

The last Afromontane forests in Angola are threatened by fires



Afromontane forests – a unique ecosystem of cool, moist temperate forest that is now mostly restricted to high elevations – are a relic of glacial periods, when they were much more widespread in Africa^{1,2}. In southwestern Africa, only around 700 ha remains, all of which is located in Angola. The Namba mountain range in the highlands of western Angola contains the majority (about 85%) of the Afromontane forest patches of the region³. Despite these mountains only recently being explored by scientists³, they represent the best opportunity to conserve the most-threatened habitat in Angola – however, the situation there is alarming.

The Afromontane forest centre in Angola is part of a broader archipelago of Afromontane centres⁴; the centres were intermittently connected and isolated throughout dynamic Plio-Pleistocene climatic cycles, which created many opportunities for speciation. The Angolan centre has been particularly isolated throughout its geological history^{5,6}, which makes the levels of endemism – and the potential for scientific species description – enormous¹. For example, there are 18 endemic or near-endemic species and subspecies of birds¹; the Namba flat gecko (*Afroedura bogerti*) is known only from the Namba range (Fig. 1a). Several Angolan subspecies (such as Bocage's akalat (*Sheppardia bocagei bocagei*)) could be elevated to species status⁵ but until recently precious few had modern genetic samples, hindering such decisions. Furthermore, ten biologists who recently undertook an expedition to Namba (for 11 days in May 2022) are currently in the process of describing nine or ten probable new species from the trip: at least two rodents, at least three bats, one or two pygmy toads, one frog and one dragonfly (Fig. 1b, c). The trip recorded 271 plant taxa, including five new records for Angola (D. J. Goyder et al., manuscript in preparation). Given the high levels of endemism of Afromontane forests, Angola's 'National Biodiversity Strategy and Action Plan'⁷ calls for additional studies to advance protection of this ecosystem – but

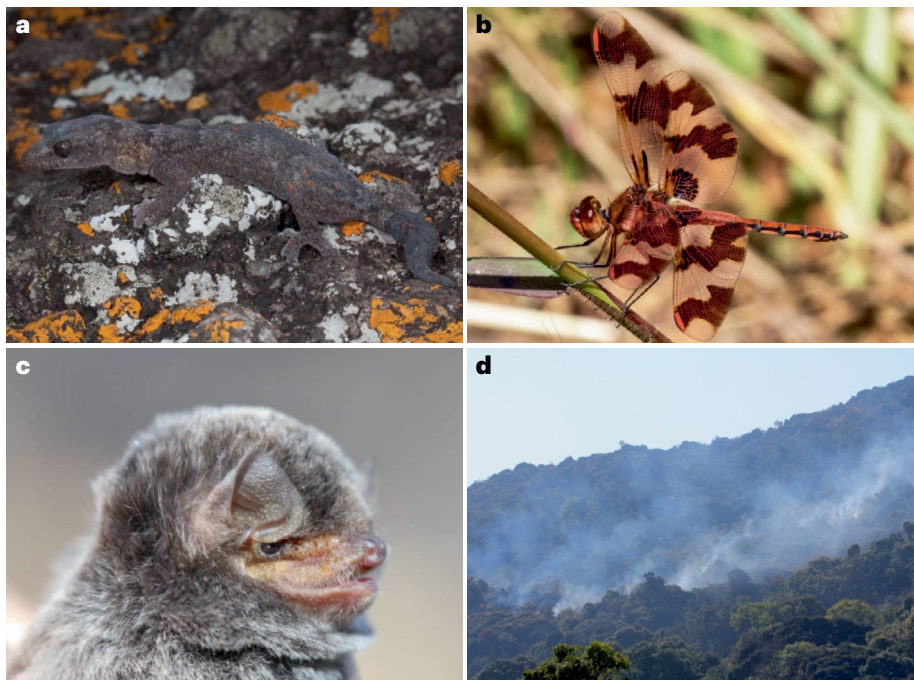


Fig. 1 | The Namba Mountains in central Angola. **a**, The Namba flat gecko (*Afroedura bogerti*) is known only from Namba. **b**, A new species of *Trithemis* dragonfly, found only at streams and bogs in the Namba Mountains; these wetland habitats rely on precipitation from the Afromontane forest fragments and, lying in the valleys, are particularly vulnerable to impacts such as grassland fires and drainage for agriculture. **c**, An undescribed species of *Miniopterus*, one of three bat species from the 2022 expedition that will soon be formally described. **d**, Fire within the interior of the forest observed during the 2022 expedition. Photographs by P.V.P. (a), Rogério Ferreira (b), A.M. (c), L.L.P. (d).

the plans are vague and there is no mention of the importance of the Namba Mountains.

Despite the promising findings of a large number of endemic and forest-restricted taxa, our excitement is tempered by observations of an escalating threat to the Namba forests. During three expeditions, in 2010 (M.S.L.M. and M.M.), 2021 (P.V.P. & K.C.) and 2022 (all authors), we documented fires within the closed-canopy forest (Fig. 1d). Fires were documented on 8 out of 18 total expedition days. Local people have corroborated the regularity of forest fires, reporting them in the interior forests of Namba as well as the losses of many hectares of edge to the surrounding grasslands. Fires have also been reported in the approximately 85 ha of Afromontane forest at nearby Mount Moco¹, which (as with

Namba) remains unprotected. Fires – both natural and manmade (for clearing) – have probably occurred sustainably in the adjacent grasslands for millennia. However, increasing human pressure combined with drier conditions (linked to climate change) may have changed this. Increasing demand for fuelwood and timber along with increased fire frequency has degraded the edges and enabled fires to penetrate into forest interiors. These conditions are no longer sustainable: one particularly severe fire in a dry year could jeopardize the future of the last remaining 700 ha of forest. Fires now pose an existential threat to this habitat akin to a tipping point, as in normal conditions these forests are effectively fireproof and they cannot regenerate under a regular fire regime^{8,9}. With at least

18 villages and settlements within 5 km of Namba, ongoing internal migration to the area and Angola's human population expected to quadruple by 2100 (ref. ¹⁰), the outlook for these forests is very concerning.

To protect these forests (which hold a critical piece of evolutionary history), the following actions are urgently needed:

- (1) Protect the land and involve local communities in its stewardship. Foundations such as The Rainforest Trust could arrange the private purchase and protection of much of these 700 ha of forest. Further, the newly re-elected Angolan government is likely to be receiving a windfall of profits from fossil fuels after the West's pivot from Russian energy; a small part of these profits could be used to protect Namba. Any formal protection of Namba and the adjacent grasslands and wetlands should be done in concert with local communities who should retain stewardship and whose ancestral conservation practices can inform management strategies. In a designated protected area, locals would have opportunities as eco-guards, guides, environmental educators and land managers.
- (2) Rely on local knowledge to control fires. We must first understand the cultural importance of fires for local communities in the adjacent grasslands and miombo woodlands. This knowledge should be used to create management systems towards protecting the Afromontane forests from the escalating fires in the area – similar to what is currently being done at Mount Moco, with the implementation of fire breaks using prescribed burns.

(3) Continue scientific exploration. Further biological expeditions are necessary to fully understand local levels of biodiversity and of endemism – including the use of molecular analyses to uncover cryptic species.

Although the unique Afromontane forests of Angola are under immediate threat from timber exploitation and uncontrolled fires, the relatively small size of the remaining forest and the lack of arable land on these rugged forested mountaintops are silver linings that offer the prospect of hope.

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References

1. Collar, N. J. & Stuart, S. N. *Key Forests for Threatened Birds in Africa* (International Council for Bird Preservation Monograph No. 3) (Cambridge Univ. Press, 1988).
2. Huntley, B. J. S. *Afr. Wildl. Mgmt. Assoc.* **5**, 157–166 (1974).
3. Mills, M. S. L., Melo, M. & Vaz, A. *Bird Conserv. Int.* **23**, 159–167 (2013).
4. White, F. *Afr. J. Ecol.* **19**, 33–54 (1981).
5. Vaz da Silva, B. A. D. N. *Evolutionary History of the Birds of the Angolan Highlands - The Missing Piece to Understand the Biogeography of the Afromontane Forests*. MSc. thesis, Univ. do Porto (2015).
6. Huntley, B. J. *Ecology of Angola: Terrestrial Biomes and Ecoregions* (Springer Open, 2023).
7. Government of Angola. *Presidential Decree no. 26/20 of February 6th. National Biodiversity Strategy and Action Plan (NBSAP 2019-2025)* (2020).
8. Hirota, M. et al. *Science* **334**, 232–235 (2011).
9. Kelly, L. T. et al. *Science* **370**, eabb0355 (2020).
10. UN Department of Economic and Social Affairs, Population Division. *World Population Prospects 2022*. <https://population.un.org/wpp/Graphs/Probabilistic/POP/TOT/24> (2022).

Competing interests

The authors declare no competing interests.