

THE GEOGRAPHICAL REVIEW

VOL. VI

OCTOBER, 1918

NO. 4

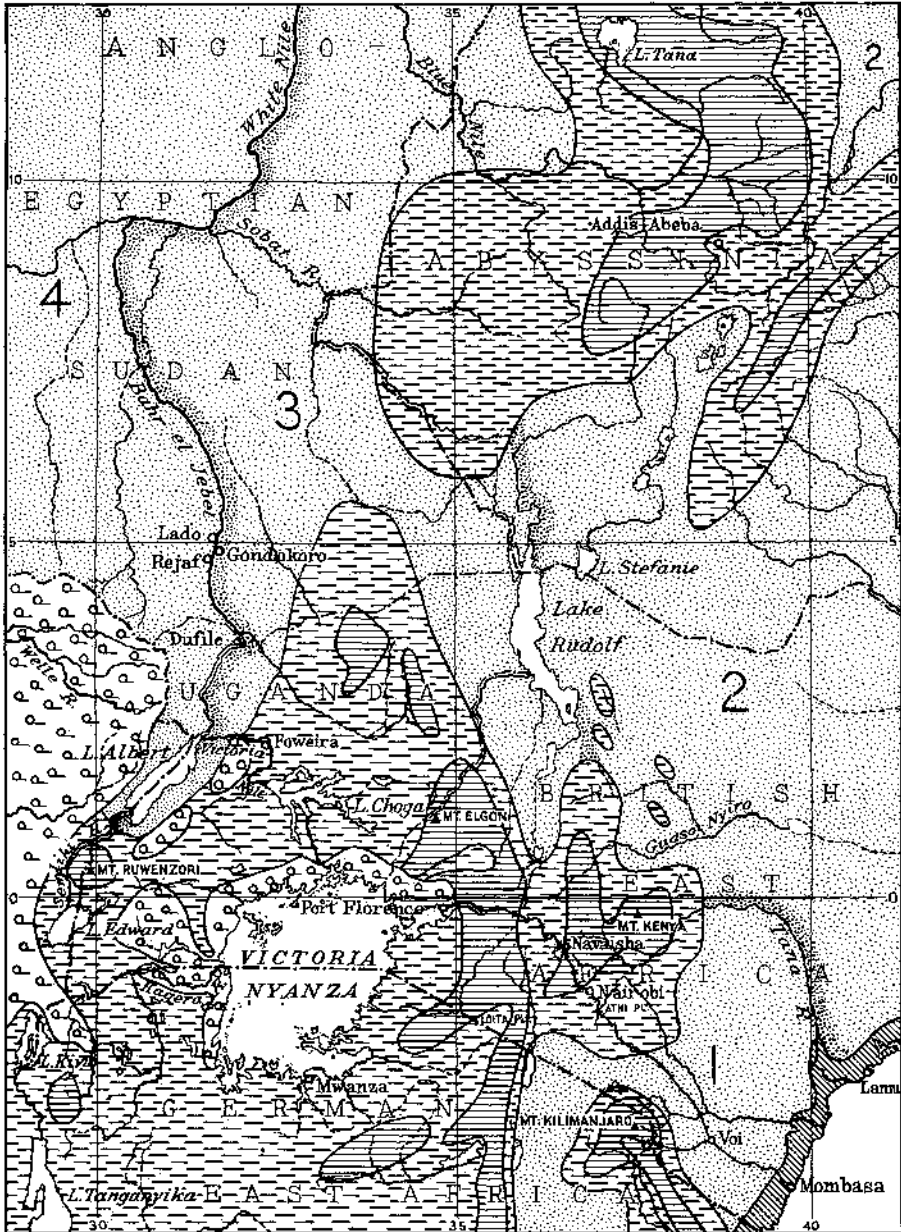
THE GEOGRAPHICAL BARRIERS TO THE DISTRIBUTION OF BIG GAME ANIMALS IN AFRICA

By EDMUND HELLER

Only those persons who have traveled through the highland grassy veld of East or South Africa realize how extremely abundant big game animals are in these regions. The favorite feeding grounds on the plains are as well stocked with big game as are our ranches of the West with cattle. On the plains of British East Africa I have often seen five hundred or more head of big game in a day's trek over such favored spots as the Loita, Athi, and Uasin Gishu Plains. From some of the small kopjes rising above the Loita Plains I have looked down and counted at one time some three hundred head of hoofed game feeding in small herds and groups made up of such species as kongoni hartebeests, Thomson and Grant gazelles, wildebeests, zebras, Masai giraffes, elands, topis, waterbucks, impallas, and wart hogs. Associated with these herds but hidden by the grass were such cover-haunting species as steinboks and plains duikers, which are of small size. Fully a third of this assemblage of game was made up of zebras, which occurred in herds of fifteen to twenty animals. The wildebeests were few in number and in herds, but the hartebeests and gazelles were very numerous and scattered about in groups of mixed species as far as the eye could see. Large assemblages of game of this sort could be seen daily on the same plain, for it is quite normal and not due to the temporary crowding of a favorite feeding ground. In the immediate vicinity of such herds but hidden during the day in cover lurk such carnivorous animals as hyenas, jackals, cheetahs, lions, and an occasional leopard.

RANGES OF BIG GAME ANIMALS

This circumstance, so fortunate for the naturalist, must be accredited to a benign policy of conservation. Before the European had been in the



LIFE ZONES OF EASTERN EQUATORIAL AFRICA

Scale 1:11 750 000 50 0 100 200 miles

- Coast Zone
- Desert, or Nyika, Zone
- Highland, or Grass Veld, Zone
- Highland Forest Zone
- Congo, or Tropical, Forest Zone

- 1 Beja, or South Tana, Division
- 2 Abyssinian, or North Tana, Division
- 3 Sudan, or East Nile, Division
- 4 Bahr-el-Ghazal, or West Nile Division

THE GEOGR. REVIEW, Oct. 1918

FIG. 1.—Map showing the life zones of eastern Equatorial Africa and the subdivisions of the desert, or nyika, zone. Scale, 1:11,750,000.

territory long enough to effect any serious diminution of the game the government created vast reserves and a system of rigorous game laws.¹

The native tribes are chiefly agricultural and seldom if ever eat the meat of game animals or slaughter them. Fire arms have carefully been kept from them by the European governments under whose protection they now dwell. Hence today, with the possible exception in certain districts of the elephant and black rhinoceros, we find the big game still enjoying their natural range. Another factor favoring our knowledge of the ranges of the big game mammals is the comparatively fixed character of the distribution of most species: because of the equable climate and the permanence of the grass and other vegetation there is little tendency to seasonal or other migrations. In habits most of the animals now under consideration live on open plains or at times on plains bearing a widely scattered growth of thorn trees or bush in which cover they are readily detected and can themselves detect their enemies by sight alone. The chief game animals such as gazelles, hartebeests, wildebeests, zebras, and some others, are open-plains animals and cannot be driven into thick cover even by an army of pursuers. These animals have developed great fleetness of foot and trust to speed alone to escape a dangerous enemy. The open plains are therefore their haven and their home, and they are easily detected wherever they occur, so that their distribution is now well known. Since the beginning of the present century great numbers of sportsmen have annually gone on *safari* in Equatorial Africa, and today the distribution of the bush and forest species, such as the buffaloes, bongos, bushbucks, giant pigs, duikers, elephants, etc., as far as their haunts are concerned, is quite as well known as that of the plains antelope. This unusually favorable combination of circumstances has enabled us to map out with a high degree of accuracy the actual distributional limits of big game mammals in Equatorial Africa.²

FACTORS CONTROLLING DISTRIBUTION

Notwithstanding the completeness of our knowledge of the facts of such distribution we are at a loss to explain them. In all species there is a natural tendency to enlarge the area of distribution, but it is held in check by forces of whose manner of control we know little except in a general way, or in the case of some few species only. We see the ranges of species brought to a halt at certain points by high mountain chains, sand deserts, great forests, large rivers, lakes, and seas. Climate, we know, is one of the chief barriers to areal spread, but of the manner of its operation other

¹For notes on the preservation of big game in Africa and for maps of the game preserves in British East Africa and other British possessions in Africa see J. Stevenson-Hamilton's "Animal Life in Africa," London, 1912.—EDIT. NOTE.

²For maps of the range of various big game mammals see Roosevelt and Heller's "Life Histories of African Game Animals," 2 vols., New York, 1914. Attention may also be called to the bibliography of eastern Equatorial Africa at the end of Volume 2.

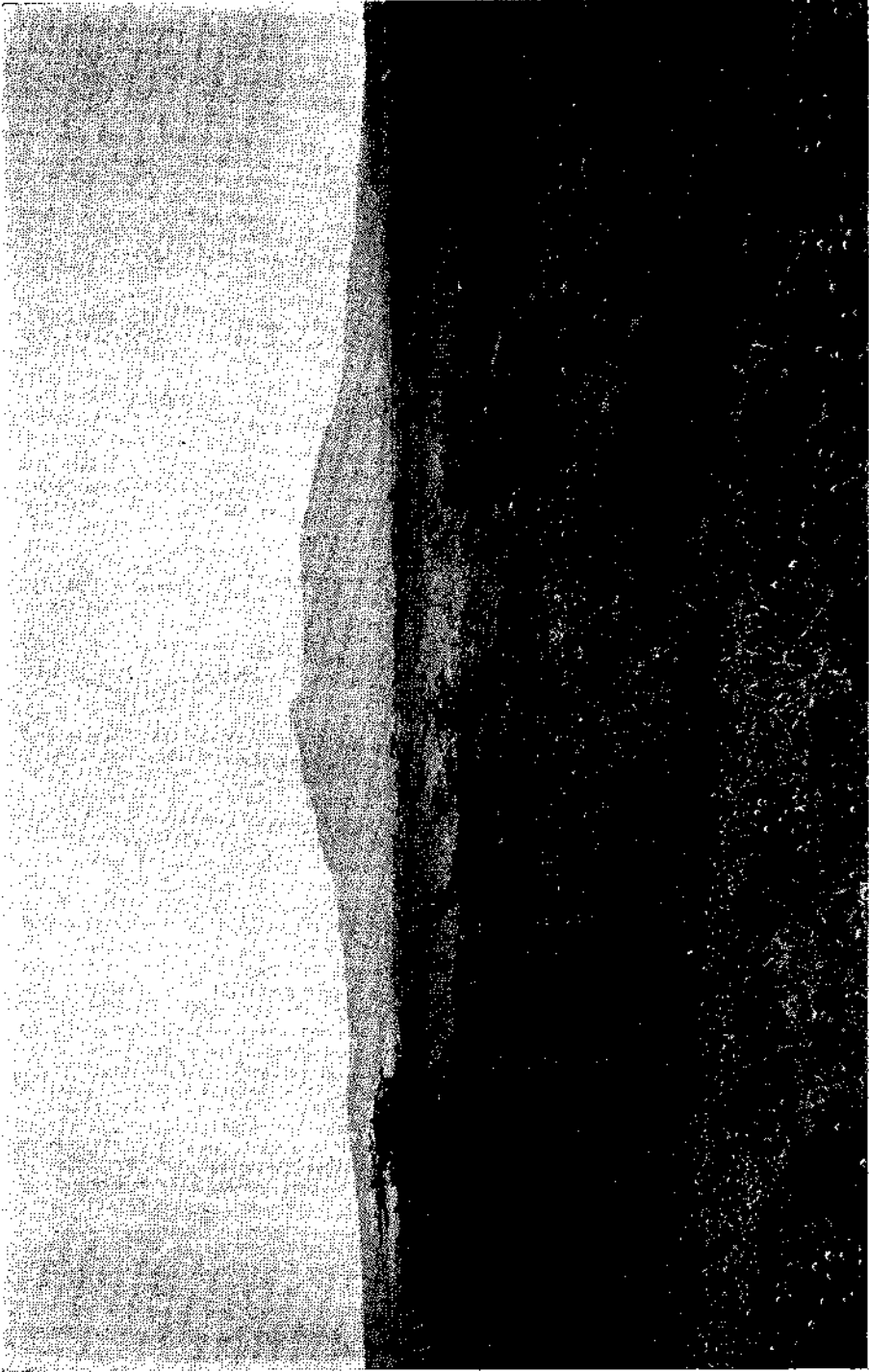


FIG. 2—Scene in the great Rift Valley of East Africa. Mount Longonot, a lofty volcano with perfectly preserved crater, in the background. (Illustrations, unless otherwise stated, from photographs by the author.)

than in limiting certain vegetable growths which may furnish food or cover to the species concerned we know little indeed. An important rôle in the limitation of mammal ranges in Equatorial Africa is played by unseen foes, by disease germs or blood-sucking insects which transmit them, such as various species of tsetse flies, ticks, mosquitoes, etc. The purpose of the present paper is to demonstrate the range limitations of big game mammals in Equatorial Africa through the operation of certain of these controls—the great geographical barriers such as the high mountain escarpments of the Rift Valley, the great rivers, the Nile and Tana, the deserts of British East Africa and Abyssinia, the forests, and the climatic barriers.

THE SAHARAN BARRIER

The African fauna of today has been preserved to us through the barrier of the vast Sahara Desert, which through a long period of time has prevented the more modern animals of Asia and Europe from reaching Africa proper. The real Africa, or the Ethiopian region of biologists, comprises only that part of Africa south of the Sahara Desert. North Africa, which borders the Mediterranean, has a Eurasian fauna. The chief big game mammals—sheep, ibex, and deer—are generically the same as those inhabiting Europe and Asia and only distantly related to the antelopes of Ethiopia. During middle Tertiary time, however, antelopes of several genera, hippopotamuses, lions, hyenas, and other true African mammals lived in Europe and Asia also, and this fact has led to the inference that Africa during that remote period obtained its present fauna from Eurasia. The evidence, however, is very one-sided, for Africa proper—Ethiopia—has practically no fossil record to balance against that of Eurasia; hence the theory of Eurasian derivation is accepted as plausible only. Africa is a very old continent and has without doubt been the birth-place of many groups of animals and plants.

ETHIOPIA AND ITS TWO FAUNAL REGIONS

The Ethiopian realm of zoölogists has two main faunal regions, the rather dry plains and plateau country of East and South Africa, which is characterized by its great herds of game, and the great forested area of the Congo Basin, which has a humid climate and a heavy rainfall and where game animals are few in species and individually very rare.³ The former region, South Africa and East Africa (the area as far west as Lake Tanganyika and the Nile and as far north as Abyssinia), shows a certain homogeneity in climate, vegetation, and fauna and is the big game region of Africa. The whole of the eastern half of Africa rises in a series of plains and plateaus from the coast westward towards the interior, where much

³ Compare the note in the "Geographical Record" for this month on "African Fish Fauna and Faunal Regions."—EDIT. NOTE.

of the land reaches elevations of 4,000 to 7,000 feet. This elevated interior tract, which extends from Abyssinia to the Cape region of South Africa, has an agreeable climate, free from tropical fevers, and it will some day support a large Caucasian population. The white settlers who have thus far established themselves here are leading comfortable, contented lives and are engaged in successful agriculture and experimental stock-raising. This, indeed, is not the Africa of popular imagination. By most people Africa is visualized as a land of low tropical jungle in which lurk



FIG. 3—The Rift Valley at Lake Elmenteita. Volcanic cone in the background. (Photo by C. E. Akeley.)

deadly fevers fatal to the white man. Such an incomplete and partial picture, doubtless established by Stanley's vivid account of his travels in the Congo Basin, is, however, being rapidly dissipated today by the numerous and annually increasing accounts of travel and adventure in eastern Africa.

The Life Zones of Eastern Equatorial Africa

Without doubt the most logical way of describing the distribution of big game mammals in eastern Equatorial Africa is by a discussion of the life zones we find there. By this, the ecological method, we shall associate the floral features, the climate, and the geological formations with the animal life and show some of the influences these features have on big game distribution. Human relationships will also be briefly noted.

THE COAST ZONE

Bordering the eastern coast on the shores of the Indian Ocean is a narrow strip of land of tropical appearance as regards its tree growth and climate (map, Fig. 1). The width of this strip is not more than fifteen miles on an average, and it terminates at Lamu, north of which the second, or desert zone, actually reaches the seashore. The climate of this coast strip is equable and somewhat moist, owing to the presence of the sea, so that the cocoa palm is here a dominating feature of the landscape.



FIG. 4—Looking down into the Rift Valley south of Lake Baringo. (Photo by C. E. Akeley.)

The cocoa palms are in a semi-cultivated state, but beyond the territory occupied by them the land is thickly bushcovered, with occasional groups of the forked dôm palms and the gouty baobab tree. There are definite rainy and dry seasons, but the country never has a really arid appearance. During the rainy season the bushes blossom and trees such as the baobab leaf out into life. The coast at Mombasa is a coral formation, the town itself being located on a coral island set in a deep indentation of the coast and guarded on its sea side by numerous coral reefs on which the breakers pound. Inland a short distance is a yellowish sandstone of Triassic age, and this formation continues into the arid desert area a short way. Immediately beyond the coral formation the land rises gently and slopes up to the desert plateau, which is in many places flanked by a low escarpment a hundred feet or so in height.

MAMMALS OF THE COAST ZONE

The sable antelope, the trophy most prized by the sportsman, occurs only in this narrow maritime zone in Equatorial Africa, and here it reaches its extreme northern limit. Farther southward, from Lake Tanganyika to the Cape region, it is a fairly common species, but on the coast of British East Africa it is of rare local occurrence, and few indeed are the sportsmen who have bagged it in this district. We know of no explanation for the fact that in South Africa the sable antelope inhabits cool uplands, while in Equatorial Africa it is found only in the low, hot coast region. Buffaloes still occur in the bush of the coast, but they are now few in numbers and seem never to have regained their high place in faunal society since the rinderpest swept the great herds away thirty years ago. Formerly elephants wandered through the bush of the coast zone, but they have long since been shot for their ivory by traders, to whom the coast ports have been accessible for at least two centuries. Haunting the coast forests, formerly the home of the giant among living mammals just referred to, is a diminutive antelope no larger than a hare and known as the blue duiker. It is a distinct race peculiar to the coast zone, and no representative of the species is to be found inland until we reach the Nile watershed some four hundred miles distant. One of the hangers-on in the zone is Haggard's oribi, a small antelope which lives on the grassy flats bordering the zone on its inland or desert side. A host of other game mammals occur in the coast district, but none are peculiar to it. Bush pigs, bushbucks, hyenas, leopards, and occasional lions are to be met with here.

THE COAST PEOPLES: SWAHILI AND DURUMA

That comparative accessibility of the coast which encouraged the extermination of its economically valuable big game shows itself also in foreign influences on the native population. Several tribes of Bantu stock inhabit the coast district, but the predominating and best known is the Arab-modified Swahili, who has been the source of transport for all caravans to the interior from the very earliest organization of exploration and trading *safaris*. His language, Ki-Swahili, has gone with him and is now a *lingua franca* for all Equatorial Africa from sea to sea. The Swahili occupy the coast ports, islands, and larger towns, but there are still living several primitive tribes over much of the area planted to the cocoa palm. One of these, the Duruma, who occupy territory near Mombasa, probably live today much as the Swahili did before the Arabs came among them, bringing Mohammedanism and such Mohammedan arts as the building of mud-walled and stone houses. The Duruma live in small villages in thatched huts built in the groves of cocoa palms. Both the Swahili and Duruma are agricultural tribes, but they vary their diet by fish when such food is procurable at the seashore.

THE DESERT, OR NYIKA, ZONE

Flanking the coast strip and covering an immense area inland we encounter next the desert, or nyika, zone. The term *nyika*—the country of the Wanyika—is used in Swahili to signify jungle or thornbush country. It has a width of from two hundred to as much as one thousand miles in its greatest eastward extension, where it embraces not only the coast drainage but much of the Upper Nile watershed as well. In altitude it ranges from 100 to 3,000 feet above sea level. The climate over this vast area is hot and dry, and the rainfall is not more than a few inches annually and is limited to a short period, sometimes less than a month. The nyika is not a desert in the strict sense but a bush region with open spaces of sandy soil between the scattered vegetation, much like the American deserts in California and Arizona. The bush and tree growth is specialized to resist dryness and remains leafless and dormant throughout most of the year, only resurrecting itself to leaf and blossom after the short rainy season. A great many of the species of desert bushes are members of or closely allied to the genus *Acacia*, which is a dominant African type. Several euphorbias of cactuslike appearance and usually miscalled cacti by the sportsmen have established themselves widely over the nyika. The two most prominent trees are the branching dôm palms and the gigantic trunked baobab, the latter usually leafless and desolate in appearance. Forming the undergrowth in this bush world are the formidable spike-shaped sansevierias and aloes. The British East African portion of the nyika is covered by a bright red soil derived from the granitic (gneiss) rocks which are to be seen as outcrops or low hills in many parts of the desert plain. North of the Tana River this red soil is replaced by a yellow sandy variety that is again met with in the Nile region in the same zone.

MAMMALS OF THE NYIKA ZONE

The streams which cross the nyika are marked by wide dry sandy beds and low banks, the water seldom or only after heavy rains reaching the surface and forming a true river. The margins of these dry streams are usually well defined by a narrow fringe of dôm palms and acacia trees. Aside from springs the game animals which inhabit the region obtain their water from holes which they themselves dig in the sandy bed of the streams in those places where the water is not more than two or three feet below the surface. The Tana River, which cuts direct through the desert from the base of Mt. Kenya to the Indian Ocean, is a permanent supply for the numerous herds living along its banks. With the exception of the Nile it is the only perennial river which traverses the nyika zone. Some few, however, of the game animals have become highly specialized for existence in the desert and have quite given up the habit of drinking water

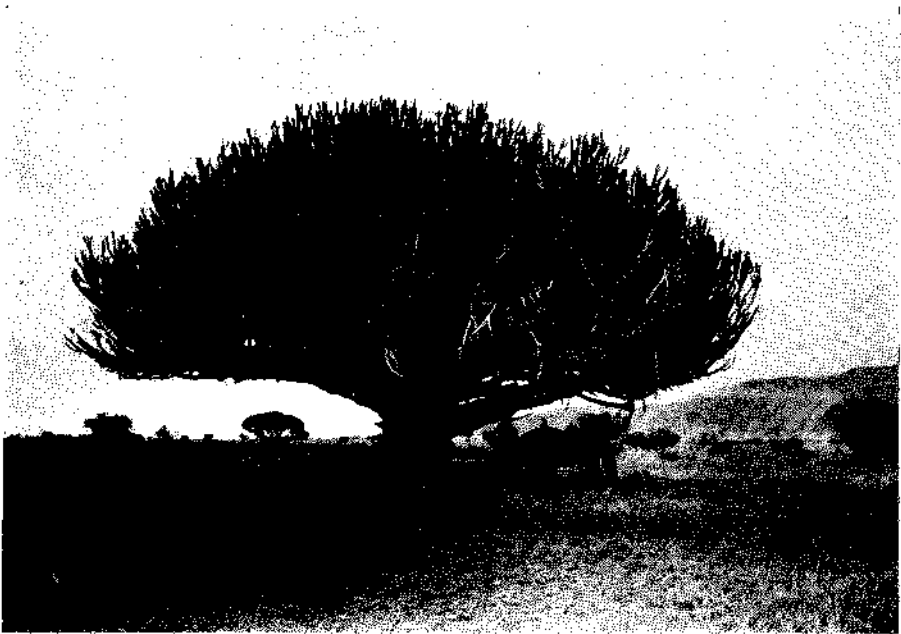


FIG. 5.



FIG. 6.

FIG. 5—Giant euphorbia tree, Loita Plains, British East Africa.

FIG. 6—The baobab, a characteristic tree of the nyika, or desert, zone, and leafless most of the year.
(Photo by C. E. Akeley.)

even when it is available. Such species are the gerenuk—the flamingo among antelopes, being chiefly neck and legs—the lesser koodoo, the diminutive dikdik, the rock-haunting klipspringer, and several others which live outside the range of our territory. The species of antelope just mentioned, with the exception of the dikdik and klipspringer, are peculiar to the nyika. Others which hold this distinction are the oryx, Grévy zebra, and reticulated giraffe; and these are limited to the nyika track north of the Tana River, which forms also the southern barrier for the Somali wart hog and the Hunter antelope, and the large-snouted dikdik. This river makes a singularly sharp barrier for such a species as the Hunter antelope, which is found only in the immediate vicinity of the river and only on its northern bank. This species is a distinct one and is the sole living representative of its genus. The Somali wart hog is also structurally a distinct species from the common wart hog. On the basis of this zoölogical evidence we are justified in assuming that the Tana River has been a barrier to these game mammals throughout most of the later Tertiary age. South of the Tana River we find occurring as peculiar forms the fringe-eared oryx, Thomson gazelle, Coke hartebeest, white-bearded wildebeest, and Masai giraffe.

CROCODILES AS BARRIERS TO DISTRIBUTION

All large streams in tropical Africa are infested by crocodiles, which patrol the water's edge vigilantly for such prey as game mammals, which they seize by the muzzle or leg when in the act of drinking. The victim is then pulled into the stream and under the water, where it is devoured. Through fear of these reptiles game animals approach the margin carefully and seldom or never enter or swim across large rivers. An American sportsman, Mr. Fleischmann, actually witnessed the drowning of a full-grown rhinoceros by crocodiles in the Tana River. It was not possible to see in the dark water how many crocodiles had hold of the rhinoceros, but the huge beast was gradually pulled under the surface by some strong force. But the rivers of Equatorial Africa have not been a barrier to the distribution of a majority of the game mammals, and such occur on both sides of rivers ranging over the whole valley. Some few, like the sitatunga, are actually water-loving species and swim fearlessly, at least in Victoria Nyanza. Other species, like the Nile lechwi and the bushbucks and to a less extent the waterbucks, frequent reedy swamps on the margins of lakes and rivers. His gigantic size and fearsome tusks preserve the hippopotamus from attack by crocodiles, and the elephant is immune in much the same way. Crocodiles, however, have instilled a wholesome dread of large bodies of water in the minds of many antelopes and other ungulates, which has acted as an important deterrent to their distribution across such barriers throughout a long period of time.

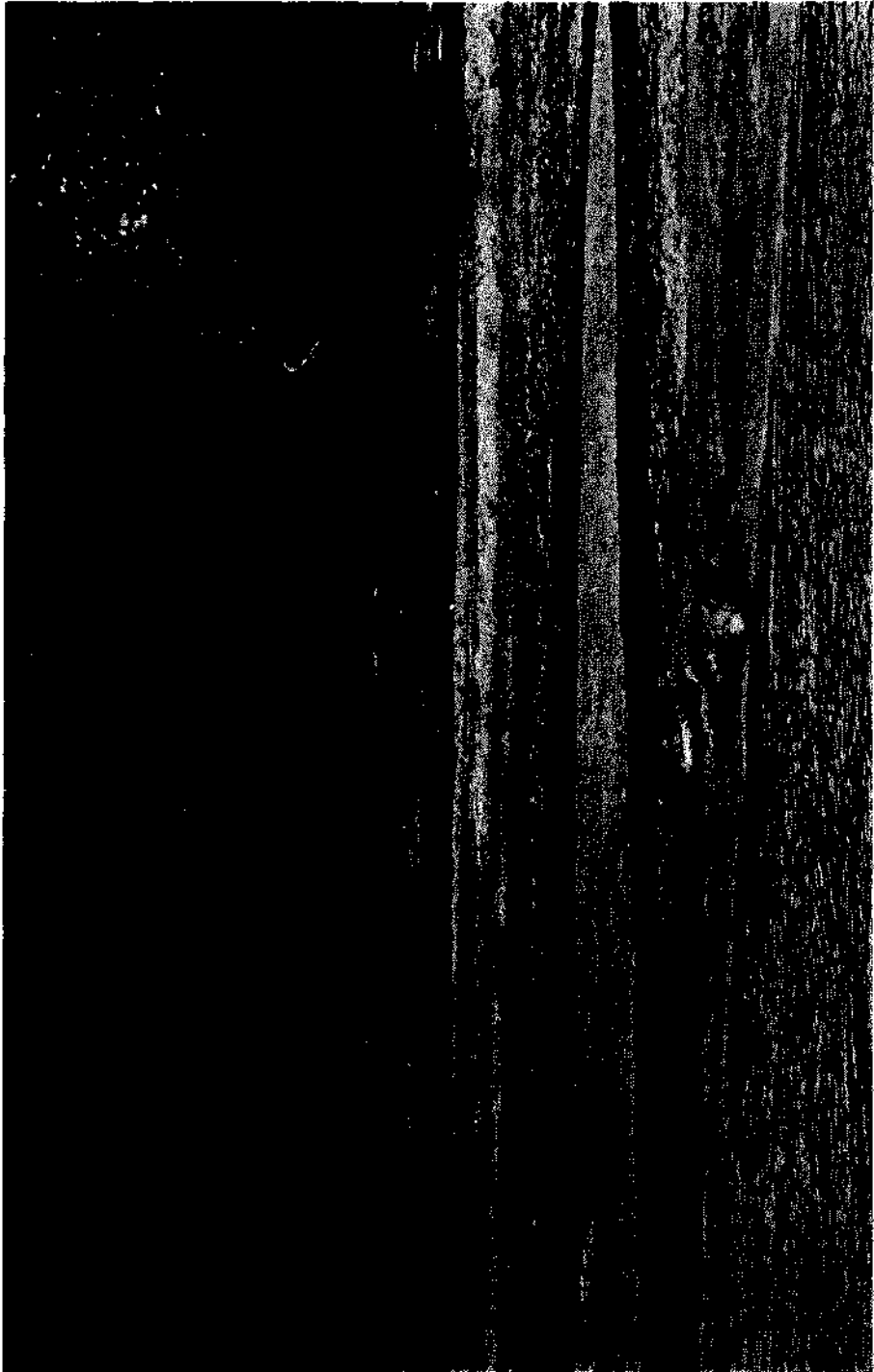


FIG. 7.—The crocodile, the guardian of the Tana. The Tana River is the chief barrier to big game animals in eastern Equatorial Africa. (Photo by C. E. Akeley.)

TRIBES OF THE NYIKA ZONE

The Tana River acts to some degree as a barrier to man as well as to big game animals: the raiding Somali does not penetrate south of it. Scattered through the nyika zone in a few favored places where there are permanent water holes may be found a few families of the Wanyika tribe, who till the soil during the short rainy season and harvest a small variety of crops on which they subsist. The higher hills which rise above the plain in certain places, as in the vicinity of the station of Voi on the Uganda railroad, accumulate more moisture on their summits than the surrounding desert, and they are inhabited by another tribe, the Wateita, who find them a fertile field for the raising of millet, maize, bananas, and vegetables. Formerly the indigenous tribes found the mountain tops a secure refuge from their powerful warlike neighbors, the Masai, who once raided over the nyika as far as the sea itself. Inhabiting the upper edge of the nyika, where the highland grassy veld begins to encroach on the desert, we find another tribe, the Wakamba, who, though agricultural, do considerable hunting of game with bows and poisoned arrows. These people are fond of the flesh of game animals and are expert hunters and beaters, the latter method being one of their modes of capture. These people have the custom, unknown among other East African tribes, of filing down the incisor teeth to sharp points. The practice is usually associated with cannibalism, and with such the Wakamba have been credited, but the accusation is denied by Hobley.*

THE NILE NYIKA

The desert nyika extends far westward past Lake Rudolf to the Nile and then northward, embracing the vast expanse of the Sahara itself and becoming gradually more desolate and arid as we proceed northward from its southern border at Albert Nyanza. In the Upper Nile Valley, in the Lado Enclave and northern Uganda, the nyika lies at a general level of 3,000 feet and consists of grass-covered plains dotted at wide intervals with small trees and bushes. The rainy season is short but sufficient to produce a heavy growth of tall grass, which in the dry season is systematically burned by the natives. Only a few of the hardier or more favorably situated trees can withstand this annual ordeal by fire. The Nile itself flows through the region like a great newly cut canal without bordering forests or any marked luxuriance of vegetation except papyrus to mark its course. The characteristic trees of the Nile nyika are various species of acacia and other leguminous trees, the peculiar *Kigelia*, the *Borassus*, or fan palm, and the dôm palm. The climate in the dry season is hot and dry and decidedly more trying to a European than that of equal elevations in British East Africa. During the short rainy season the moisture

* C. W. Hobley: *Ethnology of A-Kamba and Other East African Tribes*, Univ. Press, Cambridge, 1910; reference on p. 18.

produces a humid, depressing climate quite as uncomfortable as that of the Congo forest region. The soil over much of the region is of the usual bright red (ferric oxide) clay variety so widespread in Africa.

THE NILE AS A BARRIER

The Nile is a more important barrier to big game mammals than the Tana River; in fact it is the most important river barrier in all Africa. No fewer than five of the largest game mammals of eastern Africa occur on the eastern bank but fail to cross the river. These are the black rhinoceros, the Cape eland, Burchell's zebra, the five-horned giraffe, and the red-fronted gazelle. On the opposite bank we find an equally important assemblage of big game which are barred by the Nile from farther extension eastward. The most important of these species are the white rhinoceros, the giant eland, and the Congo giraffe. Living on both sides of the Nile and occurring in abundance we find such species as the Nile buffalo, Cape elephant, Nile kob, harnessed bushbuck, defassa waterbuck, Nile lechwi, yellow reedbuck, oribi, bush duiker, etc. All of these species, which are now found on both sides of the Nile, probably represent the older residents in the region, the more recent arrivals such as the rhinoceroses and elands having had less time to effect a crossing.

The Nile along most of its course is a really formidable barrier, being wide and lakelike in expanse, the margins boggy and overgrown by a heavy growth of papyrus and other aquatic plants which form an impassable barrier of floating *sudd*. Animals as large as elephants have been found mired and drowning in this treacherous plant growth. Between the Dufile rapids and Gondokoro the river is greatly narrowed, so much so that at a few spots it seems possible for large mammals to cross, but apparently they do not try the adventure, perhaps owing to fear of the swift current. It is evident from the presence of distinct genera of rhinoceroses on opposite banks that the Nile has been an open stream of considerable size for a great length of Tertiary time.

NATIVES OF THE NILE NYIKA

The natives of the Uganda portion of the Nile are chiefly members of the Acholi and Bari tribes, who live in small stockaded villages and are agricultural. Lower down the river in the Sudan portion we meet with other tall, slender Nilotic peoples, like the Dinkas and Shilluks, who, like the Masai of the Rift Valley, are largely pastoral. These nude people protect themselves against mosquitoes by smearing their bodies with wood ashes, which gives them a weird and ghostly appearance.

THE HIGHLAND VELD ZONE

The highland veld zone may be described as the sportsman's paradise. It is a region of grassy plains, well watered by a moderate rainfall and

lying at altitudes of 4,000 to 8,000 feet. The climate is delightfully cool at night notwithstanding the torrid sun of the day. Great herds of game feed on the grassy plains and live there the year round. Cutting through this zone from north to south and dividing it into two sections is a great trough, the Rift Valley, of recent tectonic origin. The Rift Valley in British East Africa is bounded by two great escarpments which rise from 2,000 to 4,000 feet above the floor of the valley. The escarpments are forest-clad, in marked contrast to the grassy plains of the Rift Valley, with its numerous small lakes of independent drainage and often saline waters.



FIG. 8—Hippopotamus herd on the Tana River. (Photo by C. E. Akeley.)

Northward the Rift Valley descends rapidly from its culmination of 6,000 feet at Lake Naivasha to the low desert plains of Lake Rudolf, which is less than 1,000 feet in altitude. The Rift Valley with its independent local drainages separates the coast drainage from the Nile but is not a very important physical obstruction to game animals. A few antelopes, among which may be mentioned the lelwel hartebeest, the defassa waterbuck, the five-horned giraffe, the Uganda kob, and the sitatunga, find here their most eastern range, the last two species stopping on the Mau Escarpment west of the Rift but the first three mentioned passing this barrier and stopping in the Rift Valley itself. Proceeding westward from the Mau Escarpment the highland veld region continues over much of Uganda, occupying all of the basin of Victoria Nyanza and the lower slopes of the Ruwenzori massif. The Uganda veld is a region of tall grass and is quite devoid of plains-loving antelopes, being chiefly the haunt of buffaloes, ele-

phants, bush pigs, duikers, sitatungas, bushbucks, and other cover-haunting species.

MAMMALS OF THE EASTERN HIGHLAND VELD ZONE

Reverting to the British East African portion of the highland veld zone, which includes the Rift Valley and all the veld lying east of it in the coast drainage, we encounter as peculiar species the Thomson gazelle, the Coke hartebeest, the white-bearded wildebeest, and the diminutive steinbok. Bordering the rivers and streams which dissect the veld are scattered groves of green-barked, flat-topped, and other species of acacia. A remarkable type of tree which attains its perfection in the highland veld is the *Euphorbia candelabrum*, of weird, cactuslike appearance, leafless, and made up of angular succulent stems. It grows to gigantic size, often producing an immense globular branching crown as much as a hundred feet across and having a trunk several feet in circumference. No palms occur in this zone except a dwarf species of the wild date (*Phoenix*).

MASAI, KAVIRONDO, AND BAGANDA TRIBES

In the old days the powerful cattle-keeping Masai, migrating southward along the pasture belts, occupied the Rift Valley and the highland veld of the coast drainage as well as the Laikipia and Athi Plains and also held sway far southward on the grassy slopes at the base of the lofty snow-capped Kilimanjaro. They were the lords of Equatorial Africa, until the rinderpest reached the continent, swept their cattle away, and so weakened their military power. They are a pastoral people and depend for food on the milk and blood of their herds, eating little or no vegetable matter nor the flesh of game animals. The ravages of the rinderpest in 1890 reduced their herds to remnants and their powerful standing army of warriors to a mere handful. The white man soon afterward entered the country and has now established himself securely in these pleasant highlands.

Living in the Nile drainage on the eastern shores of Victoria Nyanza are the Kavirondos, a tall, athletic, agricultural race who till the soil in fields won from the forests flanking the Mau Escarpment and the Nyanza plain. The Kavirondos live in that innocent state which prevailed in the Garden of Eden, but on the opposite side of Victoria Nyanza we find a well-clothed race, the Baganda, who have been subject to a dynasty for several centuries and have reached the state of culture which expresses itself in extreme forms of polite speech and servile deportment. These people, like most African tribes, are agricultural. Bananas and sweet potatoes are their staples of existence, and their dress consists often of bark cloth made from a tree common in the country.

THE HIGHLAND FOREST ZONE

Bordering the highland veld on its upper levels we encounter the highland forest. There is no intermediate parklike country between



FIG. 9.



FIG. 10.

FIG. 9—Masai giraffe and Wakamba skimmers, Athi Plains, Roosevelt expedition.

FIG. 10—Domesticated common eland in a Meru village.

forest and grass plains. The forest flanks the grass land as a solid wall quite as dense on its outer face as in its interior. How this sharp line of grass plains is maintained against the encroachments of the forest is a biological mystery. There is no burning of grass plains in this high region, the grass being short and the climate as a rule too wet for fires. The forest begins at an altitude of 6,000 feet and ranges up to 11,000 feet on the highest mountains such as Kenya and Ruwenzori.⁵ Its quality is quite variable, the lower portions being composed of olive trees, albizzias (allied to acacias), crotons, the yellow-woods (African yew), *Podocarpus gracilior* and *P. thunbergii*, the Ibean camphor (*Ocotea usambariensis*). On dry slopes a large juniper (Kenya cedar) forms pure forests in places; on damp slopes giant tree ferns and fig trees are common. The upper levels of the forest are composed of an alpine bamboo, *Arundinaria alpina*, quite pure in growth, bordered at its upper limits by *Hypericum* trees, a close relative of the Saint-John's-wort of our gardens.

MAMMALS OF THE HIGHLAND FOREST ZONE

The East African mammals dwelling in the forest are bushbucks, red duikers, bush pigs, buffaloes, elephants, and leopards. Along with them are two very rare species which remained for many years unknown. They are the bongo (an elandlike antelope) and the giant pig. Both animals have recently come from the Congo by way of intervening forest areas. They have crossed the barrier of the Rift Valley from the Mau forests and now are found as far east as the slopes of Kenya, where they dwell securely in its dense forest covering. These two species have been prevented from reaching the extensive forests of Kilimanjaro by the lack of intervening forest belts.

ALPINE REGIONS

Above the forest zone at 11,000 feet altitude on Kenya an open moorland or alpine region occurs, and this same type of country is found on the top of the Aberdare Range, on Kilimanjaro, and on the Ruwenzori Range. The ground at these high elevations is boggy and covered by alpine plants such as mosses, alchemillas, brambles, heathers, immortelles (*Helichrysum*), giant groundsels (*Senecio*), and lobelias of several sorts. The groundsels are gigantic forms and treelike in habit and very different from our own, which are insignificant roadside weeds. The very largest of the game mammals, the elephant, reaches this high range as a transient visitor, but is never resident at such an altitude. The buffalo is also an occasional intruder. Living in the zone is a race of the bush duiker and an occasional leopard and serval cat. Certain species of the rock hyrax are peculiar to this zone, and great numbers of small rodents and shrews make this lofty moist region their home.

⁵ See note in "Geographical Record" for this month on "New Observations on Mount Kenya."—
EDIT. NOTE.



FIG. 11.

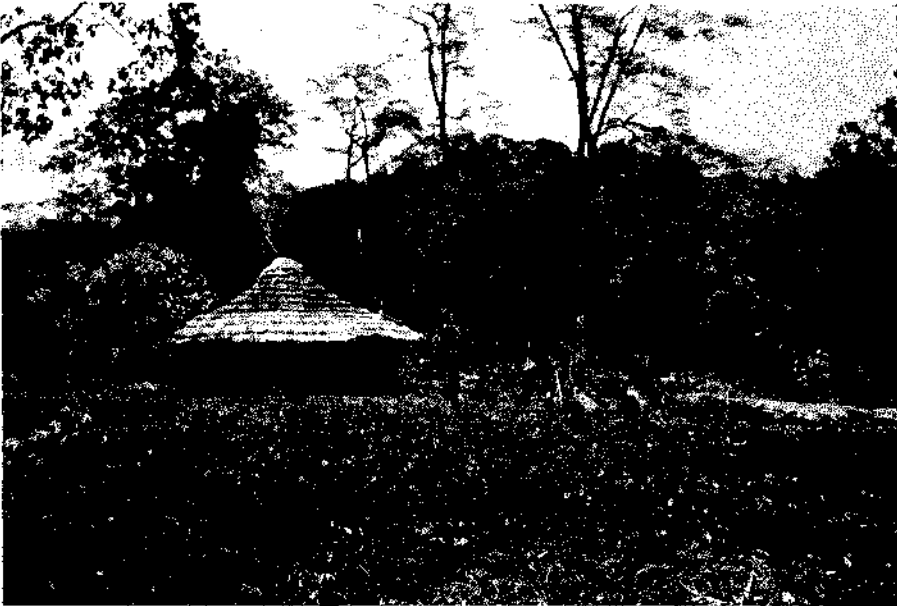


FIG. 12.

FIG. 11—Dry river of the nyika zone, bordered by döm palms.

FIG. 12—Kavirondo field and hut, showing Kakanwega forest in the background. This is the easternmost extension of the tropical Congo forest in Africa.

TRIBES OF THE MOUNTAIN FORESTS

No true forest tribe occurs in the high mountain forests of eastern Equatorial Africa but we find dwelling there the Wandorobo people, helots of the Kikuyu and Masai tribes, who have taken to the forest, where they subsist on the game they catch in pits and on the stores of wild honey they



FIG. 13—Batian, the summit peak of Mount Kenya, 17,200 feet in altitude. Taken at snowline, 14,500 feet altitude.

find in trees. These people have no definite tribal organizations but live in small family communities: they probably represent remnants of older, subjected tribes. On the extreme lower edge of the forest bordering the grassy plains, in the Kenya region, we find several large agricultural tribes of whom the Kikuyu are the best known. They grow millet, sugarcane, cassava, potatoes, maize, beans, squashes, and other vegetables. The activities of the Kikuyu bear an important relation to the forest and its wild life: constantly clearing new land in order that luxuriant crops may be obtained, they steadily encroach upon the forest. It has been estimated



FIG. 14.



FIG. 15.

FIG. 14—Alpine vegetation of Mount Kenya, growing at an altitude of 13,000 feet. Giant lobellias.
FIG. 15—Bamboo forest of Mount Kenya at its upper limit, 11,000 feet. In the foreground, inmortelles in blossom.

that the forest belt of the Aberdare Range has recently been diminished at the rate of about half a mile yearly. On the forested slopes of Kilimanjaro, Mount Elgon, and the Ruwenzori Range are numerous other agricultural tribes similar in physical characteristics and habits to those of Kenya. These tribes are local in range, speak distinct languages, and have little intercourse one with another.

THE TROPICAL FOREST ZONE AND ITS MAMMALS

A forest quite as dense as that of the high mountains but composed of tropical tree species is found occurring in patches through Uganda and as far eastward as the base of the Nandi escarpment. It is really a part of the great Congo forest, which sweeps across Africa from the west coast to the base of Ruwenzori. Large patches of tropical forest are found in Uganda on the shores of Victoria Nyanza: the easternmost outlier is the Kakamwega forest lying northeast of Victoria Nyanza in the basin of the Yalo River (foot of the Nandi escarpment). A great number of species of trees are found assembled in this tropical forest of Uganda. Many of the giant trees are figs, others are zapotes, but none are related to our own forest trees. The killer fig, which is parasitical on the trunks of trees in its youth and strangles them later, becoming a many-branched and many-stemmed tree, is a loathsome type common to the forest here. Palms are rare, but bananas of several species are abundant and replace them. Tree ferns also occur but are less numerous than in the highland forest. The Uganda forests were the highways by which the bongo and giant pig reached East Africa. These two species still occur in these forest bridges as well as in the great Congo forest itself. Besides these species there are elephants and several small forest duikers and bushbucks. Peculiar to the Congo forest but living on its eastern edge chiefly is the okapi, a recently discovered ungulate allied to the giraffes but very little known because of its secretive habits and the dense nature of its haunts. Also confined to this tropical forest but more widespread than the okapi are the chimpanzees. Their distribution practically coincides with the entire tropical forest area of Africa. Not so, however, does the range of the gorilla, which is limited to the Cameroons and Ogowe districts of the west coast and is absent from the whole Congo Basin. One species of gorilla is found in a small area of highland forest on the volcanic Mufumbiro mountains northeast of Lake Kivu. What is the explanation of the limited and widely separated distribution of the gorilla, the most powerful of the anthropoid apes, and the widespread range enjoyed by his smaller kin the chimpanzee?

THE TRIBES OF THE CONGO FOREST

Dwelling in the Congo forest proper there are several tribes of normal size of common Bantu stock, agriculturalists who are subject to a tribal

organization of considerable complexity; but the most interesting people in the Congo are the pygmies. They are a shy forest folk who avoid oppression by keeping aloof and away from their larger and more powerful negro neighbors as well as from the few white men who travel through their domain. In habits they resemble the okapi, with which they share their territory.

Summary

It is climate that exerts the chief control over the distribution of animals in Equatorial Africa. The five zones which we have here employed in defining the ranges of game animals and native tribes have been established on a climatic basis. Coincident with climate are distinctions of flora on which the animals are dependent for food and protection. Temperature first, and then moisture are the most important climatic elements. Temperature is dependent chiefly on altitude, and our zones, inasmuch as they are primarily defined by temperature, have very definite altitudinal boundaries and lie one above another. In accord with the banded orographical structure of the region we find the life zones disposed in ribbonlike arrangement and paralleling the coast in a general way the whole length of the eastern side of the continent. Summarizing the five life zones briefly (map, Fig. 1), we have first the narrow coast zone rising from sea level to 500 feet or so. Above this the great desert, or nyika, zone extends from 500 feet to an altitude of 3,000 feet. Above the desert the highland veld rises from 3,000 to 8,000 feet, its altitude giving it a cooler and moister climate. Rising still higher above the plateau there is a highland forest area on mountain slopes and summits covering the altitudes between 8,000 to 11,000 feet, where the climate is decidedly moister and cooler. The area lying above the tree zone, which is alpine in the character of its plant growth and climate, is infinitesimal in Africa in comparison with the other zones. In Uganda we have an area or zone, the tropical forest, which is dependent on soil conditions rather than altitude. Here we find a dense tropical forest covering certain areas within a grass veld region. To some extent this area is artificial, the grass veld having been extended by native agricultural methods at the expense of the forest area. Within these zones are two important river barriers, the Nile and the Tana, which subdivide the nyika zone, as their waters form important barriers to big game mammals. As a barrier these rivers are here only of great importance to the distribution of big game, smaller mammals being much less effected. Reptiles, birds, other animals, and vegetation are scarcely effected at all by these rivers in their distribution, though they are subject to the zonal or climatic barriers quite as much as are big game mammals. There is no region in the world where large mammals have been so limited in their distribution by rivers as in Equatorial Africa.