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THE MAMMALS OF KILIMANJARO

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ABSTRACT

This paper presents an up to date account of 154 mammal species recorded on Mount Kilimanjaro, Tanzania, and the surrounding area, from 1883 to the present, when 128 species are known to occur. Old records are reviewed and several new records added, while four recorded species have been excluded. One species, the black rhinoceros, is reported to have become extinct; another, the klipspringer, does not now occur in the area. Evidence for its alleged former presence and extinction is assessed. Red deer, introduced to Kilimanjaro during the German colonial period, is now extinct on the mountain. Other reported extinctions and colonisations of mammal species on Kilimanjaro are discussed and 19 marginal species or taxa for which further information is needed are mentioned for completeness.

INTRODUCTION

The Kilimanjaro massif in northern Tanzania is the result of three major and numerous minor centres of volcanic activity, now extinct with the exception of the dormant main cone, Kibo, which has the distinction, at 5895 m, of being the highest point in Africa (Downie & Wilkinson, 1972). The relative location of Kilimanjaro within the "Afromontane archipelago" (White 1981) has interested biologists and geographers since its discovery to European knowledge in 1848. As a relatively young mountain, believed to be less than one million years old (Hanby, 1987), it is of particular interest to biogeographers studying the distribution of species over time and space.

Scientific study of the mountain began in 1861 with the visit of Baron C.C. von der Decken and continued with some intensity until the defeat of the then colonial power, Germany, in the First World War. Under the British mandated administration there was little scientific activity on the mountain, with the notable exception of the University of Sheffield geological expeditions in 1953 and 1957 (Downie & Wilkinson, 1972). However several visitors during this period have left biological records. Since Independence in 1961 there has been a constant, if small, scientific output from research on the mountain. In recent years momentum has picked up with the publication in 1991 of the symposium *The Conservation of Mount Kilimanjaro* edited by W.D. Newmark, the extensive Kilimanjaro Elephant Project of Grimshaw and Foley in 1990, Cordeiro's

studies of birds (e.g. Cordeiro, 1994) and Lepidoptera, and Grimshaw's continuing vegetation survey (Grimshaw, in prep. a), with the result that we now have a much more complete understanding of the Kilimanjaro ecosystem.

The mammals of Kilimanjaro have received particular attention with publications by Thomas (1886, and in Johnston, 1886), Johnston (1886), Hunter (in Willoughby, 1889), True (1890), Sclater (1893), Volkens (1897), Lönnberg (1908), Miller (1934), Moreau (1944), Swynnerton & Hayman (1951), Salt (1953), Guest & Leedal (1954), Child (1965), Newmark, Foley, Grimshaw, Champegga & Rutazaa (1991) and Grimshaw & Foley (1991) all giving lists of mammals present on the mountain. In addition considerable information may be gleaned from the writings of travelers, explorers and big-game hunters (e.g. Thomson, 1885; Willoughby, 1889; Meyer, 1891). Museum collections have also been sources for some records. There are also several accounts of specific mammals as attributed in the list below.

Despite this considerable body of information there are several reasons why we feel it desirable to add this contribution to the literature. Firstly it presents a synopsis of reports of mammal occurrence from 1883 to the present day, a survey wider in scope than any of its predecessors, and permits the publication of the considerable body of recent information collected during our own research. In addition, this full survey makes it possible to present an alternative view to that expressed by Newmark *et al.* (1991) concerning the extinction of two species of mammals (klipspringer and mountain reedbeek) on Kilimanjaro.

The origins of the mammalian forest fauna of Kilimanjaro, an isolated recent volcano, have been discussed by Kingdon (1981) and Rodgers *et al.* (1982). It is considered that during times of climatic adversity during the Pleistocene, forest cover in East Africa was confined to an area in the eastern Zaire basin, from which forest and its associated fauna radiated during periods of climatic amelioration, such as that which followed the last glaciation. It seems probable that mammalian colonisers spread from the refuge by a northern and a southern route (Kingdon 1981, Rodgers *et al.* 1982). To the north and west Kilimanjaro is connected to the refuge by the Rwenzori, Mt Elgon, Mt Kenya and other Kenya highland areas; to the south the link is via the crystalline mountains of the Eastern Arc and the volcanics of the Southern Highlands of Tanzania. Studies indicate that mammals have reached Kilimanjaro by both routes, as well as from the coastal forests, and Rodgers *et al.* (1982) consider it to be an intermediate or transitional site in the process of mammalian spread.

The distribution of mammals on an East African mountain is largely determined by the vegetation type and Kilimanjaro is no exception. A number of altitudinal vegetation belts can be defined, of which the most important broad categories are wooded or bushed grassland, cultivation, montane forest, heathland, alpine and nival (fig. 1). The vegetation zones are not regularly concentric and are directly related to climate (Pócs, 1990, Grimshaw, in prep.a). In general it can be stated that rainfall is greater on the southern and eastern slopes than on the northern and western slopes, resulting in significant differences in forest composition. A distinct rainfall distribution pattern may also be seen with precipitation increasing with altitude from the plains to the upper part of the montane forest and then decreasing to a minimum above 5000 m (Hastenrath, 1991; Sarmett & Faraji, 1991). This and the temperature gradient largely determine the vegetation zones.

The wooded grassland of the lower southern and eastern slopes has now been largely destroyed for agriculture, but relic patches remain. It is characterized by broad-leaved, evergreen small trees, in contrast to the *Acacia* 'savanna' of the lower northern and western slopes. The lower parts of the montane forest have also generally been lost to cultivation, especially on the south and east. Here little natural vegetation remains between 1000–800 m. Above this is wet forest, characterized by *Ocotea usambarensis*, but this is often replaced by secondary regrowth

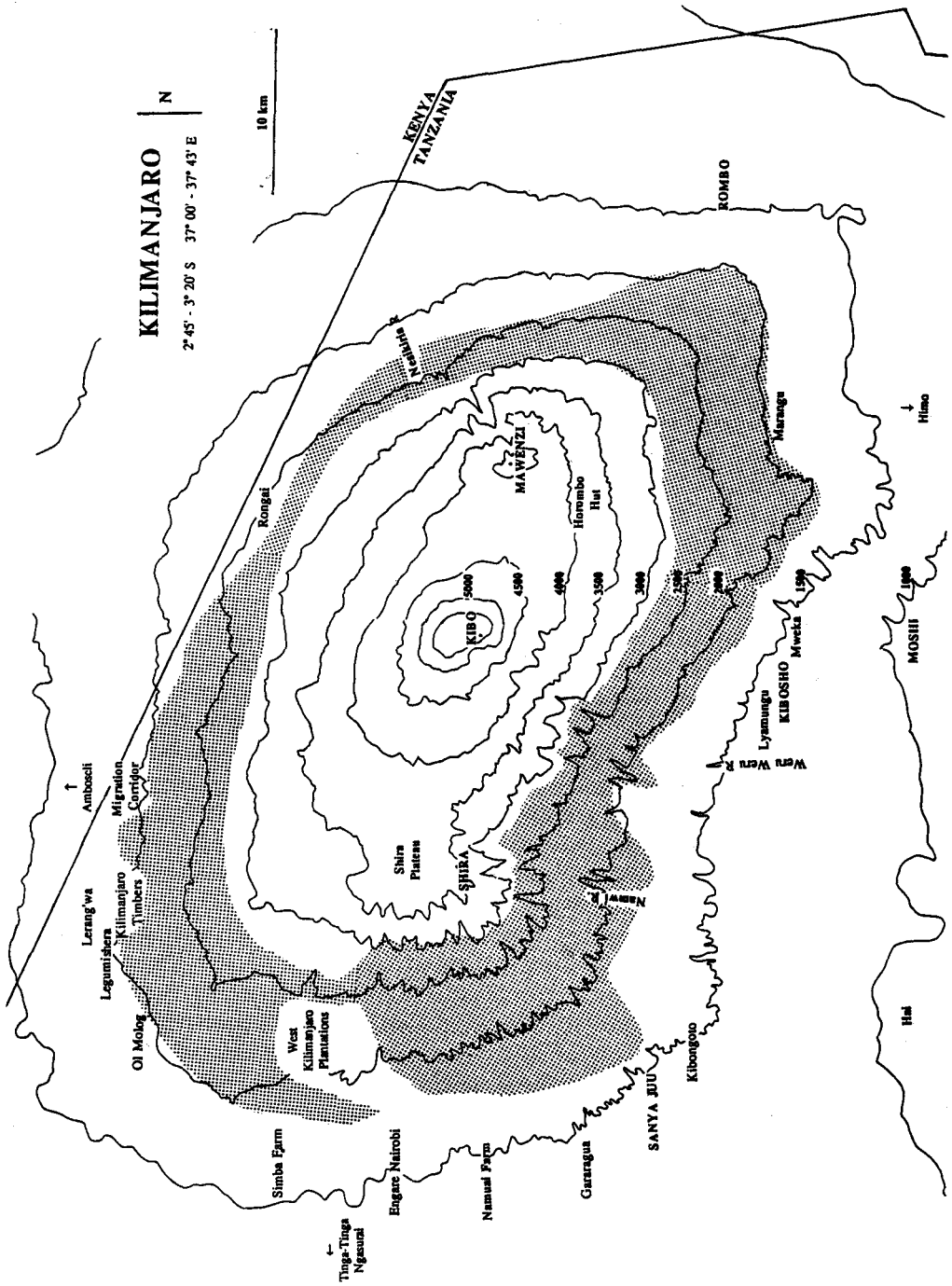


Figure 1. Kilimanjaro and its environs.

in which *Macaranga kilimandscharica* is abundant. The understorey is dense, with many woody herbs or shrubs of the Acanthaceae and Rubiaceae. Above about 2400 m *Podocarpus latifolius* becomes the most important tree; the cooler, wetter conditions are indicated by the increased importance of bryophytes. Between 2700–3000 m the forest gives way first to ‘Giant Heather’—a fire-induced community of *Erica excelsa*, and then to altimontane vegetation (the ericaceous and alpine belts) of grassland and shrubland, which diminishes in stature with altitude in passing through the alpine regions. The limit of vegetation is at about 4700 m.

On the western and northern slopes the forest is much drier and appears quite different. The lower parts are not completely destroyed and are often dominated by *Olea europaea* ssp. *cuspidata* (syn. *O. africana*) with trees such as *Calodendrum capense* and *Croton megalocarpus*. Above this is a band of dry montane forest, often very strongly dominated by *Cassipourea malosana*, with Acanthaceae and the shrubby *Piper capense* beneath. As with the southern slope, *Podocarpus latifolius* is again dominant above 2400 m, but here it grows above a very open forest floor. Giant *Erica excelsa* again forms the transition between forest and altimontane vegetation.

The montane forest is protected as a Forest Reserve, while land above 2700 m forms Kilimanjaro National Park, which also has six corridors through the forest zone (IUCN/UNEP, 1987). The only area around Kilimanjaro in which natural vegetation remains in unbroken progression from the plains to the limit of vegetation at about 4600 m, is a 7 km broad strip on the northern slope. This area acts as a migration route and dispersal area for mammals from Kilimanjaro and the Amboseli basin (Grimshaw & Foley, 1991) and has been awarded protected status by the Tanzanian Government (District Commissioner, Monduli, pers. comm., 1994). Elsewhere the mountain is encircled by a zone of cultivation and settlement, which has almost entirely replaced the natural vegetation. On the southern and eastern slopes this is characterized by the smallholdings of the Chagga people, with their intensively cultivated banana and coffee plantations, down to approximately 1000 m. Below this level agriculture has spread out onto the plains and away from the area formerly occupied by montane vegetation (O’Ktingati & Kessy, 1991). On the drier western and northern slopes the lower limit of cultivation is between 1300–1600 m. Below these altitudes typically montane vegetation was replaced by dry bushland which is now, in places, under partial cultivation. There are also large areas (6125 ha) of plantation forests on the western and north-eastern slopes (Lamprey *et al.*, 1991).

The mammal fauna of the plains is largely distinct from the montane fauna, and previous authors, especially Moreau (1944), Child (1965) and Newmark *et al.* (1991), have attempted to make a rigorous distinction between the mammal fauna of the montane forest and that of the cultivated areas and natural plains vegetation. In view of the mobility of most mammal species we believe this to be artificial and unreliable, resulting in a crop of additions or deletions of records for each belt. In addition the forest edge, on all slopes of the mountain, appears to be largely an artifact of human action, and to have been so for the entire time-span of this review (Grimshaw, in prep. a). In this paper we therefore consider all mammals known to occur in the area defined below, and note localities and habitats in which they have been recorded to occur.

The definition of ‘Kilimanjaro’ for the purpose of this or similar studies is not easy. The area of Kilimanjaro volcanics can be defined quite precisely (Downie & Wilkinson, 1972) and certainly delimit the mountain in a geological setting. However, the geological margins are variable in altitude and extent on the different aspects of the mountain. Ecological boundaries are also variable, as described above, and although it would be possible to use certain species of plants, such as the baobab *Adansonia digitata*, as indicators of non-montane ecosystems in certain

areas, there is no one definitive species to fulfil this role for the entire mountain (JMG, pers. obs.). Swynnerton & Hayman (1951) defined Kilimanjaro as the land lying above the 900 m contour within the coordinates 2° 45' to 3° 20' S and 37° 55' to 38° 40' E. It would be desirable to use this definition for purposes of continuity and comparison, but unfortunately the latitudes given are incorrect (overlooked by Child (1965)). We have therefore decided to use the widely available and extremely accurate 1:100,000 *Tourist Map of Kilimanjaro* (Ordnance Survey/ Government of Tanzania, 1989: Special Sheet) to define Kilimanjaro for the purpose of this paper. The coordinates we use are therefore 2° 45' to 3° 20' S and 37° 00' to 37° 43' E. This has the advantage that the longitudinal boundaries are the same as those used by Swynnerton & Hayman (1951); we also follow them by excluding records from below 900 m and Kenya. Despite the different boundaries used, Swynnerton & Hayman's list (1951) remains the foundation of this paper; most of their records are listed with identifiable locations, which enables them to be related to the boundaries defined here. Nomenclature and sequence of families follows the family authors in Wilson & Reeder (1993); this modern review introduces some unfamiliar names and in these cases synonymy is indicated for the sake of continuity. English names follow Davies & Vanden Berghe (1994).

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INSECTIVORA

Erinaceidae

Atelerix albiventris (Wagner, 1841) (syn. *Erinaceus albiventris*) Four-toed Hedgehog

Child (1965) and Newmark *et al.* (1991) erroneously recorded the local hedgehogs as *A. frontalis* A. Smith, 1831 (Southern African Hedgehog); Moreau (1944) was correct in attributing the local hedgehog to *A. albiventris*. Hutterer (1993) defines the distribution of *A. frontalis* as being southern African, occurring chiefly south of the Zambesi, while *A. albiventris* is recorded from most of sub-saharan Africa south to Malawi and Zambia. Hedgehogs are common in the cultivated zone on the southern and eastern slopes and may often be seen in Moshi town. Moreau (1944) excluded it from his list of montane mammals on the grounds that it was a species of the cultivated zone, not penetrating the forest; Kingdon (1974) also states that it does not usually occur in forests, but Newmark *et al.* (1991) include it as a forest species.

Soricidae

Sylvisorex granti Thomas, 1907 Least Long-tailed Forest Shrew

Present in montane forest, high altitude grassland and the alpine belt (Heim de Balsac, 1957, Kingdon, 1974; Rodgers *et al.*, 1982).

Crocidura allea Osgood, 1910 Highland Musk Shrew

An Afromontane endemic in Tanzania and Kenya, occurring from the forest to the alpine zones. Shore & Garbett (1991) found it to be the second most abundant small mammal on the Shira Plateau, occurring at densities of 2.9-5.8/ha. It has been recorded to at least 3700 m (Child, 1965).

[*Crocidura elgonius* Osgood, 1910 Mt. Elgon Musk Shrew

Rodgers *et al.* (1982) record this species from the Kilimanjaro forest, but no earlier records or specimens have been traced. Elsewhere the species is known from Mt. Elgon (Heim de Balsac & Meester, 1971), Kingori Juu and the Uluguru range (Swynnerton & Hayman, 1951), with a recent record from Amani, East Usambara (W. Stanley, pers. comm., 1995).]

- [*Crocidura fischeri* Pagenstecher, 1885 Fischer's Musk Shrew
Recorded from Himo (Hutterer, 1993) and may occur in the defined area.]
- [*Crocidura fumosa* Thomas, 1904 Kenyan Montane Musk Shrew
This species is known only from Mt Kenya and the Aberdares (Hutterer, 1993) but has been reported from the cultivated area at Kibongoto (Lönnberg, 1908) to about 2600 m in the forest (Moreau, 1944; Swynnerton & Hayman, 1951; Child, 1965). These records are presumably in error for another species and thus must remain inconclusive until specimens are re-evaluated or further collections are made on Kilimanjaro.]
- [*Crocidura gracilipes* Peters, 1870 Peter's Musk Shrew
C. gracilipes is known only from the type specimen; with the locality of 'Kilimanjaro' (applied by Matschie (1892)) (Hutterer, 1993). R. Hutterer & D. Kock (pers. comms., 1995) have both emphasised that the collecting locality of the holotype is actually unknown, being merely 'from the collections of von der Decken on his way to Kilimanjaro' (Peters, 1870) - which could be anywhere en route from the coast. The type specimen resembles *C. cyanea*, a lowland species (Hutterer, 1993). We therefore exclude it from the list of Kilimanjaro mammals.]
- C. hildegardeae* Thomas, 1904 Hildegard's Musk Shrew
Records of *C. gracilipes* from 1800 m in the forest and below (Moreau, 1944; Child, 1965), and at Lyamungu (Swynnerton & Hayman, 1951) probably refer to *C. hildegardeae* (a common species of forests in central and eastern Africa) with which it was formerly considered to be conspecific (Hutterer 1993). Specimens of *C. hildegardeae* collected by B. Cooper in 1937 at 1400 m on the western slope are preserved at the Field Museum of Natural History, Chicago (henceforth; "specimens in FMNH leg. B. Cooper, 1937").
- Crocidura luna* Dollmann, 1910 Greater Grey-brown Musk Shrew
Known from the western slope at 1400 m (specimens in FMNH leg. B. Cooper, 1937), and recorded from 'Kilimanjaro, Moshi' by Dippenaar & Meester (1989).
- [*Crocidura maurisca* Thomas, 1904 Northern Swamp Musk Shrew
Known only from Entebbe and Echuya swamp (Uganda) and Kaimosi (Kenya) (Heim de Balsac & Meester, 1971; Hutterer, 1993). Lönnberg (1908) recorded it from Kibongoto, presumably in error, probably for *C. monax* R. Hutterer (pers. comm., 1995).]
- Crocidura monax* Thomas, 1910 Rombo Musk Shrew
A forest species, noted from the forest at 1800 m by Moreau (1944) and Child (1965) and from Rombo (1650 m) (specimens, including the type, in the Natural History Museum, London (henceforth; NHM, leg. R. Kemp, 1910), and accepted for Kilimanjaro by Dippenaar (1980). May also occur at higher altitudes.
- Crocidura olivieri* (Lesson, 1827) (syn. *C. martiensseni*, *C. flavescens*) Northern Giant Musk Shrew
Occurs near or just within the forest between 1800-2000 m, with a record from Marangu (Moreau, 1944; Swynnerton & Hayman, 1951; Child, 1965) and Mweka (specimen in NHM leg. G.S. Child 1971).
- Myosorex zinki* Heim de Balsac & Lamotte, 1956 Kilimanjaro Mouse Shrew
R. Hutterer (pers. comm., 1995) regards this as a good species (included, in error (pers. comm., 1995), as a synonym of *Crocidura allea*, in Hutterer (1993); it is the only endemic mammal on Kilimanjaro, known from just two specimens from the ericaceous or alpine belt (Heim de Balsac, 1970).

CHIROPTERA

Pteropodidae

Epomophorus labiatus (Temminck, 1937) Little Epauletted Fruit Bat

The only record for this species in the Kilimanjaro area describes an attack by hornbills *Bycanistes cristatus* on a flock of 20-25 individuals, that roosted for a period of 'at least four weeks' in a tree at Lyamungu. The bats roosted at a height of about 10 m from the ground (Mrs. J. Kingdon, 1973). This species is known to move about in flocks, staying for short periods and moving on again (J. Kingdon, pers. comm., 1995).

Epomophorus wahlbergii (Sundevall, 1846) Wahlberg's Epauletted Fruit Bat

Recorded from Engare Nairobi and Old Moshi (Lönnberg, 1908; Neumann, 1900; Swynnerton & Hayman, 1951; Child, 1965), Moshi (Matschie, 1892; Bergmans, 1988), Kibosho (Demeter & Topal, 1982) and near Sanya Juu (Eisentraut, 1958; Bergmans, 1988); probably occurs in the lower parts of the forest and surrounding cultivation.

Eidolon helvum (Kerr, 1792) Straw-coloured Fruit Bat

Recorded from the Weru Weru River (Swynnerton & Hayman, 1951; Child, 1965; Bergmans, 1991).

Rousettus aegyptiacus (E. Geoffroy, 1810) Egyptian Fruit Bat

Recorded from Moshi by Eisentraut (1958) (including the Makoa cave) and Bergmans (1991) and by J. Kingdon (pers. comm., 1995) from the southern slope near Mweka in the 1970s.

Rousettus angolensis (Bocage, 1898) Bocage's Fruit Bat

Recorded by Swynnerton & Hayman (1951) from Kibongoto, and from Moshi by Eisentraut (1958).

Rousettus lanosus Thomas, 1906 African Long-haired Fruit Bat

Recorded by Lönnberg (1908) from Kibongoto.

Emballonuridae

Taphozous mauritanus E. Geoffroy, 1818 Mauritian Tomb Bat

Recorded from Moshi by Kock (1969).

Nycteridae

Nycteris hispida (Schreber, 1775) Hairy Slit-faced Bat

Recorded from between Moshi and Mweka by J. Kingdon (pers. comm., 1995).

Nycteris thebaica E. Geoffroy, 1818 (syn. *N. capensis*) Egyptian Slit-faced Bat

Recorded from Kibongoto (Lönnberg, 1908) and the Kilimanjaro area (Neumann, 1900; Swynnerton & Hayman, 1951; Child, 1965); probably occurs in lower parts of the forest and surrounding cultivation.

Megadermatidae

Cardioderma cor (Peters, 1872) (syn. *Megaderma cor*) Heart-nosed Bat

Probably occurs in cultivated areas and woodland below the forest (Swynnerton & Hayman, 1951; Child, 1965).

Lavia frons (E. Geoffroy, 1810) Yellow-winged Bat

Recorded from Kibongoto (Lönnberg, 1908) and Engare Nairobi (Swynnerton & Hayman, 1951); present in cultivation and bushland below the forest.

Rhinolophidae

Rhinolophus clivosus Cretzschmar, 1828 (syn. *R. deckenii* Peters, 1867) Arabian Horseshoe Bat

Recorded from below the forest by Moreau (1944) with specific localities of Rombo (Thomas, 1913; Swynnerton & Hayman, 1951), Kibongoto (Lönnberg, 1908), Kibosho (Demeter & Topal, 1982). Child's (1965) record of *R. ferrum-equinum* Schreber, 1774, (a Palearctic species)

refers to this taxon.

[*Rhinolophus fumigatus* Rüppell, 1842 Rüppell's Horseshoe Bat

J. Kingdon (pers. comm., 1995) believes that this species occurred in the roof of his house near Moshi during the 1970s, but the record needs verification.]

Rhinolophus landeri Martin, 1838 (syn. *R. lobatus*) Lander's Horseshoe Bat

Occurs below the forest (Moreau, 1944; Child, 1965), with records from Rombo and Marangu (Thomas, 1910; Swynnerton & Hayman, 1951) and Kibosho (Demeter & Topal 1982) and near Moshi (Eisentraut 1958).

Hipposeridae

Hipposideros caffer (Sundevall, 1846) Sundevall's Leaf-nosed Bat

Probably occurs below the forest (Child 1965); recorded for the Kilimanjaro area (precise locality unspecified) by Andersen (1906) and from near Moshi (Eisentraut 1958).

Vespertilionidae

Pipistrelus nanus (Peters, 1852) Banana Bat

Noted from Moshi (Thomas 1886), Kibongoto (Lönnberg 1908), Kibosho (Demeter & Topal 1982); common in banana plantations and possibly occurring in the lower parts of the forest.

Chalinolobus sp. (poensis) (syn. *Glauconycteris poensis* Gray, 1842) Butterfly Bat

This west African species (Hayman & Hill, 1971; Koopman, 1993; D. Kock, however, considers that *C. poensis* does occur in Tanzania (pers. comm., 1995)) is recorded by Uchikawa (1991) as a specimen collected at Marangu 23 November 1968, now in the American Museum of Natural History, New York. This record clearly needs verification; several other species of *Chalinolobus* occur in East Africa and it is possible that this specimen was misidentified. J. Kingdon (pers. comm., 1995) has suggested that this specimen is most likely to be *C. variegatus* (Tomes, 1861).

Eptesicus tenuipinnis (Peters, 1872) White-winged Serotine

J. Kingdon (pers. comm., 1995) has observed this distinctive species near the College of African Wildlife Management at Mweka.

Mimetillus moloneyi Thomas, 1904 Moloney's Flat-headed Bat

A specimen was collected in 1974 by J. Kingdon (pers. comm., 1995) from over a pool near Mweka College.

Scotophilus nigrita (Schreber, 1774)/*dinganii* (A. Smith, 1833) African Giant House Bat

Occurs below the forest (Child, 1965) and recorded (as *S. dinganii*) from Moshi (Eisentraut, 1958). The taxonomy of *Scotophilus* is still unresolved; D. Kock (pers. comm., 1995) believes that the species of the Kilimanjaro area is *S. dinganii* (A. Smith, 1833).

[*Miniopterus schreibersi* (Kuhl, 1817) Common Long-fingered Bat

A widespread species, collected by Kittenberger at Arusha-Chini in 1902 (Demeter & Topal, 1982); may possibly occur within the defined area.]

Molossidae

Chaerephon ansorgei (Thomas, 1913) (syn. *Tadarida ansorgei*) Ansorge's Free-tailed Bat

Present below the forest; noted from Lyamungu (Swynnerton & Hayman, 1951) and the Weru-Weru river (Harrison 1960).

Chaerephon bemmeleni (Jentink, 1879) (syn. *Tadarida cistura*) Gland-tailed Free-tailed Bat

Present below the forest; noted from the Weru Weru river (Swynnerton & Hayman, 1951; Peterson, 1971).

Chaerephon pumila (Cretzschmar, 1826) (syn. *Tadarida naivashae*, *T. pumila*) Little Free-

tailed Bat

Occurs below the forest; noted from the Weru-Weru river by Swynnerton & Hayman (1951) and from 'Kilimanjaro' by Kershaw (1921).

Tadarida fulminans (Thomas, 1903) Spotted Large Free-tailed bat

Present below the forest; noted from the Weru-Weru river (Swynnerton & Hayman, 1951; Harrison, 1971). D. Kock (pers. comm., 1995) suggests that some records of certain *Chaerephon/Tadarida* species from the Kilimanjaro area may be confused.

[*Tadarida ventralis* (Heuglin, 1861) (syn. *T. africana*) African Giant Free-tailed Bat

Recorded from 'Kilimanjaro, 1902' from the collections of K. Kittenberger (Demeter & Topal, 1982).]

PRIMATES

Galagonidae

Otolemur garnettii (Ogilby, 1838) (ssp. *panganiensis*) (syn. *Galago crassicaudatus* (E. Geoffroy, 1812) Large-eared Greater Galago

Common in the cultivated zone and lower part of the forest, to at least 2400 m on the western slope (NJC pers. obs.). Something of a pest in cultivation as it eats fruit. A melanistic individual was seen in the forest above Lerang'wa in 1990 (JMG & CAHF).

Galagoides zanzibaricus (Matschie, 1893) (syn. *Galago zanzibaricus* Matschie, 1893, *G. senegalensis* (E. Geoffroy, 1796)) Zanzibar Galago

A dry bush species; probably widespread on the plains but only observed by us in the North Kilimanjaro Migration Corridor at about 1600 m. Recorded from Old Moshi by Swynnerton & Hayman (1951) and collected at 1500 m on the western slope by Cooper (specimens in FMNH leg. B. Cooper, 1937). Jenkins (1987) comments that this species has previously been generally ascribed to *G. senegalensis*.

Cercopithecidae

Papio hamadryas (Linnaeus, 1758) Baboon

Groves (1993) considered all baboons to be subspecies of *P. hamadryas*, a view that is not widely accepted (e.g. Napier, 1981; J. Kingdon, pers. comm., 1995), but followed here to conform with the nomenclature of Wilson & Reeder (1993).

Child (1965) recorded the presence of two baboon species from Kilimanjaro; *Papio anubis*, the Olive Baboon and *P. cynocephalus*, the Yellow Baboon. *Ssp. cynocephalus* seems to occur at lower altitudes, usually outside the defined area. The population in Amboseli has been the subject of a long-term research project. *Ssp. anubis* is the common baboon of northern Tanzania and is found on the northern and western slopes of Kilimanjaro where water is present, and where it is a noted pest of cultivation. Usually found at the forest edge, it occasionally penetrates deep into the dry forest of the lower slopes. Swynnerton (1955) recorded the interesting observation of baboons catching small trout from the Engare Nairobi South river. This is one of the species Newmark *et al.* (1991) listed as a new record for the forest, although Johnston (1886) recorded it as being abundant on the southern slope up to 1830 m. It is also currently present in the Kahe and Rau Forest Reserves south of the mountain (NJC pers. obs.). It seems probable that this (and other species listed as new records for the forest by Newmark *et al.* (1991)) had not been previously recorded from the forest as a deficiency of observation, especially on the remote northern slope, rather than being present due to a recent colonisation event. There is some evidence that it migrates from north Kilimanjaro to Amboseli, where a hybrid zone with the yellow baboon (ssp. *cynocephalus*) occurs (Samuels & Altmann, 1986). A putative hybrid baboon has also been

noted from the Kikafu river area at about 980 m (Swynnerton & Hayman, 1951).

Chlorocebus aethiops (Linnaeus, 1758) (syn. *Cercopithecus aethiops*) Vervet Monkey

A dry bush species, but also occurring in relict patches of forest in farmland, as at Legumishera Farm (1740 m) on the northern slope, where it also raids cultivation. On the southern slope there are old records from Old Moshi (Swynnerton & Hayman, 1951) and Kibongoto (Lönnerberg, 1908).

The use of *Chlorocebus* is contentious (P.D. Jenkins, J. Kingdon, pers. comms., 1995); J. Kingdon prefers to consider all vervets as a superspecies, *Cercopithecus pygerythrus* (pers. comm., 1995).

Cercopithecus mitis (Wolf, 1822) (ssp. *kibonotensis*) Blue Monkey

Extremely common throughout the forest, especially at mid-altitudes, although occurring to 2700 m (specimen in Natural History Museum, London, cited by Napier, 1981). It also extends below the montane forest along riverine forest; for example it is frequently seen on the bridge carrying the main Arusha to Moshi road over the Kikafu river at 980 m. It is a pest in the shambas and also in the conifer plantations of the western and north-eastern slopes where large numbers are shot by the Forest Project authorities (Grimshaw & Foley, 1991).

Erythrocebus patas (Schreber, 1775) Patas Monkey

A dry bush species, listed for Engare Nairobi by Swynnerton & Hayman (1951). A small population still occurs in the *Acacia* woodland west of Simba Farm, below Lotigeli hill. A single individual was also observed in the North Kilimanjaro Migration Corridor in 1990 (JMG & CAHF). The population of this area may be disjunct from any other, as the nearest known population is in the western Serengeti (Swynnerton & Hayman, 1951); it has never been observed in Amboseli (J. Poole, pers. comm., 1990).

Colobus guereza Rüppell 1835 (syn. *C. abyssinicus*) (ssp. *caudatus*) Kilimanjaro Black-and-white Colobus

A distinct subspecies, characterized by its bushy tail that is white from the base; it is generally stated to be endemic to Kilimanjaro and Mt Meru (e.g. Haltenorth & Diller, 1980), but Napier (1985) cites a specimen of this subspecies from the western Serengeti. On Kilimanjaro it is found throughout the montane forest, although it varies in abundance. Apparently most frequent on the northern and western slopes between 1800-2300 m where very dense populations occur; less abundant on the southern slope and sometimes, as on the Marangu and Mweka routes, distinctly scarce. On the Umbwe route it is, however, more abundant (NJC pers. obs., 1984). In the past it has been hunted for its coat and this may sporadically still occur. It also occurs in conifer plantations, where it is not shot, and riverine forest. Relict and now isolated populations occur in the Rau and Kahe I and II forest reserves.

Guest & Leedal (1954) document the surprising discovery of a colobus carcass at 4680 m in a cave on the south-eastern slope of Kibo; presumably a freak ascent.

CARNIVORA

Canidae

Canis mesomelas Schreber, 1775 Black-backed Jackal

Common in dry bushland below the forest. In 1990 it was reported from the Shira Plateau by a Partridge Films crew working there; a jackal species was also recorded in this area in 1982 by a British school expedition (Tomlinson, 1982). It is likely to occur within the montane forest occasionally.

Canis adustus Sundevall, 1847 Side-striped Jackal

According to Newmark *et al.* (1991) sightings of this species by JMG & CAHF in dry forest

on the northern slope in 1990 were the first record for the forest, although Johnston (1886) records it as being the most common canid. In more recent times it had almost certainly been overlooked. P.D. Moehlan (pers. comm., 1990) believes that it probably occurs in the coffee plantations around Kilimanjaro, as suggested by Swynnerton & Hayman (1951) and Lönnberg (1908) with records from Kibongoto to Moshi. In 1992 it was seen by JMG in dry bushland near Ol Molog.

[*Canis aureus* Linnaeus, 1758 Golden Jackal

Listed by Child (1965) as occurring in the Kilimanjaro area. A dry bush species, it was noted by Swynnerton & Hayman (1951) and Lönnberg (1908) from the Engare Nairobi and Kibongoto areas. It occurs on the plains to the west of Kilimanjaro (NJC, pers. obs., 1983-85, JMG, pers. obs., 1994) but its presence within the defined area needs confirmation.]

Otocyon megalotis (Desmarest, 1822) Bat-eared Fox

Apparently a new record for the Kilimanjaro area; a dead individual was seen on the road at Gararagua (1350 m) in 1993 by JMG. A plains species.

Lycyon pictus (Temminck, 1820) Hunting Dog

This endangered species is the only mammal other than man known to have reached the summit of Kilimanjaro (5895 m) (Thesiger, 1970). Child (1965) also documents their presence in the moorland and alpine zones, first recorded on skeletal evidence from 5730 m by Guest & Leedal (1953), but questions whether they were resident on the mountain. A possible high altitude record was made in 1989 (Watson, 1989). It is believed that Hunting dogs still occur in Tsavo National Park and there are regular sightings on the Masai Steppe to the south of Kilimanjaro (T. Fitzjohn, pers. comm., 1993). Hunting dogs were seen crossing the main road between Namanga and Nairobi near the village of Bissel (Kenya) in 1992 (J. Roberts, pers. comm., 1992), and near Namanga (on the Tanzanian side) in 1986 (P. Eglund, pers. comm., 1986) so it seems that a population still exists in the bushland adjacent to Kilimanjaro from which vagrants may visit the mountain. From this wider population it is of note that between 1981 and 1990 Game Scouts shot 52 individuals of this species in Kilimanjaro Region (which also includes the North and South Pare mountains and the Mkomazi Game Reserve area) (Regional Wildlife Officer, pers. comm., 1990).

Mustelidae

Ictonyx striatus (Perry, 1810) Zorilla

Probably reasonably common in the drier parts of the cultivated zone as it suffers heavy road casualties, but numbers seem to fluctuate. Moreau (1944) records it to 1830 m; he also records it from the moorland of Mt Kenya.

Mellivora capensis (Schreber, 1776) Ratel or Honey Badger

Present in the cultivated zone of West Kilimanjaro at about 1750 m, and probably occurring widely throughout the area. Lönnberg (1908) noted it from Kibongoto.

Viverridae

Nandinia binotata (Gray, 1830) African Palm Civet

Lönnberg (1908) recorded a pregnant female from Kibongoto in 1905; there seem to be no other records of this species, although it is probably present in at least the cultivated zone of the southern slope. The single record for this species is probably due to its nocturnal and retiring behaviour.

Civettictis civetta (Schreber, 1776) East African Civet

Probably found throughout the Kilimanjaro area; common in the cultivated zone where it is a frequent road casualty; and observed in the forest at Kilimanjaro Timbers (2000 m) in 1990

(JMG & CAHF). Moreau (1944) and Child (1965) list records for the moorland and alpine zones.

Genetta maculata (Gray, 1830) (syn. *G. tigrina*) Large-spotted Genet

Present in the forest of the northern slope and probably widespread; Moreau (1944) gives a record from Marangu at 1830 m. Demeter & Topal (1982) record it from Moshi, and road-casualties of genets have been seen there in recent years (JMG), although it is not clear to which species they belong. In 1993 a melanistic genet was observed on several occasions near Ol Molog (C. Stubbs, pers. comm.); it was not possible to ascertain its species. Formerly recorded as *G. tigrina* Schreber, 1776, as currently delimited this species is restricted to South Africa (Wozencraft, 1993), but this classification is controversial, according to J. Kingdon (pers. comm., 1995).

Genetta genetta (Linnaeus, 1758) Common Genet

Believed to be present in the drier parts of the lower slopes (Allen, 1939), but requiring strict confirmation.

Herpestidae

Herpestes ichneumon (Linnaeus, 1758) Egyptian Mongoose

Common in the cultivated zone of the western and northern slopes and recorded from Moshi by Demeter & Topal (1982). Also observed at 2000 m in the forest on the northern slope by JMG in 1992, and in the vicinity of the West Kilimanjaro plantation forests in 1991 (NJC).

Galerella sanguinea (Rüppell, 1836) (syn. *Herpestes sanguinea*) Slender Mongoose

Apparently frequent within the forest, and almost certainly present in the cultivated zone. Melanistic specimens seen at 2000 m on the northern slope.

Atilax paludinosus (G. Cuvier, 1829) Marsh Mongoose

Listed by Moreau (1944) and Child (1965) as present in the Kilimanjaro area; J. Kingdon (pers. comm., 1995) saw tracks of this species by the Weru-Weru river at about 1200 m in 1995, but otherwise not noted recently. A road casualty was seen by JMG at Kahe, south of Kilimanjaro, in 1993.

[*Mungos mungo* (Gmelin, 1788) Banded Mongoose

Listed by Demeter & Topal (1982) from Moshi and by Child (1965) for the Kilimanjaro area, but not observed by us within the defined limits of this survey. It may occur in uncultivated bushland in the lowermost parts of the area.]

Ichneumia albicauda (G. Cuvier, 1829) White-tailed mongoose

Common in the cultivated zone where it is often seen on roads at night. Recorded from the forest (northern slope) for the first time by Newmark *et al.* (1991) although almost certainly it had been previously overlooked.

[*Helogale parvula* (Sundevall, 1847) Dwarf Mongoose

Observed by NJC a few kilometres south of Hai in 1993 and 1994, but although it probably occurs in suitable semi-arid habitats on the south-west, western and northern slopes of Kilimanjaro, it has not been observed within the defined area.]

Hyaenidae

Crocuta crocuta (Erxleben, 1777) Spotted Hyaena

Occurs in the bushland and cultivated zone of the northern and western slopes. Recorded from the forest for the first time in 1990 (Newmark *et al.*, 1991). In 1993 it occurred regularly up to at least 2050 m, where footprints have been seen by JMG. Local opinion suggested that the hyaenas were following the domestic herds being illegally grazed within the Forest

Reserve during the prolonged dry season, in the chance of picking off a straggler. Faeces were found in 1992 by the skeleton of a poached elephant at 2000 m on the northern slope, suggesting that hyaenas have probably always utilised the forest if a food source is available. On Mt Kenya spotted hyaenas have been recorded to 4100 m (Young & Evans, 1993).

Hyaena hyaena (Linnaeus, 1758) Striped Hyaena

Recorded by Johnston (1886) and Hunter (in Willoughby, 1889) but apparently overlooked by later observers until recorded on West Kilimanjaro by Grimshaw & Foley (1991). Johnston (1886) commented that he had seen this species between 900-1800 m, while the spotted hyaena (*Crocuta crocuta*) occurred below 900 m. In 1990 a dead individual was found in farmland immediately adjacent to the forest edge at 1800 m on Simba Farm; it has also been sighted several times on the road between Engare Nairobi and Lerang'wa between 1990-1994 (JMG & CAHF). Tomlinson (1982) recorded a sighting of hyaenas from the 'north-western edge' of the Shira Plateau, but failed to identify them further (pers. comm., 1996). In 1994 local sources told JMG of sightings of hyaenas in the ericaceous zone of the northern slope above Lerang'wa and identified them (from illustrations) as belonging to this species, so it is possible that Tomlinson's record also refers to *Hyaena* rather than *Crocuta*.

Proteles cristatus (Sparrman, 1783) Aardwolf

Previously listed only by Grimshaw & Foley (1991); apparently reasonably common in the lower cultivated and dry bush zones. Road casualties have been seen at Gararagua (1350 m) on several occasions 1990-1993, and at the Kikafu River (980 m) in 1993.

Felidae

Felis silvestris Schreber, 1775 (syn. *F. lybica* Forster, 1780) African Wild Cat

Common in the cultivated zone of West Kilimanjaro and probably in bushland elsewhere. May interbreed with feral domestic cats, which are also present in the cultivated zone.

Leptailurus serval (Schreber, 1776) (syn. *Felis serval*) Serval

Common in the cultivated zone of West Kilimanjaro and probably in the bushland elsewhere. It is eaten by local people in the Ol Molog area. Not recorded from the forest but present in the moorland to at least 3850 m (M. Grossmann & NJC, pers. obs., 1984), where droppings are abundant. A melanistic individual was observed on the Shira Plateau at 3650 m by JMG (and R.M. Grimshaw) in 1992. Melanistic servals are well known from the moorland of the Aberdares and Mt Kenya (Kingdon, 1977), but this is apparently the first such record for upper Kilimanjaro. Hunter (in Willoughby, 1889) records a black serval skin bought in Old Moshi at 1525 m, but it is not clear if it had been killed at that locality. Melanistic servals are common near the North Pare mountains (J. Kingdon, pers. comm., 1995).

Caracal caracal (Schreber, 1776) (syn. *Felis caracal*) Caracal

Listed by Child (1965) for the Kilimanjaro area, and noted by Johnston (1886) as being present in the plains. A caracal was sighted below Engare Nairobi in 1993 (C. Stubbs, pers. comm.), but this seems to be the only recent record.

Panthera pardus (Linnaeus, 1758) Leopard

Occurs in all zones except perhaps the cultivation of the southern and eastern slopes. It is not common in the forest on the northern slope, although an individual was seen there in 1990 (JMG & CAHF); on the western slope in 1991 droppings were mainly noted above 2500 m (NJC). Child (1965) noted that leopards were then heavily poached in the forest, which may account for their current scarcity. No recent evidence of specific leopard poaching has been found. Footprints are often seen on the Shira Plateau. In the cultivated zone of the western and northern slopes leopards are quite frequent, and sometimes take dogs and

domestic livestock. In 1993 there were sightings of juveniles in the arable land of Simba Farm (H. King, A. Benthem, pers. comm.).

The freeze-dried leopard made famous by Hemingway in *The Snows of Kilimanjaro* (1939) found on the crater-rim of Kibo at 5640 m in 1926 has long since disappeared (Reader, 1982).

Panthera leo (Linnaeus, 1758) Lion

Present on the plains between Kilimanjaro and the Arusha-Namanga road and occasionally sighted in the lowest part of the cultivated zone e.g. at 1300 m on Namuai Farm in 1990 (B. Stevens, pers. comm.), but now extinct in Amboseli National Park (C. Moss, pers. comm., 1993). Grimshaw & Foley (1991) note that vagrant lions, apparently from Tsavo, are occasionally seen in the cultivated zone of the eastern slope. First recorded from the forest by Child (1965), with recent records indicating the presence of a population inhabiting the upper part of the forest and the moorland and alpine zone in the north-western quadrant of the mountain. A lion believed to be from this population was seen on the Ol Molog farms in 1992 (C. Stubbs, pers. comm.). In 1993 and 1994 lions were seen in the forest and giant heather zone above Lerang'wa, descending to 2300 m, with a dead immature female being found in the moorland at 2800 m. Young were present in May 1994 (JMG). Partridge Film crews on the Shira Plateau saw lions in 1990 and 1992 (P. Morris, pers. comm., 1992), and several people have reported seeing footprints there within the past few years. A National Park ranger, F. Mtui, observed a lion at about 4300 m in 1977 - probably the current altitude record on Kilimanjaro - and reported that rangers have recently seen lions further east, towards Mawenzi.

There is no evidence to suggest that the lions of upper Kilimanjaro are in any way different from those of the plains, although this is a frequently asked question presumably based on the old stories of spotted lions on Mt Kenya (Dower 1937).

Acinonyx jubatus (Schreber, 1775) Cheetah

Present on the plains between Kilimanjaro and the Arusha-Namanga road and in Amboseli National Park. Occasionally sighted in the lowest part of the cultivated zone of West Kilimanjaro (B. Stevens, pers. comm. 1990).

PROBOSCIDEA

Elephantidae

Loxodonta africana (Blumenbach, 1797) African Elephant

Detailed information about the historical distribution of elephants in the Kilimanjaro area is available from 1848 (Rebmann, 1849) onwards and has been summarised by Grimshaw & Foley (1991). Formerly occurring throughout the forest and bushland they have been confined since the 1960s to the forest of the western and northern slopes. A population estimate in 1971-72 put the population at about 1200 (Afolayan, 1975). In 1990 Grimshaw & Foley, using a dung counting method, found that the population stood at about 220, distributed between the Namwi River (SW) and the Nesikiria River (NE), with about 450 km² being regularly used by elephants. They consider Afolayan's figure erroneous as he applied a population density estimate derived from one area to the entire mountain, including the moorland and alpine zones and areas where it was known that elephants no longer existed. However, there does seem to have been a general decline in elephant numbers, with evidence for heavy poaching in the 1970's. Very little recent evidence of elephant poaching has been found and it is considered that the population is stable to increasing.

Elephants occur throughout the forest zone but visit the drier lower parts only when surface water is available. Some crop-raiding occurs on West Kilimanjaro. We have seen no evidence of elephants above 2900 m, but the occurrence of elephant remains at 4875 m (Moreau, 1944) suggests that they do occasionally use the upper part of the mountain.

Elephants still regularly migrate to Amboseli National Park from the northern slope of Kilimanjaro (Moss, 1988; Grimshaw & Foley, 1991) and efforts to protect the migration corridor are underway. Other migration routes from the mountain to the plains have been cut by cultivation, although there is a regular but small movement to the eastern slope by elephants from the Tsavo West National Park population. In 1993 and 1994 many elephants were shot here for raiding crops, and a force of Game Scouts was employed to drive off others (Regional Wildlife Officer, pers. comm., 1993). It is believed that dry conditions had encouraged these elephants to seek food amongst the lush banana groves of the lower mountain slopes.

PERISSODACTYLA

Rhinocerotidae

[*Diceros bicornis* (Linnaeus, 1758) Black Rhinoceros

Formerly widespread on Kilimanjaro, both in the bushland and the forest; now extinct as a result of poaching. In the 1930s rhinoceros were so abundant in the lower moorland of the northern slope that Moreau & Moreau (1939) could humorously refer to this area as 'the rhino belt'; ornithology had to proceed with caution. Rhino were reported to be present in the forest of the northern slope as late as the 1980s (numerous local sources to JMG & CAHF, 1990), but no evidence for their continued existence has been found since 1990. There is some evidence for former migration from Amboseli National Park using the North Kilimanjaro Migration Corridor, but the Amboseli population is now down to a very few individuals (C. Moss, pers. comm. 1993).]

Equidae

Equus burchelli (Gray, 1824) Burchell's Zebra

Occurs in bushland below the forest and is sometimes seen on the West Kilimanjaro farms. An unconfirmed record of zebra and kongoni on the Saddle (4400 m) was communicated to JMG & CAHF in 1990 by the late Miss E. von Lany of the Marangu Hotel, who believed she saw them there in 1926. No confirmation of this can be found in contemporary literature.

HYRACOIDEA

Procaviidae

Dendrohyrax validus True, 1890 East African Tree Hyrax

The tree hyrax on Kilimanjaro was studied by J.N. Kundaeli in 1972 (Kundaeli 1976a,b). He found that population density was generally highest on the southern (23/ha) and western (13/ha) slopes, although 70/ha was recorded at 2620 m on the northern slope. Hyrax were very scarce on the eastern slope. Kundaeli considers that the optimum conditions for a high hyrax density are undisturbed forest containing many large old trees providing enough holes for the solitary habits of this species. Favoured tree species noted were *Ocotea usambarensis*, *Schefflera volkensii*, *Nuxia congesta*, and *Podocarpus* spp. Hollow dead logs are also used.

Personal observations (JMG) suggest that in the Kilimanjaro Timbers area (2000 m) there is a high hyrax density, despite the considerable degree of disturbance to the forest. Here

the favoured tree seems to be *Ficus thonningii*. Hyrax seem to be most abundant between 1900-2000 m on the western slope, and between 2000-2400 m on the southern slope (NJC, pers. obs.).

Dendrohyrax is generally considered to be nocturnal (Estes, 1991), but on Kilimanjaro it seems to be active for much of the day and calling starts at about 16.00. It often descends to the ground and in places on the northern slope colonies occupy densely vegetated rocky slopes at 2500 m.

The tree hyrax is heavily poached for its meat and has been legally hunted for its skin. Kundaeli (1976 a) records 4708 legally caught hyraxes between May 1972 and July 1973. The skins are made into blankets. Noose snares are generally used.

Procavia capensis (Pallas, 1776) East African Rock Hyrax (syn. *P. johnstoni*)

The record by Grimshaw & Foley (1991) of rock hyrax on outcrops on West Kilimanjaro seems to be the first for the defined area; it may also occur on outcrops in the plantation area near Endonet where a diurnal hyrax was seen in 1990. Cooper collected specimens from "Arusha Prov., plains west of Kilimanjaro" in 1937 (specimens in FMNH, leg. B. Cooper, 1937), which suggests that there may be further populations on outlying hills.

TUBULIDENTATA

Orycteropodidae

Orycteropus afer (Pallas, 1766) Aardvark

Not recorded from the Kilimanjaro area since Johnston's expedition in 1884 when it was described as 'common on the plains' (Johnston, 1886). However it is present in the forest of at least the northern slope, up to about 2400 m, although most frequent in the drier lower forest areas where characteristic scrapings at ant nests and burrows can be seen. Also present in the cultivated zone at least of West Kilimanjaro, where one was seen in 1992 (H. King, pers. comm.).

ARTIODACTYLA

Suidae

Potamochoerus larvatus (F. Cuvier, 1822) (formerly recorded as *P. porcus* (Linnaeus, 1758))

Bush Pig

Found throughout the forest but apparently not very abundant. It leaves characteristic disturbed areas where the soil has been turned over. It can be an agricultural pest when it ventures into cultivation (H. Cordeiro, pers. comm.).

The large size and dark colouring of the Kilimanjaro bush pig, ssp. *daemonis*, seems to have misled some into believing that the giant forest hog, *Hylochoerus meinertzhagenii* Thomas, 1904, is found on Kilimanjaro (Johnston, 1971), but as with records of this species from Mt Meru and Oldeani mountain (Crater Highlands) (all derived from Zukowsky, 1921), such records are based on misidentifications of large dark individuals of *P. larvatus* (Grimshaw, in prep. b).

Phachochoerus africanus (Gmelin, 1788) Warthog

A plains species, present in bushland below the cultivated zone on the western (NJC pers. obs.) and northern (Lerang'wa villagers, pers. comm.) slopes. It has been recorded from the forest of the northern slope by Newmark *et al.* (1991) and Grimshaw & Foley (1991), on the testimony of Lerang'wa villagers, but we have not personally observed it in such habitat. P.J. Wood (pers. comm. 1995) told us that it formerly occurred in the West Kilimanjaro glades (now converted to conifer plantations). Johnston (1886) recorded warthog to 2440 m, but

did not observe the bush pig and it seems probable that he confused the two.

[Cervidae

Cervus elaphus Linnaeus, 1758 Red Deer

H.F. Lamprey has communicated to us the information that during the German colonial period red deer were introduced to Kilimanjaro. That the species may have persisted for some time is suggested by a report made to the District Commissioner in Moshi in about 1941, of a large animal with branched horns seen on the Shira Plateau (H.F. Lamprey, pers. comm., 1995). Similar introductions were made to Mt Kenya in the early part of the century and it was believed that they multiplied there for some time (Dower, 1937). The species has not survived on either mountain.]

Giraffidae

Giraffa camelopardalis (Linnaeus, 1758) Giraffe

Common in bushland below the cultivated zone on the western and northern slopes. Enters the lower part of the forest on the northern slope (Child, 1965).

Bovidae

Cephalophus harveyi (Thomas, 1893) Red Duiker

Common in the drier forest and lower parts of the ericaceous zone of the northern and western slopes; status elsewhere unknown.

Cephalophus spadix True, 1890 Abbott's Duiker

This large duiker is endemic to Kilimanjaro and a few other mountains in Tanzania (Kingdon, 1982). By virtue of the larger extent of forest remaining on Kilimanjaro than in the other locations it has been assumed (Kingdon, 1982) that the Kilimanjaro population is the largest remaining. While this is probable it has not been conclusively proven; indeed very little information is available about the status of this elusive duiker. The type specimen was recorded by Abbott to have come from 'High altitudes on Mount Kilima-Njaro, frequenting the highest points' (True, 1890), a report that initially caused some confusion. For example Sclater (1893) attributed to this species a duiker found by Hans Meyer at high altitude ("20000'"). A careful reading of True's list reveals that the specimen was obtained at 2400 m (True, 1890). It is a strictly forest species, believed to be mostly frugivorous (Kingdon, 1982). Formerly best known on the southern slope (the source of the mounted specimen in the National Museum, Nairobi) the general dearth of larger mammals there as a result of poaching pressure suggests that it may no longer be common. In recent times specimens for trophy hunters have been obtained by snaring on West Kilimanjaro (sources anon., 1990, 1993). Local information supplied to JMG & CAHF in 1990 indicated that on the northern slope Abbott's duiker occurs in steep-sided valleys with dense vegetation cover, where it is well known to the local poachers. A dead male was found by JMG in 1993 in such habitat at 2600 m, and a sighting of a living individual was reported from the giant heather zone at about 2700 m (L. Kephass, pers. comm.).

Sylvicapra grimmia (Linnaeus, 1758) Grey Duiker

Present in bushland below the cultivated zone of the western and northern slopes and in the moorland and alpine zones, where it has been studied by D.G. King (King, 1975), who believes the moorland population to represent a distinct, although unnamed race; similarly woolly races are found on other high East African mountains. He found it to occur from the treeline to 4600 m, with the highest density (1.8/ha) on the Shira Plateau. It is undoubtedly the commonest large mammal of upper Kilimanjaro.

The confusion that has surrounded the small antelope of upper Kilimanjaro is remarkable. King (1975) reviewed all the readily available records of three species (mountain reedbeek, klipspringer and Kirk's dik-dik) made since Johnston's expedition in 1884 and came to the conclusion that the only species of small antelope ever present on upper Kilimanjaro was the grey duiker. All the sightings of the other species, over nearly seventy years, were in error (King, 1975).

The literature review by King (1975) overlooked, as have all previous lists, four published accounts of duiker in the moorland zone. Hunter (in Willoughby, 1889) records the shooting of a long-haired duiker at 3000 m, together with sightings of the same species to 3690 m. Meyer (1891) records finding a dead duiker at Hans Meyer Notch on the rim of Kibo at 5600 m. The botanist G. Volkens, who missed very little during his time on Kilimanjaro in 1893-94, records grey duiker but not, significantly, klipspringer (Volkens, 1897). Dundas (1924) makes a specific reference to duiker in the moorland zone.

Raphicerus campestris (Thunberg, 1811) Steinbok

Common in the cultivated zone and bushland of the western and northern slopes.

Nesotragus moschatus (Von Dueben, 1846) Suni

Common in the forest of the western and northern slopes to at least 2500 m. Status elsewhere not known, although recorded from Kibongoto by Lönnberg (1908) and by Kittenberger from Moshi (Demeter & Topal, 1982). 'Suni' is apparently the Chagga name for this species (True, 1890).

[*Oreotragus oreotragus* (Zimmermann, 1783) Klipspringer

The only first-hand published record of klipspringer on Kilimanjaro was by F.J. Miller, an honorary game ranger, who recorded 'several pairs of klipspringer to 3960 m, in addition to duiker, on the Marangu route (Miller, 1934). Moreau (1944) interestingly states that it was Miller who identified as this species an antelope seen at 3000 m mentioned by Gillman (1923). These records were then listed by Moreau (1944), Swynnerton & Hayman (1951), Guest & Leedal (1954) and Child (1965). In addition, Moreau lists a sighting of a solitary individual at 3800 m by Capt. Moore of the Game Department.

At present the klipspringer is not known to occur anywhere within our defined boundary. In the period 1964-69 it was observed on the small hills west of Kilimanjaro near Tinga-Tinga by H. Cordeiro; it is not known whether this population still exists. On Mt Meru klipspringers occur on the rocky walls of the crater where they are conspicuous and easily identified (JMG, pers. obs.)

The klipspringer is one of two species of antelope (the other being mountain reedbeek) stated by Newmark *et al.* (1991) to have become extinct on Kilimanjaro. However, it is possible to present a case, as King (1975) has done, that the klipspringer and mountain reedbeek were never present in the upper regions of Kilimanjaro, and that all records of these species are in error for the extremely abundant grey duiker. Miller's sightings of klipspringers are less easy to dispute than most of the records of small antelope, especially as he specifically recorded duiker as well. For example, he recorded klipspringer in pairs, which is characteristic for the species.

However, the typical habitat of the klipspringer is rocks and kopjes with grass and patches of bush between them. On the Marangu route on which Miller claimed to have seen klipspringers no such rock outcrops occur until the foot of Mawenzi is reached. The montane forest belt would also have formed a formidable barrier to klipspringers as Moreau (1944) perceptively pointed out. He thought it curious that the grey duiker had not been recorded (he had overlooked the four records mentioned above) on Kilimanjaro while the

reedbuck and klipspringer had, despite the obvious difficulties in penetrating the forest faced by a species so habitat-specific as the klipspringer (although there is reason to believe that at times, such as during the last glacial maximum, the forest belt has been incomplete (Grimshaw, in prep. a). Moreau drew a comparison with Mt. Kenya where only the grey duiker is present, despite the 'treeless gap' on its northern slope permitting ready access for plains species to the moorland zone (Moreau, 1944) (as in the case of zebra at the present time (Coe, 1967)).

Below we conclude, in agreement with King (1975), that mountain reedbuck were never present on Kilimanjaro, but the case for the occurrence of klipspringer is more complex. The ecological evidence strongly suggests that its presence was unlikely; but against this must be set sight records of Miller and Moore. It is possible that a small population of klipspringers once existed on Kilimanjaro and that they have since become locally extinct; at this point in time it is impossible to tell and the case must remain unproven.]

Madoqua kirki (Gunther, 1880) Kirk's Dik-dik

Present in dry bush below the cultivation of West Kilimanjaro; also observed in the North Kilimanjaro Migration Corridor at about 1700 m.

Earlier records of Kirk's dik-dik from upper Kilimanjaro to an altitude of 4270 m (Moreau, 1944; Swynnerton & Hayman, 1951; Guest & Leedal, 1954) are derived from a misidentification by O. Thomas (in Johnston, 1886) of an antelope shot by Johnston at 3350 m in 1884. Most unfortunately the specimen was not retained and the identification was from a drawing made by Johnston of the antelope's head. This drawing is reproduced in Johnston's book (1886) and clearly shows a duiker's head. Johnston (1886) also mentioned that he believed this species to occur to 4270 m. In fairness to Thomas it should be mentioned that Kirk's dik-dik had been named only in 1880 and was not yet well known, hence the apparently blatant error in ascribing a dry bush species to the moorland zone. It is perhaps not untrue to say that, had Johnston's specimen been retained and correctly identified, much confusion over the identity of the antelope of upper Kilimanjaro could have been avoided.

Redunca fulvorufula (Afzelius, 1815) (ssp. *chanleri*) Mountain Reedbuck

Present on the preferred habitat of grassy hills (Estes, 1991) on West Kilimanjaro, especially at Simba Farm at least until 1990; not observed since then at this location. It has also been reported from similar hills near Engare Nairobi (Swynnerton & Hayman, 1951; R. Trappe, pers. comm., 1992).

This species, with the klipspringer, was long included in lists of mammals from upper Kilimanjaro and was considered extinct there by Newmark *et al.* (1991). The records of mountain reedbuck are even less reliable than those for the klipspringer, and in every case are hesitant and carefully qualified. Thus Moreau (1944) "thought" he saw this species, as did Capt. Moore (cited in Moreau, 1944). Guest & Leedal (1954) tentatively ascribed Meyer's dead antelope (Meyer, 1891) to this species. They add their sight record ("at 150 yards") of "two small buck" on the slopes of Mawenzi, and say that they "may have been reedbuck or possibly klipspringer". Swynnerton, a highly competent observer, records it from the Shira Plateau (Swynnerton, 1949), but King, who examined Swynnerton's diary for the Shira Plateau expedition, states that the record is 'based on an indefinite sighting by one of (Swynnerton's) companions and on one indefinite set of spoor' (King, 1975). Child (1965) also records an undated sighting at 4800 m by members of the Kilimanjaro Mountain Club.

After careful consideration and independent study of the literature we accept King's view that the mountain reedbuck has never occurred on upper Kilimanjaro, having been recorded in error for the grey duiker.

Redunca redunca (Pallas, 1767) Bohor Reedbuck

Observed in 1990 by JMG & CAHF on farmland on West Kilimanjaro and also on small hills in the upper part of the migration corridor.

Kobus ellipsiprymnus (Ogilby, 1833) Waterbuck

Recorded by Child (1965) as present in the Kilimanjaro area without locality; observed by JMG in the forest of the northern slope in 1993 (ssp. *ellipsiprymnus*) where it is apparently well known to the local people. B. Stevens (pers. comm., 1994) reports that it occurs in the forest above Namuai Farm.

Aepyceros melampus (Lichtenstein, 1812) Impala

Common in bushland, including the migration corridor; sometimes in cultivated land on West Kilimanjaro to over 1700 m.

Gazella thomsonii Gunther, 1884 Thomson's Gazelle

Common in bushland below the cultivated zone on western and northern slopes, also often on cultivated land up to at least 1700 m. The horn of this species found at 3960 m on the Shira Plateau by Guest & Leedal in 1953 (Guest & Leedal, 1954) was presumably carried there by some other species, probably a vulture as suggested by Child (1965).

Gazella granti Brooke, 1872 Grant's Gazelle

Present in the migration corridor and other areas of bushland; may occasionally enter the lower parts of the cultivated zone.

Litocranius walleri (Brooke, 1879) Gerenuk

Present in the dry bush west of Kilimanjaro and Amboseli National Park; might occur occasionally in the lower part of the migration corridor. Observed on farmland at about 1740 m near Ol Molog in 1993 (C. Stubbs, pers. comm., 1993).

Oryx gazella (Linnaeus, 1758) (ssp. *callotis*) Fringe-eared Oryx

Present on the plains between Kilimanjaro and the Arusha-Namanga road and Amboseli National Park; also observed by CAHF in the migration corridor in 1990. It has occasionally been observed in the lower part of farmland on West Kilimanjaro (F. Neinhaus, pers. comm., 1990).

Alcelaphus buselaphus (Pallas, 1776) (ssp. *cokii*) Kongoni or Coke's Hartebeest

Present in the migration corridor, but rather scarce.

Connochaetes taurinus (Burchell, 1823) Brindled Wildebeest

Present in the lower part of the migration corridor and on the plains west of the mountain; may occasionally enter cultivated land.

Tragelaphus scriptus (Pallas, 1766) Bushbuck

Common in forest on the northern and western slopes, although it is much poached. Status elsewhere unknown although recorded to occur throughout the forest (Child, 1965). Although it is common in the ericaceous belt of the Aberdares (M. Coe, pers. comm., 1995) it is not known to occur much above the forest line on Kilimanjaro—Swynnerton's record for the Shira Plateau is based on a specimen shot in the forest belt (Swynnerton, 1949).

Tragelaphus imberbis (Blyth, 1869) Lesser Kudu

Present in the dry bush below West Kilimanjaro, especially near Tinga-Tinga, and in the migration corridor. In 1993 lesser kudu were observed on farmland near Ol Molog at about 1740 m (C. Stubbs, pers. comm.). Johnston (1886) recorded "kudu" at 4270 m, surely in error for eland.

Taurotragus oryx (Pallas, 1766) Eland

Present and apparently reasonably abundant in the bushland below the western and northern slopes and often entering cultivation. Available evidence, based on regular sightings of the animals and their droppings, suggests that a large population occurs in the forest on the northern and northwestern slopes, especially in the upper, more open parts. Some animals

seem to migrate into the forest from the bushland and tracks used by eland have been observed at Kitenden, but it is unclear to what extent the population long known to exist in the moorland and alpine zones moves down. It is our view that the eland often seen on the Shira Plateau and occasionally on the Saddle also make use of the less exposed lower moorland areas. On the Shira Plateau they are often to be seen near the southern edge and if disturbed will flee over it into the steep valley systems below. Eland are also recorded to be abundant near the foot of Mawenzi, the slopes of which they ascend to 4890 m (Guest & Leedal, 1954). On the western slope of Kibo they have been noted at 4750 m near the Lava Tower (Guest & Leedal, 1954). Vegetation at these altitudes is sparse and it seems probable that, like buffalo, eland visit shallow caves with deposits of minerals in them (Miller, 1934; Moreau, 1934; JMG, pers. obs.).

Syncerus caffer (Sparman, 1779) African Buffalo

Present throughout the forest on the northern and western slopes, although not particularly numerous. It is a grazer and numbers are probably limited by the available grassy areas (Child, 1965; Sinclair, 1977). Its status in the forest elsewhere is unknown, but probably rather rare. It is heavily poached and as a result is very wary and almost totally nocturnal. On the northern slope there is evidence for migration up from Amboseli (Grimshaw & Foley, 1991). It is present in the lower moorland and also regularly visits the alpine zone. JMG has observed small herds of buffalo on the Shira Plateau (3500 m) and Lent Valley (4200 m) and tracks at 4500 m near the Lava Tower. In the Lent Valley and probably elsewhere are shallow caves in which soda (sodium bicarbonate) crystallises; these are entered by buffalo, which must sometimes have to bend to their knees to reach the deposits which are chewed off. Similar geophagic behaviour has also been noted on Mt Kenya, although at lower altitudes (Mloszewski & Mahaney, 1989).

RODENTIA

Sciuridae

Heliosciurus undulatus (True, 1892) (syn. *H. rufobrachium undulatus*) Eastern Sun Squirrel

Common in the lower parts of the forest below 2000 m. Below this it occurs along rivers and also in the Rau and Kahe Forest Reserves. Formerly recorded as *H. gambianus* (Ogilby, 1835).

Paraxerus ochraceus (Huet, 1880) Huet's Bush Squirrel

Abundant in bushland and cultivation below the forest; despite its inclusion as a forest species by Child (1965) it is not a forest resident, although it may occur in scrubby, disturbed forest areas.

P. vexillarius (Kershaw, 1923) (syn. *P. byatti*) Swynnerton's Bush Squirrel

Present and often common on all slopes of the mountain from 1900 m to the heath zone. The taxonomy of this group of squirrels is confused; we follow Hoffman *et al.* (1993). K. Howell & J. Kingdon (pers. comms., 1995) prefer to retain them as separate species.

Xerus rutilus (Cretzschmar, 1828) Unstriped Ground Squirrel

Common in bushland, especially on the northern, eastern and western slopes.

Muridae

[*Acomys* Spiny Mice

Two species were recorded from Himo by Hubbard (1963); *A. subspinosus* and *A. dimidiatus*. Neither is found in East Africa and the records are probably in error for, respectively, *A. wilsoni* Thomas, 1892, and *A. kempfi* Dollman, 1911 (Musser & Carleton, 1993). They are probably found in bushland and cultivation around the mountain. There are specimens of

A. wilsoni from Taveta in the collection of the Natural History Museum (*leg.* R. Kemp, 1910.)

Aethomys kaiseri (Noack, 1887) Kaiser's Bush Rat

Occurs below the forest (Child, 1965). B. Cooper collected specimens at 1400 m on the western slope (in FMNH *leg.* B. Cooper, 1937).

Aethomys chrysophilus (de Winton, 1897) Southern Bush Rat

Present below the forest (Child, 1965).

Arvicanthis nairobae (J.A. Allen, 1909) (formerly recorded as *A. abyssinicus*, *A. niloticus*) Kenyan Grass Rat

Noted from 1400 m on West Kilimanjaro (specimens in FMNH *leg.* B. Cooper, 1937), Kibosho (Swynnerton & Hayman, 1951), lower forest (Child, 1965) and Moshi (Hubbard, 1963). W. Stanley (*pers. comm.*, 1995) notes that the taxonomy of *Arvicanthis* remains incompletely understood.

Arvicanthis somalicus Thomas, 1903 Somali Grass Rat

Collected from Rombo (1600 m) (specimens in NHM, *leg.* R. Kemp, 1910).

[*Beamys hindei* Thomas, 1909 Lesser Pouched Rat

This species has formerly been considered rare (Kingdon, 1974), but more recent work has shown that it is local, confined to forest on sandy substrates (FitzGibbon *et al.*, 1995). The type specimen was collected from Taveta, and it has been recorded from Moshi by Dieterlen (1979), but it is not clear whether it occurs within the defined area.]

[*Colomys goslingi* Thomas & Wroughton, 1907 Velvet Rat

Stated to be present in the Kilimanjaro forest by Rodgers *et al.* (1982), but the source of this record is unknown. Kingdon (1974) and Musser & Carleton (1993) agree that *Colomys* does not occur in Tanzania.]

Cricetomys gambianus (Waterhouse, 1840) Forest Pouched Rat/Giant Rat

Recorded from Machame and Lyamungu by Swynnerton & Hayman (1951), and noted for Kilimanjaro by Child (1965) but not included as a forest species. Grimshaw & Foley (1991) note that it is scarce on the northern slope, although NJC has found it to be common between 2200-2350 m on the western slope.

Dasymys incomtus (Sundevall, 1847) Shaggy Marsh Rat

Noted from wet areas on the mountain (Child, 1965).

Dendromus insignis (Thomas, 1903) (*syn.* *D. mesomelas* *ssp. kilimandjari*) Montane Climbing Mouse

Occurs in the heath and alpine zones, first described from the area around Horombo Hut (3800 m) (Swynnerton & Hayman, 1951), extending to Kibo Hut at 4700 m (specimen in NHM, *leg.* G.S. Child, 1971). Shore & Garbett (1991) found it to be scarce at 3500 m on the Shira Plateau. It may possibly occur in the upper parts of the forest.

Dendromus melanotis Smith, 1834 (*ssp. nigrifrons*) Grey Climbing Mouse

A savanna species recorded near the forest at 1500 m by Swynnerton & Hayman (1951), but may occur higher as it does on Mt Kenya (Moreau, 1944).

[*Gerbillus harwoodi* Thomas, 1901 Kenyan Gerbil

A marginal species not recorded from the defined area, but collected from Ngasurai in 1968 by G. Child (specimen in NHM).]

Grammomys dolichurus (Smuts, 1832) (*syn.* *Thammomys surdaster*) Common Thicket Rat

Known to occur in cultivation at Kibongoto (Lönnerberg, 1908), West Kilimanjaro (specimens in FMNH *leg.* B. Cooper, 1937) and Rombo (Swynnerton & Hayman, 1951) and the lower forest (Moreau, 1944), but may also occur higher; on Mt Meru it has been recorded between 2300-2700 m (Demeter & Hutterer, 1986). Another genus in need of revision (W. Stanley,

pers. comm., 1995).

Lemniscomys barbarus (Linnaeus, 1766) Barbary Striped Grass Rat

Occurs below the forest belt (Swynnerton & Hayman, 1951).

Lemniscomys striatus (Linnaeus, 1758) Common Striped Grass Rat

Inhabits the lower forest, cultivation and bushland, recorded from Kibongoto (Lönnerberg, 1908), Kibosho (Demeter & Topal, 1982) and Rombo (Swynnerton & Hayman, 1951). In 1994 a specimen was brought to JMG from Lerang'wa.

Lophuromys flavopunctatus Thomas, 1888 (ssp. *aquilus*) Eastern Brush-furred Rat

This race is known only from Kilimanjaro, where it is present throughout the forest and heath zones to at least 3500 m (Lönnerberg, 1908; Moreau, 1944; Swynnerton & Hayman, 1951). NJC has recorded this species from 1900 m on the Mweka route (November 1991), 2450 m on the western slope (October 1991) and at Kilimanjaro Timbers (June 1990).

Mastomys natalensis (Smith, 1834) Natal Multi-mammate Rat

Occurs in cultivation and bushland; recorded from Kibongoto (Lönnerberg, 1908), Kibosho (Demeter & Topal, 1982), western and north-western slopes (1500 m) (specimens in FMNH leg. B. Cooper, 1937), Lyamungu (Swynnerton & Hayman, 1951), and Rombo (Hubbard, 1963).

Mus musculoides (Temminck, 1853) Northern Pygmy Mouse

Known from a specimen from the northern slope at c1800 m (specimen in FMNH leg. B. Cooper, 1937) and from Ngasurai just west of our area (specimen in NHM, leg. G.S. Child, 1971).

Mus musculus Common House Mouse

Probably occurs in proximity to human settlements; collected from Mweka (specimen in NHM leg. G.S. Child, 1971).

Mus tenellus (Thomas, 1903) Eastern Pygmy Mouse

Recorded from the lower forest and cultivation (Moreau, 1944; Swynnerton & Hayman, 1951), but by analogy with Mt Kenya may occur at higher altitudes within the forest (Moreau, 1944).

Mus triton (Thomas, 1909) Grey-bellied Pygmy Mouse

Occurs in cultivated areas and the lower forest (Swynnerton & Hayman, 1951; Child, 1965).

Otomys angoniensis Wroughton, 1906 (syn. *O. divinatorum*) Angoni Groove-toothed Rat

A grassland species noted from 1600 m on both the western slope (specimens in FMNH leg. B. Cooper, 1937) and Rombo (Swynnerton & Hayman, 1951).

Otomys tropicalis Thomas, 1902 Tropical Groove-toothed Rat

Present below the forest between 1750-1900 m on the northern and western slopes (Bohmann 1952) and to at least 3850 m in the Barranco Valley (NJC, pers obs., 1984), always in the vicinity of wet places. Its presence on the Shira Plateau has been noted by several authorities (Swynnerton, 1949, Swynnerton & Hayman, 1951; Salt, 1953; Child, 1965; Shore & Garbett, 1991). Several earlier records from Kilimanjaro have confused this species with *O. irroratus* (Brants, 1827), a South African species.

Otomys typus Heuglin, 1877 (ssp. *zinki*) Northern Groove-toothed Rat

Known from a specimen trapped on the northern slope at 1800 m (specimen in FMNH leg. B. Cooper, 1937) and otherwise only from the Horombo Hut area (c 3800 m) (Swynnerton & Hayman, 1951; Child, 1965), but it may occur elsewhere in the moorland. It was included as a forest species by Rodgers *et al.* (1982) although Kingdon (1974) records it only from alpine and savanna habitats.

Pelomys fallax (Peters, 1852) Common Creek Rat

Recorded from Kibongoto (Lönnerberg, 1908).

Praomys delectorum (Thomas, 1910) (formerly recorded as *P. jacksonii*) East African Soft-furred Rat

Noted from the lower forest by Lönnberg (1908), Moreau (1944), Swynnerton & Hayman (1951), and at 2000 m at Kilimanjaro Timbers in 1990 (JMG & CAHF, pers. obs.).

Rattus rattus (Linnaeus, 1758) Black Rat

Very common in the vicinity of human settlements around the mountain.

Rhabdomys pumilio (Sparrman, 1784) (ssp *diminutus*) Four-striped Grass Mouse

Present from 1750 m (Bohmann, 1952) upwards to 4180 m in the Oehler Valley (Guest & Leedal, 1954). In the forest it has been noted to be common around human habitation at Kilimanjaro Timbers (2000 m) in open, disturbed forest, but with numbers dropping rapidly after the occupants left. In the moorland and alpine zones it is often extremely abundant; Shore & Garbett (1991) recorded a density of 14/ha on the Shira Plateau, while Gunther (1989) reported a density of 2/m² in the immediate vicinity of Horombo Hut where it is an opportunist on spilt food and waste. It is in fact one of the few mammals that a visitor to Kilimanjaro using the Marangu Route is likely to see. In natural conditions *Rhabdomys* feeds on *Helichrysum* and grasses, especially *Pentaschistis* (Gunther, 1989).

[*Saccostomus campestris* (Peters, 1878) Southern Pouched Mouse

A grassland species listed by Child (1965).]

[*Steatomys parvus* Rhoads, 1896 Pygmy Fat Mouse

A marginal species not recorded from the defined area, but collected from Ngasurai in 1968 by G. Child (specimen in NHM).]

Tachyoryctes daemon Thomas, 1909 Mt Kilimanjaro Mole Rat

Common below the forest in all areas and a pest of cultivation, especially the potato-growing areas of West Kilimanjaro. It also occurs in the heath and alpine zones up to 4300 m (Salt, 1953; Guest & Leedal, 1954) where Shore & Garbett (1991) found it to be common on the Shira Plateau. Some authors *e.g.* Demeter & Topal (1982) seem to have recorded this species as the more northerly distributed *T. splendens* (Rüppell, 1835).

Tatera nigricauda (Peters, 1878) Black-Tailed Gerbil

Hubbard (1963) noted this species from near Himo; it may also occur within the defined area in bushland on the eastern slope of the mountain. Kemp collected this and the next species from Taveta (specimens in NHM), while Child collected *Tatera* species (unidentified) at Ngasurai (specimens in NHM), suggesting that these are dry bush species.

Tatera robusta (Cretzschmar, 1826) Fringe-tailed Gerbil

Recorded from Moshi and Himo (Hubbard, 1963); probably occurs in bushland on the lower slopes.

Tatera valida (Bocage, 1890) Northern Savanna Gerbil

Present below the forest; probably common in bushland (Child, 1965).

[*Taterillus harringtonii* (Thomas, 1906) Harrington's Gerbil

A marginal species not recorded from the defined area, but collected from Taveta by Kemp (specimen in NHM).]

[*Zelotomys hildegardae* (Thomas, 1902) Broad-headed Mouse

Recorded without location by Child (1965); Kingdon (1974) states that it inhabits moist savanna and scrub.]

Pedetidae

[*Pedetes capensis* (Forster, 1778) Springhare

Listed by Child (1965); probably occurs in dry bushland on the lower slopes.]

Bathyergidae

Heliophobius argenteocinereus (Peters, 1846) (*H. spalax*) Silvery Mole Rat

A species of well drained woodland soils around the mountain; noted from Engare Nairobi (Lönnerberg, 1908; Swynnerton & Hayman, 1951) and Kibosho (Demeter & Topal, 1982).

Myoxidae

Graphiurus murinus (Desmarest, 1822) African Common Dormouse

Present throughout the forest to 2600 m (at Kibongoto) (Swynnerton & Hayman, 1951); noted recently from Kilimanjaro Timbers (2000 m: JMG) and near Londorosi (2350 m: NJC).

Graphiurus parvus (True, 1893) East African Pygmy Dormouse

This bushland species was recorded from the Kilimanjaro area by Swynnerton & Hayman (1951).

Hystricidae

Hystrix cristata Linnaeus, 1758 (*H. galeata*) Crested Porcupine

Found throughout the area up to at least 3350 m (Child, 1965), with the possible exception of the cultivated zone of the southern and eastern slopes. In the forest it seems to be scarce. Raids cultivation but is itself eaten by local people.

Thryonomyidae

Thryonomys swinderianus (Temminck, 1827) Common Cane Rat

Grassland (Child, 1965); recorded from 1800 m near Lerang'wa by NJC.

T. gregorianus (Thomas, 1894) Lesser Cane Rat

Grassland; recorded by Child (1965) and Kingdon (1974).

LAGOMORPHA**Leporidae**

Lepus spp. Hares

Swynnerton & Hayman (1951) list *L. capensis* (Linnaeus, 1758) (widespread in Africa (Hoffmann, 1993)) for the Kilimanjaro area, while Newmark *et al.* (1991) record "*L. crawshayi*" for the moorland. The taxonomy of East African hares is extremely confused, especially from the application of the epithet *crawshayi* to several distinct species, none of which occurs in East Africa (Hoffmann, 1993). The hare found in Tanzania is *L. victoriae* Thomas, 1893, according to R. Hutterer (pers. comm., 1995).

Hares are abundant in the cultivated zone and bushland of the western and northern slopes. They also occur in the moorlands near Mawenzi (Newmark *et al.*, 1991). J. Kingdon (pers. comm., 1995) notes that the hares on the mountain will be 'bush hares', of whatever species it eventually turns out to be, while *L. capensis* occurs on the dry plains below. Specimens need to be collected from all areas to resolve their true identity.

MACROSCELIDEA**Macroscelididae**

[*Elephantulus rufescens* (Peters, 1878) Rufous Elephant Shrew

The only record of this dry bush species from the Kilimanjaro area is of a specimen collected by Kittenberger (1902-1904) at 'Moshi'. Others (*e.g.* Kemp) have collected it from localities such as Taveta (Thomas, 1910; specimens in NHM); the series of Tanzanian specimens in

the Natural History Museum, London, indicates that it occurs widely in northern Tanzania, but there are no specimens from within the defined area.]

DISCUSSION

Information is presented above on 154 mammal species recorded in the vicinity of Mt. Kilimanjaro from 1883 onwards. Of these we accept 128 species as currently occurring here. Swynnerton & Hayman (1951) listed 103 species for the area they defined; our contraction of the boundaries defining Kilimanjaro has not excluded any species they list. Nineteen species are undoubtedly borderline cases or uncertain records (Table 1), but as the compilation of a definitive checklist is confounded by the absence of precise locality records by previous observers, deficiencies or

Table 1. Alphabetical list of all species that have been rejected, are extinct, or for which further information is required before their presence within the defined Kilimanjaro area can be confirmed.

Species	Status
Extinct or rejected species:	
<i>Diceros bicornis</i>	Extinct
<i>Cervus elaphus</i>	Introduced but extinct
<i>Colomys goslingi</i>	Rejected: not found in Tanzania
<i>Crocidura fumosa</i>	Rejected: records in error for another sp.
<i>Crocidura gracilipes</i>	Rejected: collection locality mislabelled
<i>Crocidura maurisca</i>	Rejected: recorded in error for <i>C. monax</i>
Marginal and/or insufficiently known species:	
<i>Acomys</i> spp. (2 spp.)	Marginal: require re-examination of specimens and taxonomic review
<i>Beamys hindei</i>	Old record from 'Moshi'
<i>Canis aureus</i>	Marginal on west slope
<i>Crocidura elgonius</i>	Source of record unknown
<i>Crocidura fischeri</i>	Marginal on south slope
<i>Elephantulus rufescens</i>	Old record from 'Moshi'
<i>Gerbillus harwoodi</i>	Marginal on west slope (Ngasurai)
<i>Helogale parvula</i>	Marginal near Hai
<i>Miniopterus schreibersi</i>	Marginal from Arusha-Chini
<i>Mungos mungo</i>	Marginal
<i>Oreotragus oreotragus</i>	Records inconclusive; possibly never occurred
<i>Pedetes capensis</i>	Marginal from lower slopes
<i>Rhinolophus fumigatus</i>	Record from Mweka needs confirmation
<i>Saccostomus campestris</i>	No exact location provided
<i>Steatomys parvus</i>	Marginal on west slope (Ngasurai)
<i>Tadarida ventralis</i>	No exact location provided
<i>Taterillus harringtonii</i>	Marginal from Taveta
<i>Zelotomys hildegardeae</i>	No exact location provided

inequalities in observation and the motility of mammals, these species have been included.

Mammal extinctions on Kilimanjaro were the principal subject of a paper by Newmark *et al.*, (1991). They argued that klipspringer and mountain reedbeek had become extinct in upper Kilimanjaro, and cited increasing isolation for the disappearance of these populations. The authors unfortunately overlooked King's paper (King, 1975), in which he hypothesised that neither mountain reedbeek nor klipspringer ever occurred on upper Kilimanjaro. This has provoked us to examine both claims carefully, in the light of both a much wider survey of the literature and broader experience of local conditions. We conclude that there is no reliable evidence for the presence of mountain reedbeek on upper Kilimanjaro at any time in the past century and do not accept that it ever occurred there. The evidence for the presence of klipspringer is almost equally tenuous, being based on two sight records. The negative evidence, largely the failure to observe or collect klipspringer by any of the many trained scientists who, both before and after the reported sightings, visited the areas where they were made, as well as the improbable habitat, is very strong. Only the fact that Miller recorded klipspringer and duiker consecutively (Miller, 1934) has prevented our rejection of the presence of klipspringer as for the reedbeek. There are no klipspringer on Kilimanjaro, or even in the near vicinity, at the present time; if a small population had occurred in the past it would now have to be considered extinct.

The only mammal known for certain to have become extinct in the Kilimanjaro area is the black rhinoceros. Newmark *et al.* (1991) optimistically recorded it as 'possibly present', a statement based on the testimony of a Forest Guard, who had seen a rhinoceros on the northern slope a few years previously, and local Masai residents who reported seeing a rhinoceros in the migration corridor, moving up from Amboseli to the lower slopes of the mountain. They told JMG & CAHF that in the past such movement had been common, with the animals remaining on the mountain for a few weeks before returning to Amboseli. Our investigations in 1990 and in subsequent years have failed to document its continued existence. In his survey of rhino populations across Tanzania, R. Heyworth (Frankfurt Zoological Society) also visited the northern slope and has confirmed that the black rhinoceros must now be considered extinct on the mountain (R. Heyworth, pers. comm., 1993). As with all other populations of this species, intense selective poaching has been the cause of this extinction.

Three species of shrew, *Crocidura fumosa*, *C. gracilipes* and *C. maurisca* (listed by Swynnerton and Hayman, 1951), and one rodent, *Colomys goslingi* (recorded by Rodgers *et al.*, 1982) have been excluded from this list on the grounds that, according to authoritative modern reviews (e.g. Kingdon, 1974 a & b; Hutterer, 1993; Musser & Carleton, 1993) their range does not include Kilimanjaro. Their exclusion, and the uncertainty over the identity of other species recorded, emphasises the necessity for a comprehensive and accurate small mammal survey of the forest and lower zones of Kilimanjaro, to confirm species' presence and establish their distribution.

Twenty-six species of mammal have been added to the Kilimanjaro checklist since Swynnerton & Hayman produced their version (for the whole of Tanzania) in 1951. The increase in known mammal species diversity and distribution in the Kilimanjaro area, especially within the forest zone on the northern and western slopes, where most of the new records are reported from, can largely be attributed to greater observer frequency in recent years. Historically these areas have been neglected by naturalists. It is almost certain that, as discussed in the individual species accounts, new records of species occurring in the forest reported by Newmark *et al.* (1991) may be considered to have been overlooked in the past.

The general pattern of land use around the mountain was established by the 1950s, with the exceptions of the spread of maize into lower areas and the replacement of blocks of natural

montane forest and bushland by the establishment of plantations (totaling 6125 ha or 6.3% of the total forest area (Lamprey *et al.*, 1991)). The Forest Reserve boundaries have remained the same, and although the montane forest has often become degraded, and sometimes severely so, this has been insufficient to cause total habitat loss for any species.

There is no evidence that any species has succeeded in becoming established in the defined area as the result of a recent colonisation event, or even deliberate introduction, although many species have undoubtedly been able to increase their range within the area as a result of human activity enlarging the extent of favourable habitat. For example the cultivated areas of the western slopes represent an upward extension of an open plains habitat to formerly forested altitudes. This means that certain plains species can now occur much higher than formerly—the record of gerenuk and lesser kudu at over 1700 m is a particularly striking example of this—but as this area has been under cultivation since 1950 (J. Millard, pers. comm., 1994), with other farms on West Kilimanjaro having been opened up prior to 1914, it cannot be seen as the result of recent events. The gradual spread of cultivation around the lower slopes of the mountain has, however, undoubtedly led to the severing of contact between the forest and plains habitat and to the loss of traditional migration routes. This has been documented for elephants (Grimshaw & Foley, 1991) but also applies to routes used by several other species of mammals. At present Kilimanjaro is surrounded by cultivation with the exception of a seven kilometre-wide strip of bushland on the northern slope which links the mountain with the Amboseli basin. This area is used as a corridor by elephants, buffalo and eland migrating to and from the plains, and by other species of large mammals as a wet season dispersal area. The isolation of protected areas and the genetic consequences to mammal populations within them has become an issue of considerable concern (e.g. Soulé, 1986). Island biogeography theory also predicts that the probability of extinction increases with diminishing area. In addition to the potential isolating effects of the severance of the migration corridor, concern has also been expressed that the plantation blocks on the western and north-eastern slopes have reduced the area of natural habitat available, and more importantly, fragment the montane forest into two halves (Lamprey *et al.*, 1991). In two such discontinuous, smaller areas the independent probability of species-loss is greater than if they were united (Newmark *et al.*, 1991) through random demographic and environmental fluctuations (Shaffer, 1981; Gilpin & Soulé, 1986).

It is possible that, over many years, genetic deterioration might occur in populations of mammals isolated on the mountain, but at present there is no evidence to suggest that populations of any species on Kilimanjaro (with the possible exception of lions) are both isolated and small enough for this to be an immediate threat. Should the migration corridor be severed, or the plantations increased in size, the likelihood of local extinctions occurring on the mountain would probably increase, particularly for some of the larger mammals such as eland. These populations, in the absence of recruitment, would be susceptible to extermination through direct human action, or disease, rather than the cumulative, slow effects of genetic deterioration.

It cannot be stressed too strongly that the immediate threat to species survival—of all taxa—on Kilimanjaro comes from direct human pressure. The population of Kilimanjaro Region is increasing at a mean annual rate of 2.1% (Gamassa, 1991) and the forest reserve is coming under increasing pressure to provide firewood, extra land and very often bush meat. The effect this has on mammal populations on Kilimanjaro is not quantified, but the dearth of large mammals on the southern slopes (where human density is highest) suggests that hunting for meat is instrumental in causing serious depletion. This is of particular concern in the cases of the threatened large mammals (Table 2); Tree hyrax, Abbott's duiker and Mountain reedbuck, all of which are hunted for food, with the latter two known to be scarce. Other threatened species

using at least parts of the Kilimanjaro area (African elephant; cheetah; hunting dog) have suffered indiscriminate persecution under the guise of crop and livestock protection by farmers and wildlife officers; other solutions should be sought to deter these animals from 'raiding' farmland. All the threatened species mentioned above, the two smaller threatened species and Kilimanjaro's only endemic mammal, *Myosorex zinki*, require further biological monitoring as very little is known about their ecological requirements on Kilimanjaro.

Table 2. Alphabetical list of threatened and endemic taxa occurring within the defined Kilimanjaro area. Categories of threat as defined by IUCN (Groombridge 1993) are as follows: E = in danger of extinction; V = vulnerable; R = rare; I = indeterminate; K = insufficiently known.

Species	Category of threat
<i>Acinonyx jubatus</i>	V
<i>Beamys hindei</i>	V
<i>Cephalophus spadix</i>	V
<i>Crocidura monax</i>	K
<i>Dendrohyrax validus</i>	I
<i>Loxodonta africana</i>	V
<i>Lycaon pictus</i>	E
<i>Myosorex zinki</i>	endemic: IUCN category currently unknown (recent elevation of status)
<i>Redunca fulvorufula</i>	V: for ssp. <i>chanleri</i>

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