intercepted and condensed atmospheric moisture at high elevations, increasing total precipitation; restoration may therefore have benefits for water supply.

A species of gecko, *Cnemaspis alantika* (EN), is narrowly endemic to Mt Vokré and the nearby Atlantika mountains (Bauer et al., 2006; LeBreton et al., 2021). Ninety-one bird species have been recorded, three of which were at their most northern recorded site (Larison et al., 2000), although none were rare and few forest species were found. The spider *Malinella vokrensis* appears to be narrowly endemic to the site (Bosmans & Van Hove, 1986; World Spider Catalog, 2022).

## Ecosystem service categories

**Provisioning –** Fresh water

**Provisioning –** Medicinal resources

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

Mt Vokré qualifies as an IPA under criterion A(i) through its important populations of several globally threatened species, most notably *Antherotoma clandestina* (EN), *Crotalaria ledermannii* (VU) and *Ledermanniella raynaliorum* (EN).

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Acanthaceae | *Phaulopsis symmetrica* | NT | | B(ii) | | | | |
| Asteraceae | *Crassocephalum bauchiense* | VU | A(i) | | ✓ | | | |
| Asteraceae | *Vernonia chapmanii* | | | | ✓ | ✓ | ✓ | |
| Asteraceae | *Wahlenbergia ramosissima* subsp. *ramosissima* | | A(i) | | ✓ | | | |
| Clusiaceae | *Garcinia afzelii* | VU | A(i) | | | | ✓ | |
| Detarioideae | *Afzelia africana* | VU | | | | | | |
| Dombeyoideae | *Dombeya ledermannii* | CR | A(i) | B(ii) | ✓ | | | |
| Lamiaceae | *Vitex bogalensis* | | | | | | | |
| Loranthaceae | *Globimetula oreophila* | | | | | | | |
| Melastomataceae | *Antherotoma clandestina* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Myrtaceae | *Eugenia poliensis* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |
| Orchidaceae | *Ansellia africana* | VU | A(i) | | | | ✓ | |
| Papilionoideae | *Crotalaria ledermannii* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Indigofera dasycephala* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Papilionoideae | *Pterocarpus erinaceus* | EN | A(i) | | | ✓ | ✓ | |
| Papilionoideae | *Rhynchosia ambacensis* subsp. *cameroonensis* | | A(iii) | | ✓ | ✓ | ✓ | ✓ |
| Poaceae | *Panicum acrotrichum* | VU | A(i) | | ✓ | ✓ | | |
| Podostemaceae | *Ledermanniella raynaliorum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Polygalaceae | *Polygala tenuicaulis* var. *tayloriana* | NT | | | | | | |
| Rutaceae | *Vepris oubanguensis* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Santalaceae | *Thesium equisetoides* | VU | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Vitellaria paradoxa* | VU | A(i) | | | | ✓ | |
| Vitaceae | *Cyphostemma leucotrichum* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | High | Ongoing – trend unknown |
| Small-holder grazing, ranching or farming | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |
| Gathering terrestrial plants | Medium | Ongoing – trend unknown |
| Mining and quarrying | Medium | Ongoing – trend unknown |
| Logging and wood harvesting | High | Ongoing – trend unknown |

## IPA

# Mt Tinguelin

**International site name:** Mt Tinguelin
**Local site name (if different):** Hoséré Tenglé
**Site code:** CMNTIPA045
**Administrative region:** North
**Assessed by:** Bruce Murphy, Gilbert Todou, Jean Michel Onana

**Latitude** (decimal degrees)**:** 9.41450
**Altitude minimum:** 250
**Area** (km²)**:** 53.0
**Longitude** (decimal degrees)**:** 13.45280
**Altitude maximum:** 710
**IPA criteria met:** A(i)

## Site description

Mt Tinguelin is a sandstone table-top formation about 10 km north of the city of Garoua in North Region, Cameroon. Garoua is an important port on the Benue river with a population exceeding 360,000 (UNDP, 2018). The proposed IPA boundary has been drawn to incorporate the main plateau area, extending from the summit peak in the east to the western rim, which may be one of the locations indicated by Lebrun (1977).

## Botanical significance

*Polycarpaea garuensis* is globally threatened (EN) and was considered a 'remarkable' instance of local endemicity to the sandstone outcrops around Garoua (Lebrun, 1977). It has been collected at least three times from Mt Tinguelin (Letouzey R. 6651; Raynal, J & A 12414; Malzy, P. 98), most recently in 1964, while two collections, including the type, collected in 1939 by Jacques-Felix, were also from sandstone rocks near Garoua and may be from the same site. Other collections exist from around Garoua and most recently from nearby Sanguere in 1983 (Abba 572), while a single further record exists from Nigeria which is considered possibly anomalous by Onana & Cheek (2011). In addition, *Vepris heterophylla* (EN) was recorded in 1964 and although there are several collections of this species from West Africa there are few other sites in Cameroon.

Other threatened species collected in the vicinity include *Khaya senegalensis* (VU), *Afzelia africana* (VU), *Cleome coeruleorosea* (VU), *Cyphostemma cuneatum* (EN), *Barleria bornuensis* (VU), *Chlorophytum caudatibracteatum* (DD) and *Chlorophytum altum* (EN). It is not known if any of these are present at the Tinguelin site. *Plagiosiphon longitubus* (CR) has also been recorded nearby but this species is more widespread than first thought and now considered not threatened (Onana & Cheek, 2011).

## Habitat and geology

The climate is hot with a single wet season (Koppen classfication: Aw) and c. 1,000 mm of rain p.a., peaking in August. The winter is dry with no rain typically recorded between December and February. Daily maximum average temperatures range from 30.6 °C in August to nearly 40 °C in March and April, while daily minima drop to 17.5 °C in December (World Meteorological Organization, 2022a; data covers period 1971–2000).

**Land-use change near Mt Tinguelin.**
Photograph © Gilbert Todou.

**The sandstone tabletop formation of Mt Tinguelin near Garoua.**
Photograph © A.P.M. van der Zon, 1982.

Garoua is situated in a sedimentary basin, associated with the large Benue basin running through Nigeria from Lake Chad to the Gulf of Guinea (Cratchley et al., 1984). The depression at Garoua is infilled with middle to upper Cretaceous marine sandstone overlying the crystalline basement rocks (Kamguia et al., 2005). The sandstone is medium to course grained, dominated by quartz with abundant kaolinite minerals (Bessong et al., 2011) and forms Mt Tinguelin's impressive plateau formations overlooking the plain to the south-west. At the eastern foot of the hill, feldspar deposits have also been reported (Mbodiam, 2016). Soils deriving from the sandstone rocks are described as sandy with bare rock outcrops (Lebrun, 1977). One of the collections of *Polycarpaea garuensis* was described as from the 'summit of the western sandstone cliff in the joints of the bare horizontal slabs of the edge of the plateau, between patches of *Loudetia* grassland'.

Mt Tinguelin is within the East Sudanian savanna ecoregion according to the classification by Olson et al. (2001). On Letouzey's (1985) detailed phytogeographic maps it is a type 55, 'Sudano-Sahelian wooded savannas around the Benoué, ± degraded to *Burkea africana*; sometimes fallow'.

## Conservation issues

The site is in need of surveying to relocate *Polycarpaea garuensis* and discover how much of the proposed site it occupies and what threats it faces, and to investigate the other threatened plant species. Other important species found close to the site may have been impacted by development and land-use change.

Garoua is one of the largest cities in Cameroon, having grown rapidly in size to an estimated 361,000 inhabitants by 2022, a tenfold increase in 50 years (UNDP, 2018). Natural vegetation in this region is very heavily impacted by agricultural production, fuelwood collection and grazing, all of which are associated with high-population densities (KBA partnership, 2023b). The rocky sandstone slabs apparently favoured by *Polycarpaea garuensis* are unlikely to be used for cultivation of local crops such as cotton but could be degraded by grazing and fire.

Feldspar deposits at the foot of the site may pose an additional local threat (Mbodiam, 2016). Invasive species are also probably a greater concern in these grazed savanna regions than in the wet forests of southern Cameroon.

The Gashiga-Demsa IBA and KBA (KBA Partnership, 2023b) is demarcated a few km to the west of the site and was considered the only non-protected wooded site remaining in North Region but already under threat in 2000; it is not known how much survives.

## Key ecosystem services

The sandstone plateau formations are striking and command views of the landscape and town; they are therefore a potential tourist and leisure attraction.

## Ecosystem service categories

**Cultural –** Recreation and mental and physical health

**Cultural –** Tourism

## IPA assessment rationale

As the site of the most significant global population of *Polycarpaea garuensis* (EN), Mt Tinguelin qualifies as an IPA under criterion A(i). Verification of the site's current condition and presence of other threatened species is urgently required.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Caryophyllaceae | *Polycarpaea garuensis* | EN | A(i) | B(ii) | ✓ | ✓ | ✓ | |
| Papilionoideae | *Aeschynomene neglecta* | | A(iv) | B(ii) | ✓ | ✓ | ✓ | |
| Rutaceae | *Vepris heterophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |
| Sapotaceae | *Vitellaria paradoxa* | VU | | | | | | |

## Protected areas and other conservation designations

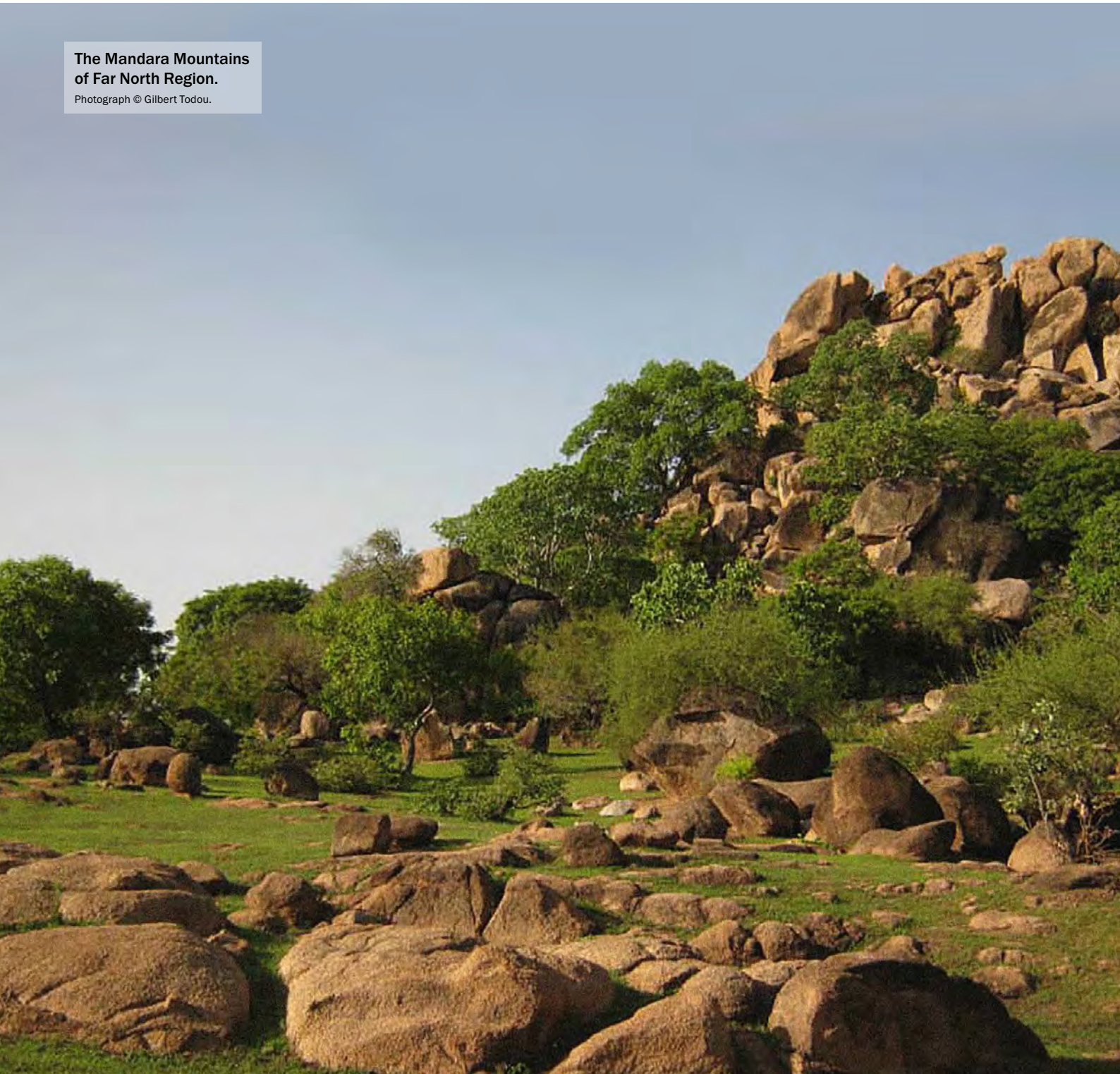
None.

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Development – housing and urban areas | Medium | Ongoing – trend unknown |
| Small-holder farming | Medium | Ongoing – trend unknown |
| Small-holder grazing, ranching or farming | Medium | Ongoing – trend unknown |
| Increase in fire frequency/intensity | Medium | Ongoing – trend unknown |
| Mining and quarrying | Low | Future – inferred threat |

Important Plant Areas (IPAs)

# Far North Region

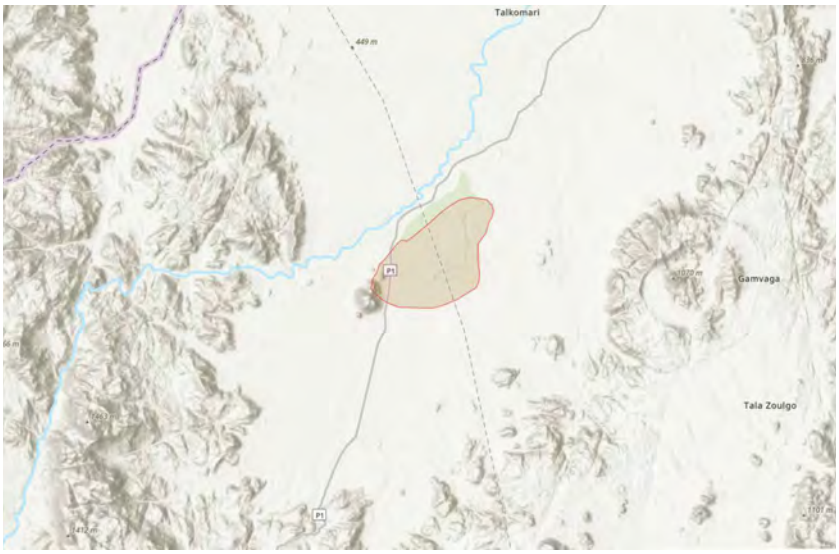


The Mandara Mountains of Far North Region.
Photograph © Gilbert Todou.

## IPA

# Mozogo-Gokoro National Park

**International site name:** Mozogo-Gokoro National Park
**Site code:** CMNTIPA050
**Administrative region:** Far North
**Assessed by:** Bruce Murphy, Gilbert Todou




**Latitude** (decimal degrees)**:** 10.96300
**Altitude minimum:** 435
**Area** (km²)**:** 17.24
**Longitude** (decimal degrees)**:** 13.92500
**Altitude maximum:** 465
**IPA criteria met:** A(i)

## Site description

Mozogo-Gokoro National Park (MGNP) lies within Mayo-Moskota sub-division of Mayo-Tsanaga division, in the arid Far North Region of Cameroon, quite close to the Nigerian border. It lies between ridges of the Mandara mountains in a relatively low-lying valley. The area is stated as 1,400 ha by Protected Planet (2021) but their boundary map indicates 1,724 ha, which is also given by DOPA (2021). Apparently, there is no buffer zone (Sani et al., 2020) so we propose the larger area for the IPA. The Mokolo-Mora road runs along the western boundary of the site, passing through the adjacent town of Mozogo.

The site was established as a forest and wildlife reserve in June 1932 by French colonial decree, making it the oldest protected area in the subsequent nation of Cameroon. It was upgraded to a national park by the Cameroon government in 1968 (Sani et al., 2019).

## Botanical significance

MGNP is visible on satellite imaging as a remarkable green oasis against a background of degraded savanna. Although it is a lowland site and probably not representative of the important plant communities that once characterised upland areas of the Mandara mountains (White, 1983), it is almost unique in this region in its surviving dense canopy forest. Letouzey (1968) and Aubreville (1950) were doubtful that it could be considered primary forest rather than regrowth occurring after decades of protection (Sani et al., 2020). A contrary view was expressed elsewhere (Delwaulle, 1973). Regardless, the site provides an enduring example of the type of vegetation that flourishes here when the otherwise intense anthropic pressures are relaxed. The site has apparently been excluded from cutting and burning for many decades (Seymour, 2004).

Sani et al. (2019) recorded 110 species in 46 genera. Three Red List species are present: *Khaya senegalensis* (VU), *Pterocarpus erinaceus* (EN) and *Afzelia africana* (VU). All are wide ranging and assessed to be in decline, largely due to over-exploitation. *Pterocarpus erinaceus* for example is in serious decline due to overharvesting across West Africa where it was previously commonly recorded. It is also slow growing and does not seem be replacing itself (Barstow, 2018); it is at the eastern limit of its range in Cameroon. *Dalbergia melanoxylon* (NT) (also recorded from Waza

National Park and Mayo Louti Forest Reserve) is likewise very widespread but slow growing, often poorly regenerating, and in serious decline due to exploitation and habitat loss. In Cameroon, it is limited to the North and Far North regions, with few recorded sites (Barstow, 2020).

It remains possible that more rare species are present. Many economic species that are not threatened occur here. Some of these are at the eastern limit of their range and are likely to have declined heavily in their West African strongholds. *Celtis integrifolia* (a possible synonym of *Celtis toka*), for example, has been widely recorded in West Africa but is likely to have declined. It is scarcely recorded east of Nigeria.

## Habitat and geology

Geologically the site lies at the north-western edge of an area of plutonic Neo-proterozoic and Cambrian basement rocks, presumably associated with the northern edge of the Congo craton. This formation abuts the vast Chad basin to the north where deep Paleogene-Quaternary sediments overlie the pre-Cambrian strata (Thiéblemont et al., 2021). The site is also at the southern edge of where Lake Mega-Chad would have reached until at least 5,000 years ago (Armitage et al., 2015; Drake et al., 2022). The climate is semi-arid with a two-season rainfall regime influenced by the Mandara mountains to the west which receive c. 1,000–1,500 mm per annum compared with c.600 mm at Maroua to the east (World Meteorological Organization, 2022b). Sani et al. (2019) indicate 800–1,000 mm at the site and the average annual temperature is 26–28 °C. There is almost no rainfall between November and March. Soils in the area are predominantly free-draining and often infertile regosols, leptosols and luvisols, derived from the granitic mountains and influenced by the arid climate (Yerima & Van Ranst, 2005). Some more fertile clays and other soil types are also present in alluvial areas (Sani et al., 2019; Seymour, 2004).

The site is mapped by Letouzey (1985) as vegetation type 38, 'Sahelo-Sudanian (Maroua) and Sudano-Sahelian (Garoua) shrub steppes of degradation, on ± halomorphic (hardy) but often atypical soils'. According to the classification of Olson et al. (2001) it is on the border of the Mandara Plateau Mosaic and Sahelian Acacia Savanna ecoregions. *Isoberlinia doko* woodland is considered to have once been dominant in this area (Seymour, 2004). The arid Sudanian nature of the vegetation is seen in the high proportion of Combretaceae and Leguminosae (Sani et al., 2019). The non-permanent Mayo Nguetchewe flows northward through the eastern part of the site and Mayo Ngassawe parallels it on the western side just outside the boundary. These seasonal watercourses (mayos) support denser, higher gallery forest in these parts of the park, with more open forest and thicket in between (Sani et al., 2019).

## Conservation issues

MGNP is one of three national parks in the Far North Region. Legal protection, combined possibly with some natural protection from dominant thorny species (*Senegalia* [*Acacia*] *ataxacantha*) and local respect for forest conservation and taboos appear to have successfully limited human impacts (Sani et al., 2019; Seymour, 2004). This can be verified from up-to-date satellite imaging (Global Forest Watch, 2022). Yengue (2000) suggests it is the only protected area in good condition in the Far North Region. Sani et al. (2019) describe it as a model of conservation in the Sudano-Sahelian part of Cameroon.

Conservation concerns are, however, numerous. Fire, wood-gathering and grazing are the main threats (Seymour, 2022) and likely explain the starkly different vegetation outside the park. Substantial wood extraction from within the park does appear to take place and it may be that partial use of non-destructive practices such as pollarding limit the extent of degradation. Local population density is high, exceeding 300 people per km². There is no demarcated border zone or management plan. The Boko-Haram insurgent group is active in the Mandara mountains making the site largely out of bounds for conservation workers. Introduced species such as *Azadirachta indica* are also a potential threat (Sani et al., 2020). Local fire dynamics may need to be studied to ensure that long-term fire prevention does not result in hotter, more damaging burns (Seymour, 2004).

## Key ecosystem services

The site provides wood and medicinal plants to the local people (Todou et al., 2019). It is an important reservoir of genes and source of propagules for timber and other species in an area where almost no forest remains. Various fauna including *Python sebae* (NT) are recorded (Seymour, 2004)

## Ecosystem service categories

**Provisioning –** Medicinal resources

**Regulating –** Erosion prevention and maintenance of soil fertility

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

Mozorgo-Gokoro may qualify as an IPA under criterion A(i) through the presence of a few species that are widespread but globally threatened largely due to over-exploitation. However, it may have a stronger case under criterion C as one of the best representatives of a nationally threatened habitat type, Sudano-Sahelian dry forest and shrubland.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Papilionoideae | *Pterocarpus erinaceus* | EN | A(i) | | | ✓ | ✓ | |
| Meliaceae | *Khaya senegalensis* | VU | A(i) | | | | ✓ | |
| Papilionoideae | *Dalbergia melanoxylon* | NT | | | | | | |
| Detarioideae | *Afzelia africana* | VU | A(i) | | | ✓ | ✓ | |
| Bignoniaceae | *Stereospermum melanoxylum* | | A(iii) | B(ii) | ✓ | ✓ | ✓ | ✓ |

## Protected areas and other conservation designations

| Conservation designation | Protected area name | Relationship of IPA to protected area |
|---|---|---|
| National Park | Mozogo-Gokoro National Park | Protected/conservation area matches IPA |

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | Low | Future – inferred threat |
| Nomadic grazing | Low | Ongoing – trend unknown |
| Gathering terrestrial plants | low | Ongoing – trend unknown |
| Logging and wood harvesting | Medium | Ongoing – trend unknown |
| Increase in fire frequency/intensity | Low | Ongoing – trend unknown |
| Invasive non-native/alien species/diseases | Low | Ongoing – increasing |
| War, civil unrest and military exercises | Medium | Ongoing – trend unknown |

# IPA
# Mt Opay

**International site name:** Mt Opay
**Local site name (if different):** Hosere Opay, Hosere Ziver, Mt Tourou
**Site code:** CMNTIPA047
**Administrative region:** Far North
**Assessed by:** Bruce Murphy, Jean Michel Onana

**Latitude** (decimal degrees)**:** 10.86040
**Altitude minimum:** 700
**Area** (km²)**:** 60.0
**Longitude** (decimal degrees)**:** 13.77470
**Altitude maximum:** 1,494
**IPA criteria met:** A(i)

## Site description

Mt Opay and neighbouring Mt Ziver are the highpoints of the Mandara mountains, a range of rain-intercepting, granitic mountains in the otherwise largely arid Far North Region of Cameroon. The Mandara Plateau mosaic is a unique mapping unit in the classification of White (1983) and Olson et al. (2001), sharing affinities with the Sudanian and Afromontane regional centres of endemism. The area has long been densely populated and is ethnically diverse. Seasonal transhumance and terrace cultivation is used to improve the yields of the steep, porous and often infertile terrain. Natural vegetation is sparse and much degraded. The site itself is close to the Nigerian border, north of Mokolo, and about 60 km west of Maroua.

## Botanical significance

The Mandara mountains are recognised as a major phytogeographical unit and ecoregion, combining arid Sudano-Sahelian vegetation with outlying moist forest and Afromontane elements (White, 1983; Olson et al., 2001; Seymour, 2004). Only at higher altitudes (above 1,200–1,300 m) are the latter elements notable, with species such as *Olea capensis* and *Pittosporum viridiflorum* (White, 1983). One of the most important species recorded is *Euphorbia desmondii* (DD), which is only recorded from a handful of other locations in northern Nigeria and Cameroon, and in Central Africa Republic (Rivers, 2021). Other threatened species include *Pavetta brachycalyx* (EN), *Garcinia afzelii* and *Monanthotaxis elegans* (provisionally VU, Onana, 2013). *Ceropegia rhynchantha* (VU), *Afzelia africana* (VU) and *Cleome coeruleorosea* are other species which may occur although they are not yet recorded. Despite many suggestions that the area harboured an important endemic flora, it has been little studied and there are few collections. It is possible that this flora is partly already extinct.

## Habitat and geology

Unlike the spectacular volcanic (trachyte and rhyolite) necks and dykes of the Kapsiki peaks to the south, this part of the Mandara mountains is formed of uplifted ancient granite (or granitic) rocks (Seymour, 2004; Thiéblemont et al., 2021). These rocks weather in the arid climate to porous, poorly developed and infertile soils, predominantly regosols, leptosols and luvisols (Yerima & Van Ranst, 2005). Some more fertile clays and other soil types are

also present in alluvial areas and the landscape is much modified by terrace cultivation, crop rotation and livestock fertilization (Sani et al., 2019; Seymour, 2004).

There is a two-season climate with c. 1,000–1,500 mm precipitation per annum (WMO, 2022b). Mean temperatures are from 15–30 °C (Seymour, 2004).

The original vegetation of the Mandara mountains is believed to have been a form of *Isoberlinia doko* woodland but is now much degraded (Seymour, 2004). Species such as *Vachellia* (*Acacia*) nilotica*, Faidherbia albida*, *Balanites aegyptiaca, Ziziphus* spp., *Crateva adansonii* and *Khaya senegalensis* are common where trees survive, and grasses dominate the herbaceous vegetation.

## Conservation issues

The Mandara Plateau ecoregion is assessed by Seymour (2004) as critically threatened, having lost an estimated 98% of its natural habitat, the highest of any ecoregion in Africa or Madagascar.

Population density exceeds 300 people per km² and the area has a long history of human occupation owing to the wetter climate and protective mountains (Seymour, 2004; Sani et al., 2019).

Terrace farming, grazing, burning and intense wood-gathering have transformed the landscape and remain the main threats. The continuing activity of the insurgent movement Boko Harem, which uses the mountains as a stronghold, limits the current potential for conservation action and fieldwork. However, surveying is vitally needed. Since the vegetation has never been well known it is hard to know what species may have been lost from the area, some perhaps narrow endemics.

## Key ecosystem services

The Mandara mountains harbour rare wildlife, with 319 birds and 84 mammals recorded, including Ruppel's griffon (*Gyps rueppelli,* EN), the Egyptian vulture (*Neophron percnopterus*, EN) and the western mountain reedbuck (*Redunca fulvorufula* subsp. *adamauae*, EN), and three near-endemic reptile species: Mt Lefo chameleon, Langheld's skink and African wall gecko (Seymour, 2004). Gilbert et al. (2019) found that 50 species of woody plant had ethnobotanic uses in the local district of Merri.

The loss of natural vegetation is likely to have impacted the water-retention of the mountains, especially given the free draining mountain soils (Yerima & Van Ranst, 2005), leading to erosion, drought and flooding in the valleys.

## Ecosystem service categories

**Provisioning –** Food

**Provisioning –** Raw materials

**Provisioning –** Medicinal resources

**Habitat or supporting services –** Habitats for species

## IPA assessment rationale

Due to the small nature of the site and its assumed heavily degraded condition, populations of globally threatened taxa recorded from the site may not meet the IPA criteria. However, the site may qualify as a potential IPA through being a nationally and globally significant site for *Euphorbia desmondii* and through possible nationally important populations of *Khaya senegalensis* and *Monanthotaxis elegans*. The site is likely to qualify as a threatened habitat type under criterion C if surveying can establish that the habitat is capable of survival or restoration.

## Priority species (IPA criteria A and B)

| Family | Taxon | IUCN | IPA criterion A | IPA criterion B | ≥ 1% of global population | ≥ 5% of national population | Is 1 of 5 best sites nationally | Entire global population |
|---|---|---|---|---|---|---|---|---|
| Annonaceae | *Monanthotaxis elegans* | | | B(ii) | | | | |
| Clusiaceae | *Garcinia afzelii* | VU | A(i) | | | | ✓ | |
| Euphorbiaceae | *Euphorbia desmondii* | DD | A(i) | | ✓ | ✓ | ✓ | |
| Meliaceae | *Khaya senegalensis* | VU | A(i) | | | ✓ | ✓ | |
| Rubiaceae | *Pavetta brachycalyx* | EN | A(i) | B(ii) | ✓ | | | |
| Rutaceae | *Vepris heterophylla* | EN | A(i) | | ✓ | ✓ | ✓ | |

## Protected areas and other conservation designations

None.

## Threats

| Threat | Severity | Timing |
|---|---|---|
| Small-holder farming | High | Ongoing – trend unknown |
| Nomadic grazing | High | Ongoing – trend unknown |
| Increase in fire frequency/intensity | High | Ongoing – trend unknown |
| Logging and wood harvesting | High | Ongoing – trend unknown |
| War, civil unrest and military exercises | Medium | Ongoing – trend unknown |

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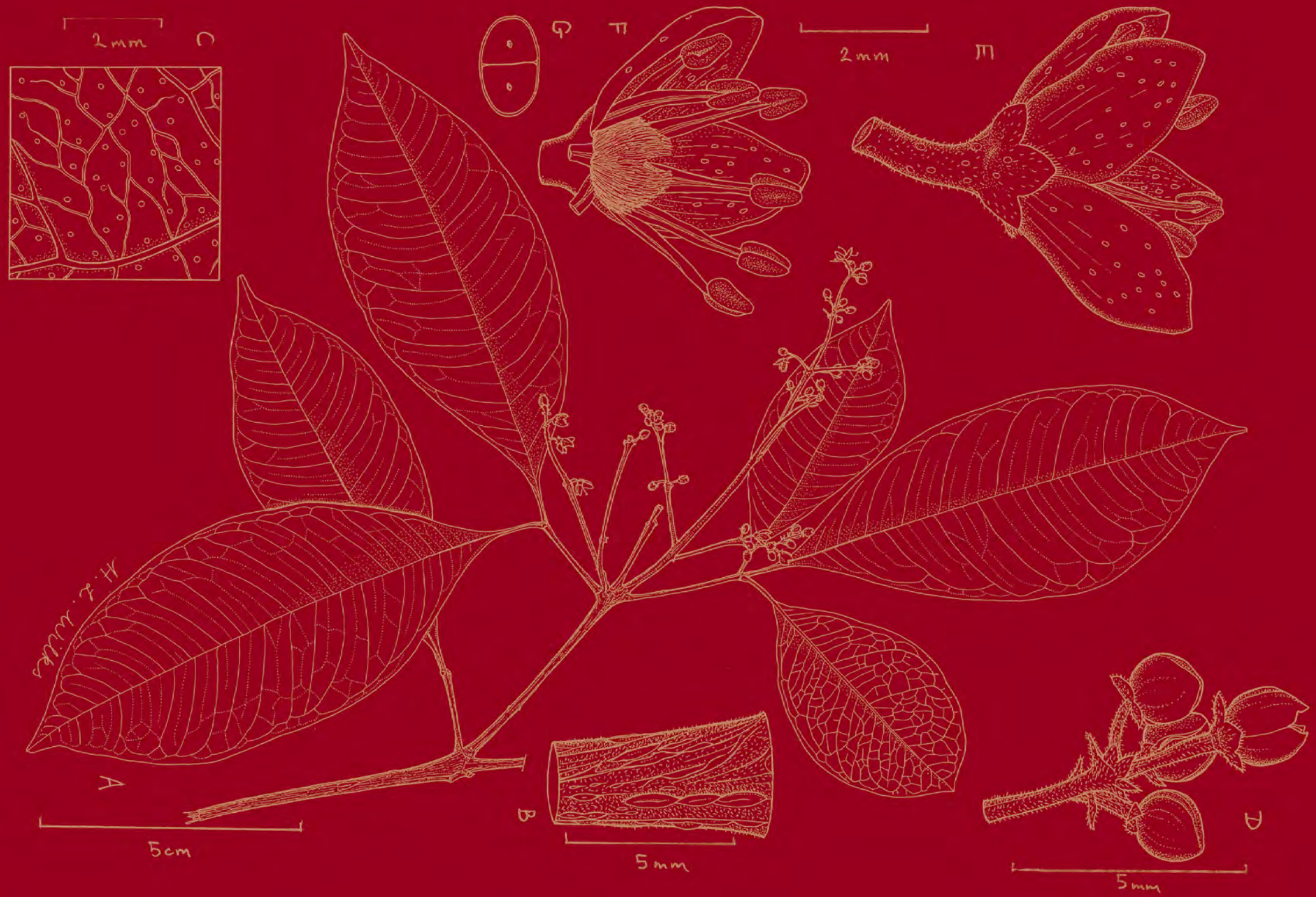
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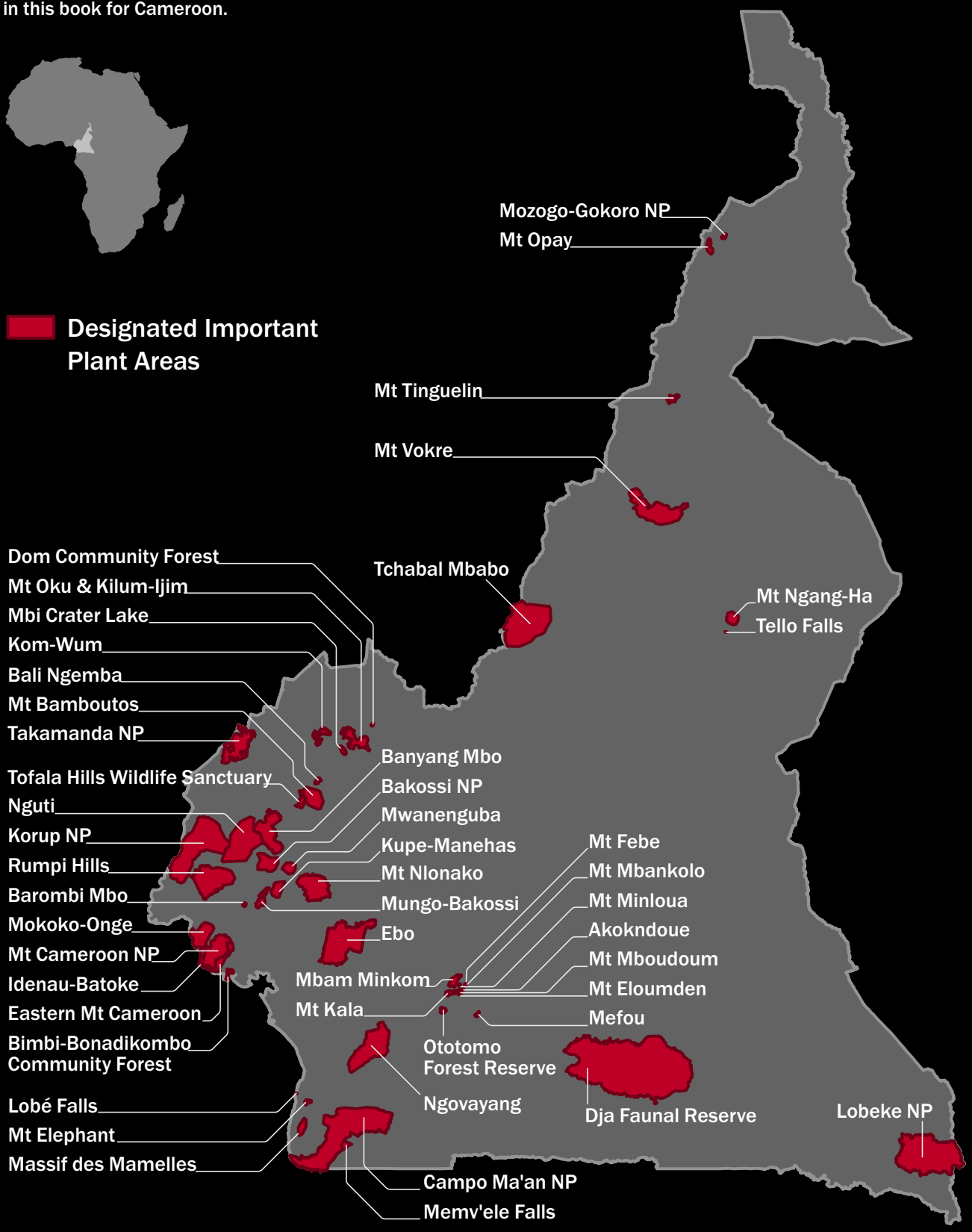
Map showing the distribution of the 49 Important Plant Areas designated and documented in this book for Cameroon.




ISBN 978-1-3999-5449-5