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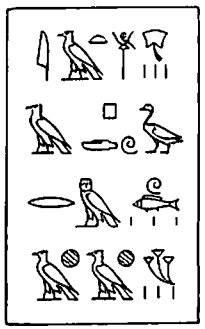

AN ECOLOGICAL RECONNAISSANCE OF THE MARA PLAINS IN KENYA COLONY

by

F. FRASER DARLING

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FRONTISPIECE. Three male lions at rest in the Mara region. Photograph by Lee Merriam Talbot.

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THE PROBLEM

The general problem of a fairly small but prolific game area being conserved, with the pressure of pastoralism on one side and of African commercial gang poaching on the other, and the insidious, slow degradation of the habitat, is the one on which I have made the present reconnaissance. As is so often apparent when an attempt is made to conserve wildlife, the problem is not a clean-cut one of plant and animal ecology, but of human ecology as well, and once that is admitted, the world of human politics is found to be a considerable ecological factor. The administrative settlement of the dilemma is not my problem though it must be appreciated in setting forth the biological background insofar as that is comprehensible to me.

GENERAL DESCRIPTION OF THE MARA PLAINS

The Mara Plains of Kenya are at the southwestern extremity of the Masai Land Unit and adjacent to the international boundary with Tanganyika, which boundary runs northwest by west–southeast by east. The plains cover an area of 1,000 square miles or thereabouts and are surrounded by hills and escarpments. As far as this study is concerned, the surrounding hills have been included to the extent of a further 500 square miles, and reconnaissances farther afield have been made.

The altitude of the plains is 5,000–5,500 feet and although the area is only 1° 30′ south of the Equator it could not be called tropical in character except where original high forest has remained, bordering the watercourses. Indeed, the climate is exhilarating, for daytime temperatures rarely exceed 85°F. and the atmosphere on the hills which rise to 7,500 feet is always fresh and pleasant. Rainfall is supposed to be in the neighborhood of 30 inches, being heavier on the west in what is called the Mara Triangle and much less on the east side. The administrative Boma of Narok is 15 miles northeast of the boundary of the study area, a station which gave an average of 18 inches of rain over 8 years of recording. Rain falls in two seasons, the short rains of thundery character in November and December, and the more gentle, long rains from March to May.

The Mara River flows from north to south through the area and is obviously of great faunal and floral significance, for it is a perpetual river, 20 yards across, contained for most of its course between high banks and carrying a good body of water at a current of about 2½ knots in the dry season. The Mara takes a sharp turn westward at the Tanganyika Border and changes in character from a silent high-banked river to one flowing over many rapids of granite boulders and bed rock, and the banks, though permanent, are much lower. This fact is of importance to the game of the Mara Plains because fords are so much more numerous than on the Kenya side of the border.

Drainage lines to the Mara River flow mainly from east to west through the plains, the principal tributary being the Talek, which is joined by the Jagartek from the northeast, 4 miles above the confluence with the Mara. The Talek dries out as a running stream, but it always carries water in pools, and the river is considerable enough to carry residual patches of riparian forest. The Sand River or Lossemin follows the international border very approximately; it is a considerable watercourse coming out of the Sianna and Loita hills, steep-banked and 15–20 yards broad, but it dries out completely and the deep, sandy floor, flanked by high forest trees, makes a delightful walk for a biologist, and an apparently equally pleasant playground for many animals as diverse as the elephant (*Loxodonta africana*), the vervet monkey (*Cercopithecus aethiops*), the baboon (*Papio*), and the banded mongoose (*Mungos mungo colonus*). Water is always accessible by digging, and this the elephant does extensively.

The streams flowing from the Isuria Escarpment, the western boundary of the area, to the Mara River are short and not persistent. They appear as shallow *karongas* (dry stream bed or gully) or mere depressions where a certain amount of water may lie in pools or wallows puddled in the soil. These streams cannot be said to carry riverine vegetation though the banks hold dense clumps of low bush here and there. Two salt marshes with perpetual highly brackish water are found in a more or less central position in the Mara Triangle, i.e., in the 200 square miles enclosed by the international border, the Isuria Escarpment, and the Mara River. This area has been a National Game Reserve for several years.

The Sianna Hills and the drainage of the Sand River are composed of quartzite which frequently outcrops (Fig. 1). This formation reaches north to the Talek River, but in the bed of this watercourse there is a great deal of metamorphic, amphibolitic mica schist which, in the lower reaches, shines and sparkles like the skin of a mackerel newly caught from the sea. Mica schist also appears as the bed rock at the lower reaches of the Sand River. The plains north of the Talek, and reaching far eastward to the Loita Plains and Esuvetai, are on basaltic lava. Such little hills as Oldonyo Lo-ip and Esuvetai, rising from the plains, are typical volcanic bosses. Lava is also the stuff of the flat-topped Isuria Escarpment, below which there is a green, soil-covered talus slope, then the gentler plain littered with lava boulders stretching down to the Mara River. There is a distinct undulating bit of quartzite country in the southern tip of the Mara Triangle, covered with acacia bush and tiresome of passage; then, immediately north of that is an area of low, bush-capped laval cones and hillocks.

The typical plains country either side of the Talek River is called the Olara l'Muny to the north, the Egilok Plains to the south, and the Bardamit Plains to the northeast. Although there are unbroken stretches of grassland some thousands of acres in extent, the plains are quite liberally dotted with patches of short bush from 10 to 300 acres in size. I have called this "lion-bush" for want of a better name because it is in these patches that the numerous lions (*Panthera leo*) of the Mara Plains lie up, have their cubs, and take advantage of as cover.

The Sianna Hills would be forested were they not so frequently burnt, and many residual patches of original forest are still apparent from afar. But on the whole, the quartzite hills and drainage to the plains are covered with thin bush of *Commiphora–Acacia* and small, dense ant hill communities of shrubs similar to lion-bush. The little hill of Oldonyo Lo-ip (Masai for the hill of shade) is suffering from repeated fire and will soon need to be renamed. Some other little hillocks have completely lost their bush.

The Mara Triangle National Game Reserve contains much more bush though there are also large areas of grassland. The bush is richer and merges into the splendid residual patches of riverine forest along the Mara.

The Isuria Escarpment must have been densely forested within fairly recent time, possibly a century, but it is now almost bare. Such a slope engenders a roaring fire which only the most heat-resistant species of trees can survive.

The Mara Plains are the home ground of great herds of white-bearded gnu (wildebeest) (*Gorgon taurinus*), zebra (*Equus burchelli*) and topi (*Damaliscus korrigum*), and flocks of Thomson's gazelle (*Gazella thomsoni*). There are also herds of eland (*Taurotragus oryx*) and kongoni (*Alcelaphus buselaphus*), and giraffe (*Giraffa camelopardalis*) are numerous. Flocks of impala (*Aepyceros melampus*) are to be found round almost every patch of lion-bush and many Grant's gazelle (*Gazella granti*) mingle with the flocks of Thomson's gazelle on the plains or are found in little groups on their own. Packs of wild dogs (*Lycaon pictus lupinus*), up to a dozen or even a score, may be seen on the plains, but they are not numerous. We never saw them collectively hunting the Thomson's gazelle or the impala, nor did we see any animals showing fear of the dogs. Hyenas (*Crocuta crocuta*) are ubiquitous, but not so numerous as to show that sign of over-

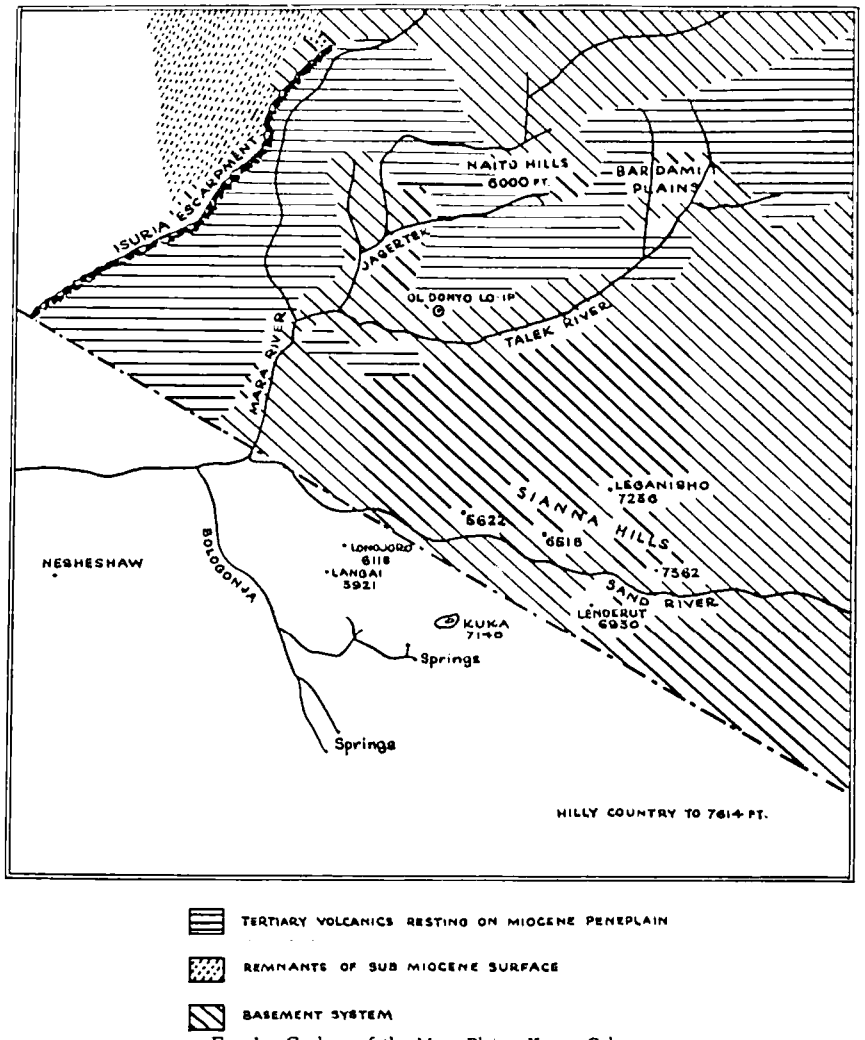

FIG. 1. Geology of the Mara Plains, Kenya Colony.

population, packing. A large herd of elephants, some hundreds strong, keeps rather close in the riverine forest of the Mara and Sand rivers during the dry season, but spreads far and wide over the study area during the rains. At that time, the patches of lion-bush are honeycombed by the elephants and there can be no doubt that bush is receding in the area, what with increased frequency of fire and heavier usage by elephants. Reedbuck (*Redunca redunca*) occur generally near the *karongas*, in the Sianna Hills, and along the river flats.

The surrounding hills carry species not

seen elsewhere in the area—klipspringer (*Oreotragus oreotragus*), obviously, for it is so much associated with rocky *kopjes* (rough granite hills), but the oribi (*Ourebia ourebia*) also occurs and Chanler's reedbuck (*Redunca fulvorufula*), and occasionally roan antelope (*Hippotragus equinus*). The roan antelope is easily caught by poachers using nooses; a small herd still survives to the north of the Sand River, and a larger herd has sanctuary in the Mara Triangle but, if they spread over the Border they are lost. The greater kudu (*Strepsiceros strepsiceros*) survived in the Sianna Hills till 15–20 years ago but has now gone, though a few persist on the Loitas.

The Mara Plains carry several large herds of buffalo (*Syncerus caffer*). Although this animal must be somewhere near water, it has a fairly wide adaptability; for example, a herd may be found in the foothills of Kuka, 7,148 feet, (with tracks near its summit), in the bush along the Talek and Sand rivers, and taking refuge in the high riverine forest of the Mara. Waterbuck (*Kobus defassa*) also occur in groups of 6 to 20 almost anywhere within a mile of water. The smallest buck of all, the dik-dik (*Rhynchotragus kirki*), is seen in twos and threes wherever there is bush of any kind. We have also seen two steinbok (*Raphicerus campestris*) in the course of our survey, on heavily burnt degrading bush. The lion population is large still, but much less than 25 years ago. Cheetahs (*Acinonyx jubatus*) were so heavily hunted after the Second German War as almost to disappear, but they have now increased again without being numerous. Ostriches (*Struthio camelus*), single birds and groups of up to half a dozen, are seen most days. It seems strange that any nests of eggs should survive, so numerous and varied are the possible predators, avian and mammalian. Bat-eared foxes (*Otocyon megalotis*) are common in the plains and are seen at dusk, appearing from shallow burrows in the open plains. The three species of jackal (*Canis*) are present.

The country to the southwest of the study area is of great importance to the game of the Mara Plains for it is here they come when grass is scarce in the Plains. Unfortunately, it is in Tanganyika, remote at that, and therefore under different administration. The country on the right bank is of the same character as the Mara Triangle, the international boundary creating an entirely false line ecologically. We have called this area the Lamai Wedge and shall have cause to consider it later. The left and south bank of the Mara River over the Tanganyika boundary is quite different. It is undulating and the rock is granite of coarse grain which outcrops frequently, and forms a bold *kopje* in Nesheshaw, 5,313 feet. It is poor, acid country, heavily burnt, but there are still dense and considerable patches of tall lion-bush or low forest. The geological formation favors springs of water and it is obvious that the area has good seasonal value for game. Indeed, early in October when we flew over it, there were dense concentrations of wildebeest and zebra, but when we penetrated by Land-Rover and on foot in November, after it had been burnt, the country was empty.

South of the study area, also in Tanganyika, is a country of considerable quartzite hills and long, wide valleys. It was once well forested, with open glades or large lawns on the valley floors. The whole area is so often burnt that forest and close bush on the hills occur only fragmentarily, and it may now be called close acacia savannah. This area also takes wildebeest and zebra of the Mara Plains stock if it receives rain when the plains are dry. On one of our reconnaissances into this country we saw no game for 40 miles; two days later there were large herds of wildebeest and zebra feeding on short green grass which had appeared in such a short interval of time. South of this large area of hilly savannah are the great Serengeti Plains.

The east side of the Mara Plains merges into a vast country of flat volcanic plains with occasional shapely volcanic cones, the grazing ground of many thousands of Masai cattle and sheep. The country may be said

to be approaching desert by reason of overgrazing, yet it is to the Loita Plains that the wildebeest of the Mara Plains come for calving in March and April. Why do they come there, to a degraded herbage of *Pennisetum* grass and the shrubby herbs *Justicia* and *Sida*? Perhaps for the very reason that the great flat plains are so open, affording little cover for predators. The Loita Plains are the eastern limit of movement of the Mara wildebeest, and the animals are there only for the calving period.

Samples of soil were taken near Eland Lick, a saltlick in one of the Sianna valleys, from the floor of the plain near Oljoro Loromon, and from the summit flat of one of the Egilok Plains, in order to gain a general idea of the character of the soils. Mr. Bellis of the Scott Agricultural Laboratories, Nairobi, kindly furnished the following analyses (Table 1).

TABLE 1.—ANALYSES OF SOILS, BY CHEMICAL AND BIOLOGICAL TESTS, FROM THREE AREAS: NEAR ELAND LICK, IN LIGHT BUSH, COLUMN 1; NEAR OLJORO LOROMON, IN THE VALLEY, COLUMN 2; AND EGILOK PLAINS, ON THE FLAT CREST, COLUMN 3. KENYA COLONY, 1958. DEFICIENCIES (IN ITALICS) ARE INDICATED FOR N, P, AND S IN ALL AREAS. OTHERWISE ALL ARE FERTILE SOILS.

	1	2	3
(a) Chemical Tests			
pH	7.0	5.7	6.0
Dil. acid extractable			
Na m.e.%	0.6	0.4	0.2
K m.e.%	0.6	0.6	1.6
Ca m.e.%	10.0	10.0	9.3
Mg m.e.%	2.3	2.6	2.6
Mn m.e.%	0.4	0.8	0.5
P-ppm	*26*	*7*	*31*
(b) Biological Tests (*Cunninghamella*)			
Nitrogen	*420*	*1200*	*833*
Phosphorus	*136*	*189*	*67*
Sulphur	*45*	*36*	*65*
Trace elements	4	0	0
Efficiency	52	54	56

The Kenya Veterinary Department is conducting a bush-clearing and tsetse-elimination scheme to the north of the study area, to form a tsetse fly barrier to the lands northward. The game is not being shot out under the scheme and no sport shooting is allowed. Whether bush clearance on the 25,000-acre scale is feasible has still to be established, for the shrub *Euclea* is extremely resistant. The Lemek Valley is still heavily wooded, much frequented by elephant, and presumably will not be cleared.

The remaining country bounding the Mara Plains is the flat basaltic plateau on top of the Isuria Escarpment (*circa* 6,500 feet), and the volcanic hills and valleys beyond. The devastation of the escarpment itself leads one to imagine similar conditions on top, but in fact the country there is forest in small islands with fire-made grassland in between. *Acacia* savannah has not developed and the trees are the broad-leaved kinds found in the forest along the Mara. Every ant hill carries its dense community of shrub and forest tree. The islands of woodland are close enough to each other that it would be easy, momentarily, to get lost walking in the grassland. The volcanic hill country beyond, over the Moghori River is very beautiful, much forest remaining in clumps and the meandering grasslands being free from that thinly spread acacia growth which can render a landscape monotonous. There is not the evidence of overgrazing which characterizes the volcanic country farther east, though this area is still within the Masai Land Unit, with some herding of cattle and sheep being done, and it is quite different in character from the hill country to the south of the study area. Rainfall is almost certainly heavier than in the Mara Plains, though probably not much more than in the southern hills. It is presumed that geological formation has exerted its influence. Game was very scarce in the country over the Isuria Escarpment and it is believed that except for elephant, the Mara game does not ascend this natural barrier.

The Mara district and its surrounding hills became the last refuge of Mau-Mau gangs so that it was closed to safaris of any kind. When it was reopened in 1957, the Kenya Game Department very wisely closed the Mara Tsetse Fly Area to all hunting, but allowed photographic safaris to be made. By this means, a large area was added in effect if not in name to the National Game Reserve of the Mara Triangle, so that more than 1,250 square miles are closed to shooting.

The Masai in Kenya are a purely pastoral people: cattle are of fundamental and spiritual significance to them, with sheep and goats as subsidiaries. The life of the Masai is in effect a perpetual search for grass: as the herds come to areas well provided, scouts are ahead looking for fresh growth resulting from showers which are limited in incidence and expanse. The Masai culture is built round the necessity for movement and protection of their herds. Permanent dwellings are not in keeping and even the temporary thorn-*boma cum* cow-dung-and-wattle huts, known as a *manyatta*, are burnt to the ground as the group of families moves on. Intentional positive influence on the landscape is not envisaged, but where the Masai have been there is usually a reduction of climactic bush as a result of overgrazing and fire. The numbers of cattle (though the Masai would consider it impious to count them) mean more to the elders than the visible effects of overstocking which are always put down to the rains now being not what they were. It would scarcely be possible, in the Masai mind, for there to be too many cattle. Fire is looked upon as the means of getting rid of uneaten and uneatable dry grass and of encouraging new growth. The fact of reduction of forest or dense bush is probably of little significance to the Masai in that their firing is not an *ad hoc* measure towards increasing the area of grazing.

Some areas of the Masai Land Unit are so badly overgrazed and burnt as to show serious erosion. The northern part of the study area has not quite reached this stage though it does show the effects of overgrazing. Naturally, the Masai culture being what it is, their tribal territory covers grazing country and they are not interested in forest. Furthermore, although some areas are potential grazing ground, they are not occupied by the Masai because of the presence of tsetse flies and East Coast fever. The Masai early discovered that the bite of the tsetse fly caused the disease, which they call *ngana*, in cattle. The white man's contribution to the understanding of this phenomenon was that a trypanosome was parasitic within the circulation of the fly and that it was transmitted to cattle when the fly punctured the skin.

The reason that the greater part of the study area is not overgrazed is that a tsetse fly (*Glossina swynnertoni*) is present in considerable numbers. Sheep are not affected by trypanosomiasis and goats almost negligibly, so at the moment the Mara Plains and surrounding hills are grazed seasonally by closely herded flocks of sheep in charge of Masai youths, and not by cattle, except on the northern and eastern part where tsetse flies are absent. Observers who have known the area for 30 years state that even the penetration of sheep and goats to the Mara Plains is a recent practice.

Masai culture has been traditionally tolerant of the presence of game animals. As there is no cultivation there is no antipathy to wild animals for the damage they might cause, and as the Masai are nutritionally self sufficient with their herds and flocks, they are not hunters. Indeed, they disdain to hunt the wild ruminants; carnivores are hunted insofar as they may cause trouble, but in fact it is unusual for domesticated animals to be attacked in a country where game is numerous. Close herding, the thorn *boma* (ring fence), and strategic disposition of fire are in general sufficient to protect the herds and flocks. Lions are hunted from time to time for the masks and manes, used in traditional dances.

This tolerance of the Masai for the game animals has been of very great importance to the preservation in Kenya of some of the

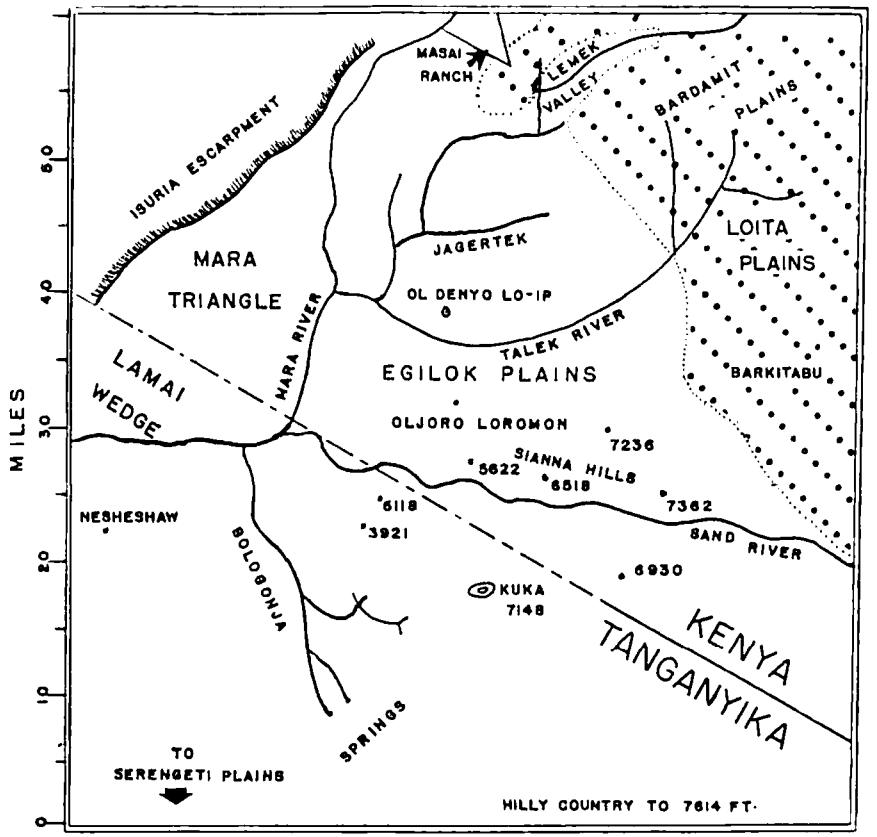

FIG. 2. Distribution of the tsetse fly in the Mara Plains, Kenya Colony. The dotted area represents that which is clear of the tsetse fly and, very closely, that which shows overgrazing by cattle.

Shrubs and Herbs:
Rhus natalensis
Courbonia (geophyte)
Capparis
Commiphora (on degraded ant hills)
Hypoxis (geophyte)
Priva
Solanum campylacanthum
Cissus
Maerua
Ocimum
Talinum
Nidorella
Orthosiphon (Labiatae)
Tribulus terrestris

Longer grass nearer *karongas* included:
Brachiaria brizantha
Panicum maximum
Panicum infestum
Setaria sphacelata
Sporobolus phyllotrichus
Eragrostis chapelieri
Digitaria sp.

Edges of waterholes:
Cyperus spp.
Carex spp.
Aponogeton

The grassland of the low quartzite hills, where there is a good deal of bush growing on old ant hills, presents a more varied flora of herbs:

Grassland among bush

Grasses:
Exotheca abyssinica
Sporobolus stapfianus
Loudetia simplex
Aristida adoensis
Eragrostis exasperata
Eragrostis racemosa
Microchloa kunthii
Digitaria

Herbs:
Fuerstia africana
Cyperus obtusifolius
Becium
Scilla
Barleria
Ruellia
Aerva
Oldenlandia
Bulbostylis
Tephrosia
Aster
Leucas
Solanum

The ant hill community must be recorded as an entity because it is so common and, being slightly above the level of the grassland, it serves a function of harboring various animals temporarily, sometimes a lion, a leopard (*Panthera pardus*), or, if it is large enough, a poacher's hiding place. Many of the species reappear in the lion-bush complex. It is a well-drained habitat and always clear of inundation. The full ant hill community may suffer degradation by overbrowsing and ultimate treading till it grows nothing more than a low plant of *Commiphora* and one or two *Aster*. A still further stage is when the *quondam* ant hill is quite flat, bare, and providing a rolling place with fine dust for the zebra. I would like to record a phenomenon observed but not understood: what I would call degraded ant hills, almost flat, are common and sometimes only a few yards apart, especially on gentle slopes: when viewed from the air these ant hills seem to resolve themselves into lines (see Fig. 3), following the drainage slopes.

Ant hill community

Shrubs:
Commiphora spp.
Scutia myrtina
Euclea schimperi
Acacia brevispica
Croton dichogamus
Rhus natalensis
Euphorbia (candelabra type)
Albizia sp.

Herbs:
Cissus rotundifolia
Asparagus falcatus
Cotyledon barbeyi
Carissa edulis
Achyranthes aspera
Aloe (stalked and sessile)
Sansevieria intermedia

The formation which I have called lion-bush is a community containing the species found on the ant hills and a few additional ones. Near the Mara River and in the Mara Triangle, the bush tends to be a little higher and may contain specimens of forest trees which never reach maturity or grow beyond 20 feet. Characteristic lion-bush, often capping undulations of the plains on the low ridges of quartzite pebbles, is important ecologically. My opinion is that it is receding through fire and the browsing and treading of elephants. Figure 4 shows the formation as it appears from the air, honeycombed by paths. My impression is that lion-bush is curiously empty of birds.

Lion-bush community

Shrubs:
Acacia brevispica
Ziziphus mucronata
Scutia myrtina
Croton dichogamus
Grewia tembensis
Grewia trichocarpa
Cordia ovalis

curving rides into the forest. When these lagoons come to the edge of the forest or are just outside it, they are of great advantage to the plains game which is shy of approaching water flanked by dense cover. One such depression on the east bank of the river has evidently been out of the forest for a long time, and because of the springs and the constant usage as a watering place by the game, has taken on the character of a marsh. The puddling of many feet on the black cotton soil has rendered the floor of the marsh impervious. The generations of animals have helped to create this present amenity of their environment.

The habitat of the riverine forest is most richly represented along the Mara River, but fragments occur along the Sand River and even the Talek. Furthermore, a good perpetual spring will create the conditions for blocks of a few acres where some, but not all, the species will occur. Oljoro Loromon in the Egilok Plains is an example which we enjoyed as a camp for several weeks. The riverine forests provide a habitat for a sharply defined group of birds such as the turacaos (*Turaco*), trogons (*Trogon*), and bulbuls, and there is a small-mammalian fauna of rats (*Thyronomys*, *Pelomys*), striped mice (*Lemniocomys*), squirrels (*Heliosciurus*, *Paraxerus*), shrews (*Crocidura*), and so on which is as yet far from adequately explored.

Riverine Forest

Trees:	*Aphania senegalensis*
	Warburgia ugandensis
	Ficus spp.
	Elaeodendron
	Rauwolfia
	Syzygium
	Podocarpus
	Diospyros abyssinica
	Chaetachme aristata
	Acacia gerrardii (in glades)
	Phoenix reclinata (palm)
Shrubs:	*Dovyalis macrocalyx*
	Euclea divinorum
	Euclea schimperi
	Teclea simplicifolia
	Albizia
	Croton dichogamus
	Hilleria latifolia
	Hippocratea (a liane)
Herbs and grasses:	*Hibiscus*
	Abutilon
	Setaria plicatilis
	Setaria longiseta
	Digitaria scalarum
	Panicum

Description of the area in this way gives little sense of the beauty and clarity of the landscape, the wonder of the animals within it, and the richness of the experience. One evening stands out in its splendid pageantry. Major Temple-Boreham and I were on Roan Hill, looking southwards over a valley to the Sand River, and to small hills and lightly bushed areas beyond. The evening sunlight was brilliant in its gold, lighting the pelts of the animals which were now moving gently. A herd of 50 elephants appeared and disapeared among the riverine vegetation, playing and resting. Nearly a hundred buffalo crossed the plain to water, slowly and in untroubled, extended order; eight roan antelope were just below us. There were giraffe and eland in the landscape, a herd of impala, knots of zebra, kongoni and topi, flocks of Thomson's gazelles, a few bull wildebeest, two reedbuck and a lion at rest. There was a quietness as well as silence.

THE ANIMALS OF THE MARA: THEIR MOVEMENTS AND HABITS

The continent of Africa is remarkable for the numbers (formerly) and the variety of ungulate species inhabiting the various regions and habitats. A figure ranging from 24 to 30 is a quite common sum for any one area. The remarkable nature of this variety of grazing-browsing animals is in the complex utilization of the habitat and the interrelatedness of use by each species. The elephant makes paths through otherwise impenetrable growth, breaks down trees and browses the tops of trees, thereby allowing

penetration by other species and providing them with young growth at levels they can reach, whether eland, roan or smaller antelope, down to the tiny dik-dik. Each species has it own niche and together they present a beautiful stratification or spectrum of activities of the ungulate fauna. I have developed this aspect at greater length in *Wild Life in an African Territory* (Oxford, 1960). The ungulates found in the whole Mara area already described are as follows:

Wildebeest	15,000
Zebra	12,000
Thomson's gazelle	12,000
Impala	5,000
Topi	4,000
Buffalo	4,000
Kongoni	1,000
Giraffe	750
Waterbuck	500
Eland	500
Grant's gazelle	500
Elephant	500
*Reedbuck	250
*Bushbuck (*Tragelaphus scriptus*)	150
*Oribi	150
Rhinoceros	100
Hippopotamus	3–5 per mile of river or creek
*Dik-dik	common in bush but not estimated
*Chanler's reedbuck *Klipspringer *Steinbok *Duiker (*Sylvicapra grimmia*)	occasional in own habitat
*Giant forest hog	some in the Mara forest
*Bush pig (*Potamochoerus porcus*)	rarely seen but signs noticed
*Wart hog (*Phacochoerus aethiopicus*)	very common

Those species marked with an asterisk, i.e. nearly half of the array, can be neglected for the purposes of this study. Some, like the wart hog, are numerous, others, like the Chanler's reedbuck, are rare, but probably none is in any danger of extinction or even of reduced numbers. Paradoxically, it is the most numerous game that is in greatest danger, except for Thomson's gazelle, though I am told it also is in fewer numbers than formerly, and its status should never be taken as assured. The numbers given against each species are in general estimated from critical sample countings of herds, but the wildebeest were counted individually, by two or three observers at one time, at the rate of around 5,000 a day. This number *per diem* was found to be about the limit one's eyes could count in a day, for the most part working with binoculars. The wildebeest stock was counted at intervals of a week, and may be considered to be near the actual figure for the area. Buffalo were also counted individually when the animals gave us the chance, but the total figure is assessed from the aerial counts. We found zebra exceptionally trying to count on the ground because of their pattern, their near colorlessness when being counted, their tendency to mass, their restlessness, and the heat haze. Counts of zebra from the air were much more satisfactory. The several species of antelope such as kongoni, topi, impala, and waterbuck give no difficulty in identification from the air at 500–700 feet. Wildebeest are quite distinctive from the air because the lighter shading on the back shines almost like a lamp.

Aerial counts were made from a Cessna 180 aircraft piloted by Supt. Beareraft. Two such censuses were taken, one on October 20–21, and the other on November 27, 1958. The first consisted of three separate flights (Fig. 7) at an average speed of 85 mph and and average height of 600 feet while counting. Of the total time, 3 hours 10 minutes was spent south of the Talek River and 2 hours 40 minutes north of it. The weather was fine and sunny, and Messrs. Temple-Boreham and Sheldrick acted as observers. The second census consisted of two flights at an average height of 800–1000 feet, with Mr. Sheldrick as observer. The weather was fine in the morning but became slightly overcast during the afternoon flight.

with a goodly proportion of young stock. This is another key species in any future policy of African game cropping and such stocks as this one in the Mara should be looked upon as a valuable sanctuary stock. As the Mara is administered at present the eland is in no danger, but in other areas where care is lifted, the eland rapidly disappears. The Mara eland are wary and well distributed in the light bush and savannah areas. They are only rarely seen in the open plains.

Grant's Gazelle

The population of perhaps 500 is scattered, and found more in the drier part of the area. These animals are not seen in large flocks, but in half dozens; flocks of Thomson's gazelles often have two or three bucks of the Grant's species. Their status in this area seems to be fairly constant. The ecology of the two species would be a study to be welcomed.

Elephant

The elephants of the Mara are excessively wary, quite the shyest elephants I have met with in Africa. The estimate of 500 is the most approximate in this study. Some informants would estimate much larger numbers, and certainly the evidence of heavy pressure on the habitat is considerable, but from what we saw, I could not estimate beyond this figure. We were present in the Mara when the elephants were occupying the dense forest, whereas in the long rains they range over the whole area. A count should be attempted at that time.

The Mara elephants carry small ivory but are of large bodily size. Major Temple-Boreham and I found one old bull walking eastward purposefully, far up on the Bardamit Plains: at that moment he was in gall acacia regeneration which gave us opportunity of close approach. I was much impressed by his immense size. Had it been possible I should liked to have followed him to discover his lonely purpose.

The Mara elephants would seem to be rather hemmed in, though they do ascend the Isuria Escarpment and go into the country beyond. Their influence inside the Mara riverine forest is not significant, but they are so damaging the edge that it is receding. They are also clearing areas of scrub along some of the *karongas* within three miles of the Mara River. Many acacia trees of perhaps 15 feet high are being stripped of their bark or pulled over, though this means little in influence on habitat in this particular place. My impression is that the Mara elephant herd could stand some reduction, but I would not like direct action to be taken until someone had tackled the very awkward job of estimating their number during dispersal in the wet season. As I have suggested in *Wild Life in an African Territory*, the growing tendency of mankind in Africa to restrict the free range of elephant herds makes control of the numbers of cows and calves more difficult.

Reedbuck

A scattered *karonga*-edge population of 250 would seem to be constant. Indeed, the influence of the elephants in creating more grassy areas near the *karongas* may well help the reedbuck.

Bushbuck

These animals occur in the Mara forest, in the Sianna Hills and under Kuka, and along the Talek River. The bushbuck is a markedly stationary species, and very wary.

Roan Antelope

This species is in great danger of extinction in the Mara area. We counted 21 in the Mara Triangle, but there may be 30–40 in all. Unfortunately, this herd is too near the Tanganyika Border and the Lamai Wedge, and may well cross into that perilous place in its normal movement. There is also a herd of possibly a dozen around the Sand River below Roan Hill. A few more occur in the Siannas, but do not seem to have herd unity or cohesion.

The roan antelope is large and could be an important meat resource in those parts of Africa where it occurs. The fact that the roan does not migrate, but is markedly local, should make the animal particularly valuable for cropping, but until proper conservation is practiced, its habit of staying in one locality renders it liable to complete extinction. Obviously, true sanctuary areas for roan antelope are necessary at this critical stage and the Mara should be one of them.

The other small antelopes listed on page 23 are not numerous and cannot be considered as being in much danger of excessive diminution. The oribi, indeed, is a species I have found elsewhere to be the last to go, and endures on much-degraded burnt habitats.

Black Rhinoceros

There may be 100 head of this species, an improvement on the presumed figure of 10 years ago. It is my belief that the rhinoceros is a key species in management of African vegetation, and that its wanton and drastic reduction in half a century is one of the factors which have led to a decline of much habitat. The black rhinoceros eats vegetation of coarse and prickly nature which does not seem to be affected by other species. Observation of the diligent action of the rhinoceros in getting hold of young plants of gall acacia and pulling them out of the ground leads one to wonder what effect the animal has had in the past in keeping land open. If 250 of such plants were eaten by each rhinoceros *per diem*, a conservative guess, the influence must have been considerable. What we do know now, is that gall acacia has vastly increased its areas, to the impoverishment of game-carrying capacity of the land. The rhinoceros should be protected absolutely throughout Kenya. The slaughter of rhinoceros during the last 10 years has been extensive and intensive—and senseless. The name of this animal should be removed from the schedule of game which may be killed for sport, because there is no sport in killing a rhinoceros. Its so-called tendency to charge, too much encouraged by those safe in a Land-Rover, is largely a spurious evocation of behavior, despicable in the human being provoking it for a false thrill of danger.

Hippopotamus

If there are 3–5 hippopotamus per mile of the Mara River between the Tanganyika Border and Veterinary Department's Cattle Ranch, it is not an excessive figure. There are a few more on the Talek River and in a natural canal of the Talek a few miles from its junction with the Mara. My estimate was made in the dry season when the animals were concentrated. The Mara could carry a larger stock quite comfortably because of dispersion into the drainage system during the rains and for some time after. The species is important as an animate drainage tool, and in Africa as a whole the hippopotamus has a function of river and lagoon fertilization. As a potential species for meat cropping, it is one of the easiest species to manage. The attention of other Administrations should be drawn to the successful reduction and careful utilization of hippopotamus in the Queen Elizabeth National Park in Uganda.

Lion

Some remark is necessary on this species because the conditions of its existence are not widely understood; and for some obscure reason, the lion is a species that many white men have a desire to kill. Furthermore, they are prepared to kill lions by the skulking means of setting up a bait and waiting for them. This phase of white man's behavior will probably pass within another 25 years, but the lion could be exterminated from most places long before that. Major Temple-Boreham's work in conservation of the lions of the Mara is widely known and notable, and his recent decision to stop all killing by baiting in the Mara area is a courageous forward step in humaneness. There is probably no place in Africa where wild lions can be observed in such numbers and with such mutual confidence as in the Mara. I have seen over 30 in one day without going to look for them: the total population may be 200–250. The animals have