Kilimanjaro and Mount Kenya: some comparisons, with Special Reference to the Mammals and Birds; and with a Note on Mount Meru

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With a Bibliography of Kilimanjaro, by C. Gillman

INTRODUCTION

SOME TIME AGO I had the idea that it would be interesting to make a comparison between the respective mammal faunae and bird faunae of Kilimanjaro and Mount Kenya. I soon found that although it is nearly a hundred years since the mountains were discovered by Europeans, and nearly eighty and sixty years respectively since the moorlands of Kilimanjaro and Mount Kenya were first reached by explorers, a great deal of preliminary work had to be done to assemble the scattered information. As a start, therefore, I made the first attempt at a comprehensive account of the mammals and birds of Mount Kenya, discussed the results in relation to the vegetation zones and geographical position, and provided the first bibliography of the mountain.* For Kilimanjaro much more of the preliminary work had already been done, but it has been an unpleasant surprise to find on careful examination that the published information about the mammals of the higher levels of Kilimanjaro is hopelessly defective. In fact, even including the unpublished records which have most generously been communicated to me, it is at present impossible to make a useful comparison between the mammal fauna of Kilimanjaro and that of Mount Kenya. However, even though I cannot carry out my original plan it is, I think, useful to put on record the present extent of our knowledge and also to discuss certain features of the environment that must be taken into account in any zoo-geographical discussion.

The present studies are intended to deal only with the montane mammals and birds. The limits of the montane fauna are easy to define in general but not in particular because of the difficulty of fixing the lower limit. I aim at including primarily the inhabitants of the moorland and the main forest belt, both of which are ecological islands, even though the latter is in ring form. If all the species of mammals and birds that enter the lowest edges of the forest or the lowest clearings were included the elements significant for discussion of the montane zoo-geography would be obscured. I have therefore tried to concentrate on those species normally living for the most part above about 6,000 feet. There is no defined lower edge to the forest belt. Vestiges and fringing forest occur right down to the plains surrounding both Mount

* "Mount Kenya: a contribution to the biology and bibliography." *J. E. Afr. Nat. Hist. Soc.* (in Press).

Kenya (on the east) and Kilimanjaro. As has been written before (Moreau, 1936) of the latter mountain, the actual "lower boundary of the main forest belt is the resultant of two opposed human forces . . . on the one side the conservative efforts of the Forest Department, on the other the agricultural pressure of the Wachagga and the grazing hunger of the Masai, powerfully assisted by the pyrotechnics of the native honey-hunter. Stabilization has more or less taken place where the Chagga are concerned. The same can be said with less certainty on the Masai front of the west and north, where, under a drier climate, the forest is more susceptible to fire. In consequence the lower edge of the highland forest and the local limits of many species of birds and mammals are to be regarded as adventitious, dependent on that unconscionable biotic factor, man".

I have to make a number of acknowledgments for unpublished information and for other help; especially to Captain and Mrs. M. S. Moore for allowing me to quote the information they obtained on their recent journey on Kilimanjaro, to Mr. R. W. Hayman of the British Museum in connection with the list of mammals, to Mr. C. L. Bancroft for an extract from the Forest Department files, to Mr. C. Gillman for discussion of a number of points, to the Rev. Dr. R. Reusch for personal information and to Mr. P. J. Greenway for botanical assistance. I am indebted also to Mr. H. F. I. Elliott and Mr. N. R. Fuggles-Couchman for reading the draft of this paper, and to the former for allowing me to quote important unpublished bird-records of his.

For Kilimanjaro the essential work of compiling a bibliography had already been done by Mr. Gillman in 1932 (*The Icecap*, 1, 69-71); but as that source will not be a very accessible one for future workers he has kindly acceded to my suggestion that his bibliography might be brought up-to-date and reprinted following this present paper.

HISTORICAL AND BIBLIOGRAPHICAL

The history of exploration and scientific documentation has been very different on the two mountains, with Kilimanjaro on the whole far in the lead. Only fifteen years after it had first been sighted, Baron Carl Claus von der Decken made the first attempt on it, but reached no further than about the top of the forest belt. In the following year (1862) he and Kersten got to over 14,000 feet. British, Germans, Austrians and an American succeeded these pioneers, but none got higher than the saddle between Kibo and Mawenzi. Most left some account of their expeditions; Johnston, who collected both plants and animals, devoted a book to the mountain, and made by far the most important contribution to its biology up to that date. The summit of Kibo was eventually gained in 1889 by Hans Meyer, who described his journeys at length, in several different forms. He published a book on the subject in 1890 and another, which is regarded as the standard work on the mountain,

in 1900, both accompanied by large-scale maps. Meanwhile Volkens, whose botanical work on and round the mountain had lasted for several months of 1893 and 1894, had produced a book on the subject in 1897. Incidentally his map shows that a *Schutzhütte* had already been established, apparently the original of Johannes Hut. Thus, by 1900 Kilimanjaro had already inspired four full-sized books that contain a great deal of information of scientific value. In the last twenty years Dundas and Geilinger have contributed two more, though the former is not in the same class as the others. There has also been a book by Stuart-Watt, about which, to judge from the review in the *Geographical Journal* 77, page 81 (1932), the less said the better.

These are all general books, but the most imposing publication connected with the mountain deals in three volumes with the work of the Swedish Zoological Expedition under Sjöstedt, which spent the years 1905 and 1906 on and around Kilimanjaro and Mount Meru. Finally, to complete the list of books, Klute (1912) has collated the physical data. In addition to all these full-length publications, there have been numerous scientific papers dealing with different aspects of Kilimanjaro, apart of course from mountaineering accounts.

By comparison Mount Kenya makes a poor showing. Teleki climbed it to 13,800 feet in the 'eighties, but nearly fifty years after its discovery, and at a date when Kilimanjaro had already been well mapped and climbed to the top, and its biological aspects described in some detail, so little was known about Mount Kenya that it was still an open question whether it had a well-preserved crater, hardly any plants or animals had been collected on it, and the estimates of its height varied between 18,000 feet and 23,000 feet. The magnificent effort of Gregory in the early 'nineties removed the worst of these reproaches – his *Great Rift Valley* (1896) is the finest story of African exploration I know, all the more striking by comparison with the despicable circumstances of its start. Mackinder, with his successful first ascent to the top in 1899, did more; but no second ascent was made until 1929 and that was pure mountaineering. No book was written about the mountain until Dutton's *Kenya Mountain* (1930), still the only one, but of little scientific value; except for an appendix. Widely scattered papers, mostly Swedish or American, have dealt with the zoology and the botany. Nevertheless, the available information about the Mount Kenya birds proves when collated to be at least as good as that for Kilimanjaro and that about the Mount Kenya mammals by far the better.

On both the mountains the biological information is most unevenly distributed. On Kilimanjaro a very large part comes from between east and south-west, Rombo to Kibongoto. Some collecting, almost exclusively botanical, and some observation has been done on the north, above Engare Rongai, by Volkens, Geilinger, the Moreaus and Gilbert Rogers (no published results). Nothing seems to be known about the exceptionally difficult country at the eastern foot of Mawenzi; and for the entire sweep of the mountain on the west

and north-west, very little information of any kind has been published.* By contrast, on Mount Kenya the early work was done in the south-west corner by Teleki and Gregory. Subsequent information nearly all comes from the west, north-west and north-east (above Meru—which is, of course, nothing to do with Mount Meru). The whole south-eastern quadrant of Mount Kenya, which is the most deeply cut by ravines, the wettest, and potentially the richest biologically, is practically undocumented, except for some unpublished departmental information.

TOPOGRAPHICAL

This is no place to attempt any general description of either mountain. I wish only to stress certain features that must be taken into account when, ultimately, the montane faunae are sufficiently well known for a definitive analysis and comparison of them. Apart from the vegetation, which is dealt with in the next section, two elements are important in this connection, the conformation and the position in relation to other highland areas.

No one having the slightest acquaintance with the upper levels of the two mountains can fail to gain the impression that Mount Kenya provides a great rolling plateau between its snow-peaks and its forest, and that on Kilimanjaro the corresponding area is much smaller and steeper. This may be emphasized by considering that while the plinth of Kilimanjaro is actually smaller than that of Mount Kenya, Kilimanjaro has two peaks, Kibo of about 19,500 feet,+ Mawenzi of about 17,300 feet, with a long saddle between them, while Mount Kenya has only one single close group of peaks all reaching just about 17,000 feet. The relative areas at high altitudes on the two mountains are brought out in Table 1, which shows that the area available between 10,000 and 15,000 feet, which may roughly be taken as the moorland life-zone, is half as great again on Mount Kenya as on Kilimanjaro. The areas (square miles), obtained by calculation from the latest maps, are of course only approximate.

TABLE 1

	Above 9,000 ft.	Above 10,000 ft.	Above 11,000 ft.	Above 14,000 ft.	Above 15,000 ft.
Kilimanjaro	340 ...	240 ...	185 ...	48 ...	21
Mount Kenya	420 ...	320 ...	200 ...	24 ...	6

Several small lakes, some of which have been stocked with brown trout, exist on Mount Kenya between 11,000 and 14,000 feet and occasionally attract water-birds. On the Kilimanjaro moorland Meyer's map (1900) shows no permanent lakes. Dr. Reusch tells me that apart from a few temporary ponds on the south-south-east and south-west foot of Kibo, which dry more or less completely between October and March, there is a permanent pond on the north-west side of Mawenzi, fed by the Mawenzi snowfields. Another pond,

*The Tanganyika Forest Department have, however, made enumerations in parts of this area.

+ 5,030 metres = 19,455 feet according to Klute, 6,010 metres = 19,718 feet according to Meyer 19,585 feet on T.T. 1 : 2,000,000. Dar es Salaam, 1941.

on the saddle, contains water for nine or ten months in the year, but is salty, while on the Shira plateau a semi-permanent pond is fresh during the rains, salty later in the year and usually dry in January and February. Gillman notes that all these ponds are shown on Klute's map (1912).

Salt-licks have been noted especially on the western edge of Mawenzi and salt-encrusted pebbles close to Kibo Hut (Moore).

In their relation to other highland masses the two mountains differ greatly. Mount Kenya is on the north-eastern edge of the Kenya highlands, which may be taken as forming a continuous mass of land capable, so far as altitude is concerned, of supporting montane animals and plants. Mount Kenya has a connection above the 6,000 feet level with the Aberdares and with the highlands west of the rift. The Aberdares in particular support a moorland association that is a close counterpart of that on Mount Kenya and is within sight of it.

By contrast Kilimanjaro is ecologically more isolated and is to a much greater extent the predominant montane element in a large surrounding area. The mountain has at its feet a hot dry steppe, less than 3,000 feet above the sea, in every direction except the west. There a narrow bridge at about 4,500 feet, which may be taken, I think, as about the lower limit of dispersal for most montane species in Tanganyika, connects Kilimanjaro with Meru and through that with the ridge of high ground running west through Mondul to Burko and Essimingor, where it is terminated by the floor of the Rift Valley. On the east, Kilimanjaro is separated by a narrow but very low gap from the narrow ridge of the Pare mountains, which hardly exceed 7,000 feet. In fact Kilimanjaro above 5,000 feet may be regarded as constituting the eastern part, and more than half the area, of the montane ecological island that forms a narrow belt running west to the Rift Valley. Nevertheless, there are, as will be shown subsequently, several points in which Mount Meru has stronger affinities with the mountains west of the rift than with Kilimanjaro; so that the outline given above tends if anything to under-rate the ecological isolation of Kilimanjaro and its contrast to Mount Kenya in this respect. Moreover, the very small moorland areas on Mount Meru and, on the far side of the rift, Loolmalassin, zoologically still most imperfectly known, are the only ones nearer to Kilimanjaro than Mount Kenya itself, two hundred miles away.

VEGETATIONAL

On Mount Kenya the outstanding features are—

(1) The forest belt, deepest on the south and south-east, narrows northwards on both sides of the mountain and disappears altogether at the northern end. The result is that a broad, unimpeded, grassland corridor is provided from the game country of the Northern Frontier Province to the moorland; a corridor that cannot fail to have made the incursion of mammals easier.

(2) Except where this corridor occurs, the mountain is surrounded by a great belt of bamboo (*Arundinaria alpina* K. Schum.), which becomes the dominant, to the practical exclusion of trees, between about 8,500 and 10,000 feet. At the upper edge of the bamboos a belt of big trees, *Hagenia anthelmintica* (L. E. Gmel. (*Brayera anthelmintica* Kunth), often occurs on the edge of the moorland.

(3) Giant groundsels and giant lobelias extend up to over 15,000 feet and the highest flowering-plant recorded, an everlasting (*Helichrysum*), is at no less than 16,500 feet. Two species of giant groundsel (*Senecio keniodendron* R. E. and T. C. E. Fries and *S. brassica* R. E. and T. C. E. Fries) with their golden plumes of flowers and two giant lobelias (*Lobelia telekii* Schweinfurth and *L. keniensis* R. E. and T. C. E. Fries) flourish on on the open moorland above about 11,500 feet.

If one were to accept the recent, and perhaps the most authoritative, description of the vegetation of Kilimanjaro, that by Engler (1925), one would conclude that Kilimanjaro provides no contrast to Mount Kenya in feature (1) and that it differs rather markedly in feature (3) as well as in feature (2). Both these conclusions would be wrong; and the reason why Engler gives such a false impression is that he based his statement not only on Volkens (1897) but also on the even earlier work of Meyer (1890).

Because Engler has written with all the authority of the *Pflanzenwelt Afrikas* in the *Vegetation der Erde* series it is desirable to traverse his statements in detail where necessary. Moreover the question of a break in the forest ring is of great importance in a discussion of the moorland fauna from a geographical and evolutionary point of view when that eventually becomes possible. Engler's statement (1925, pages 255-56), translated literally, is as follows:—

> This forest begins in the south at about 1,900 metres (6,300 feet) a.s.l. and in general extends up to 2,600 metres (8,500 feet), but above Kibosho up to 3,000 metres (9,800 feet). In the north the forest is situated between 2,200 and 2,800 metres (7,200 and 9,200 feet) and in the north-west disappears completely, giving way to extensive scrub and grass formations. Above the limit of the unbroken forest, tongues of short-tree stands run up to 3,200 metres (10,500 feet) along the water-courses and depressions on the south side.*

Elsewhere (pages 251-52) Engler states:—

> Closed forest on the west up to 3,000 metres (9,800 feet) . . . on the south to 2,800 metres (9,200 feet) abuts on the mountain meadows† of

*Hollister, *U.S. Nat. Mus. Bull.* 99, Part 3, p. 7 (1924), makes an error in stating that the timber line is 13,000 feet on Kilimanjaro.

†A literal translation of *Bergwiesen*, itself a badly undescriptive term, since the clumpy nature of the grass and the woody nature of the rest of the vegetation are quite unlike any characters of a meadow that suggest themselves automatically to a European. "Moorland" is a preferable term, though by no means exactly descriptive of these areas of high-altitude grassland and scrub.

> the sub-alpine region or on tongues of woodland or on thickets of giant heather. . . . Sub-alpine region up to about 3,400 metres (11,100 feet) with . . . patches of giant heather or up to 3,600 metres (11,800 feet) with *Ericinella*, Alpine region, lower part, up to 4,200 to 4,500 metres (13,800 to 14,700 feet). Low bushes of *Euryops*, tufts of grass and cushion plants between the blocks of stone. Upper part, moss and lichens.

I am indebted to Gillman for detecting that Engler reproduced the statement that the forest disappears completely in the north-west word for word from Meyer (1890). At that date Meyer's remark can hardly have been based on personal observation, for there is no evidence that he had followed a route that either carried him through the forest of the north-west quadrant or enabled him to view it from below. On his accompanying map the lines delimiting the forest run round the north-east and disappear nearly due north of Kibo. From the south the lines are carried round until the upper one hits the Shira plateau. Every subsequent map has shown a complete forest belt but its conformation has varied greatly. That of Volkens (1897) shows a belt of forest, in a hearty and most convincing deep green, right round the mountain and actually wider (five to seven miles) between north-east and west than anywhere else on the mountain. On the other hand, in 1900 Meyer, while retaining the complete ring, makes it widest on the south and about two and a quarter to four miles wide all the way round the north and north-west.

D.O.A. 1 : 300,000 map 1911 provides another variant, for in that the widest part of the entire forest ring is in the north-west corner, eight miles wide opposite Ol Molog. On the other hand, the stretch north-north-east of Mawenzi is narrowed to one and a half miles. These features were reproduced in the General Staff G.E.A. 1 : 300,000 B.5 (1915); and with minor variations the same impression is conveyed by the very latest map (1943).

Sketch-maps published with my own papers (Moreau 1936 and *Ibis* 1937, plate 16) naturally followed the General Staff map, but since then further acquaintance with the mountain has suggested to me that the mapping of the forest belt is incorrect. I therefore approached Mr. C. L. Bancroft, Assistant Conservator of Forests at Moshi, who replied as follows :—

> "I can definitely state that there is no break in the forest belt around Kilimanjaro. It would be correct, however, to say that forest growth is narrowest on the north-western slopes of the mountain between Engare-Nairobi North and Ol Molog rivers where it is interrupted by fire-created open glades.* The following extract is quoted from Mr. W. F. Baldock's *Preliminary Report on the Kilimanjaro Forest Reserve*, dated May 1924 :—

*There is not, however, a continuous channel formed by glades through the forest; there is a succession of them set at various angles and with narrow strips of forest still existing between them (Elliott *in litt.*).

> . . . the western face of the mountain shows the quickest variations from one type of forest to another but the areas concerned are small. That lying between the Lolmolog and Engare-Nairobi North consists principally of open grassland with a belt of a few hundred yards to a mile deep of dry Brown-Olive type forest much scorched by Masai fires and containing no useful timber except a very occasional cedar. Above this area was at one time (as at Endoinet) a fine cedar forest. At present stumps and bare trunks of dead trees of cedar and brown olive are to be seen in the long grass that covers the whole area, but except for some small patches and individual trees the area is almost blank. The cedar is well grown though small and usually free of large branches near the ground; this belt runs irregularly up the mountainside and gradually gives place to isolated *Lororoni* (*Nuxia platyphylla* Gilg.). The average depth is two miles and the slope gradual; the area is dotted with Masai cattle roads and numerous manyatta dating from 1916 to 1919. Above the cedar belt the *Lororoni* is found growing singly and in groups of five to ten for a further mile after which there is a series of rounded hills covered with heaths and the valley between with bog grasses. Between the arms of the Engare-Nairobi North River is a patch of cedar growing pure and undamaged by fire giving some indication of the fine forest that must have at one time existed here. In this area though near the upper limit of the cedar forest the trees are big and stand close together yielding fifty tons per acre . . .'."

In a further letter, which also he allows me to quote, Bancroft states that on the north-east of the mountain, near Leitokitok, where the forest is shown on the latest map as hardly more than two thousand yards wide, it is in fact five thousand three hundred.

Meanwhile a categorical published statement had been made by Geilinger (1930) that the forest surrounds the mountain in an uninterrupted belt, reduced on the north. Since, apparently, no other author has given a description of the north side, this remark may be amplified by a translation of a subsequent unpublished statement of Geilinger for which I have to thank Gillman :—

> Everywhere the lower edge of the northern Kilimanjaro forest lies higher than on the south, at about 1,900 to 2,000 metres (6,200 to 6,500 feet). The upper edge runs generally at about 3,000 metres (9,800 feet) frequently very indistinct . . . merging not into alpine grassland, but direct into a very dense and tall Macchia formation, that is to say entirely differing from the south side.* This northern forest is not only considerably narrower than the southern (to traverse it requires only about two hours), but it is generally less dense and is often interrupted by large openings consisting of "high-grass savannah" (probably mostly with *Artemisia*). *Juniperus procera*, entirely missing on the south side, is characteristic. [As it is on the west.—R.E.M.].

*Greenway comments that Macchia formation does occur on the south side in patches.

Actually, I think, the upper limit of 9,800 feet for forest on the northern side is too high, at any rate in places. Recent fires coming down from the moorland had done so much destruction that when Mrs. Moreau and I were working the area above Engare Rongai (just west of Leitokitok) in 1938 we recorded our opinion that true forest remained only in shreds and patches above about 8,000 feet, though charred cedars (*Juniperus procera*) showed what had been lost. The process there had been the same as described by Baldock for the west side.

Thus it is clear that Engler's statement about the break in the forest is wrong and that the breadth of the actual forest belt as depicted on even the latest maps is equally wrong in the other direction. But a process has started, evidently in very recent historical times, perhaps only in the last fifty years, that will make Engler's erroneous statement come true unless protection is effective.

In sum, it appears that while the forest belt is still complete, the barrier it presents to the movement of non-forest animals up and down the mountain is less on the north-west than anywhere else except perhaps the north-north-east; and at the present time it is probably less effective than it has ever been in the past. This means that there has been until very recently little prospect of interchange between mammal populations on the moorland and those of the open country surrounding the foot of the mountain.

Moorland fires are probably an important ecological factor on both Kilimanjaro and Mount Kenya. There seems no doubt that they frequently are not due to human agency. Elliott (*in litt.*) mentions seeing a fire started by lightning on Ruwenzori; and Greenway tells me that he has seen isolated patches of grass burnt in such a way and in such situations on the saddle between Kibo and Mawenzi as to make it virtually certain that combustion had been spontaneous. This would have been facilitated by the extreme intensity of the radiation and dryness of the air (see Meyer, 1900, page 149). What was presumably a stable relationship between forest ring and moorland has certainly shown signs of breaking down in recent years, especially on the north through fire on the upper side of the forest. Is this due to a new factor, man's agency in causing fires on the moorland, or is a drier climate to blame?

Bamboo (*Arundinaria alpina*) is nowhere mentioned in the literature of Kilimanjaro; and the general impression is that none exists there—a striking contrast to Mount Kenya. This is not, however, wholly true. To the Tanganyika Forest Department "one patch is known, which is scarcely fifteen acres in extent and is situated at the extreme top edge of the forest on the right bank of the Kitenden River on the north of the mountain" (Bancroft *in litt.*). Actually there may be some more bamboo on Kilimanjaro. Elliott *in litt.* has reason to believe there is some on the north-west: and C. R. V. Bell

has stated (communicated by L. M. Fernie) that there is a very narrow bamboo belt at about 9,000 feet above Leitokitok. He adds: "I remember very clearly that the bamboos had been crushed by elephants".

Meyer has stressed the existence of alpine desert starting on Saddle plateau at about 14,500 feet and comprising all from that level upwards. Gillman (1923) has commented that its present surface is due to "desert weathering". Its desertic nature is very pronounced though it is in parts not so devoid of plants, both ephemeral and perennial (of specialized habit) as, for example, parts of the Libyan Desert known to me. Mackinder in the discussion on Gillman's paper (*Geog. J.* 61, 23) has already commented that there is no similar alpine desert on Mount Kenya. Instead, as Mackinder pointed out, on Mount Kenya "you get domed bushes with rat paths between them, and that vegetation extending to within a few hundred feet of the ends of the glaciers".

Another point Mackinder made (*loc. cit.*) was that "whereas on Kenya you go right out of the forest and some way through the zone of bush heath before you reach the great valleys which are studded all over with thousands of giant groundsels and giant lobelias", he had gained the impression from photographs that on Kilimanjaro these plants "were mixed in the upper edge of the forest". This doubtless arises from confusion between *Lobelia giberroa* Hemsl., which is a species of the forest edge and of openings in the forest, and *L. deckenii* Hemsl. which is no less a plant of the open moorlands than are *L. telekii* and *L. keniensis* on Mount Kenya. Similarly *Senecio cottonii* Hutch. and Taylor is a purely moorland species, recorded by Greenway up to 14,800 feet—Geilinger (unpublished) agrees—and even 15,000 feet in exceptionally sheltered spots. Another giant groundsel, *S. kilimanjari* Mildbraed, overlaps the lower edge of *S. cottonii* at about 12,000 feet, and the two species cannot safely be distinguished except when in flower. *S. kilimanjari* is characteristic of the lower, bushy part of the moorland, and is the species photographed by Greenway with the characteristic local sunbird on top (Moreau 1936, plate 4). Lower still, in the forest belt and forest patches from 7,000 feet upwards, occur two other giant groundsels, *S. johnstonii* Oliver and an unnamed species, alongside *Lobelia giberroa* and the so-called *L. volkensii* Engl., which latter may not really be distinct. Greenway has found *S. johnstonii* exceptionally up to 10,700 feet, where there was a single one in a stand of *S. kilimanjari*. There has been much confusion* about these spectacular features of the Kilimanjaro vegetation and I am grateful to Greenway for enabling me to elucidate them.

*Even by botanists. The photograph labelled *S. johnstonii* by Hitchcock (fig. 103 in "A botanical visit to South and East Africa", *Explorations and Field-work of the Smithsonian Institution in 1930*) is of either *S. cottonii* or *S. kilimanjari*. In Geilinger (1930) the *Senecio* in fig. 121, which is called *S. johnstonii* on page 110, is, according to Greenway, either *S. kilimanjari* or *S. cottonii*, and the *Lobelia* on fig. 118 is probably not *giberroa*. Good photographs of the Giant Senecios, critically named, have been provided by Schlieben, H. J., "Die Riesengreiskraut-Gewächse des Kilimanscharo", *Natur und Volk*, 67, 602-608 (1937), but he gives the range of *S. cottonii* as up to 5,000 metres—over 16,300 feet. This is much too high.

The distribution of the epiphytic orchids on Kilimanjaro is a point that is of personal interest to me though hardly relevant to the present discussion. It is surprising that they appear to be exceedingly rare in the main forest belt of the south side, where the wet climate and dense growth of trees, loaded with moss, lichen and ferns, would seem especially favourable. In fact, however, no species have so far been found above about 6,000 feet, except that the tiny *Polystachya confusa*, only about two inches high and with rose-pink flowers, appears at the edge of the forest belt about 9,000 feet. It may be that epiphytic orchids are better distributed in the drier forests of the north and west. The richest localities are evidently the river gorges on the south side: but the entire list for Kilimanjaro, so far as we know it at present, while a little longer than that for Mount Kenya, is altogether poorer than that of the ancient crystalline blocks, Usambara and Uluguru.

THE MAMMALS

Lönnberg in Sjöstedt (1910) lists an imposing number of mammals, including those obtained by the Swedish expedition and those of all previous workers; but on analysis the list is found to consist mainly of species that belong to the foothills and the surrounding plains, which on the west, near Engare-Nairobi, rise to over 5,000 feet above the sea. Hardly any specimens could be recorded above 6,000—why the Swedish expedition did not devote more attention to higher altitudes is not apparent—and the position has not been much improved in the thirty years since Lönnberg wrote. Mr. R. W. Hayman has been good enough to verify that the only published records since 1912 are thirteen species from Rombo (collected by Robin Kemp) in a paper by Oldfield Thomas (*Ann. Mag. Nat. Hist.* (8) 6, 308-16, 1910), and three incidental records by Kershaw (*Ann. Mag. Nat. Hist.* (9) 11, 592, 1923) from a collection made in various parts of Tanganyika by the Game Department. Of all these sixteen records only two are from as high as Bismarck Hut, at the upper edge of the forest.

The present position is that we do not seem to have a single authenticated and properly identified specimen of a mammal from the moorland above 9,000 feet and but few from above 6,000 feet. For the moorland mammals nothing but sight-records exist and it is fortunate that these have recently been reinforced by the observations made by a Game Department expert, Captain Moore. He has generously allowed me to quote his results. He followed the usual route by the huts, Bismarck, Peter's, Kibo and Mawenzi, and found game excessively scarce. This was probably due in the main to disturbance by human beings in this relatively much-frequented area, and partly perhaps to the dryness of the season (February 1944).* Captain Moore was, however,

*However, game may be genuinely scarce on the moorlands. Volkens, after spending several days in his march across the northern half of the moorlands, does not mention one single mammal.

able to make important additions to knowledge of the high-altitude mammal fauna by the study of the spoor and dung that were encountered. How much remains to be done, especially among the rodents, may be gathered from the fact that it is still uncertain which the mice are that infest Peter's Hut and that Captain Moore observed heaps of rodent droppings under rocks as high as 16,000 feet—over 7,000 feet above the highest authenticated rodent specimens.

In compiling the attached list I have combined the information available in the published sources, drawn upon Moore's notes and also used a list of the British Museum identifications kindly given me by Mr. B. Cooper for specimens collected by him.

I have tried to exclude from the list species that are essentially of the plains or the foothills and that may be expected to reach their upper limit at about the lower edge of the main forest belt, though occasionally they may penetrate the glades. Among those specimens which I have excluded on these grounds are the following, several of which have had their type-locality given as "Kilimanjaro": hedgehog, *Ateleria pruneri kilimanus* Thomas (originally recorded as *Erinaceus hindei* Thomas); bats, *Rhinolophus deckenii* Peters and *R. lobatus* Peters; shrews, *Crocidura gracilipes* Peters; honey-badger, *Mellivora capensis sagulata* Hollister; mongoose, *Atilax paludinosus rubescens* Hollister; guenon monkey, *Cercopithecus aethiops johnstonii* Pocock; rodents, *Rattus concha hildebrandti* Peters, *Otomys irroratus elassodon* Osgood, and *Grammomys* (*Thamnomys*) *surdaster surdaster* Thomas and Wroughton.

SHREWS.

Crocidura monax Thomas. Type locality 6,000 feet, Rombo. Nothing stated about its ecology but possibly montane since the species occurs at the upper edge of the forest in Uluguru (Allen and Loveridge, 1927).

Crocidura fumosa subsp. Specimens from 6,500 feet are recorded as *C. fumosa* by Lönnberg as well as specimens from acacia country at Engare-Nanyuki. The type locality of the typical sub-species is at 8,500 feet on Mount Kenya and the range is central Kenya at high altitudes. Another sub-species, *C. f. schistacea* Osgood, has been described from a locality in Ukamba, nearer to Kilimanjaro. Kilimanjaro specimens might be either of these sub-species—or neither. Pending further information about their status on Kilimanjaro the population there is regarded as montane.

Crocidura martiensseni Neumann. Type locality above Marangu, 6,000 feet. Omitted from Lönnberg's list, presumably through inadvertence.

BUSHBABY.

Galago crassicaudatus panganiensis Matschie. Lönnberg records it as "very common in the lower parts of the forest" on Kilimanjaro (but on Mount Meru up to the top of the forest).

MONKEYS.

Colobus polykomos caudatus Thomas and *Cercopithecus mitis kibonotensis* Lönnberg. Probably both the Colobus and this "Blue" (Sykes') monkey extend well up through the forest but there is no exact information.

CIVET.

Civettictis civetta subsp. This has only been collected up to about 6,000 feet (Cooper), but it apparently wanders right up on the moorland where Moore saw dung as high as 15,000 feet. The sub-species is probably *C. c. schwarzi* Cabrera, which has a wide range on the eastern side of Africa.

GENET.

Genetta tigrina stuhlmanni Matschie. Johnston recorded this species "up to 7,000 feet". Specimens collected by Cooper near Marangu, at about 6,000 feet, have been named *stuhlmanni*.

MONGOOSE.

Myonax sangineus ibeae Wroughton. Recorded by Lönnberg but only for Kibongoto, i.e. at ca. 5,000 feet, and recently collected by Cooper at about the same altitude : but by analogy with Mount Kenya it is possible that this predator is a member of the montane forest community.

STRIPED POLECAT (GREATER WEASEL; ZORILLA; "AFRICAN SKUNK").

Ictonyx striatus subsp. Collected only up to 6,000 feet (Cooper), but, by analogy with Mount Kenya, may go far higher.

SERVAL CAT.

Felis serval ? hindei Wroughton. Moore recorded spoor of this species up to 12,000 feet and dung up to 15,000 feet.

LEOPARD.

Felis pardus pardus Linn. Johnston thought that leopard did not ascend to more than 8,000 feet. Meyer, Volkens and Lönnberg have none of them recorded evidence of leopard any higher, yet there is no doubt that the leopard penetrates to the moorland and beyond. In 1926 Latham reported the amazing discovery of the desiccated body of a leopard on the crater rim at the spot now called "Leopard Point". Photographs of it have been published both by Latham and by Tilman (1937). Moore notes that the carcass was a small one, either of a young beast, or even of a serval, as Reusch thinks.

In 1943 E. Robson (*East African Standard*, 19th November) has reported that "a second leopard skeleton has recently been found on the crater floor below Leopard Point, where the remains of the original leopard are still visible".

These two carcasses may be the remains of animals that climbed up the snows of Kibo at an interval of several scores or hundreds of years, yet it is difficult to imagine what impulse can have actuated the leopards to make this journey at all. The only food that I can conceive of occurring on the snows is the bodies of migratory locusts which are said to pass at those great heights. It is likely that a hungry leopard would find locusts palatable—it does not disdain such small food as mice—and might even have misguidedly followed them up the slope of Kibo to the top.

TREE DORMOUSE.

Graphiurus (*Claviglis*) *murinus isolatus* Heller. Named on Abbott's specimens from 5,000 feet. This is doubtless the dormouse Johnston figures and mentions that he found in forest at 6,000 feet.

STRIPED GRASS MOUSE.

Lemniscomys striatus ardens (Thomas). Type came from 6,000 feet. This is the *Arvicanthus pulchellus* of Lönnberg's list. A species of grassy glades.

KUSU (RAT).

Arvicanthus sp. It is difficult to understand why Lönnberg uses the name *A. neumanni* Matschie (i.e. *A. abyssinicus neumanni*, type locality Kondoa Irangi) for the solitary specimen "rescued from the claws of a hawk" on the "mountain meadows" at 10,000 feet. He expressly states that the Kilimanjaro specimen differs from *neumanni* in having the underparts rusty instead of white washed with grey.

FOUR-STRIPED GRASS MOUSE.

Rhabdomys pumilio diminutus (Thomas) (formerly *Arvicanthus*). Recorded by Lönnberg on Volken's authority and has since been collected at Bismarck Hut (Hayman *in litt.*). It was doubtless this species which Mrs. Moreau and I repeatedly noticed in the moorland at the upper edge of the forest (ca. 9,000 feet) on the north side of Kilimanjaro. *R. p. diminutus* has been collected as high as 10,700 feet on Mount Kenya and 12,000 feet on Elgon.

SHORT-HAIRED RAT.

Rattus (*Praomys*) *tullbergi jacksoni* De Winton. Recorded only from low altitudes but it probably goes well up, as on Mount Kenya.

PIGMY MOUSE.

Mus (*Leggada*) *triton murilla* (Thomas). No actual record of Kilimanjaro above 6,000 feet but, as it is a grass mouse that on Mount Kenya ascends to at least 8,800 feet in the glades, it may do the same on Kilimanjaro.

HARSH-FURRED MOUSE.

Lophuromys aquilus aquilus (True). Type came from 8,000 feet. Also collected at Bismarck Hutt (Hayman *in litt.*). A species of glades.

MOUSE.

Dendromus nigrifrons nigrifrons (True). The type came from 5,000 feet. The species may be genuinely montane since it goes to 14,000 feet on Mount Kenya.

GROOVE-TOOTHED RAT (VELDT RAT).

Otomys divinorum Thomas. Type locality Rombo at 5,300 feet. No evidence whether this is a montane species or not.

MOLE-RAT.

Tachyoryctes daemon Thomas. Type came from 5,000 feet. This is the species previously recorded by Lönnberg as *Tachyoryctes rex ibeanus* Thomas (Hayman *in litt.*); on Kilimanjaro only at low altitudes but on Mount Meru in "the uppermost part of the rain forest".

PORCUPINE.

Hystrix galeata subsp. Moore records spoor and dung at 9,500 feet; T. W. Kirkpatrick (personal communication) found a quill at 11,500 feet.

SQUIRRELS.

Heliosciurus rufobrachium undulatus (True).

Paraxerus ochraceus aruscensis Pagenstecher (probably this is what Lönnberg recorded as *Funisciurus ganana* Rhoads).

Paraxerus byatti byatti (Kershaw).

These are all forest species of which at least the first two may not go high.

TREE HYRAX.

Dendrohyrax validus validus True. Johnston and Lönnberg have recorded these to the upper limits of the forest.

ELEPHANT.

Loxodonta africana subsp. Elephants travel right up through the forest belt and have repeatedly been seen on the moorland. Meyer thought that they went as high as the *Panicum* (grass) and *Cyperus* (rush), say 11,500 feet, but not to 13,500 feet. Johnston had previously recorded them at 13,000 feet. Moore has proved that they occasionally go higher still, to about 16,000 feet, for he found the "bones of an elephant, dead for many years, under one rock shelter, the largest, situated a few hundred yards north-east of Mawenzi Hut".

Reusch (*in litt.*) states that the moorland is frequented by two herds in the dry season. One, the eastern, comes up from the Rombo-Useri section, the other, from Ol Molog in the north-west, by way of the Shira plateau.

BUSH-PIG.

Potamochoerus porcus daemonis Major. Moore observed spoor of bush-pig or wart-hog at 9,000 feet. Cooper has collected the former in forest glades between 6,000 and 9,000 feet.

DUIKERS.

Cephalophus harveyi harveyi Thomas. The type came from near the south-east base of Kilimanjaro, at Kahe, and the species probably ranges well up into the forest.

Cephalophus spadix True. A species about which little is known. In the original description its range is given as "high altitudes on Mount Kilimanjaro, frequenting the highest points" (True, 1890). This is patent nonsense as it stands: one is left to guess whether the words "highest points" should be followed by "of the forest" or "of the moorlands". I think it is a forest mammal: for it has also been collected in the West Usambara mountains (Hayman *in litt.*).

DIKDIK.

Rhynchotragus kirkii subsp. Johnston has an illustration of a dikdik killed at 11,000 feet, but not preserved, which seems undoubtedly to be *R. kirkii* and he thought it went up to 14,000 feet in the dry season. We do not know whether this was on native evidence or whether perhaps he saw dung. Lönnberg includes this species for the mountain, quoting Abbott as authority, but no specimen of Abbott's is listed by Hollister. Swynnerton (*Trans. R. Ent. Soc. London*, 84, 537) lists *R. k. hindei* (Thomas), type locality Kitui, for "Kilimanjaro", which may mean only the district.

SUNI (DWARF ANTILOPE).

Nesotragus moschatus moschatus von Düben. Sjöstedt's note about this species is confused: "common in the steppe where they seek shelter among the dense growth of bushes all the way up in the rain forest". Swynnerton (*op. cit.*) certainly regards this sub-species as belonging to forest or "closed bush". It occurs on the coast and perhaps does not ascend the mountain to any great height. Swynnerton retains the name *N. m. kirchenpaueri* Pagenstecher, type locality Arusha, for the Kilimanjaro suni, but Allen sinks this in the typical form.

? REEDBUCK, CHANLER'S.

Redunca fulvorufula chanleri (W. Rothschild). Meyer records "signs of a small antelope" at 13,000 feet. I several times saw small antelopes, which I thought were Chanler's reedbuck, on the north side

of the mountain above the forest, at 9,000 to 11,000 feet. Moore thinks the one he saw at 9,000 feet belonged to this species and he saw what appeared to be dung of it up to 15,000 feet.

KLIPSPRINGER.

Oreotragus oreotragus subsp. At 3,000 metres (9,800 feet) Gillman (1923) has a sight record of a klipspringer, which was, he tells me, identified by his companion, Mr. F. J. Miller. Moore saw a single specimen at 12,500 feet. It may belong to the sub-species *schillingsi* Neum., described from Longido.

BUSHBUCK.

Tragelaphus scriptus massaicus Neum. Recorded for the mountain, they may go higher up into the forest, as on Mount Kenya.

BUFFALO.

Syncerus caffer caffer (Sparrman). Johnston (page 354) records these up to 14,000 feet. Some mistake in the altitude might be suspected since on page 393 he states that "buffalo occur commonly in the forests up to 14,000 feet", an altitude that is far above the timber line. Probably, however, there is some copying error in the second statement. In the experience of Reusch, "the buffalo come from the northern side up to the saddle and stay sometimes for many days on the moorlands after having their salt higher up".

RHINOCEROS.

Diceros bicornis bicornis (Linnaeus). Not recorded for Kilimanjaro except round the base, but Mrs. Moreau and I know from personal experience that they are common at about 9,000 feet on the lower edge of the moorlands on the north side. It seems certain that they do not frequent the wet south side in the same way.

ELAND.

Taurotragus sp. Eland have repeatedly been observed above the forest belt on Kilimanjaro and some are presumably resident there. They appear consistently to ascend higher than any other mammals. Gillman (1923) has what appears to be the highest record of their actual feeding, a herd of five browsing on the last stunted patch of *Helichrysum* to be seen, at about 4,500 metres (15,000 feet) on the saddle. (Doubtless the "kudu" Johnston recorded as travelling up to 14,000 feet were eland.) Meyer saw fresh spoor at 15,250 feet, but recent records surpass these.

Moore writes of "large quantities of eland dung at 16,000 feet, well above Mawenzi Hut, where there is no vegetation except a single swampy patch of coarse grass. The beasts evidently go right up beyond the stream to the edge of the scree, which forms part of the wall of the higher peaks of Mawenzi; salt licks and rock shelters here being the attraction. These rock shelters are presumably used as protection against storms as it can be

seen that the animals bunch together on the western side". H. F. I. Elliott also tells me that he has noticed the convergence of eland tracks towards the western base of Mawenzi. Also Moore found traces of eland "quite close to" Kibo Hut though the only attraction possible appeared to be the salt which encrusted the pebbles under the rock shelters.

It may be that the Kilimanjaro eland are *T. oryx pattersonianus* Lydekker, the sub-species prevalent throughout Kenya and Tanganyika. The moorland animals give the impression of being large and are noticeably thick-haired. Some observers have suspected them to be a form of giant eland, *T. derbianus*; but this seems most unlikely, on both ecological and geographical grounds.

Discussion of the Mammals

As previously stated, the Kilimanjaro mammal fauna is altogether too imperfectly known for any complete comparisons to be possible. For the same reason the interesting questions of endemism and of subspecific variation with altitude on the mountain cannot be properly discussed. We know nothing of the mammals of the Pare mountains, the nearest on the south, and too little of Mount Meru, the nearest on the west. It may, however, be useful to consider the available information briefly, in order especially to show what species might be expected to turn up.

The Moorland.—On Mount Kenya the moorland fauna consists of the following species, apart from stragglers. All those marked * go well above the bushy lower half of the moorland:—

Two shrews, *Crocidura allex**, and *Surdisorex polulus*.
Two groove-toothed rats, *Otomys orestes** and *Otomys tropicalis*.
A mole-rat, *Tachyoryctes rex*.
A "mouse", *Dendromus insignis**.
A rock-hyrax, *Procavia johnstoni**.
A duikerbok, *Sylvicapra grimmia**.
Eland, *Taurotragus oryx pattersonianus**.
Leopard, *Felis pardus**.
Striped polecat, *Ictonyx striatus*.

It will be seen that the Mount Kenya moorland has quite a rich fauna of small mammals—two species of shrew and four of rodents. (*Dendromus*, notwithstanding its name, is not a tree mouse but is said to frequent the mole-rat runs.) Of the corresponding species on Kilimanjaro we are still almost totally ignorant. Against the Mount Kenya list of four rodents and two shrews we have on Kilimanjaro certain knowledge of only one of the rodents, the Four-striped Grass-mouse. But Reusch notes that shrews and mole-rats are common throughout the moorland, and Moore has observed rodent dung under a rock as high as 16,000 feet.

The rock-hyrax on Mount Kenya is a montane sub-species of a very widespread species that occurs, for example, in Mwanza. Hyraxes make such far-carrying noises that probably if they lived in any numbers on the Kilimanjaro moorland their presence would be well known. But Dr. Reusch tells me he thinks there are some round the east of Mawenzi, which is probably the least explored part of the whole mountain.

The apparent difference between the antelopes of the two moorlands is noteworthy. On both Kilimanjaro and Mount Kenya the eland is present, but while on the former both klipspringer and Chanler's reedbuck occur (subject to confirmation by specimens), on the Mount Kenya moorland there is only one small species of antelope, a duikerbok, *Sylvicapra grimmia altivallis* Heller, a moorland sub-species of a widespread animal that has also established itself on the Elgon moorlands. It is very remarkable that with the facilities afforded by the open grassland corridor Chanler's reedbuck and klipspringer, which both live round the base of Mount Kenya, should have failed to establish themselves on the moorland there, while they seem to have done so on the Kilimanjaro moorland without the same easy means of ingress.

It is probably true that the antelope population of the Kilimanjaro moorland, with its area of about two hundred square miles, is limited to a few score individuals of each species at the most. Such a population, in such a latitude, might be expected to evolve distinctive characters in a comparatively short time if isolation has indeed been effective.

The Forest Belt.—The fauna falls into two groups, one of which inhabits glades and the other of which is arboreal or is found only where the trees are dense and tall. On Mount Kenya the lists of the principal mammals of these two types are as follows, those which ascend to the upper part of the forest belt being marked † :—

Mammals of full forest—

Shrew, *Sylvisorex granti*†.
Galago, *G. crassicaudatus*.
Two monkeys, *Cercopithecus mitis*† and *Colobus polykomos*†.
Two squirrels, *Heliosciurus* sp. and *Paraxerus ochraceus*.
Dormouse, *Graphiurus murinus*†.
Crested "rat", *Lophiomys ibeanus*.
Tree mouse, *Rattus (Hylomyscus) denniae*†.
Rat, *Rattus tullbergi*†.
Tree hyrax, *Dendrohyrax arboreus*†.
Giant forest-hog, *Hylochoerus meinertzhageni*.
Two duikers, *Cephalophus harveyi* and *C. nigrifrons*†.
Bongo, *Boocercus eurycerus*†.

This gives as the purely arboreal community one galago, two monkeys, two squirrels, one tree-house and one tree-hyrax, of which the galago and the two squirrels drop out before the upper zone of the forest.

Other mammals—

Three shrews, *Crocidura t. fumosa*, *C. occidentalis* and *C. turba zaodon*†.
A mongoose, *Myonax sanguineus*.
A genet, *Genetta tigrina*.
The leopard, *Felis pardus*†.
Six rats and mice, *Lemniscomys striatus*†, *Lophuromys aquilus*†, *Oenomys hypoxanthus*†, *Rhabdomys pumilio*†, and *Mus* (*Leggada*) sp.
The bush-buck†.
The rhino†.
The buffalo†.
The elephant†.

For Kilimanjaro comparable lists cannot at present be prepared. Several of the mammals in the specific list given above for that mountain are included only provisionally. In the absence of field-notes we do not know whether mammals known only from about 5,000 and 6,000 feet belong to the plains and foothills or whether they are truly members of the forest belt that have been encountered at their lower limit.

Of the forest mammals the galago, monkeys, squirrels, dormouse and short-haired rat (*R. tullbergi*) of Mount Kenya all appear on Kilimanjaro. The tree hyrax is replaced by another species. Each mountain has two forest dukers: Harveys' occurs on both, but on Kilimanjaro the little-known Abbott's duiker, *Cephalophus spadix*, takes the place of the Black-fronted, *C. nigrifrons* of Mount Kenya. There are three notable absences from the Kilimanjaro list, the "Crested Rat", *Lophiomys ibeanus* (which is not a rat), the Giant Forest-hog and the bongo. At any rate the last two of these are not likely to be awaiting discovery unless the north-west side of the mountain is so imperfectly known that a large area of bamboo is uncharted. On the other hand, Kilimanjaro may be one up in squirrels, with a third species, *Paraxerus byatti*, but it is still not known whether this is really montane.

The mammal community of the forest glades is similar in composition on both mountains, if the three shrews tentatively included in the Kilimanjaro list all belong to it, but two of the shrews species are different, only *Crocidura fumosa* occurring on both mountains. The rodent species are the same on both, except that Mount Kenya adds *Oenomys hypoxanthus*.

THE BIRDS OF THE MOORLANDS

The results of collecting on Kilimanjaro, 1932 to 1935, were collated with previous records by Moreau (1936). The whole of the information at that time available came from the south-east (from the usual route by the huts), the south (from collections above Kibosho and one brief trip by Moreau above Machame) and from the west (a collection in the forest belt above Engare-Nairobi). Some records for the north side were subsequently obtained and

published (Moreau 1939). Since then no additions have been made to the ornithology of the mountain so far as I know except that the occurrence of lammergeyers has been confirmed by Elliott and by Moore with as good a sight record as one could hope to get.* Also, augur buzzards, which are seen over the moorland to at least 14,000 feet, should be added to my published lists; through inadvertence they were there quoted only for lower altitudes.

By now the list of birds that may be presumed to be resident on Kilimanjaro is fairly complete. All the work of the last fifteen years has added only five forms to the previous list. But there is most certainly need for much more study of the birds on the mountain. Firstly, as will be seen from subsequent discussion, there are one or two absences from the moorland list that are very surprising and that one is unwilling to accept, and there is also one species, the alpine swift, the sub-species of which is unknown. Secondly, we know far too little about the breeding seasons. Those of the moorland birds are hardly known at all and those of the forest belt are complicated by the apparent change with the rainfall regime as one goes round the mountain. Thirdly, there is no reason why the list of visitors and of stragglers to the higher parts of the mountain should not be added to almost indefinitely. I had a remarkable example of this on Mount Kenya at the upper edge of the forest (10,500 feet) when in a single afternoon two such unexpected birds as a hammerkop and a crowned hornbill (*Lophoceros melanoleucos*) both appeared. On Kilimanjaro I have seen European swallows and a kite (*Milvus migrans*) at about the same height. In the same category I should put Neumann's record of the goshawk (*Melierax poliopterus* Cab.) at Kifinika Hill (about 9,500 feet). Provisionally I do the same with his records from the same area of the pipit (*Anthus richardi lacuum* Meinertz.), and the sunbirds (*Nectarinia tacazze* Stanl.,† *Nectarinia famosa* subsp. and *Drepanorhynchus reichenowi* Fschr.).‡ In the forty-five years since Neumann's visit no one else seems to have encountered these species at this height above the forest belt and I suspect that the sunbirds may actually have been collected at the upper edge of the timber line and not from the moorland, even in its most bushy lower zone. The pipit presents greater difficulties. Ecologically there would be every reason to expect a resident pipit on the moorland, but it is doubtful whether even so adaptable a species as this pipit, with a proved breeding range from sea-level in Zanzibar to the Mau plateau at 8,000 feet, could extend it to 10,000 feet, especially since the climatic difference would be exaggerated by

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*The Game Department had also a report from Baron von Fürstenberg that he had an immature lammergeyer which had been taken on Kilimanjaro and had escaped after being photographed. There were no details of locality or other circumstances.

†Since the above was written Elliott informs me that he has found *N. tacazze* common (December 1944) close to where Neumann did. A good example of the interesting results that further observations on Kilimanjaro may be expected to yield.

‡Neumann, O., *J. Orn.*, 48, 185-228, 253-313. I have given reasons (Moreau, 1939) for rejecting entirely another record, *Dryoscopus pringlii* Jacks., included for Kifinika by Sjöstedt ostensibly from Neumann.

the eco-climatic extremes encountered by a ground-nesting bird. Anyway, for the time being it seems better to regard this species as not a moorland resident.

On the north side of the mountain, above Engare Rongai, where the forest belt has been eaten away by fire from both sides until now it extends solidly only from about 6,500 to 8,000 feet, we found in February 1938 that a number of the foothill species were established in the luxuriant bushy "macchia" that has succeeded the forest. We noted *Francolinus squamatus maranensis* Mearns, *Cossypha caffra iolaema* Rchw., *Colius striatus chyulu* van Som., *Gymnogenys t. typicus* (Smith), the Black-shouldered Kite, *Elanus c. caeruleus* (Desf.), and *Coccopygia melanotis kilimensis* Sharpe. Moreover, the starling (*Onychognathus morio riippellii* Verr.) was breeding in a rock-face at 9,500 feet. None of these was above the true timber-line—the black-shouldered kite was actually on a relict tree far removed from any other—and I do not think they can be regarded as members of the moorland association at any rate at present. It will be interesting to see if their status changes in subsequent years.

There are three other birds, the yellow flycatcher (*Chloropeta similis* Richmond), the scrub-warbler (*Sathrocercus cinnamomeus rufoflavidus* Rchw. and Neum.), and the stonechat (*Saxicola torquata axillaris* Shelley), that have been recorded up to 10,000 feet* and that I hitherto have included in the moorland fauna. On further consideration I think they are better omitted. They are birds of the forest glades and of thick scrub, which do not in fact seem to go appreciably above the highest tree growth; and it would be misleading to include them in Table 2. It is possible that the Black Mountain-duck (*Anas sparsa*) should be credited to the Mount Kenya moorlands. It has repeatedly been observed on the small lakes there; but pending further information of its status there it is omitted from the table. I am taking the same course with the nightjar *Caprimulgus poliocephalus* Rüpp. Those species marked (x) in Table 2 are confined to the lower part of the moorland and records that are only by sight are bracketed.

TABLE 2.—*Comparison of the moorland avifaunae*

Species	Kilimanjaro sub-species	Mount Kenya sub-species
Buzzards:		
(x) *Buteo oreophilus*	*oreophilus* Hart. and Neum.	*oreophilus*
Buteo rufofuscus	*augur* (Riipp.)...	*augur*
Lammergeyer:		
Gypaëtus barbatus	(? *meriodionalis* Keys & Blas.)	(? *meridionalis*)
Francolin:		
(x) *Francolinus shelleyi* ...	—— ...	*theresae* Meinertz.
Pigmy Crake:		
(x) *Sarothrura lineata*	—— ...	*antonii* Mad. and Neum.
Snipe:		
(x) *Capella nigripennis*	—— ...	*nigripennis* (Bp.)

*Specimens of the flycatcher and of the stonechat are recorded by Oberholser (1905), at 10,000 feet, but as other species, that are purely forest birds, are recorded from this altitude in the same paper it is clear that the 10,000 feet cannot be taken as connoting the open moorland.

Species	Kilimanjaro sub-species	Mount Kenya sub-species
Eagle-Owl:		
Bubo capensis	—— ...	*mackinderi* Sharpe
Swift:		
Apus melba	(subsp.)	? *striatus* Meinertz.
Pipit:		
Macronyx sharpei	—— ...	*sharpei* Jackson
Hill Chat:		
Pinarochroa sordida	*hypospodia* Shelley	*ernesti* Sharpe
Grass-warbler:		
Cisticola hunteri	*hunteri* Shelley	*prinioides* Neum.
Raven:		
Corvultur albicollis	*albicollis* Lath.	*albicollis*
Starling:		
Onychognathus tenuirostris ...	—— ...	sub-species
Sunbird:		
Nectarinia johnstoni	*johnstoni* Shelley	*johnstoni*
Canary:		
Serinus flavivertex	*flavivertex* Blanf.	*flavivertex*
Seed-eater:		
Poliospiza striolata	*striolata* (Rüpp.)	*striolata*

It will be seen that the Mount Kenya moorland avifauna is much the richer: each of the ten Kilimanjaro species occurs on Mount Kenya, which possesses six more as well. These six may be considered individually:

(1) There is some evidence that Shelley's francolin occurs above the forest at any rate on the north side of Kilimanjaro, but confirmation by specimens is necessary.

(2) and (3) The crake and the snipe both require patches of fresh water swamp, which are more extensive on Mount Kenya than on Kilimanjaro.

(4) The eagle owl might still turn up on Kilimanjaro. It is known from Iringa as well as the Kenya highlands and there is apparently no lack of rodents for it on the Kilimanjaro moorland.

(5) The pipit is a species found at high altitudes throughout the Kenya highlands, including the base of Mount Kenya, and is therefore practically a ready-made colonist for the moorland. There is no species similarly eligible for Kilimanjaro.

(6) The starling "ought" on geographical and ecological grounds to be on Kilimanjaro, but it is a fairly conspicuous bird and I doubt whether it would have been overlooked for all these years. It is known from Kivu, Uluguru and Njombe as well as Kenya and Abyssinia.

One of the species, *Cisticola hunteri*, occurring on both Kilimanjaro and Mount Kenya is of special interest from an evolutionary point of view. On Mount Kenya the sub-species *prinioides* occurs from 6,000 feet, or lower, up to 15,000 feet, apparently resident throughout and with no appreciable difference. On Kilimanjaro the *C. hunteri* occurring above the forest on the south side are much darker than those occurring below: and for many years the upper ones were called *C. h. hunteri* and the lower *C. h. prinioides*. But when a series was collected on the north side in 1938 it was found that the birds on the upper

side of the attenuated forest belt were hardly darker than those below it until the altitude of 9,500 feet was passed. Specimens from 10,200 feet were definitely darker and a bird from 11,300 feet had the full depth of pigment of typical *C. h. hunteri*. Since there is so complete a transition and the low-altitude birds on Kilimanjaro are not entirely identical with those on Mount Kenya, the latest view is that all the Kilimanjaro birds should be called *C. h. hunteri* and the Mount Kenya *C. h. prinioides* (Lynes *in* Moreau 1939). On Mount Meru all the birds are *C. h. prinioides*.

Another species, the "seed-eater" (*Poliospiza striolata*), might prove interesting from this point of view. Throughout Kenya and northern Tanganyika the birds bear the name *P. s. striolata*, except that on the Elgon moorland they are sufficiently distinct to have been named *P. s. ugandae* van Som. On the Mount Kenya moorland differentiation has begun (not showing the same trend as on Elgon), but has not gone far enough to warrant a subspecific name. No one seems to have collected a series at high altitudes on Kilimanjaro, where this species goes to over 13,000 feet, and it would be interesting to know whether the highest birds differ in any way from those at say 4,500 feet.

The ten species that make up the moorland bird community on Kilimanjaro, so far as we know it, do not seem to fill all its ecological niches. A plover and a pipit might certainly have been expected. There is no bird that nests and finds its food on the ground except the *Pinarochroa* chat. Of the three accipitrine birds, one buzzard (*B. oreophilus*) probably specializes on the chameleons, and the other, the augur, on the small rodents. Judging by their habits outside the tropics, the lammergeyers would be dependent on the bigger mammals for food in the form of carrion, of bones which are cracked by dropping on a rock, and perhaps of living small buck. The ravens are doubtless complete opportunists, taking anything edible. From experience of these birds elsewhere I should say that they would certainly take an occasional small rodent. But they would not make much impression on the rodent population as a whole and the eagle owl of Mount Kenya, which no one has ever reported on Kilimanjaro, seems "demanded" there. Casts should be looked for in rock-shelters.

The alpine swifts of course feed exclusively on flying insects, and on occasion go right down to the foothills to get them. (Fuggles-Couchman and Elliott have seen them over Moshi township.) On the other hand some species of the swallow tribe not resident on the moorland occasionally forage there. The *Cisticola*, though called "grass-warbler", is a bird of the bushes, going up to a level where the bushes are very scanty and small indeed, and it is exclusively insectivorous. The sunbird (*Nectarinia johnstoni*) is the biggest of its family, with an exceptionally long bill well-adapted to exploring the deeply sunken flowers of *Lobelia deckenii*. It also frequents the Proteas a good deal in the lower part of the moorland. Its presence on the spikes of the giant groundsels is no doubt due to the wealth of tiny insects, for most sunbirds depend on this source

of food (or minute berries) as well as nectar. The canary and the *Poliospiza* are, as might be expected, seed-eaters. The former go astonishingly high, beyond any obvious attraction, and they are almost certainly the "golden birds" that have been found dead on one of the Kibo glaciers.

THE BIRDS OF THE FOREST BELT

The forest birds can be divided into those which are dependent on full forest and those which frequent glades and forest edges. As with the mammals, I try to exclude those species, listed below, which are essentially lowland or which reach their upper limit with the cultivation zone at 5,000 or 6,000 feet. Some of them may subsequently be found to qualify as "montane". Those marked (K) and (Kmj.) are species known from Mount Kenya or from Kilimanjaro respectively (at low altitudes) but not from the other mountain.

Accipiter melanoleucos A.Sm., *Astur badius sphenurus* Rüpp., *Gymnogenys t. typicus* (A.Sm.), *Tympanistria t. fraseri* Bp., *Chrysococcyx cupreus intermedius* Hartl., *Bycanistes buccinator* Temm., *Bubo lacteus* (Temm.), *Telecanthura ussheri stictilaema* (Rchw.), *Colius striatus* subspp., *Apaloderma n. narina* Steph., *Pogoniulus biliniatus alius* Friedm. (K), *Buccanodon leucotis* subsp., *Thripias n. namaquus* Licht., *Dendropicos fuscescens (lafresnayi* subspp., *Anthus* spp., *Suaheliornis k. kretschmeri* Rchw. and Neum. (Kmj.), *Phyllastrephus cerviniventris* Shelley (Kmj.), *Tchitrea* spp., *Eurillas virens* subspp., *Pycnonotus barbatus* subspp., *Chlorocichla flavirentris* subspp., *Stelgidillas gracilirostris percevali* Neum. (K), *Trochocercus bivittatus* subspp., *Batis molitor puella* Rchw., *Arythropygia hartlaubi kenia* van Som. (K), *Apalis p. pulchra* Sharpe (K), *Sigmodus scopifrons keniensis* van Som. (K), *Lanius collaris humeralis* Stanl., *Parus a. albiventris* Shelley, *Corvus capensis kordofanicus* Laubm. (K), *Nectarinia k. kilimensis* Shelley, *Buphagus erythrorhynchus caffer* Stanl., *Cinnyris r. reichenowi* Sharpe (K), *Cyanomitra verticalis viridisplendens* Rchw. (K), *Phormoplectes insignis ornatus* Granvik (K), *Mandingoa nitidula chubbi* O.-Grant, *Coccopygia melanotis kilimensis* Neum., *Hypargus niveoguttatus* Peters, *Spermophaga r. ruficapilla* Shelley (K).

One species, *Coracina caesia*, must be added to the lists given for Kilimanjaro by Moreau (1936 and 1939). It was overlooked that Sjöstedt collected a specimen at 6,000 feet above Kibonoto. Another has since been obtained by my collector at about 6,500 feet above Engare Nairobi, and Fuggles-Couchman has got one from the same altitude, above Old Moshi.

In the following tables records not supported by specimens are shown in round brackets. Birds that are known only in the lower part of the forest belt are marked (x); and those not proved, but believed, to form part of the montane forest community, at any rate in its lowest parts, are marked (o). Status and altitude ranges may of course be altered by subsequent observation, especially on the southern half of Mount Kenya and the opposite part of Kilimanjaro. It must be emphasized, too, that the birds of the glades listed in Table 4 find their characteristic distribution in the northern half of each mountain, where the forest is less solid.

TABLE 3.—*Birds dependent on full forest*

Species	Kilimanjaro	Mount Kenya
Hawk-eagle:		
Stephanoaëtus coronatus	*coronatus* (Linn.)	*coronatus*
Francolin:		
Francolinus jacksoni	——	*pollenorum* Meinertz.
Pigeons:		
Columba arquatrix	*arquatrix* Temm. and Knip. ...	*arquatrix*
Turturoena delegorguei	*sharpei* Salvad.	*sharpei*
Dove:		
Aplopelia larvata	*larvata* Temm. and Knip. ...	*larvata*
Lourie:		
Turacus hartlaubi	*hartlaubi* Fschr. and Rchw....	*hartlaubi*
Parrot:		
Poicephalus gulielmi	*massaicus* Fschr. and Rchw.	*massaicus*
Hornbill:		
Bycanistes cristatus	(x) *cristatus* Rüpp.	*cristatus*
Wood-hoopoe:		
Phoeniculus bollei	—— ...	*jacksoni* (Sharpe)
Wood-owl:		
Ciccaba woodfordii	(o) subsp.	(x) subsp.
Trogón:		
Heterotrogon vittatum	(x) *vittatum* Shelley ...	(x) *vittatum*
Barbet:		
Viridibucco simplex	(x) *leucomystax* (Sharpe) ...	(x) *leucomystax*
Woodpeckers:		
Campethera taeniolaema ...	—— ...	(x) *hausburgi* Sharpe
Mesopicos griseocephalus ...	*kilimensis* Neum.	——
Hill-babbler:		
Pseudoalcippe abyssinicus ...	(x) *abyssinicus* Rüpp. ...	(x) *abyssinicus*
Bulbul:		
Phyllastrephus fischeri	(x) *placidus* Shelley	(o) *placidus*
Stelgidocichla latirostris	—— ...	(o) *eugenia* Rchw.
Arizelocichla milanjensis ...	(x) *striifacies* Rchw. & Neum.	——
,, *tephrolaema* ...	*nigriceps* Shelley	*kikuyuensis* (Sharpe)
Flycatchers:		
Alseonax adustus	*chyulu* van Som.	*pumilus* Rchw.
Trochocercus albonotatus... ...	—— ...	*albonotatus* Sharpe
Batis capensis	(x) *mixta* Shelley	——
Thrush Family:		
Turdus olivaceus	*deckeni* Cab.	*elgonensis* (Sharpe)
Geokichla gurneyi	—— ...	(x) *chuka* van Som.
,, *piaggiae*	*kilimensis* Neum.	*kilimensis.*
Cossypha semirufa	(x) *intercedens* (Cab.) ...	(x) *intercedens*
Pogonocichla stellata	*guttifer* Rchw. and Neum. ...	*guttifer*
"Warblers":		
Seicercus umbrovirens	*dorsalichrous* (Rchw. & Neum.)	*mackenzianus* Sharpe
Sathrocercus mariae	*mariae* (Mad.)	*mariae*
Apalis cinerea	—— ...	(x) *cinerea* Sharpe
,, *flavigularis*	*griseiceps* Rchw. and Neum.	——
Sylvietta leucophrys	—— ...	(x) *leucophrys* Sharpe
Cuckoo-shrikes:		
Campephaga quiscalina	—— ...	(x) *martini* Jacks.
Coracina caesia	(x) *pura* (Sharpe)	*pura*
Shrike:		
Chlorophoneus nigrifrons ...	(o) *nigrifrons* Rchw. and mutants.	(o) *nigrifrons* and mutants.
Oriole:		
Oriolus percevali	—— ...	(x) *percevali* O.-Grant
Starlings:		
Pholia femoralis	*femoralis* Richm.	——
,, *sharpii*	—— ...	(x) *sharpii* Jacks.
Stilbopsar kenricki	(x) *kenricki* (Shelley)... ...	(x) *kenricki*
Onychognathus walleri	(x) *walleri* (Shelley)	(x) *keniensis* van Som
Sunbird:		
Cyanomitra olivacea	(x) *neglecta* Neum.	(x) *neglecta*

Species	Kilimanjaro	Mount Kenya
Weavers:		
Cryptospiza salvadorii	*kilimensis* Sclater & Moreau	(x) *ruwenzori* W. Sel.
Estrilda atricapilla	—— ...	(x) subsp.
Finches:		
Poliospiza burtoni	*kilimensis* (Richm.)	(x) *albifrons* Sharpe
Linurgus kilimensis	*kilimensis* (Rchw. & Neum.)	(x) *keniensis* van Som.

TABLE 4.—*Other birds of the forest belt*

Species	Kilimanjaro	Mount Kenya
Duck:		
Anas sparsa	*leucostigma* Rüpp. ...	... *leucostigma*
Ibis:		
Lampribis olivacea	(*akeleyorum* Chapman) ...	*akeleyorum*
Hawk-eagle:		
Lophoaetus occipitalis	(o) *occipitalis* (Daud.) ...	(x) *occipitalis*
Buzzard:		
Buteo rufofuscus	*augur* Rüpp.	... *augur*
Francolin:		
Francolinus squamatus	(x) *maranensis* Mearns ...	(o) *maranensis*
Kingfisher:		
Megaceryle maxima	—— ...	(x) *maxima* Pallas
Bee-eater:		
Melittophagus lafresnayii ...	(x) *oreobates* Sharpe ...	(x) *oreobates*
Woodpecker:		
Dendropicos fuscescens	(o) *massaicus* Neum. ...	(o) *lepidus* Cab. and Heine
Flycatchers:		
Dioptrornis fischeri	*fischeri* Rchw.	*fischeri*
Chloropeta similis	*similis* Richm.	*similis*
Thrush Family:		
Cossypha caffra	(x) *iolaema* Rchw.	(x) *iolaema*
Saxicola torquata	*axillaris* (Shelley)	(x) *axillaris*
"Warblers":		
Sathrocercus cinnamomeus ...	*rufoflavidus* (Rchw. & Neum)	*cinnamomeus* (Rüpp.)
Cisticola hunteri	*prinioides* Neum.	*prinioides*
Bank-martin:		
Psalidoprocne holomelaena ...	*massaica* Neum.	*massaica*
Shrike:		
Laniarius ferrugineus	*ambiguus* Mad.	*ambiguus*
White-eyes:		
Zosterops kikuyuensis	—— ...	*kikuyuensis* Sharpe
„ *eurycricotus*	*eurycricotus* Fschr. & Rchw.	——
Sunbirds:		
Nectarinia famosa	*aenigularis* Sharpe	*aenigularis*
„ *tacazze*	*tacazze* Stanl.	*tacazze*
Drepanorhynchus reichenowi ...	*reichenowi* Fschr.	*reichenowi*
Cinnyris mediocris	*mediocris* Shelley	*keniensis* Mearns
Weavers:		
Ploceus (Othyphantes) reichenowi	*reichenowi* Fschr.	*reichenowi*
Nigrita canicapilla	*diabolica* Rchw. & Neum. ...	*diabolica*
Finches:		
Serinus flaviverter	*flaviverter* Blanf.	*flaviverter*
Poliospiza striolata	*striolata* Rüpp.	*striolata*
Spinus citrinelloides	(o) *hypostictus* Rchw. ...	*kikuyuensis* Neum.

On analysing Tables 3 and 4 we get the comparative results shown in Table 5.

TABLE 5.—*Avifaunae of the forest belts*

	Full forest species.		Other Species		Combined	
	Total	Reaching upper edge	Total	Reaching upper edge	Total	Reaching upper edge
Kilimanjaro	32	18	25	19	57	37
Mount Kenya ...	39	17	26	19	65	36

It will be seen that on present information Mount Kenya has a rather richer montane avifauna than Kilimanjaro but no more species that reach the upper edge of the forest belt. Of the full forest species, twenty-eight are common to both mountains and so are practically all the other species of the forest belt. In five families, the woodpeckers, bulbuls, flycatchers, warblers (genus *Apalis*), and the starlings, the faunae include pairs of vicarious species—although so far as is known at present in four of the pairs the altitudinal ranges of the two members are not quite the same. Amongst the other species of the forest belt the *Zosterops* are shown as vicarious species but future taxonomists may regard them as forms of one species.

Among the remaining birds, the big hornbill seems to go higher on Mount Kenya than on Kilimanjaro but the reverse may be true of the *Cryptospiza*, *Poliospiza burtoni* and *Linurgus*. The additional species possessed by Mount Kenya consist of a francolin, a wood-hoopoe, a thrush (*Geokichla*), a warbler (*Sylvietta*), a cuckoo shrike (*Campephaga*), an oriole and an *Estrilda*. Except the thrush, these are all characteristically western forms, not known anywhere in the north-eastern quarter of Tanganyika Territory, in which Kilimanjaro is situated: and Mount Kenya may be said to owe them to its position as the eastern edge of the Kenya highlands. The appearance of a form of *Geokichla gurneyi* on Mount Kenya as well as *G. piaggiae* is remarkable because elsewhere these species are vicarious. The appearance of *G. piaggiae* on Kilimanjaro is even more astonishing, since the neighbouring mountains to the north, east, west and south, Chyulu, Teita, Meru, Pare, are all inhabited by forms of *G. gurneyi*.

The absence of the flycatcher (*Trochocercus albonotatus*) from Kilimanjaro is most difficult to understand, since it occurs on most of the Tanganyika mountains to the south as well as through the Kenya highlands. Another point of interest is that the proportionate status of the colour mutants of *Chlorophoneus nigrifrons* on the two mountains seems to be the same, with the flame-breasted form (*abbotti*——*elgonensis*) about as common as the golden-breasted (typical *nigrifrons*), and with the fawn-breasted (*münzneri*) very rare.

The bird community of the full forest can be analysed as follows for species common to both mountains and for vicarious species. Those species which

on one mountain or the other go high are marked H :—

BIRDS OF THE GROUND STRATUM

Species of mixed diet : *Aplopelia larvata* H, *Cyanomitra olivacea*, *Nigrita canicapilla* H.

Mainly insectivorous species : *Geokichla piaggiae* H, *Cossypha semirufa*, *Pogonocichla stellata* H, *Sathrocercus mariae* H.

Seed-eating species : *Cryptospiza salvadorii* H, *Linurgus kilimensis* H.

BIRDS OF THE MID-STRATUM

Species of mixed diet : *Pseudoalcippe abyssinicus*, *Turdus olivaceus* H.

Carnivorous species : *Ciceaba woodfordii*.

Insectivorous species : *Mesopicos griseocephalus* H——*Campethera taeniolaema*, *Phyllastrephus fischeri*, *Alseonax adustus* H, *Batis capensis*——*Trochocercus albonotatus* H, *Seicercus umbrovirens* H, *Apalis flavigularis* H——*Apalis cinerea*.

Fruit-eating species : *Irizelocichla tephrolaema* H, *I. milanjensis*——*Stelgidocichla latirostris*.

Seed-eating species : *Poliospiza burtoni* H.

BIRDS OF THE CANOPY

Species of mixed diet : *Cinnyris mediocris* H.

Carnivorous species : *Stephanoaëtus coronatus* H.

Insectivorous species : *Heterotrogen rittatum*, *Chlorophoneus nigrifrons*, *Coracina caesia* H.

Fruit-eating birds : *Columba arquatrix* H; *Turturoena delegorguei* H, *Poicephalus gulielmi* H, *Turacus hartlaubi* H, *Bycanistes cristatus* H, *Viridibucco simplex*, *Pholia femoralis* H——*P. sharpii*, *Onychognathus walleri*.

The foregoing, derived from the two mountains a couple of hundred miles apart, gives some idea of the structure of the mountain-forest bird-community in East Africa : with the proviso that not all the species will necessarily be found in any given part of either mountain, and that the altitude limits of some species may be found to differ appreciably in different parts of the same mountain. It will be noted moreover that, in addition to those included in the analysis above, Mount Kenya supports seven more species not represented, or with no equivalents, on Kilimanjaro.

MOUNT MERU

Far less has been written about Mount Meru than of the two greater mountains. There is still no good general description of the mountain in English and the account given in German by Meyer in 1909 (*Das Kolonialreich* I) has not been superseded. The published information about the plants is based almost entirely on three hundred collected by Uhlig many years ago. The small mammals are practically unknown although the mountain was visited by the Swedish Kilimanjaro-Meru expedition. Only the birds have been fairly well worked. There are several additions to those given by

Moreau (1936). Elliott has records of *Nectarinia johnstonii*, *Pinarochroa sordida* and *Serinus flaviverter*, the first at the top of the heaths at 11,500 feet and the other two on the scree that forms the final peak. Also for the sake of completeness it may be worth recording that I have specimens confirming the sound record of *Apalis melanocephala moschi* van Som., and that Elliott has collected *Smithornis capensis*, *Trochocercus bivittatus* and *Batis capensis mixta* on the Ngongongare ridge. Only the last is probably to be regarded as a montane form.

For zoo-geographical discussion the following points of topography need to be recalled. The main mass of Meru, rising to nearly 15,000 feet, is approximately conical. From the west it appears a perfect cone, a text-book volcano; from the east it is evident that the entire crater rim on that side has been blown out so that one is looking into a huge steep-sided amphitheatre shaped like a horse-shoe. The Ngongongare-Ngurdoto ridge, which is not higher than about 5,000 feet and is heavily forested, runs out eastward from the main mass for nearly ten miles. This Ngongongare forest is separated from the south-west edge of the main Kilimanjaro forest by a distance of less than fifteen miles, but most of this is very dry open country that presumably owes its dryness to its position in a rain-shadow between the two great mountains. On the other hand it is possible to cross from one forest to the other without going below about 4,500 feet and the vestiges of evergreen forest west of Sanya Juu show that the barrier to interchange of forest populations has in very recent times been less than twelve miles.

On the west Mount Meru is in full connection with the Mondul-Tarosero-Burko-Essimingor volcanic ridge. This varies in height between about 6,000 and 8,500 feet and carries patches of evergreen forest that have every indication of being continuous in recent historical times. West of Essimingor and Burko, the Rift Valley, with floor barely 3,000 feet above the sea, separates this strip of montane country from the Loolmalassin-Ngorongoro-Oldeani area that is ecologically so similar. The gap between the forest on the opposite sides of the Rift is here well under twenty miles, but appreciably wider than that between the Kilimanjaro and Meru forests. Moreover, the level of the intervening country is much below the 4,500 to 5,000 feet that I regard as probably limiting for montane species in this part of East Africa. On the other hand Elliott thinks that the Rift Valley floor towards Ngaruka is less arid than the open country between Sanya and Ngongongare. It appears, however, that on balance the barrier to montane birds between Kilimanjaro and Meru would have been much less formidable than that presented by the floor of the Rift at the western end of the Meru-Essimingor montane.

As restated by Engler (1925), the vegetation belts of Meru are, on the south side :—

Forest to 2,200 metres (7,200 feet).
Bamboo 2,200 metres to 2,700 metres (8,800 feet).