

The primates of the Udzungwa Mountains: diversity, ecology and conservation

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Summary - *The Udzungwa Mountains are one of the most important areas in Africa for primate diversity and conservation, with two endemic monkeys (Udzungwa red colobus *Procolobus gordonorum* and Sanje mangabey *Cercocebus [galeritus] sanjei*), and the near-endemic kipunji monkey *Rungwecebus kipunji*, a new genus and species discovered in 2004 and found in Udzungwa and Southern Highlands. With six species of galagos, or bushbabies, the area is also of exceptional importance for nocturnal primates. The form of Mountain galago *Galagoides orinus* occurring in the Udzungwa Mountains appears to be distinct on the base of vocalizations, and further work will be required to assess its taxonomic status. The primate community reflects the overall, exceptional biodiversity of these isolated and ancient mountains. The Udzungwa are part of the Eastern Arc mountain chain, a centre of global importance for biodiversity and endemism. Of all the Eastern Arc Mountain blocks, the Udzungwa have the largest forested area, widest altitudinal gradient and greatest habitat diversity. We review current knowledge on the diversity and distribution of the primate community of the Udzungwa Mountains, with an emphasis on ecology and conservation.*

Keywords - *Cercocebus, Cercopithecus, Chlorocebus, Colobus, Otolemur, Papio, Procolobus, Rungwecebus, Udzungwa.*

Introduction

Research on non-human primates of the Udzungwa Mountains of south-central Tanzania has increased steadily over the last 10-20 years and a considerable amount of knowledge has accumulated. Besides faunal inventories and distributional

surveys in the area, primates are among the very few groups on which ecological studies have also been conducted, including a monitoring programme in operation for almost 10 years. These efforts have contributed to detailed information on threats, and for scientifically-based conservation management recommendations. This is

therefore an appropriate time for a review on Udzungwa primates, and here we aim to do so by (i) giving an overview of the primate community for this outstanding biodiversity area, (ii) providing a detailed account for each species, (iii) summarizing species richness, abundance and ecological work, and (iv) describing the main threats and conservation issues. We conclude by listing the relevant research, monitoring and conservation initiatives in the area.

The Udzungwa Mountains

The Udzungwa Mountains (7°40' S to 8°40' S and 35°10' E to 36°50' E; see figure 1) is a massif occupying an area of about 10,000 km² and representing the southernmost "island" of an "archipelago" of mountain blocks running from southern Kenya (Taita Hills) through eastern and south-central Tanzania, known as the Eastern Arc Mountains (Lovett & Wasser, 1993). This chain, in turn, is biogeographically inscribed in the eastern African "montane circle" (Fieldså *et al.*, 2005), that includes Mount Elgon and the Kenya highlands (north), the Albertine Rift (west), and the Tanzanian Southern Highlands (south). Moreover, it is also part of the broader "Eastern Afromontane" biodiversity hotspot (Mittermeier *et al.*, 2005). The Eastern Arc is made of very ancient mountains, that are up to 30 million years old, and are partially covered in rainforest especially on the eastern slopes that are under the moist and cooling influence of the Indian Ocean. Over such long time, both altitudinal and climatic influences have maintained the forest cover, resulting in both the persistence of ancient taxa and the diversification of more recent ones (Lovett & Wasser, 1993). Therefore, endemic taxa have accumulated in the Eastern Arc Mountains over millions of years (Fieldså & Lovett, 1997) as indicated by the high density of endemic vertebrates recorded (Myers *et al.*, 2000; Burgess *et al.*, 2007). The area is vulnerable to human exploitation due to the relatively small size of the remaining forests, severe fragmentation (Brooks *et al.*, 2002) and lack of effective conservation management (Museo Tridentino di Scienze Naturali, 2007).

Within the Eastern Arc Mountains, the Udzungwa Mountain stands-out for containing the largest forest blocks, with the largest altitudinal gradient of continuous forest cover. Most forests of the Eastern Arc do not exceed 50 to 100 km² and occur only on the highest slopes (generally between 1500 and 2000 m of altitude). Instead, the eastern-facing escarpment slopes of the Udzungwa Mountains have maintained continuous forest cover from the Kilombero valley at 250 m a.s.l. to the highest ridges above 2000 m. This is probably due to the relative remoteness from the coast and the poor farming suitability of its landslide-prone slopes that delayed human colonization and prevented the area from deforestation, in comparison with other blocks such as the Usambara and Uluguru Mountains (J. Kingdon, personal communication). It is only during the 1950s, with the construction of the railway to Zambia that runs all along the eastern escarpment, that logging in the lower zones of the eastern forests was initiated. This opened the way to the development of villages and small towns such as Ifakara. Moreover, between 1929 and 1958, most of these forests were legally gazetted as Forest Reserves (e.g. Mwanihana, Nyanganje, Iyondo and Uzungwa Scarp), thus ensuring long-lasting protection.

The unique forest size and habitat diversity in the Udzungwa Mountains have probably facilitated speciation of relatively large forest mammals, including two endemic monkeys (Udzungwa red colobus *Procolobus gordonorum* and Sanje mangabey *Cercocebus sanjei*). Therefore, the importance of the Udzungwa Mountains (including 18 endemic and 42 Eastern Arc endemic vertebrates; updated from Burgess *et al.*, 2007) is very well reflected in the mammalian fauna (Kingdon & Howell, 1993; Rovero & De Luca, 2007). There are five Udzungwa-endemic mammals and 14 mammals which are endemic to the Eastern Arc Mountains, Southern Highlands and Mount Kilimanjaro (updated from Burgess *et al.*, 2007). Among the strictly endemic mammals, in addition to the two monkeys (see below), is the recently described giant elephant-