

# Chapter 13

## The Afromontane Forest and Montane Grassland Biome



### *Key Concepts and Questions: This Chapter Will Explain*

- *What distinguishes Afromontane forests from Guineo-Congolian rain forests.*
- *Why the forests of the Angolan highlands are of global conservation concern.*

### **Context: Angola's Disappearing 'Islands in the Sky'**

Angola, a neglected Afromontane Centre (due to its small size, isolation, and lack of access due to four decades of armed conflict) is not just a missing piece of the Afromontane puzzle, but a fundamental piece. (Vaz da Silva, 2015)

Globally, mountains contain half of the world's biodiversity hotspots, within less than one fifth of the planet's land area (Fjeldså et al., 2012). Angola's highlands have a special place in Africa's biogeographic history, with fragmented and fragile links to distant parts of the continent. This feature is best illustrated by the biota of the relict forests and grasslands of the country's high peaks and mountains.

These regional connections have an ancient origin. About 30 million years ago, the generally stable African continent was disturbed by a period of volcanism and mountain building, triggered by the uplift (doming) of the Earth's crust under East Africa, forming the Eastern Arc Mountains that stretch from southern Kenya and across Tanzania to northern Malawi. Today these mountain blocks, rising to 2635 m on the Uluguru Mountains, hold some of the most biodiverse ecosystems in Africa. The forests and grasslands of the mountains are host to 96 endemic vertebrates and over 800 endemic plant species (Burgess et al., 2007). They are recognised as one of the 35 global 'hotspots' of biodiversity.

These ecosystems form the Afromontane Archipelago-like Centre of Endemism (White, 1983). The term 'archipelago' refers to their similarity to oceanic islands—small patches of montane forests and grasslands that extend as a broken chain along the escarpments and highlands of Africa, surrounded by a sea of savanna and desert systems. Forests of the Afromontane centre are found in isolated sites from Sierra Leone to Somalia, and from the Sudan to Cape Town. The most distant examples are 7250 km apart, from east to west, and 6300 km from north to south. The most isolated

of these forests are found on Angola's Mount Moco and Mount Namba and as tiny relicts in the upper ravines of the Serra da Chela. These forests lie some 3000 km distant from the Eastern Arc Mountains, 1900 km from their closest sister forests in the Cape Peninsula and 2000 km from similar forests on Mount Cameroon and the Albertine Rift.

The age and fragmentation of the Afromontane forest and grassland patches have been the focus of much discussion. The grasslands have frequently been referred to as of recent anthropogenic origin. However, paleoecological and biogeographic evidence (Meadows & Linder, 1993) indicates that while the grasslands and forests have been subjected to intense human pressures in recent times, they are nevertheless ancient ecosystems rather than human-derived artefacts. This does not deny the severe pressure currently placed on the remaining forest patches. What makes the Angolan forests of such great scientific and conservation importance is that they collectively cover less than 10 km<sup>2</sup>. They are minute and fragile specks compared with the 3300 km<sup>2</sup> of the Eastern Arc forests. When measured against the 1,700,000 km<sup>2</sup> of the rain forests of the Congo Basin, the significance of these tiny relicts becomes even more evident. Today, after surviving 2.6 million years of climatic oscillations through the Pleistocene, the relict Afromontane forests of Angola are shrinking 'sky islands' in an ocean of fire. The biota of the forests represent fading biological fingerprints that offer clues to the past.

Despite the great scientific importance of Angola's relict Afromontane forests and the ancient grasslands that surround them, their biodiversity and ecology has only recently attracted serious interest. Although not as floristically rich as the Afromontane forests of eastern and southern Africa, the Angolan examples of this biome have distinct floristic and faunistic elements. In common with other Afromontane forests, these forests of the highlands of Angola share more tree species with other montane forest fragments across Africa than they share with the Angolan Escarpment forests or any other habitat in Angola. The Escarpment forests of Cuanza-Norte and Uíge, for example, have stronger links with the rich and extensive Guineo-Congolian flora of the Congo Basin than with the montane flora of the 'Archipelago-like Regional Centre of Endemism' as defined by White (1983).

### *Angola's Afromontane Forests and Grasslands (Ecoregions 4 and 5)*

## **13.1 Afromontane Forests (Ecoregion 4)**

The Afromontane archipelago-like centre of endemism is represented by two ecoregions in Angola: Afromontane Forests (Ecoregion 4) and Montane Grasslands (Ecoregion 5). Ecoregion 4, the smallest and most threatened ecoregion in Angola, has been reduced to isolated forest patches in the ravines of the highest mountains of the country's Marginal Mountain Chain (Fig. 4.10). It is probable that the combined cover of the closed Afromontane forest patches of Angola does not exceed 1000 ha (10 km<sup>2</sup>). The forest patches at 1800–2450 m on Mount Moco total 85 ha and Mount

Namba ca. 580 ha (Mills et al., 2013). These are the only patches of Afromontane closed forest in Angola of more than a few hectares in area. They are located in deep valleys, often as narrow galleries along watercourses, and where some protection against fire is provided by steep slopes or bare rock outcrops. In earlier times, before the recent increase in human-mediated fires and increased cattle densities, a broad ecotone of fire-retarding shrubs protected the margins of forest patches.

The distribution of the high mountains and peaks of Angola and related topographic features are illustrated in Fig. 18.1. The map demarcates, in broad outline, the Angolan Escarpment Zone (see Chap. 18), plus the distribution of inselbergs that rise sharply above the surrounding landscapes. The distribution of Ecoregions 4 and 5 is indicated in Figs. 3.8 and 3.9.

The mountains include Basement Complex and West Congo granites, quartzites, schists and gneisses, with shallow regosols or deeper ferralsols, depending on gradient. Surrounding the forests and extending over a significant area, are the ancient grasslands of the high planalto of Cuanza-Sul, Benguela, Huambo, Bié and Huíla (Ecoregion 5).

Mean annual rainfall is between 800 and 1600 mm (Table 13.1). The forests are subject to several desiccating months during winter (June to August). Although they are described as ‘cloud forests’ by Barbosa (1970), they probably receive less exposure to low cloud and fog than sites on the Escarpment, judging by the relative scarcity of epiphytes and by the sclerophyll characteristics of many tree and shrub species.

Afromontane forests have been characterised by White (1978) as those which include a suite of tree species that occur in the majority of the forests that constitute this centre of endemism. The floristic composition has few tree species in common with the lowland Guineo-Congolian rain forests, but some Afromontane species mix with Guineo-Congolian elements in the forests of the Angolan Escarpment.

The forests have continuous but irregular crowns, little stratification, and are usually less than 20 m height. Typical Afromontane species are represented in Angola by *Apodytes dimidiata*, *Cassipourea gummiflua*, *Ficalhoa laurifolia*, *Ilex mitis*, *Maesa lanceolata*, *Maytenus acuminata*, *Myrica conifera*, *Nuxia congesta*, *Podocarpus latifolius* (*P. milanjanus*), *Prunus africana*, *Rhamnus pruinoidea* and *Strombosia scheffleri*. Other tree species found in these forest patches and in the deep ravines of high mountains and along the crest of the Angolan Escarpment include

**Table 13.1** Climatic data for stations within the Afromontane forest and Grassland ecoregions

Station	Province	Altitude (m)	MAP (mm)	MAT (°C)	Hottest month (°C)	Coldest month (°C)
Cassongue	Cuanza-Sul	1650	1521	19.7	21.2	16.9
Huambo	Huambo	1700	1210	21.1	22.6	17.9
Humpata	Huíla	2100	805	14.6	17.2	11.2

Mean annual precipitation (MAP), Mean annual temperature (MAT) and Mean monthly temperatures for the hottest and coldest months

*Brachylaena huillensis*, *Bridelia* spp., *Buxus benguellensis*, *Chrysophyllum argyrophyllum*, *Englerophyton magalismontanum*, *Erythroxylon emarginatum*, *Faurea speciosa*, *Ficus verruculosa*, *Hymenodictyon floribundum*, *Newtonia buchananii*, *Ochna pulchra*, *Parinari curatellifolia*, *Pittosporum viridiflorum*, *Polycias fulva*, *Pteleopsis anisoptera*, *P. myrtifolia*, *Schrebera welwitschii*, *Syzygium guineense* and *Trema orientale*.

The broken quartzitic landscape of the Escarpment crest and incised ravines has a mix of stunted specimens of many of the above species, plus shrubs and forbs of genera such as *Berkheya*, *Cassia*, *Cyathia*, *Dissotis*, *Dolichos*, *Eriosema*, *Felicia*, *Geigeria*, *Gnaphalium*, *Gnidia*, *Helichrysum*, *Ipomoea*, *Myrsine*, *Polygala*, *Selago*, *Stoebe*, *Vernonia* and *Xerophyta*. In lightly shaded sites with ground water seepage, endemic species of *Streptocarpus* are found. Grasses include species of *Aristida*, *Ctenium*, *Eragrostis*, *Hyparrhenia*, *Loudetia*, *Monocymbium*, *Themeda* and *Tristachya*. On the high water-table sands of shallow valleys, members of the Cyperaceae and Orchidaceae are common.

Several genera representing Cape/Afrotemperate elements are found in the grasslands surrounding the high altitude forests, including species of *Cliffortia*, *Erica*, *Faurea*, *Kniphofia*, *Philippia* and *Protea*. On lower slopes of Mount Moco, short miombo woodlands occur, comprising *Brachystegia spiciformis*, *B. floribunda* and *Julbernardia paniculata*, often with *Protea* species.

The forest remnants are under severe pressure from regular fires around their margins, and from deforestation for firewood and cultivation. Similarly, the surrounding grasslands and shrublands have been transformed from rich mixes of shrubs and forest margin communities to short and sparse grassland. Photographs from the 1930s (Gossweiler & Mendonça, 1939) show well-developed *Protea*, *Philippia* and *Xerophyta* shrublands surrounding the forests at that time, communities that have not been recorded in recent decades. In 1960, protea authority John S. Beard photographed what he described as probably the largest protea in the world in the Moco grasslands (Beard, 1993) (Fig. 2.7). Today the grassland has been reduced to short sparse cover with abrupt margins to the forests (Fig. 13.1).

While the vegetation of these forests awaits detailed study, the avifauna has received intense interest over recent decades. The focus of attention has been on the rare and endemic species of the forests and surrounding grasslands, as discussed in Box 18.1.

## 13.2 Afromontane Grasslands (Ecoregion 5)

The Montane Grasslands of the Angolan Marginal Mountain Chain and Ancient Plateau (Diniz 1991) are found in the highlands of Cuanza-Sul, Benguela, Huambo, Bié and Huíla. The most extensive grasslands, known as *anharas do alto*, lie on gently undulating landscapes at from 1500 to 1800 m, the rolling hills rising to 2620 m on Mount Moco. The underlying geology mostly comprises Basement Complex crystalline rocks producing shallow leptosols, ferralsols and grading into arenosols

**Fig. 13.1** Fire-cut margin of Afromontane forest on Mount Moco, with *Podocarpus milanjanus* of 25 m height. Note men standing at the base of the *Podocarpus*. Photo taken in 1972



in the east. These grasslands cover less than 1% of Angola. The sources of the Cuanza, Cubango, Cunene and upper tributaries of the Congo and Zambezi drain the high planalto, and areas of seasonally saturated soils, with impermeable lateritic horizons, result in the near absence of trees, but an abundance of grass, forb and geophyte species, including many orchids (Figs. 3.10, 13.2). Better drained areas have shrubs and low trees, often with the appearance of ‘dwarf’ miombo (2–5 m height) of *Brachystegia spiciformis*, *B. floribunda* and *Julbernardia paniculata* especially on shallow rocky soils over quartzites.

In many areas of the planalto and peneplains of the Congo and Zambezi drainage, a rich diversity of geoxyles occupy positions on the soil catena between miombo woodlands and valley grasslands, where water relations, fire and in some areas, frosts account for a rich diversity of geoxyles, with 198 species from 40 families being recorded by Meller et al. (2022). The presence of geoxyles is recognised in the local designation of these areas as the *anharas do ongote* (plains of the *ongote*) named for the two most abundant species of geoxyles, *Brachystegia russelliae* and *Cryptosepalum maraviense*. These geoxyles grow on sandy ferralsols, while the same



**Fig. 13.2** *Aloe gratia* on the slopes of Mount Moco, overlooking montane grasslands of the Huambo highlands

geoxyle habit is found in a different suite of species occupying the deep arenosols of the *chanas da borracha* (plains of the rubber plant—*Landolphia*) of Lunda and Moxico provinces of eastern Angola (Box 14.3).

Trees of these grasslands include species of *Faurea*, *Protea*, *Syzygium*, *Cussonia*, *Ochna* and *Parinari*. The grasses are shorter (0.5–1 m) than those of the mesic savannas, which range from 1 to 3 m height. The grass flora awaits detailed survey, with the species composition forming a continuum from short sparse grasses on shallow soils (*Aristida*, *Ctenium*, *Eragrostis*, *Themeda*, *Monocymbium*) (Fig. 3.10) to taller, more dense cover of Andropogoneae on deeper soils.

### 13.3 Faunal Composition of Afromontane Forests and Grasslands

The Afromontane forests and grasslands of Angola have a low diversity of mammals, with the few larger mammal species that formerly occurred in the highlands having mostly been hunted to local extinction. Other than the bird fauna, the animal fauna of the Afromontane forests and grasslands, and the flora, await detailed study. The avifauna, however, is exceptionally rich in range-restricted rare and endemic species. It has received considerable interest since the first museum expeditions to the Angolan highlands in the 1930s and increasingly over the past two decades (Dean et al., 2019).

Mills and Dean (2021) have documented the bird fauna of Mount Moco and the other Afromontane forests and grasslands of the Angolan highlands. Their checklist for Mount Moco confirms records of 299 species, including eight of Angola's 24 endemic birds: Swierstra's Francolin, Red-backed Mousebird, Pale-throated Barbet, Huambo Cisticola, Angola Slaty Flycatcher, Ludwig's Double-collared Sunbird, Landana Firefinch and Angola Sweet Waxbill. In addition, Mount Moco is important for the survival of 12 subspecies endemic to the western Angolan highlands. The most important endemic at Mount Moco is Swierstra's Francolin with an estimated 75 pairs on the mountain (Mills et al., 2011).

Mills and Dean (2021) note: "Within this avifauna is found the entire continuum of the speciation process, from isolated but undifferentiated populations, such as African Olive Pigeon *Columba arquatrix*, to phenotypically divergent endemic subspecies, like the *angolensis* race of Western Green Tinkerbird *Pogoniulus coryphaea*, to species, including the endemic Swierstra's Francolin *Pternistis swierstrai*. The nearest relatives of all these birds occur in distant highland areas, and in Angola are evolving separate lineages in isolation."

The Mount Moco study area is less than 100 km<sup>2</sup> in extent, of which only 85 ha (0.85%) is closed Afromontane forests. Much of the forest is disturbed by human activities. Based on records from the 1930s and 1950s, several species of birds have already been driven to local extinction on Mount Moco, including Pale-throated Barbet, Orange Ground Thrush, Laura's Woodland Warbler and Bar-tailed Trogon have not been recorded this century. A larger area (ca. 580 ha) of Afromontane forests occurs at Mount Namba, which has yet to be surveyed in detail. Its importance as a final refuge for Angola's threatened Afromontane species is obvious. A short-list for typical amphibian, bird, mammal and reptile species recorded in Angolan Afromontane forests and grasslands is given in Table 13.2.

**Table 13.2** Vertebrate species typical of the Afromontane forests and grasslands of Angola

- **Amphibians:** Chela Mountain Reed Frog, Anchieta's Tree Frog, Udzungwa Ridged Frog
- **Reptiles:** Benguela Gecko, Mountain Day Gecko, Angolan Rough-scaled Lizard, Marx's Rough-scaled Lizard, Angolan Girdled Lizard, Anchieta's Chameleon, Angolan Adder, Link-Marked Sand Racer
- **Birds:** Finsch's Francolin, Swierstra's Francolin, Ruwenzori Nightjar, Fernando Po Swift, Naked-faced Barbet, Margaret's Batis, Perrin's Bushshrike, Angola Lark, Black-collared Bulbul, Brazza's Martin, Black-and-rufous Swallow, Laura's Woodland Warbler, Huambo Cisticola, Salvadori's Eremomela, Orange Ground Thrush, Angola Slaty Flycatcher, Bocage's Sunbird, Ludwig's Double-collared Sunbird, Oustalet's Sunbird, Bronzy Sunbird, Black-chinned Weaver, Dusky Twinspot, Angola Sweet Waxbill, Fulleborn's Longclaw, Black-faced Canary, Thick-billed Seed-eater

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