

A WINDOW OPEN ON THE WORLD

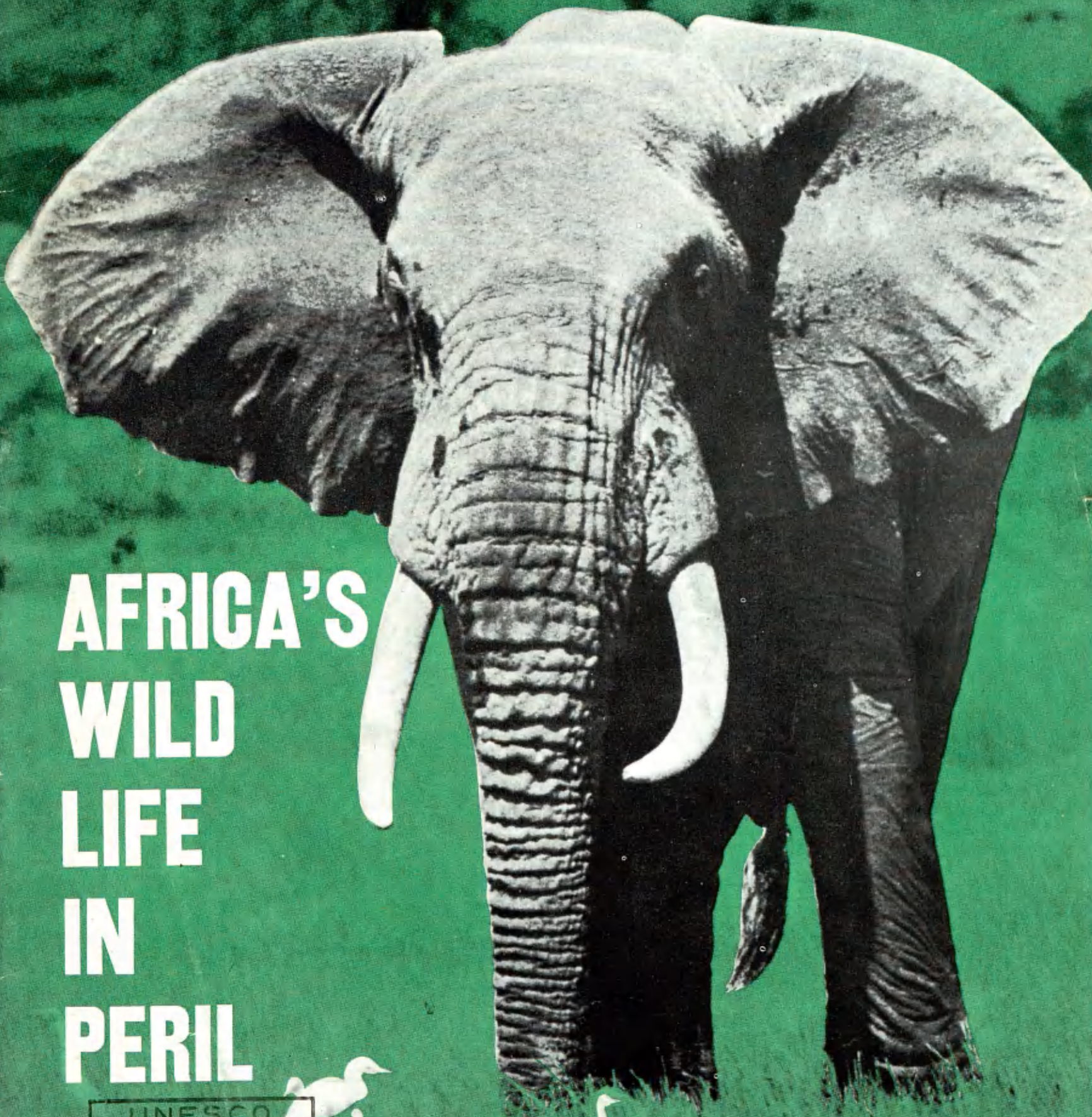
The



Courier

SEPTEMBER 1961 (15TH YEAR) PRICE: 1/-STG. (U.K.) - 30 CENTS (U.S.) - 0.70 NF (FRANCE)

**AFRICA'S
WILD
LIFE
IN
PERIL**



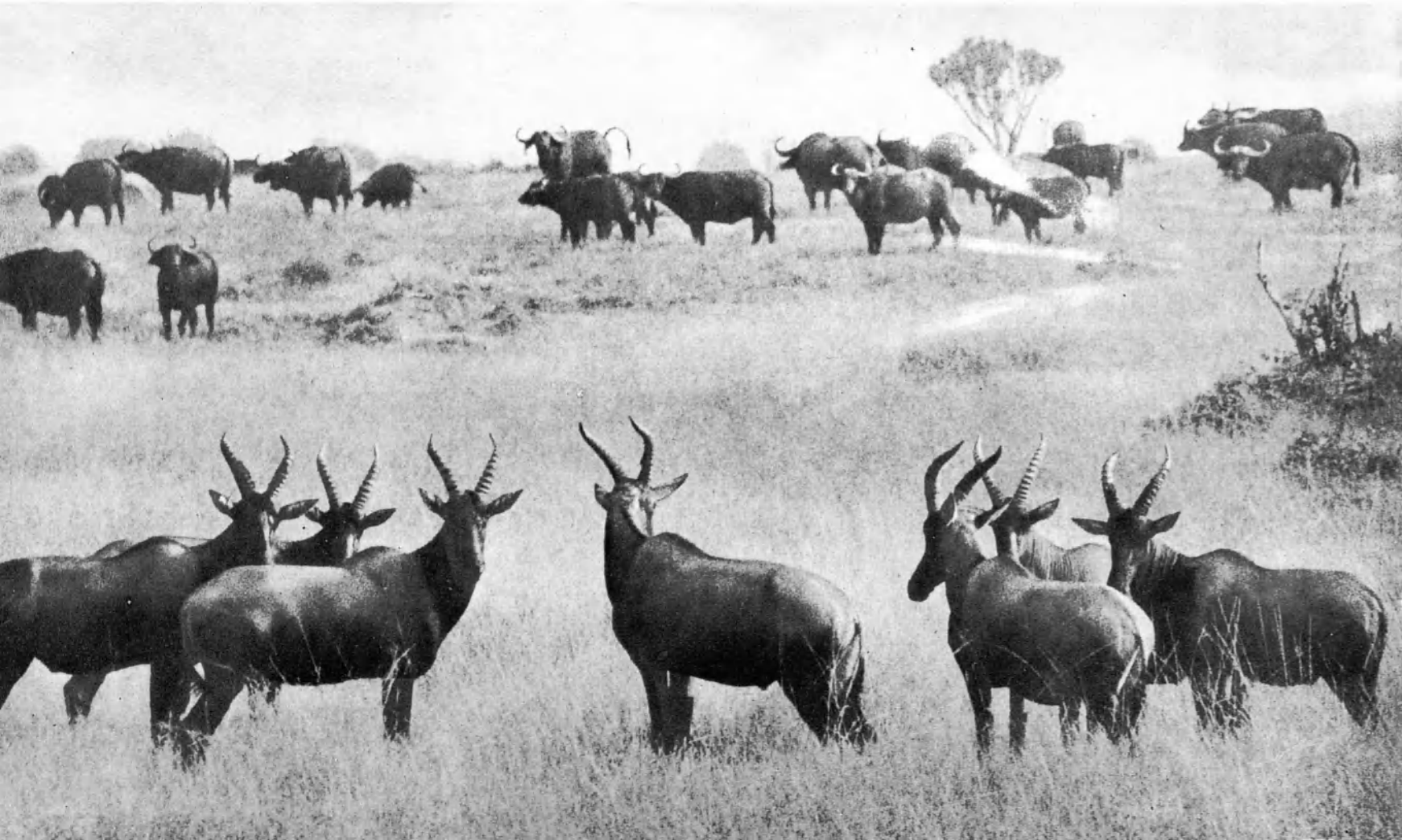
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RHINO AND OFFSPRING turn quizzical looks on the photographer in the unique Ngorongoro Crater of the Serengeti National Park, Tanganyika. Not really dangerous unless startled or annoyed into charging, rhinos will usually make off with a loud steam-engine snorting when disturbed. Ngorongoro is to be shorn from the National Park, according to a Government plan. Below, herds of Topi antelope and (background) buffaloes in the Congo's vast Albert National Park. National Parks form an irreplaceable network of protected zones for African wild life incomparable laboratories for animal research and centres of natural beauty for the enjoyment of the public.

© F. Bourlière

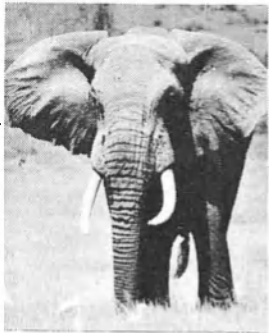


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No. 9

**PUBLISHED IN
EIGHT EDITIONS**

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COVER PHOTO

The elephant plays a unique role in nature by combining functions of aerating the soil, opening up trackways through forests, providing water for the animal community by digging, and making food available to other species such as the baboon, by knocking down fruit from off the trees. Elephants often seem the most peaceable of animals and may be watched quietly from no great distance if the wind is blowing from them. But when the great ears are spread and the trunk rises in alarm or anger, it is time to retire.

Photo Dr. B. Grzimek © Tierbilder Okapia, Frankfurt

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(M.C. 61.1.161 A)

Published monthly by
The United Nations Educational, Scientific and Cultural Organization

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THE UNESCO COURIER is published monthly, except in July and August when it is bi-monthly (11 issues a year) in English, French, Spanish, Russian, German Arabic and Japanese. In the United Kingdom it is distributed by H. M. Stationery Office, P. O. Box 569, London, S. E. 1.

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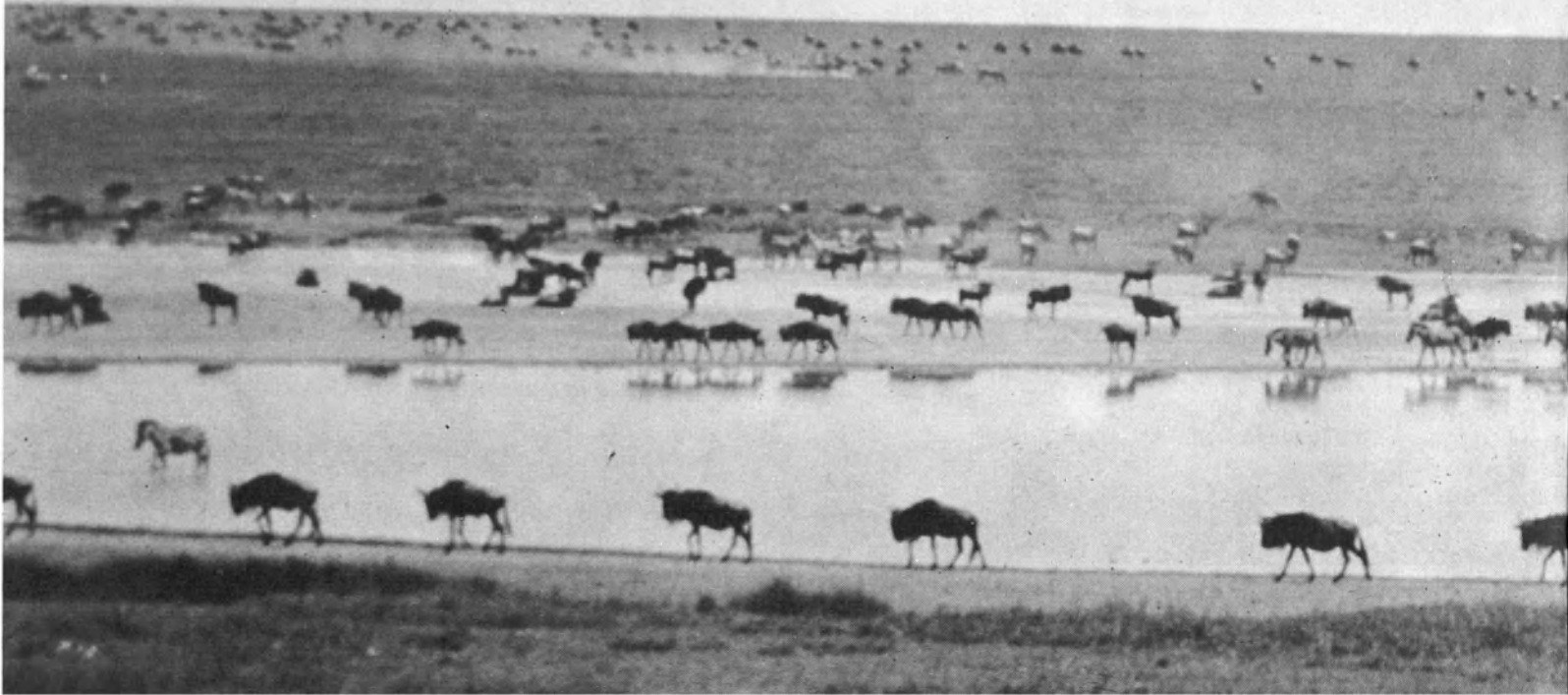
The Unesco Courier is indexed monthly in The Readers' Guide to Periodical Literature published by H. W. Wilson Co., New York.

Annual subscription rates : U.S. \$ 3.00 ; 10/-stg. ; 7.00 New Francs or equivalent. Single copies 1/-stg. 30 cents (U.S.) ; 0.70 New Francs.

Sales & Distribution Offices
Unesco, Place de Fontenoy, Paris 7*.

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AFRICA'S WILD LI



The conservation of the world's natural resources and particularly its wild life has been a serious preoccupation of Unesco since its creation.

The Unesco Courier, in the past, has devoted space in several issues to this vast problem (1). The present number deals in major part with the wild life of Africa. It is published on the eve of an important international conference, to be held this month in Tanganyika, on the threat to nature and the need for conservation in tropical Africa. The meeting under the auspices of Unesco and FAO has been called by the International Union for the Conservation of Nature and Natural Resources (IUCN) and the Commission for Technical Co-operation in Africa South of the Sahara.

Last year, Unesco commissioned Sir Julian Huxley to make an on-the-spot investigation of the state of wild fauna and natural habitats in central and east Africa. Sir Julian's book on this subject is to be published by Unesco in October. This issue brings readers salient passages from his alarming and challenging report.

Unesco has just completed, too, a broad survey of the natural resources of the entire African continent. More technical in nature, it is probably the most complete analytical survey yet made of our present knowledge of the vast resources of this awakening continent. Professor Bourlière's article, on the facing page, is an edited version of a chapter from this volume to be published at the end of the year.

It has become almost commonplace nowadays to speak of the spiralling growth in our planet's population which has increased by 500,000,000 persons since the beginning of the present century. But this and the concomitant demands of modern civilization for more food and more space, have meant that the few untouched natural areas of our planet where animal herds can still roam freely are being steadily encroached upon. They are rapidly shrinking in size and their wild life is threatened with extinction.

That is why national parks and nature reserves, which now exist in practically every civilized country, are considered of greater importance than ever before. That is why the United Nations Economic and Social Council recently deemed it both urgent and vital to ask the IUCN to complete a study of the world's existing national parks and reserves.

4 Wild life and its natural habitats are a scientific and cultural heritage of all mankind. The editors present this issue as a warning cry to alert public opinion to the perils which endanger this heritage today.

(1) Jan. 1952; April 1954; Jan. 1958; April 1958; Jan. 1959.

FE IN PERIL

Wild cattle in this panoramic view are herds of wildebeest (gnu) which range the mid-African plain by the thousand. Many now face the danger of extinction if left unprotected.
Photo A. Milotte, from the film "The African Lion"
© Walt Disney



THE VANISHING HERDS

by Professor F. Bourlière

Professor at the Faculté de Médecine, Paris
Vice-President of the International Union for Conservation
of Nature and Natural Resources

AMONG all the continents, Africa is remarkable for its wealth of large mammals, representing at the same time a zoological community unmatched elsewhere in the world and a traditional source of protein food for the human population.

Prior to the European penetration of the continent, there was a balance between this fauna—especially abundant in the savannah regions—and Man. The hunting methods then in use could not seriously endanger any wild species, and domestic livestock, their only possible competitor, was extensively raised only in certain parts of the continent, mainly in the east and the Sudan.

The drying up of the Sahara at the end of the Pleistocene era had, of course, driven many species southwards; yet, even in 1750, Michael Adamson noted the presence of elephants and hippopotamuses in the lower valley of the Senegal, and hippopotamuses were still to be found in Egypt about 1815. At the other end of Africa, the first Dutch colonists who landed in the Cape region saw a kind of zebra—the quagga—now extinct, as well as elephants, black rhinoceros, hippopotamuses and

countless antelopes, as was testified by Van Riebeck in his comments in 1653.

The extension of European influence rapidly destroyed this delicate balance, which had been maintained for thousands of years and had been chiefly due to the small size of the human communities, to demographic stagnation and static technology. The decline of wild life came earliest and was most rapid in South Africa. The development of colonization by whites very soon drove many species northwards, and this tendency increased in pace during the nineteenth century and at the beginning of the twentieth. Road building, the advance of stock farming, and the fencing of grazing lands completely did away with the large ungulates (these are chiefly grazing animals) in most of this region.

In East Africa, the same causes produced the same effects, though at a later date. In these regions, however, as well as in some places in Central and West Africa, the spread of certain methods of combating human and animal epidemics resulted in a sharp decrease in the game animal population; game eradication campaigns, for instance, destroyed hundreds of thousands of ungulates.

CONT'D ON NEXT PAGE

Network of protected zones

More recently, in all the savannah zones, the increase in the human population, and consequently in the number of cattle, sheep and goats, accentuated the tendency, since all these domestic animals came into direct food competition with the wild species. Meanwhile, the use of firearms and the practice of poaching with wire snares had spread all over the continent.

All these demographic and technological factors have combined to produce a considerable reduction in the area of distribution and in the density of the wild animal population. In the last twenty years, it has become possible to cover hundreds of miles in Africa without seeing any of the animals so closely associated in our minds with the very name of that continent.

This situation soon began to alarm many far-seeing people. In 1933, the first Conference for the Protection of the Fauna and Flora of Africa was held in London, to study methods of dealing with this problem, without, of course, in any way prejudicing the necessary improvement in the standard of living of the human population.

As a result of the conference, a convention was signed, to which most of the countries then responsible for the administration of African territories officially acceded. This London convention provided for the establishment of nature reserves and national parks in all the territories of the signatory governments; it also laid down a set of principles relating to the trade in skins of wild animals, to certain prohibited hunting methods and practices, and to the special protection to be given to some particularly threatened species.

Provision was also made for periodical meetings to consider how the convention was being applied and to improve it if necessary. The first of these meetings took place in London in 1938, and significant progress was recorded in the conservation of wild life. Because of the Second World War, it was impossible to hold the next meeting before 1953; it then took place at Bukavu (Congo), on the initiative of the Commission for Technical Co-operation in Africa South of the Sahara. Important amendments to the 1933 convention were proposed, in the light of twenty years' experience and of the advances made in animal and plant ecology.

Apart from its provisions relating to hunting and forests, the London convention had, then, implicitly been mainly concerned to ensure the establishment of a network of national parks and nature reserves in which the flora and fauna would be entirely protected and which would thus preserve for posterity as complete a sample as possible of the various African biotic communities.

This policy was the logical outcome of the ecological concepts prevailing at the time, according to which a "natural balance" was capable of maintaining the flora and fauna of a region unchanged, provided that Man and his train of domestic animals were kept out. What happened later in the best studied large national parks in Africa was, paradoxically, to prove the falseness of this concept; this result alone would justify the existence of such parks and reserves, for they are as indispensable to research in pure and applied ecology as are hospitals to medical research.

The list of African national parks and nature reserves is a long one and cannot be given here. Readers interested in this question may consult *Derniers Refuges* (Last Refuges), a remarkable Atlas of the world's national parks and nature reserves, prepared in 1956 by the International Union for Conservation of Nature and Natural Resources. It should be mentioned, however, that the parks there referred to are not all comparable as regards their statutes, their objectives, the extent of the work carried out in them, or even the effectiveness of their surveillance.

6 The parks which have enjoyed the most efficient supervision and where the most intensive research has taken place are unquestionably those of the former

Belgian Congo, and especially the Albert National Park. No part of the tropical world has been the subject of such long, careful, and exhaustive study, by specialists of 15 different nationalities. This research is still continuing, and decades will be needed before all the material collected can be fully examined.

The Nimba Reserve, in Guinea, is the best known among those in West Africa. It has been continuously explored since 1942, and has formed the subject of a number of important publications. Next comes the Niokolo-Koba National Park in Senegal, which protects a fine sample of savannah fairly near to Dakar.

The famous Kruger Park, in the Transvaal, began to be the subject of systematic scientific study only in 1958, although it is the oldest of the African parks, having been established in 1926.

In East Africa, most of the ecological research has been done—especially by a series of Fulbright research scholars from the United States—in the national parks of Uganda, the Queen Elizabeth National Park and the Murchison Falls National Park. We should also mention the game census made by the Grzimeks at the Serengeti National Park in Tanganyika, and the ecological studies and research into animal behaviour carried out at the Nairobi National Park and the Mara Reserve by various English and American naturalists.

In Madagascar, the ten nature reserves established in 1927 have been studied mainly by zoologists from the Scientific Research Institute of Madagascar. Most of the ecological work, however, still remains to be done.

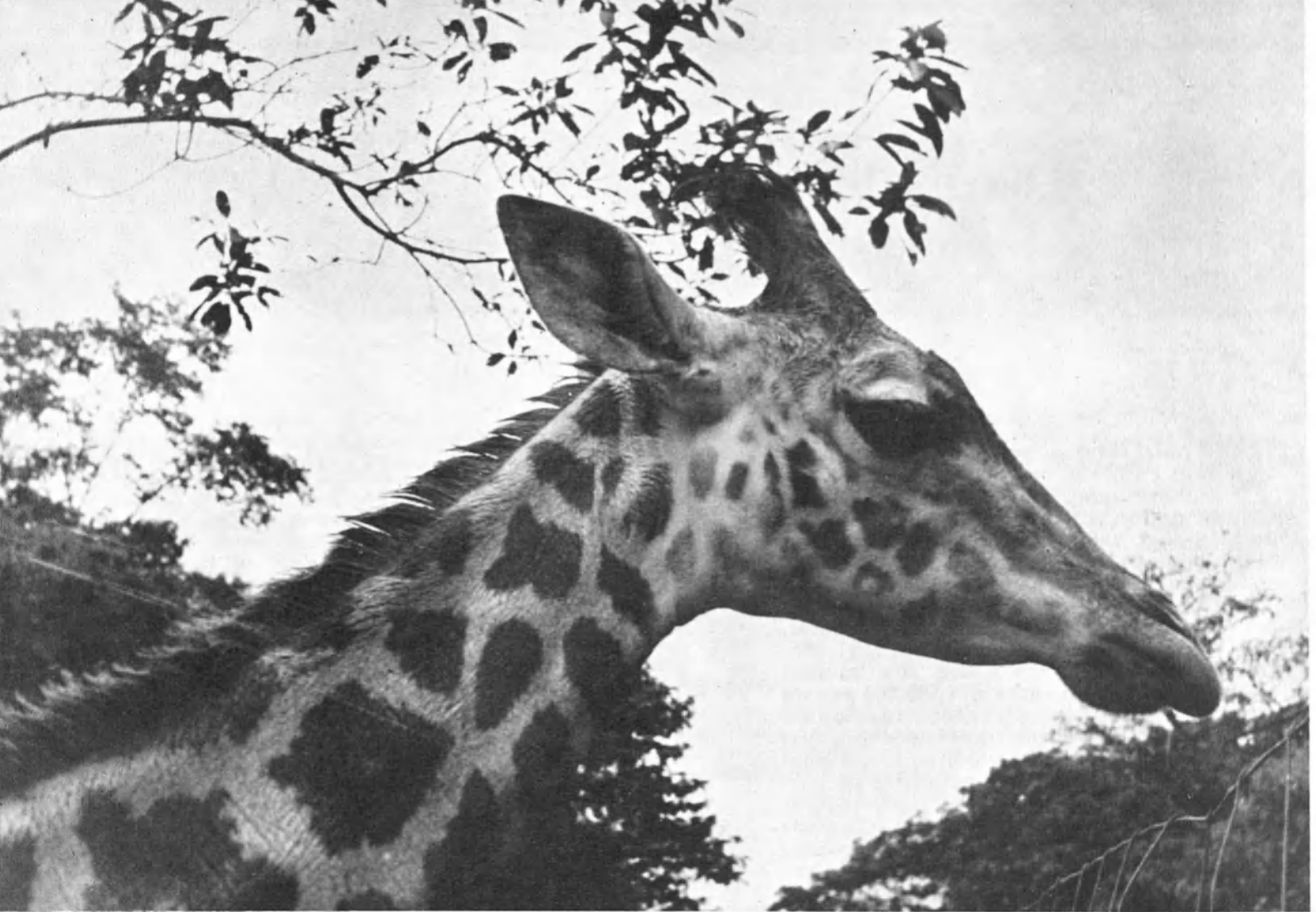
Apart from the important institutions mentioned above, which have played a notable part in the history of African biology, there are a number of parks and reserves which have not as yet been systematically prospected; they are chiefly known as tourist attractions and as economic assets for the countries which own them. Among these are the parks of Kenya (Tsavro and Amboseli), the Wankie and Kafue National Parks in the Rhodesias, Waza in Cameroon, St. Floris, Zaccouma and Baningi-Bangorram in the Central African Republic, etc.

All these reserves now form an irreplaceable network of protected zones within which most of the interesting species of African savannah fauna have been able to maintain themselves; at the same time, they are incomparable laboratories for the study of tropical ecology and all its implications; agricultural, zootechnic, and medical.

But nature conservation is not merely a matter of protecting species and environments and constituting, in the form of national parks, a series of "standard" natural habitats through which it becomes possible to appraise the good or bad effects of the transformations imposed by man on nature. It must also be deliberately dynamic, for progress in ecology makes it possible to give mankind effective help in its fight against hunger and to contribute towards better living conditions.

THERE are now, besides classical conservation techniques, new methods of wild life management which have already yielded remarkable results in other parts of the world, notably in North America and the Soviet Union. These techniques would appear to be applicable to game animals of the African savannahs, even perhaps under particularly favourable conditions.

A quantitative study of the wild African ungulates—counting their numbers, analysis of their structure by age and sex, determination of birth and death rates—has demonstrated something that had previously been only suspected and the full importance of which had not been grasped: namely, the vast size of the mammal game population and its domination of the whole savannah community. The tonnage of live animal matter (still called standing crop biomass) they represent per acre is such that these grazing animals normally make up almost the whole of the consumers of the plant food produced by the savannahs.



Unesco - Alain Gille

STRONGHOLD OF THE WILD. East Africa has been called "The Stronghold of the Wild", yet even here where 28,000 square miles of territory have been declared as National Parks or Reserves, the wild life resource has been shockingly reduced from its past abundance. Below, bathtime for hippos in Murchison Falls Park, Uganda's largest national park, which is bisected by the Nile. Above, the world's tallest grazing animal. Giraffes, which may grow to be from 16 to 20 feet tall, are splendidly adapted to the tree-browsing habit. The giraffe's tongue may be a foot and a half long and using this and its long upper lip, it can quite easily wrench loose mouthfuls of leaves.

Uganda Dept. of Information



POACHING

by Sir Julian Huxley

"THE most interesting assignment I have ever had." These are the words Sir Julian Huxley recently used to describe the investigation which Unesco asked him to undertake last year on the conservation of wild life and natural resources in Central and East Africa. Sir Julian's journey lasted three months and took him to ten countries — the Federation of the Rhodesias and Nyasaland, Tanganyika, Kenya, Uganda, Zanzibar, Mozambique, Ruanda Urundi and the eastern strip of the Congo — an area of 1,500,000 square miles, equal to the size of Europe (excluding Russia). The noted British zoologist and first Director-General of Unesco visited 25 national parks and reserves in these countries as well as in South Africa, and had discussions with hundreds of scientists, statesmen, game wardens and administrators both black and white. The following article is taken from the Introduction to the forthcoming Unesco book by Sir Julian Huxley on his mission.

THE wild life of eastern Africa is the wonder and envy of the rest of the world. Unique in abundance and variety, it has been gravely diminished in the past and is seriously threatened in the immediate future. Its natural habitats and wild lands cover more than half of its immense area, and are of tremendous potential importance if properly used. But they too have been reduced in extent, their value has been sadly reduced by improper use and they are threatened with drastic misdevelopment in the immediate future.

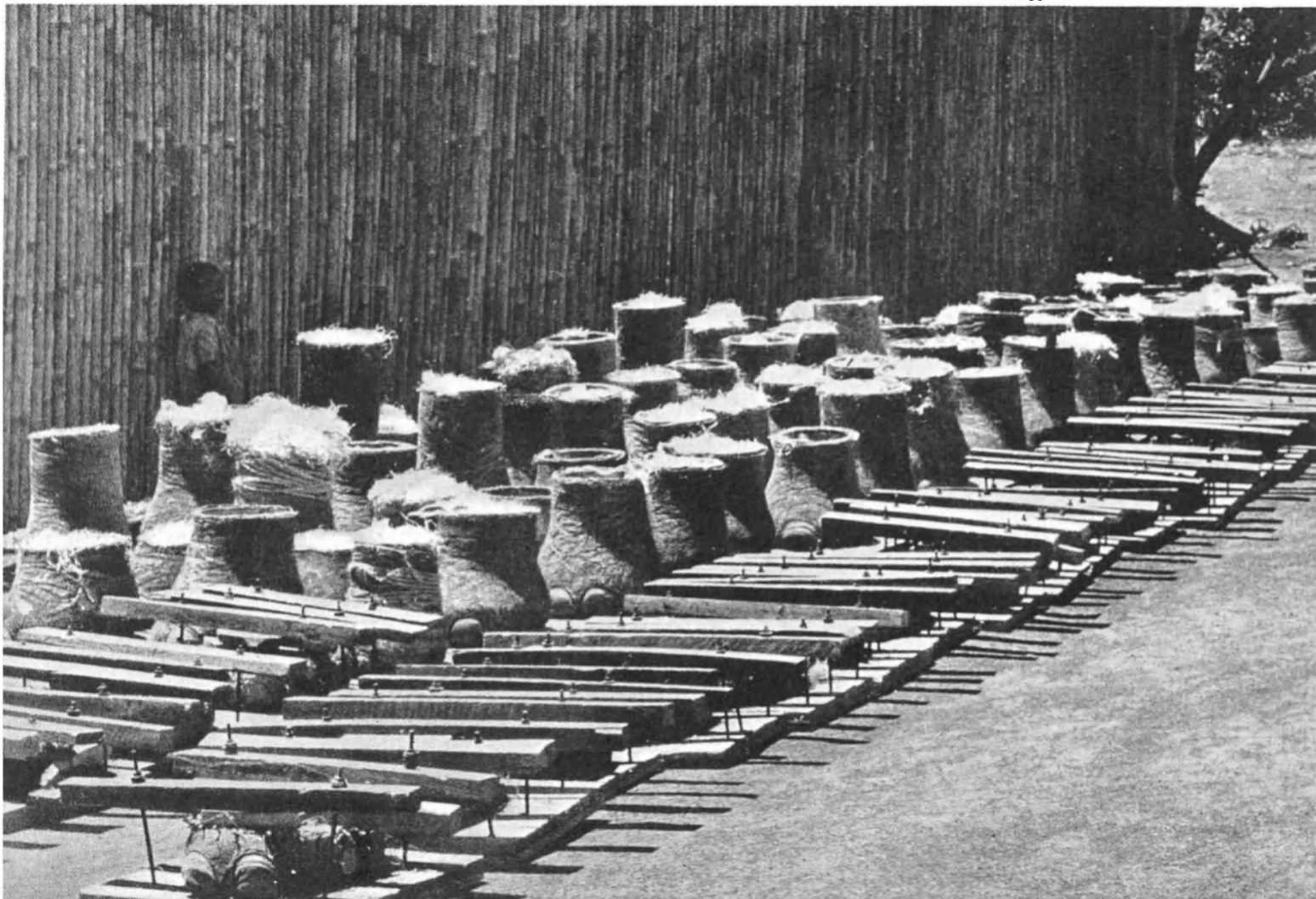
With the alarming increase in organized poaching, the equally alarming increase in population, the new methods of controlling tsetse-fly and diseases of livestock, the fashionable urge towards technological and agricultural development, the spread of money values among the African population, and the rapid emergence of African Governments, the situation is critical.

The future of African wild life is bound up with that of the conservation of natural resources. Both are now in the balance. The next five or at most ten years will be decisive in determining whether they are headed downhill towards a point of no return, or set on the upward path of beneficial development.

The situation can still be saved, provided that the conservationists can induce African Governments and the African public to understand and follow an ecological approach.

WASTE-PAPER BASKETS. Most poaching is done not to obtain food but trophies like rhino horn, tails for flywhisks and elephant tusks for curios. Carcasses are left to rot. Below, 77 elephants' feet turned into waste-paper baskets for sale to tourists. Elephants have been known to tear half their trunks off in frantic efforts to escape the poacher's wire snare.

Photos Dr. B. Grzimek,
© Tierbilder Okapia, Frankfurt



THE SHOCKING SLAUGHTER OF AFRICA'S WILD LIFE

Ecology is the science of interrelations. It studies the balance to be achieved in a system of interacting factors. Some ecological systems are in stable equilibrium—for instance, climax communities in nature, such as undisturbed rain-forest or mountain heathland. But in others the equilibrium may be upset, either by natural causes like climatic change, or by human interference, accidental or deliberate—deforestation as in Greece or China or Syria; or introduction of alien species of animals or plants, as most strikingly in places like Australia or Hawaii.

Let me state the African situation in ecological terms. The ecological problem is fundamentally one of balancing resources against human needs, both in the short and in the long terms. It thus must be related to a proper evaluation of human needs, and it must be based on resource conservation and resource use, including optimum land use and conservation of the habitat.

Over the whole of south-eastern Africa, the wild life resource has been shockingly reduced from its astonishing past abundance. In the Union of South Africa today, large wild animals have virtually ceased to exist save in scattered National Parks and Reserves or on farms where they are deliberately preserved as a source of revenue; the white-tailed gnu is almost extinct, and the quagga has disappeared for ever. Less than a century ago, we have many accounts (Baldwin's *African Hunting* is a

well-known example) of abundance of elephant, hippo and rhino, and truly vast herds of antelope and zebra.

In East Africa, a similar abundance of big game survived into the present century. In his *Kenya Diary* (1957) Meinertzhagen records seeing in 1903 a procession of some 700 elephants marching across what is now the township of Nyeri; he states that the country swarmed with rhino, one of which charged into a race-meeting; and in one day in an area of 24 square miles actually adjacent to Nairobi he counted 684 Zebra, 894 Wildebeest, 276 Coke's Hartebeest (Kongoni), 326 Grant's Gazelle, 426 Thomson's Gazelle, 184 Impala and 46 Eland, besides Giraffe, Rhino, Wart-hog, Wild Dog, and over 4,000 Masai cattle.

At the same time, Abel Chapman in his *African Safari* (1908) recorded the same profusion of Wild Life in all these East African territories, and for many years later the suburban gardens of Nairobi would be visited by lions. Everyone, including myself, who was in East Africa a mere thirty years ago, can testify to the striking diminution of its large wild life since then, and Cullen and Downey (1960) give a picture of its present grave state. Fraser Darling (1960) records a similar deterioration of the game situation in Northern Rhodesia since Charles Pitman made his survey in 1934.

In spite of all this, the wild life of this region is still

SLOW DEATH. Wire snares are by far the cruellest method used by African poachers. Animals often die slow, agonizing deaths. In the Northern Range of Uganda alone more than 2,000 snares were found last year, and reports from all over East Africa tell the same story. Here a zebra, strangled by poachers, lies dead in Serengeti Park, Tanganyika.





Al Malotte from the film "The African Lion" © Walt Disney



WATER HOLES and salt licks are favourite spots for snares. Game wardens in Uganda recently reported discovering a full grown lioness (like one above) which, snared by the leg, had wrenched the limb off only to perish through gangrene. Unless stopped, authorities say, the wire snare may ultimately exterminate Africa's wild life.

a resource of unique value. It must be preserved both as an object of study and as a spectacle to be enjoyed. Its scientific study is a necessary basis for proper land use policies, and an increasing number of people from all over the world are finding unique satisfaction and interest in it as a spectacle.

Proper management of wild lands can yield a large crop of wild meat as well as numerous ancillary animal and plant products. The meat-crop could in particular areas be commercially profitable, but of more general importance is the fact that it would go a long way to satisfying the Africans' meat-hunger, which springs from the region's marked protein deficiency.

This in turn would help in reducing the threat of poaching to African wild life. "Poaching" today is in reality a large-scale illegal trade in slaughtered wild animals. It is by no means confined to killing for meat: all too often it takes the horrible and wasteful form of merely taking the valuable trophies, such as rhino horn, wildebeest tails, or elephant ivory, and leaving the slaughtered carcasses to rot.

The abolition of this shocking trade is becoming just as compelling an aim in the Africa of the present as was the abolition of the slave trade in the Africa of a century ago. Like the slave trade, it is profitable, highly organized, extremely cruel, and quite ruthless.

Poaching is sometimes condoned, or at least leniently treated, by those in authority as a result of the not uncommon feeling among administrators that tribal Africans should in general be favoured in getting what they want, and specifically on the ground that they need all the meat they can get.

This may hold in theory for the African who is permitted a muzzleloader primarily to protect his crops, or even for the bowmen from traditional hunting tribes who are permitted to use arrow-poison. But it does not work out that way in practice.

10 For one thing, it is quite certain that many slaughtered animals described as raiding crops are really killed for meat, with crop-raiding given as an excuse. But much more important is the fact that illegal killing for meat

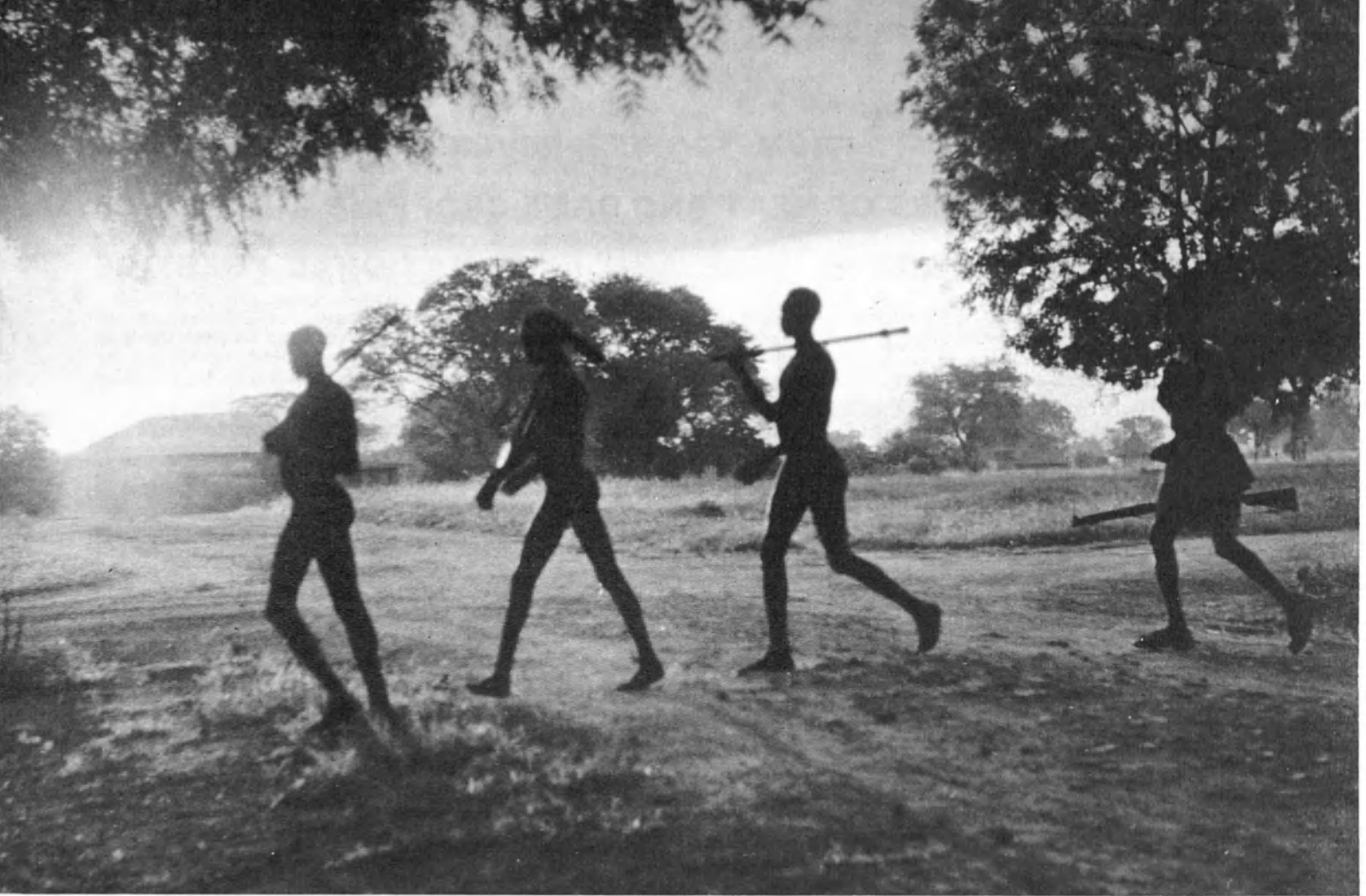
has now in several areas become a large-scale organized racket, notably to supply the protein needs of the Africans working in the Northern Rhodesian copper belt. Bicycle boys deliver the meat, either directly or to lorries which transport it to mine townships. Although often in bad or even disgusting condition, it fetches high prices, almost as high as beef or mutton in European shops.

Since game is naturally more abundant in National Parks and Reserves, these are the favourite target for the poachers. The Kafue Park in Northern Rhodesia, for instance, is suffering heavily: large areas are being devastated by fires lit deliberately by poachers to drive the game to where it can be killed. This February the Wardens in the Murchison Falls Park in Uganda had to cope with a poaching gang of 70 Africans.

But killing for meat is a minor menace. Most "poaching" is frankly killing for money—money from the sale, often for export, of commercially valuable "trophies." The main trophy is elephant ivory, employed chiefly for knickknacks and curios. This is followed closely by rhino horn, whose alleged but entirely mythical aphrodisiac properties have led to its commanding the fantastic price of over £4.10. a lb, for export to the East.

Hides of tanguatons, skins of leopards, colobes, monkeys and other species, antelope and buffalo horns, sinews, bones, and (on a surprisingly large scale) tails for fly-whisks also find a ready market. From most of the tens of thousands of animals killed by poachers in eastern Africa today, the trophies are cut out, most of them to be used for trivial or ignoble purposes, and the meat simply left to rot.

A reliable informant in Kenya has given me the following facts. For rhino horn, the poacher receives from 7/- to 10/- per lb, and for elephant ivory 2/- to 3/- per lb (except in Kambaland, where the price is much higher.) The horn and ivory passes through the hands of several middlemen, all of whom take considerable profits. The legal auction price in Mombasa during the first ten months of 1960 was between 90/- and 94/- per lb for rhino horn, and between 9/- and 23/- per lb for ivory, according to quality.



© Atlantic Press

TRIBAL PARTY, armed with antiquated guns and cheap muzzle-loaders, leaves for poaching expedition. Guns are made available for the protection of crops, but are often used for illegal poaching. In Tanganyika alone, it is estimated that there are 80,000 muzzle-loaders and shotguns in the hands of the inhabitants. Animals shot by such weapons are often maimed and die a lingering death.

In London, ivory prices are about 5/- a lb higher. The yearly *legal* sales for 1955-1960 averaged 1,400 lbs for horn and 73,500 lbs (nearly 3 1/2 long tons) for ivory, representing 175-200 rhino and around 1,000 elephants. Poaching, however, accounts for many more deaths.

The annual total of elephants legally and illegally killed in Kenya is estimated at 4,000 to 5,000, and of rhinos at 675 to 950. While the Kenya elephants seem able to hold their own, the much smaller and less biologically resourceful rhino population cannot possibly support such a drain for more than a few years. Wildebeest tails for fly-whisks may sell for as much as £2.

The poacher's methods are not only wasteful, but extremely cruel. It is bad enough when gangs of bowmen with poisoned arrows wait near a waterhole or at a gap in a prepared barrier, and shoot large numbers of animals, which then die an agonizing death. However, pitfalls are worse; in the Serengeti, for instance, whole series of carefully-sited pitfalls have been laboriously dug (providing proof of the value of the proceeds).

The large numbers of animals which fall into them suffer a much more lingering death than those shot with poisoned arrows. But wire snares are the worst of all. Wire is cheap, and can be obtained in all sizes, up to a strength which will hold an elephant. Long lines of wire nooses are laid out; zebra, wildebeest, antelope, rhinos and elephants get caught by the leg.

A few animals are caught by the muzzle, and some elephants by the trunk. In the Murchison Falls Park, the Warden has seen an elephant which had lost its trunk, undoubtedly in this way. In spite of this, it was able to feed by kneeling on its forelegs, raising its hind legs, and cropping coarse herbage with its lips—a remarkable evidence of the elephant's adaptability.

The wire is attached to a stump or to a log which the animal can barely move. Its struggles tighten the wire and make it bite deeper; the wound festers; and the creature dies a slow and horrible death, sometimes beset by vultures and hyenas. It is too often a lingering death, for the poachers usually put off visiting the snares until the animals are dead or dying.

The killing of game is facilitated by the abundance of muzzle-loading guns in the hands of Africans. This is especially serious in Northern Rhodesia and Tanganyika (in Kenya and Uganda, muzzle-loaders are not permitted except in a few cases for prestige reasons.) In Tanganyika, for instance, the Kenya Wild Life Society estimated that in 1958 there were about 70,000 muzzle-loaders and 10,000 shotguns in African hands, while the number of unlicensed weapons was probably greater.

In Northern Rhodesia between 45,000 and 60,000 muzzle-loaders and guns are estimated to be in the hands of poachers. Muzzle-loaders are either antique or home-made. They are essentially cruel weapons, for they are usually inefficient and often only wound their victims.

In areas like Kenya it is to be hoped that the new African governments will realize the importance of continuing their prohibition, in the interests of law and order as well as of game conservation. In territories where they are now permitted, it would be unwise and perhaps impossible to prohibit them by law, and measures must be taken to reduce their numbers. This could probably best be accomplished by raising licence fees.

One often hears of unfair discrimination against Africans, but in this matter of licences the discrimination is the other way round: gun and shooting licenses are very expensive for Europeans, but very cheap for Africans. A considerable rise in license fees for Africans, coupled with strict enforcement of their payment, should bring about a corresponding fall in the number of muzzle-loaders. And there would be little sense of grievance if at the same time governments were to take on more of the responsibility for crop-protection, and to start game-cropping schemes to provide more legal meat. The poaching trade flourishes as it does because of another factor in the human ecological situation—the unimportance of wild life in the eyes of most administrators in the region.

In general, it is fair to say that Wild Life and Nature Conservation are regarded as of little importance compared with Agriculture or Veterinary or Social Services. Game Departments and National Parks

CONT'D ON NEXT PAGE

PROFIT PROTEIN PRIDE PRESTIGE

PROFIT FROM TOURIST REVENUE—PROTEIN FROM SALES OF MEAT AND GAME-CROPPING — A SOURCE OF LOCAL PRIDE AND INTERNATIONAL PRESTIGE

Organizations are starved of staff and funds, and so rendered incapable, not only of preventing poaching, but of performing any of their other functions adequately—research, survey, game-control, provision of tourist facilities, publicity.

The other basic ecological factor in our region is the existence of vast areas of wild and marginal land, unutilized or too often misutilized. These probably include more than half of its one-and-a-half million square miles. Much of this is infested with tsetse (1), and much is too arid for agriculture or domestic stock. However, cultivation has been permitted in large areas and has often led to their deterioration and to the reduction of their wild life.

In other large areas, notably in Masailand and northern Kenya, traditional nomadic pastoralism is practised. Here we come up against human ecology: the pastoralists do not hunt game, but cattle have a central position in their way of life and thought, and are valued for this and not as a source of profit. Accordingly with the help of veterinary science, stock has multiplied, and these regions are suffering, in some cases severely, from overgrazing.

In general, there has been a tendency to satisfy the immediate demands of African tribes at the expense of long-term planning, and to embark on sporadic projects of a traditionally respectable nature, like agricultural development, without considering alternatives like wild life management.

What is needed is a comprehensive and conservationist land use policy for the region, based on proper survey, to decide which land should be allocated primarily for agriculture and for commercial or industrial development; which allocated for game-cropping, watershed

protection, forests, National Parks and Nature Reserves, or merely kept undeveloped in reserve until its best use can be determined; and which could be best developed by establishing a fruitful symbiosis between wild life and domestic stock.

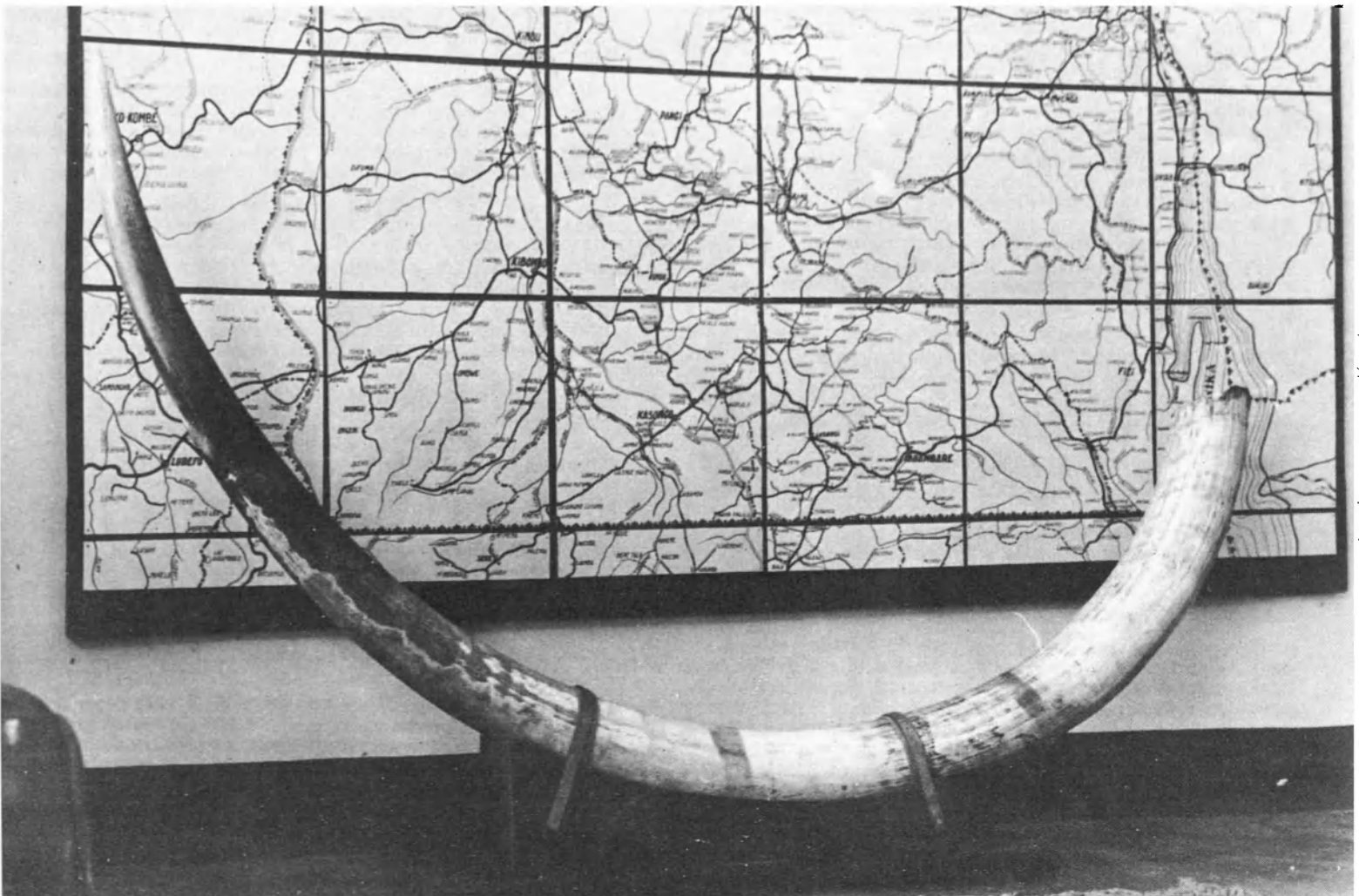
In official thinking and practice, projects involving conservation, especially of wild life, are usually subject to provisos about "human interests" or "utility." Thus the establishment of the Tsavo National Park in Kenya was only permitted because the area was regarded as "useless;" and the Conservation Unit which was set up to conserve the resources of the Crater Highlands in Tanganyika, including that unique wonder of the world, the Ngorongoro crater with its herds of wild game, was officially instructed to do so primarily in the "human interests" of the local Masai—these being of course to keep the maximum number of domestic stock in the area.

The constant use of these phrases betrays a misconception of the real situation, which would be ludicrous if it were not so serious. The term "utility" should not be confined to customary types of development and land use, or to the production of marketable products like beef, groundnuts, timber, or hydroelectric power. It should be regarded as "useful," and is certainly valuable, to preserve land from deterioration, to maintain forest cover, to keep habitats for scientific study, and to conserve wild life to attract those who want to enjoy it in natural surroundings. In any modern planning, the concept of *utility* in the customary sense must give way to the overall concept of *value*—not only utilitarian value, but

(1) It is estimated that at least one quarter of the entire area of the African continent is infested with one or more species of tsetse.

ELEPHANT TUSK below, obtained legally several years ago in the Congo, is reputed to be the world's largest. A brisk illegal trade in ivory obtained from poaching exists throughout tropical Africa despite government efforts to halt it. In Kenya it brings up to 23 shillings per pound while rhino horn commands the fantastic price of £4.10. a lb. (\$12.50). From 4,000 to 5,000 elephants are killed annually in Kenya alone.

UNESCO - Alain Gille



also physiological value, social value, scientific value and enjoyment value. *Enjoyment value* applies notably to wild life and natural scenery.

Sir Edward Grey (1933) has written of the significance of this resource in human life. In amplification of Wordsworth, he writes "When feeling is raised to an unusual height by contemplation of natural beauty, by something that quickens while it soothes and calms, the mental and moral perceptions may penetrate more deeply into the life of things." Elsewhere he tells us how "the watching of wild animals or birds gives yet another pleasure, that of a sense of privilege" in witnessing many things that are usually concealed from human eyes.

This is very true: but the witnessing of wild life on the grand scale can give not only a sense of privilege but of wonder and deep emotion. To see large animals going about their natural business in their own natural way, assured and unafraid, is one of the most exciting and moving experiences in the world, comparable with the sight of a noble building or the hearing of a great symphony or mass. A processional frieze of antelopes moving across the African horizon rivals any theatrical spectacle.

The world at large cannot afford to let this great human resource disappear.

Wild life in Africa as a resource may be summed up in the phrase Profit, Protein, Pride and Prestige, with enjoyment and scientific interest thrown in. It can yield Profit from tourist revenue, sales of meat and trophies, and Protein from game-cropping schemes; it can be a source of local Pride and of international Prestige; while its importance as a source of scientific knowledge is very great.

The best way of realizing its exceptional enjoyment value is by means of National Parks. These are areas established by Statute (and therefore only to be abolished or altered by special legislation), designed to conserve wild life and natural beauty for the enjoyment of the public as well as for scientific reasons. Game and Nature Reserves can also be useful, but they do not have the same guarantee of permanence; and so can local parks and

sanctuaries, but they do not enjoy the same prestige and international status (2).

All countries have resources or achievements of which they are proud, and which visitors from other countries come to see. Eastern Africa is fortunate in being endowed by nature with the unique resource of its wild life. All it has to do to turn it into a source of prestige and profit is to preserve it whole-heartedly and manage it efficiently.

This could be an important element in the development of its under-developed territories, and international finance could properly and hopefully be sought for any projects with such an aim.

In our region (and to a somewhat lesser extent in the Union) National Parks are the main basis of the tourist trade. This is already very valuable, but could undoubtedly be increased five or even tenfold provided that the territories develop peacefully.

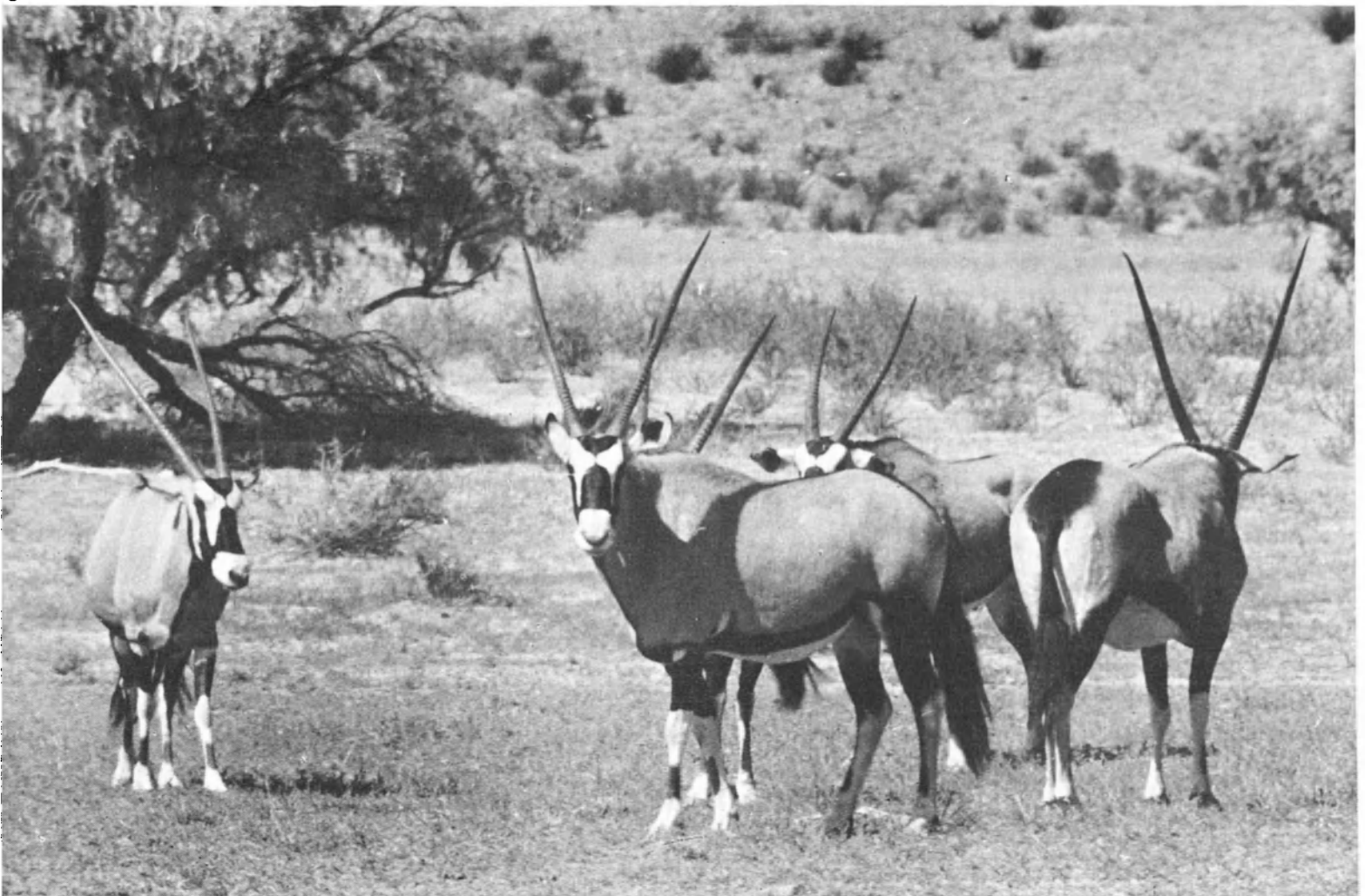
Public opinion in Africa can play a vital part in the present situation in which one of the numerous urgencies is the need to educate and rouse local opinion in favour of conserving the heritage of wild life and to persuade Africans of the international importance of their National Parks. The rousing of world opinion is equally important. The world is one: but it is also various. Africa's wild life belongs not merely to the local inhabitants but to the world, not only to the present but to the whole future of mankind. It is unique among the world's riches.

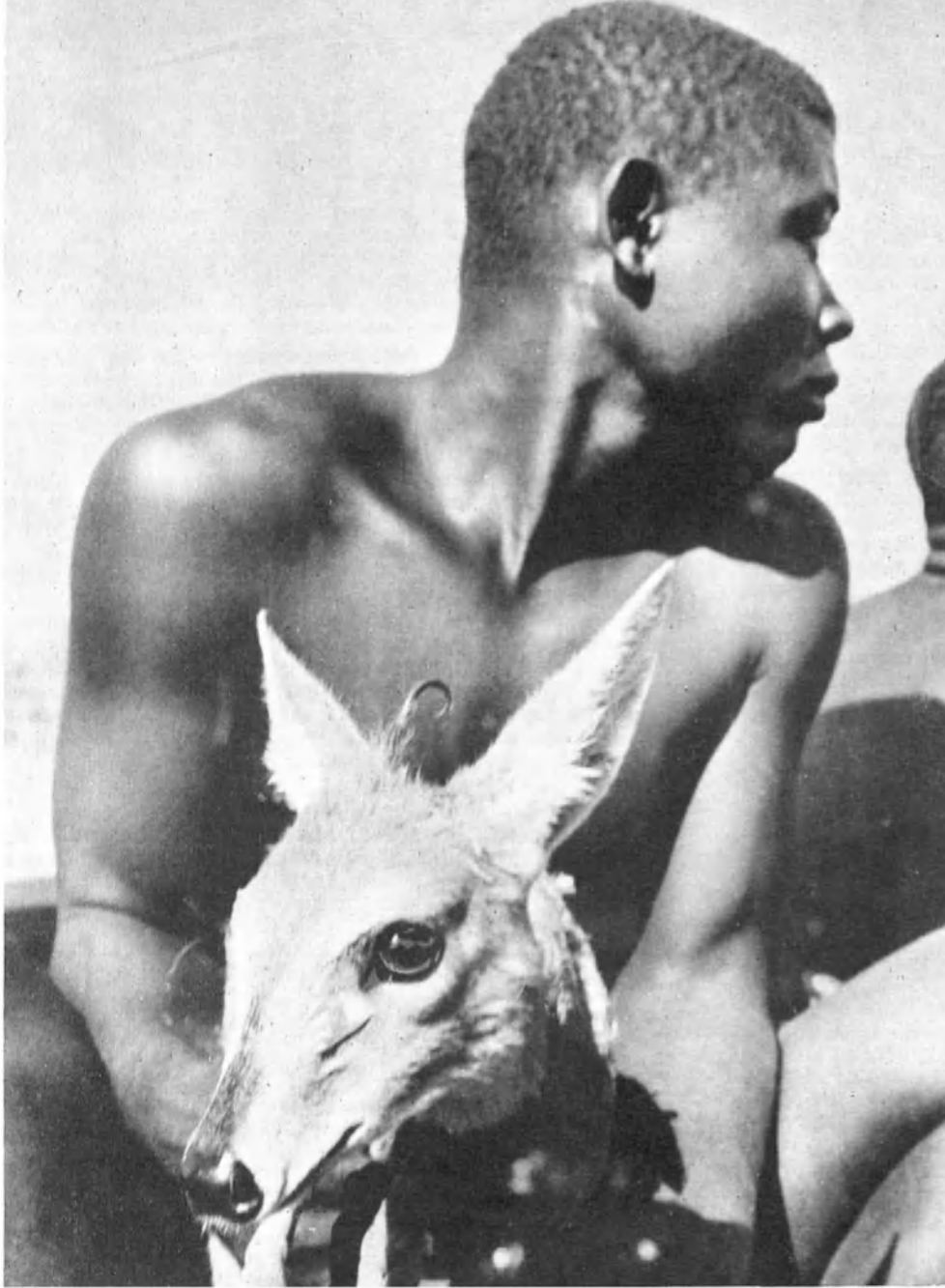
To let it die or be destroyed would be to allow a precious element in that rich variety to be submerged for ever in the drab monotonous flood of uniformity that is threatening to engulf our mass-produced technological civilization. Unesco has roused world opinion to save the threatened monuments of Nubia: it should take on the responsibility of rousing world opinion for the equally worthy task of saving the threatened wild life of Africa.

(2) National Parks are now a matter of official international concern. The U.N. Social and Economic Council has asked all Member States to submit descriptions of all their National Parks and equivalent reserves, in order that an official U.N. list may be prepared and kept always up to date. In this, the U. N. Economic and Social Council is being assisted by the International Union for the Protection of Nature and Natural Resources and Unesco.

THERE HAS BEEN a remarkable change in South Africa's attitude toward wild life. In the early days, almost every farmer killed wild game such as these Gemsbok antelope. Practically exterminated, they are now protected on Park Reserves and farmers breed and crop them scientifically for meat and hides. In the Transvaal alone, 2,000 farms now stock wild game.

© National Parks Board, Republic of South Africa





© Sir Julian Huxley

OPERATION NOAH

Construction of the Kariba Dam on the mighty Zambezi river in the Rhodesias threatened to drown the wild life of the proposed lake area. To save the animals "Operation Noah" was launched in 1959 with the joint effort of Africans and Europeans. Left, an African game warden with a little duiker he has just rescued. Below, a lion, oblivious of the traffic, nonchalantly crosses a road in the Kruger National Park, Republic of South Africa.

W.F. Schack, National Board, Pretoria



WILD LIFE AS A WORLD ASSET

On this and the following page we present excerpts culled from the forthcoming Unesco book on East African wild life by Sir Julian Huxley

THE European in Africa often starts—not unnaturally—from the assumption that African soils and African habitats can stand up to the same kind of treatment that has led to successful agriculture and stock-raising in his homeland. The error of such assumptions was disastrously illustrated by the failure of the notorious groundnut scheme in Tanganyika. Similar assumptions have led to the temporary or permanent ruination of large habitats elsewhere—in many drier parts of South Africa, in the shortgrass prairies of North America, in the once-fertile lands of North Africa, in the Western Highlands of Scotland.

MUCH the same is true of the tropical rain-forest. The European sees the astonishing bulk of vegetation growing in it, and jumps to the conclusion that the forest soils must be very rich. This, however, is unfounded. The trees are rooted in something more like a sponge than what we think of as good soil. When its vegetation cover is removed, and it is put under cultivation, it rapidly deteriorates; and the process is virtually irreversible.

IN South Africa there has been a remarkable change in the attitude to wild life. In the early days, almost every farmer, Boer or Briton, habitually killed wild game for meat and hides, or less usually for sport. Now that almost all large wild animals have been exterminated in the farming areas, the process is being reversed. Various National Parks authorities, provincial governments and even municipalities are managing Nature Reserves partly as game-farms, to build up stocks of game. Some of the stock may be converted into meat for the local market, but most of it (which includes Bles-bok, Springbok, Impala and Zebra) is sold to farmers and transported “on the hoof” to the farms, sometimes up to 1,000 miles distant. The wild species breed on the farms, and the surplus animals are cropped for their meat and hides. The value of the products from the wild animals may equal that obtained from the domestic stock, and in any case constitutes an important addition to the farmer's livelihood. This method of utilizing the productivity of wild animals is now being practised on a large and increasing scale.

Quelea quelea provides an example of human interference with the habitat resulting in an indigenous species becoming a pest. This species of colonial-nesting Weaverbird is

widespread and abundant in inter-tropical Africa. It originally fed on the seeds of wild grasses; but wherever extensive cultivation has taken place, and especially where monoculture of crops like millet and rice is practised, it has multiplied excessively and is now often a serious pest. One colony near Birchenough Bridge in Southern Rhodesia is estimated to contain 11 million individuals. This exceeds even Tokyo and New York, and must be the largest single community of any higher animal in existence. Shooting, poison, even flame-throwers, are being employed against Queleas, but no satisfactory method of control has yet been discovered.

MOST tribal Africans regard wild animals either as a pest to be destroyed or simply as meat on the hoof to be killed and eaten. This latter point of view is semantically fostered by the fact that in Swahili, as in several other African languages, the same word—*Nyama* in Swahili—does duty both for wild animals and meat; and it is physiologically encouraged by the shortage of animal protein in the area and the prevalent meat-hunger of its African inhabitants.

ONCE local Africans understand that organized game-cropping can provide them with more and probably cheaper meat than organized poaching, and that illicit individual shooting is killing the goose that lays the golden eggs, they will begin to see wild life, and all the measures designed to conserve it, in a very different light.

IN some areas, wild game is not merely shot to provide meat, but hunted by Africans as a sport. This is natural enough and experience in many lands (e.g. with fowling in Great Britain and deer-hunters in the U.S.A.) show that, with goodwill and understanding, widespread hunting and shooting can be enjoyed without detriment to wild life, indeed with advantage to it, when reserves are established for the express purpose of conserving the numbers of game animals and birds for the hunter.

EDUCATED and politically-minded Africans tend to have rather different attitudes. Some of them regard National Parks and Controlled Shooting Areas as relics of white “colonialism”, or merely as places for white men

to indulge their peculiar habit of enjoying the sight or the pursuit of wild animals; and accordingly to be abolished or at any rate not encouraged. Others retort in ways like this: “You white men have killed all your wolves and bears: why do you want us Africans to preserve our lions and elephants?” This type of argument often accompanies a more deep-seated attitude—the feeling that emergent Africa must at all costs become “modern”, and that large wild animals in a country are the reverse of modern, and indeed a badge of primitivism.

WILD life is today a Cinderella: the gloomier prophets wonder if Cinderella may not come to be regarded as an unnecessary nuisance, and simply liquidated.

RESPONSIBLE African opinion is becoming aware of the political and prestige value of wild life. In the modern world, as Africa is beginning to realize, a country without a National Park can hardly be regarded as civilized. And for an African territory to abolish National Parks already set up or to destroy its existing wild life resource would shock the world and incur the reproach of barbarism and ignorance.

IN the past, the cause of wild life conservation has been fighting, and usually losing, a series of rearguard actions against economic and social pressures and general human thoughtlessness and blindness. It is certainly encouraging to see it stepping into the centre of the political stage in Africa and demanding attention. But conservation must become a central feature of policy. The emergent African nations must come to learn the harsh lesson that without proper conservation of soil and water and natural vegetation their lands will become unprofitable and useless, and also the hopeful lesson of the positive values of their natural resources, including wild life and natural beauty.

THE first thing needed is to make Africans at all levels aware of the wild life that they possess. The interest is there, only waiting to be aroused. In Uganda, visits of students and townsmen and chiefs to the National Parks have been organized by the authorities, with encouraging results. Most of them have never seen any large wild animals and

AFRICANS CAN BE PROUD OF THEIR HERITAGE

they are deeply interested and excited when they do so. "These are *our* wonder animals—our elephants, our lions, our zebra, our antelopes. We must protect them and help other Africans to enjoy the sight of them"—that, I was told, is the usual type of reaction.

IN Britain, a Conservation Corps of young volunteers has been organized under the aegis of the Council for Nature. Its members take part in schemes for improving Nature Reserves and similar areas. If something of the sort could be organized to harness the enthusiasm of young Africans, it could be of great service. Such schemes could be affiliated to the International Youth Federation for Nature Conservation.

THE African Crocodile is a freshwater vertebrate of considerable economic importance.

Long regarded only as a pest, its skin has recently provided the basis for a valuable trade. However, unregulated and illegal shooting has virtually exterminated the species in some areas, and seriously reduced its numbers and its size in many others. The African crocodile is clearly a valuable natural resource deserving of scientific management, whose cropping must be carefully regulated.

IN 1934 C.R.S. Pitman estimated the total Lechwe Antelope population of the Kafue River Flats at a quarter of a million: today it is less than 30,000. Their numbers could readily be raised to at least 100,000 by proper management; 20,000 Lechwe a year could probably be safely cropped, and would yield 2,000 tons of meat or more.

THE Lechwe Antelope is easily hunted and killed by African spearmen and their dogs.

In comparatively recent years, the local Africans organized large-scale hunts or *chilas*, described as "Lechwe blood-baths" in which men, women and dogs drove large herds into the water and speared thousands at a time. The large majority of those killed were females, most of them gravid. This cruel slaughter was also wasteful, as it rapidly reduced the total Lechwe population. If it were replaced by a carefully organized cropping system, selected local tribesmen could presumably still participate in the operation.

IT will be difficult to get Africans to abandon their traditional practices, even when these are flagrantly inimical to good land use and their own prosperity, but it can be done. Something has already been accomplished in persuading pastoralists to limit their stocks and

sell their surplus beasts; and the new agricultural revolution in the Kenya Highlands, which has produced an array of prosperous individually-owned African farms and smallholdings, has been an outstanding success. It has also had the rather unexpected result of alerting this new class of African farm-owners to the dangers of over-population. However, in Africa as elsewhere, men must be brought to have respect for land—theirs and their country's; and the importance of right land use for the prosperity and indeed the economic and social viability of African territories must be urgently impressed on public opinion, both European and African.

IN Uganda, there are now about 5,000 visitors to the National Parks each year, and it has been estimated that they bring in a revenue of about £300,000 gross from expenditure on Park fees, transport, and curios (to which I would add a considerable sum for expenditure on photographic, camping and other equipment).

IN Kenya, tourism already provides the second largest source of revenue—some £8 million a year. Not only does Kenya possess its own famous National Parks and Reserves but it has always been the headquarters of East African tourism in general, and Nairobi the main centre where the tourist outfits himself for game-viewing and other tours, in Ken itself and also in Uganda and Tanganyika.

SOME people dislike the idea of making a profit out of rich men's desire to kill animals for sport. However, in East Africa as in almost all African territories, there are strict bag limits, and most of those who go on safari to shoot are sportsmen who, though they enjoy the excitement of hunting big game in wild surroundings, are genuinely anxious to conserve it. Furthermore, an increasing number go on safari in order to take photographs and to embark on adventure in the African bush, far from crowds and civilization.

THE shooting of a limited number of wild animals for sport is essentially another form of game-cropping, and equally legitimate as a mean of utilizing and conserving the country's wild habitats and wild life resources. However, safaris should always be subsidiary to National Parks in a territory's wild life policy.

MOUNTAINEERING is another pursuit which could expand spectacularly in East Africa during the rest of this century. As the Alps and the Rockies become increasingly

crowded, we may expect that more and more mountaineers will want to attack noble peaks like Mount Kenya, Mount Mikesco and those of the great Newenzori range. Kilimanjaro is not a mountaineers' mountain, but its vast height and portentous crater will always tempt climbers; and volcanic peaks overtopping 13,000 feet, like Meru and Elgon, Karissimbi and Muhavura, not to mention lower volcanoes like Suswa, Longonot, and Oldongo Lengai, will attract an increasing number of adventurous mountain-walkers.

THE Victoria Falls are one of the natural wonders of the world, already enjoyed by thousands of visitors. Beautiful lakes like Bunyoni with its fringe of blue water-lilies in the cool green uplands of western Uganda could be made into excellent tourist centres. Proper development of access and accommodation could bring in a greatly increased number of visitors, not only to the foothill regions of eastern Africa, but also to the lovely cool uplands like those of Inyangā in eastern Southern Rhodesia, of the Aberdares in Kenya, or of the Nyika Plateau in Nyasaland.

THE total revenue from tourism in the four territories of East Africa together is today well over £10 million. I would prophesy that this could certainly be increased fivefold, and quite probably tenfold, within the present decade. So long as western prosperity continues, with Western populations (and their revenues) increasing and Western industrialization being intensified, it is safe to forecast that more and more people will want to escape further and further from it and its concomitants, in the shape of over-large or over-crowded cities, urban sprawl, noise, smog, boring routine, deprivation of contact with nature, and general over-mechanization of existence.

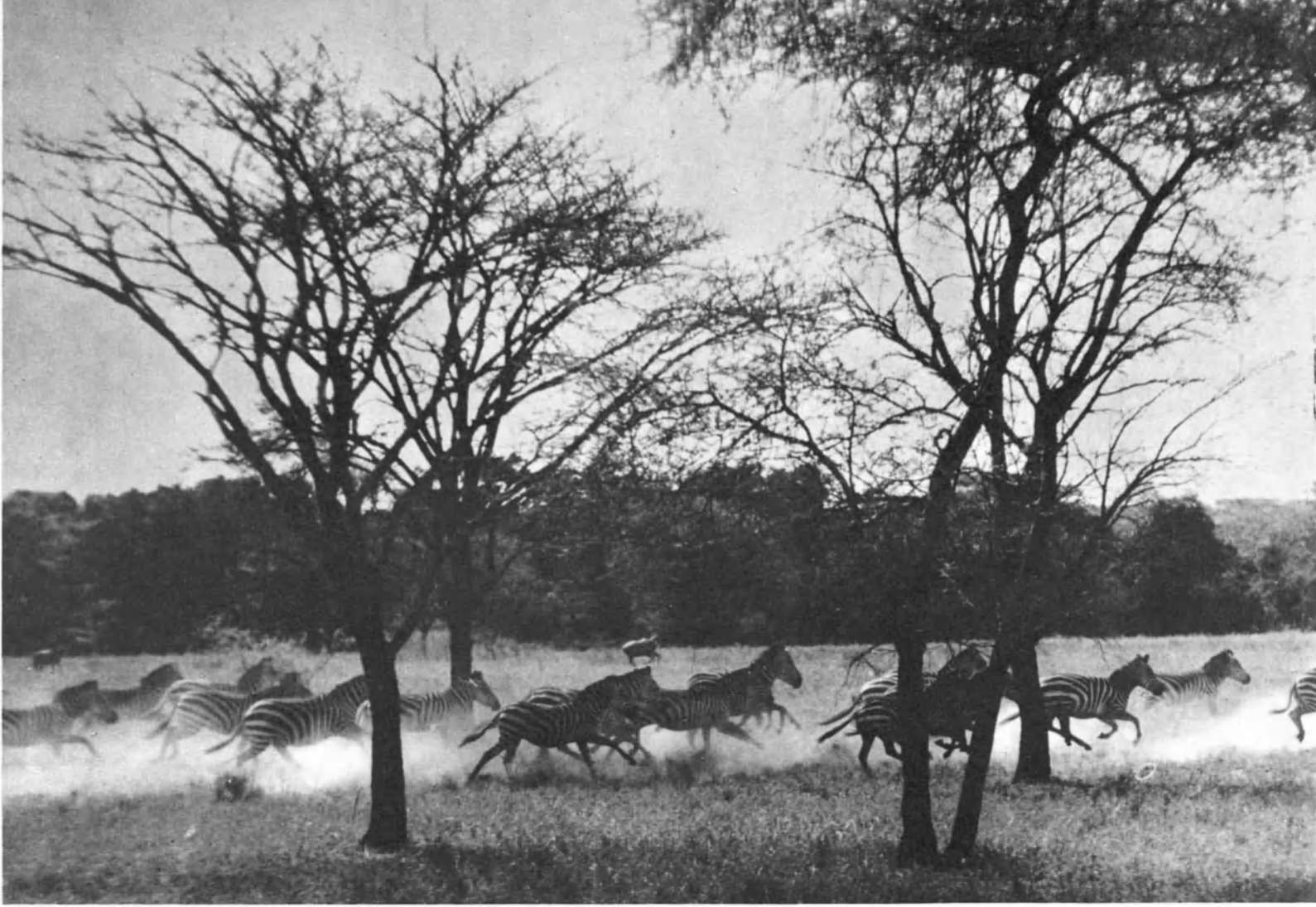
THERE must be hundreds of thousands of people in the world who, though they may not be able to travel to see African wild life in nature, are yet deeply concerned over its future, or whose concern could readily be aroused. The Fauna Society's appeal for "Operation Noah" to save the wild life of Kariba from destruction met with an immediate and generous response. I believe that a well-planned international appeal for a continuing campaign to save the world's wild life from destruction and to establish an array of National Parks and other areas devoted to the protection of nature as a kind of world-wide Green Belt for our over-mechanized civilization would meet with an equally immediate and generous response.

HEY TAXI! Once a formidable expedition, a trip to Kenya's Nairobi Royal National Park can now be made in 20 minutes by taxi from the capital. Covered with open plains and tree savannah, the park is one of the most famous places in Africa to see wild life. In 1958, 110,000 people visited the plains.

© Almasy, Paris

TAXI





THOUSANDS OF ZEBRAS, Wildebeest (gnus) and Thomson gazelles roam across the grassy plains of Tanganyika's great Serengeti Park, one of the last refuges of the vanishing herds of

Africa. To count their numbers and chart their migrations the Tanganyikan Government several years ago called upon Bernhard Grzimek of Frankfurt and his son Michael. By zebra-striped light



The Drama of Serengeti



TWO MEN & A 'FLYING ZEBRA'

by Pauline Bentley

One of the most magnificent reserves of wild life in Africa and probably in the world is to be found in the Serengeti Park and the Ngorongoro Highlands of northern Tanganyika. Here in a setting almost untouched by man, of limitless horizons, beauty and grandeur, dwell remarkable species of animals and birds which have drawn to this unrivalled corner of East Africa nature lovers, tourists, hunters and photographers. The article below tells the story of the animals census undertaken a few years ago. On page 23, Sir Julian Huxley gives a frank account of today's drama in Serengeti Park.



plane and Land Rover they spent months counting and tracking the herds of zebra (above) and wildebeest (below) which, although greatly reduced in numbers, still abound in Serengeti.



Photos Dr. Bernhard Grzimek © Tierbilder Okapia, Frankfurt

TAKE two men, enough scientific knowledge, a tiny aeroplane and limitless dedication, and the result is one of the most moving adventure stories in the struggle for the preservation of wild life. The story starts in 1957, when Dr. Bernhard Grzimek, Director of the Frankfurt Zoo, was asked with his son Michael to make a census of the huge herds in Serengeti National Park.

Serengeti is Tanganyika's only National Park, 4,500 square miles shaped rather like a kneeling elephant with its trunk extended, and stretching from Lake Victoria to just beyond the mighty Ngorongoro crater. It is the home of presumably the last great herds of wild animals still surviving in Africa, where zebra, wildebeest and Thomson's and Grant's gazelles as well as elephants, lions, flamingoes and ostriches roam freely.

The reason for the census was a British Government plan to reduce the size of the Park in favour of the many Masai tribesmen; this plan had been based on an official survey made in 1957, but the information on the seasonal migrations of the large plains animals in this study was sketchy and inaccurate. Dr. Grzimek realized the importance of accurate information not only to the destiny of the Park but to its unique herds themselves. He determined to establish the number of animals in the Park as well as whether the herds were actually protected by the present Park boundaries and would continue to be so by the proposed new boundaries.

His work had often taken him to Serengeti before, and both he and his son Michael were passionately interested in its fate. They accepted the task joyfully. It took them endless patience, courage, ingenuity and sacrifice which did not stop short of life itself, for in 1959 Michael Grzimek was killed at the age of 25 while flying on the Serengeti assignment. As a memorial to him we can enjoy his father's book, *Serengeti Shall Not Die* (1) describing their two years' work in Tanganyika, and Michael Grzimek's own film of the same name which he completed just before his death and which was awarded the 1960 "Oscar" for the best documentary of the year by the American Academy of Motion Picture Arts and Science.

Taking into account the vast area they had to cover, and the fact that the number of animals in the Park was estimated to be about a million, the Grzimeks realized that a comprehensive survey could not be attempted by car. They therefore decided to carry out their census from the air; they learned to fly. In a little single-engined

(1) Published by Hamish Hamilton, London, 1960, and Dutton, New York, 1961.



BELLING THE ZEBRA. It takes energy and ingenuity to strap a collar on a zebra, for these fleet-footed and timid animals just won't stand still even in their own interest. To discover what migratory patterns the herds followed in Serengeti Park, the Grzimeks decided to mark certain zebras so that they could be spotted later from the air. They tried catching them by the tail (above) but the razor sharp hairs proved too dangerous. Later, they mounted a platform on top of their Land Rover and lassoed them from above with a noose at forty miles an hour. Once caught, four men were needed to slip a brightly coloured featherweight collar around the animal's neck (above right and below). Very quickly the zebra was freed to rejoin the herd (far right). Once collared, the zebras can easily be spotted from a plane flying at 1,500 feet.

Photos Dr. Bernhard Grzimek © Tierbilder Okapia, Munich

Dornier 27 painted in bright black and white zebra stripes so that it should be easily spotted in case of emergency landings, they set off in December 1957 on the 6,000 mile flight to Equatorial Africa.

The little plane, specially highlegged from the ground as protection against long grass, had excellent visibility from its cockpit, it was able to fly at very low speeds close to the ground and it could operate easily independently of airstrips and landing fields.

The Grzimeks' first intention was to fly over the whole Park and photograph it with automatic cameras, but this idea proved impractical and prohibitively expensive; instead they decided to divide the area into zones demarcated by natural landmarks and fly at 150-300 feet over each zone in parallel sweeps, counting the animals on each side of the plane in 550 yard wide strips at a time.

This idea worked well in practice, but it turned out to be exhausting and earsplitting work; the plane had no insulation against the noise of its own engine and it was some time before the Grzimeks became accustomed to it; counting herds of often moving animals from a hot and noisy plane takes some concentration, but before very long Dr. Grzimek evolved a method of counting the larger herds in groups of 12 to 50 at a time.

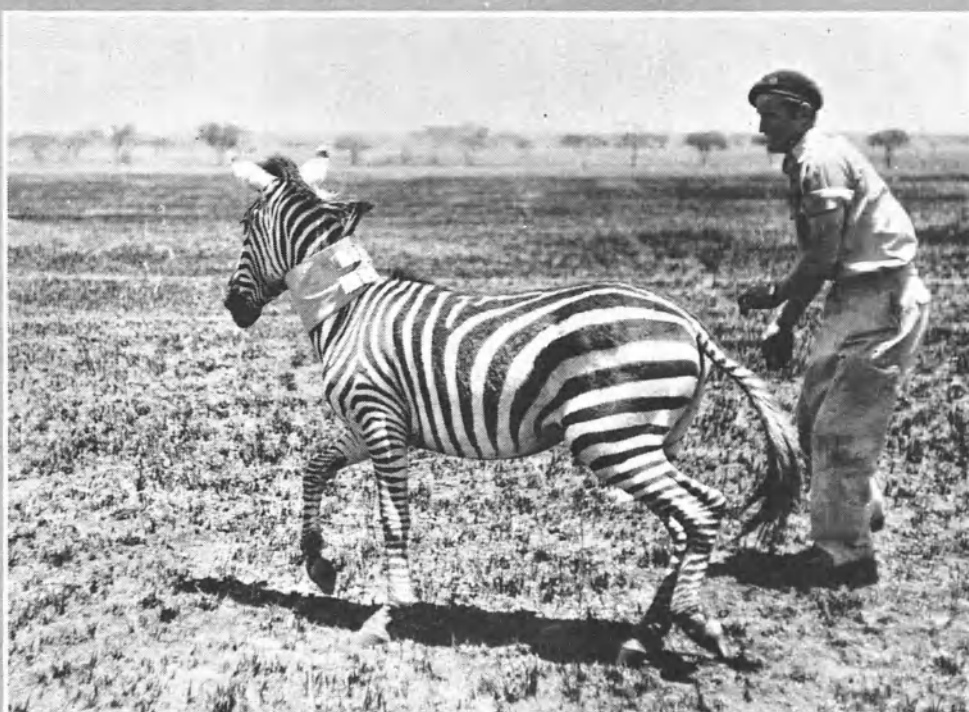
They were shocked to discover that the estimated number of one million quadruped was far in excess of that

actually in the Park. Through poaching by Africans and the hazards of wandering into unprotected areas, Serengeti's great herds now numbered approximately 367,000 .less than one-half of the original estimate. It became of even greater importance to discover the areas into which they were wandering, and to ensure that these areas should be protected, if their numbers were not to be reduced even further.

It became obvious that the herds must in some way be identified if their movements were to be traced and the present and proposed Park boundaries to be studied. The Grzimeks had already had to consider the extraordinarily varying reactions of the different animals, zebra, gazelles, wart-hog, elephant and lion, gnu, ostrich and giraffe, to the sound of their low-flying plane while taking the census, now they had to come down from the skies and catch their animals to mark them!

As a veterinarian, Dr. Grzimek rejected various ideas, such as narcotics put in the water holes used by the herds, but he finally accepted the idea of a new "miracle gun"—a weapon looking like an ordinary gun but which instead of bullets fires a steel hypodermic with a narcotic that temporarily and harmlessly renders its victim docile. They found the gun far from perfect and Michael Grzimek eventually modified it on a trip back to Germany and they finally selected nicotine salicylate as the most suitable drug to use.

Armed with this improved weapon they returned to



Serengeti, still faced with the problem of catching and marking their animals. The average speed on the ground of the larger Serengeti herds of zebra, Thomson's and Grant's gazelles and gnu is a high thirty miles an hour. Temporarily abandoning the faithful plane, the Grzimeks took to a Land Rover, an all-terrains vehicle also painted in zebra stripes. Only the zebras would never allow them near enough to "shoot" them with the miracle gun and they therefore had to be caught by hand—or rather, by the tail. This proved a highly tricky and painful operation, for the hairs of the tail are razor sharp. Later the Grzimeks discovered the Thomson's and Grant's gazelles could be caught in the dazzle of the Land Rover headlamps provided there was moonlight. They spent many extremely active nights doing this and marking the gentle and elegant gazelles, without having to drug them first.

The usual methods of marking animals are by earclip or dye, but the first would be invisible from the air and the dye brought from Europe did not take on the zebra's rough hide. Finally, the Grzimeks decided on a brightly coloured light plastic collar which not only remained distinguishable from the air but proved to have no adverse effect on other animals in the herd.

From the air they were thus able to identify particular herds and then study their movements; the results were disquieting. They found that every year the large herds move far beyond the new borders proposed for the Serengeti Park. This means that the already shrinking herds

will be exposed to further dangers if the new boundaries become law.

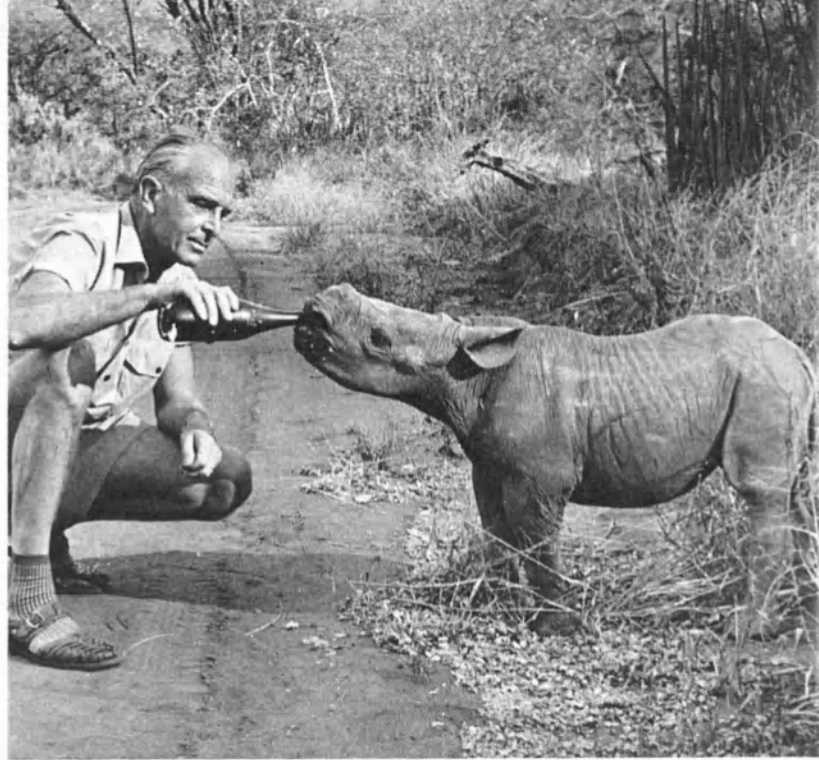
Michael Grzimek made innumerable trips to different parts of Serengeti, taking samples of soil and grasses which were sent to Europe for analysis in an attempt to find out why the herds wandered as they did. It was found from this that their preferred grazing grows largely outside the future Park boundaries in the rainy season and that what grows within the future Serengeti is not eaten by the animals during some parts of the year. In other words, the conclusion was that the herds need the area destined to be shorn from Serengeti. Dr. Grzimek also noted that the land in the park which is adequate for wild animals would be inadequate for the large herds of Masai cattle to whom it is suggested it should be given.

Dr. Grzimek's conclusion is that the new boundaries proposed for Serengeti spell certain death for large parts of the great wild herds.

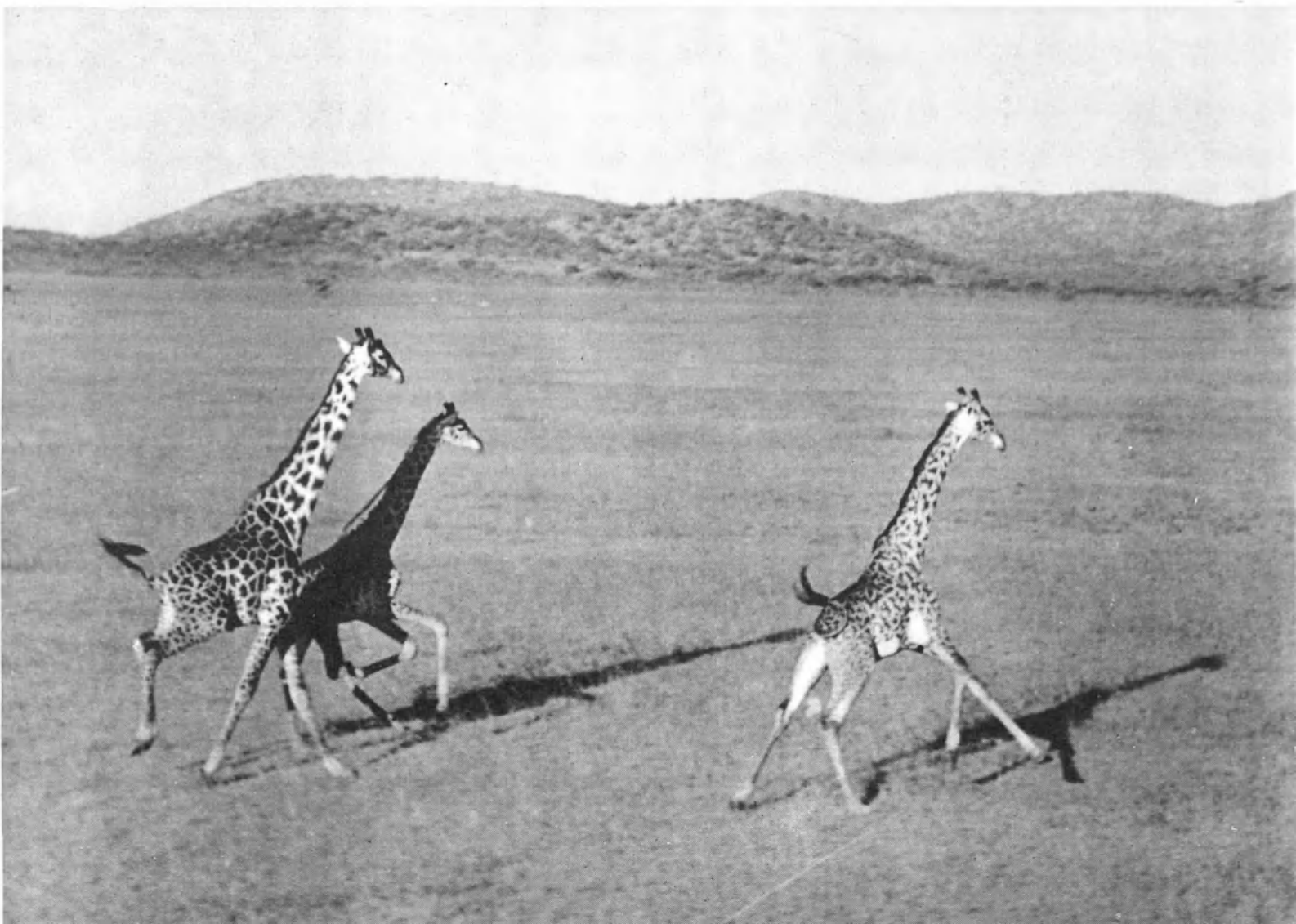
As he has written—"Neither today, nor tomorrow, but in three or four generations' time, many people may be glad that during our era someone gave a thought to the wild animals in Africa... Most national and political ambitions for which men suffer and die are transient, but Nature is of abiding importance to us all. In a hundred years' time... men will still consider it important that wildebeest should roam across the plains and leopards growl at night."



Photos Dr B. Grzimek © Tierbilder Okapia, Frankfurt



BABY THOMSON GAZELLE (left) allows itself to be caressed by Michael Grzimek at Serengeti shortly after its ear has been tagged for identification. Within minutes it will be on its feet, and a danger, despite its age, to anyone who gets in the way of its needle-pointed horns. Michael was killed not long after this picture was taken, when his plane crashed near Ngorongoro Crater. Michael's father (above) gives orphaned baby rhinoceros a refreshing drink. Giraffes, like these below bounding across the veld, proved to be among the least disconcerted of all animals by the low-flying plane. Census count numbered 837 of them in Serengeti. Gazelles were most numerous, and then wildebeest and zebras.



Nature's fight for life at Ngorongoro Crater

by Sir Julian Huxley

At the time of my visit to Africa in 1931 there were no National Parks either in East Africa or the Federation of the Rhodesias and Nyasaland, and I urged the need for their speedy establishment. Great progress has been made in the subsequent three decades, and today there are in the region some 15 devoted primarily to the conservation of wild life or wild scenery, besides a number of Reserves with essentially the same function but not officially designated as National Parks, as well as some Parks of archaeological or historical interest.

But this has been a slow operation, often carried out in the face of official inertia or even resistance, always handicapped by inadequate funds and personnel, and without benefit of any consistent and positive policy.

As a result of these handicaps and of the common tendency of administrations to underestimate the importance of wild life and its value as a resource, to give priority to agricultural and other "human" development schemes as opposed to projects for wild life conservation, and generally to favour the interests of tribal Africans whenever they appear to conflict with those of wild life conservation, many opportunities have been missed; existing National Parks systems have generally had to struggle along at a low level of efficiency, and have been unable to perform their functions fully; poaching has made many wild animals shy; a number of wild habitats, including even some in Parks or Reserves, have been invaded, damaged or lost; and there is as yet little or no sign of the framing of challenging plans for the future of National Parks in the region.

The Serengeti may be cited as an example of the unfortunate treatment which an ideal National Park area received in actual reality.

In the mid-twentieth century the Serengeti area of Tanganyika, with the continuous Crater Highlands, retained an abundance and variety of large wild animals unrivalled elsewhere in Africa or indeed in the world. The annual migration of the large herbivores, comprising hundreds of thousands of wildebeest, zebra, and gazelle, were inconceivably spectacular, and so, though in a different way, was Ngorongoro, the second largest crater on earth, 11 miles in diameter, with its vast floor liberally sprinkled with antelopes, zebras, elephants and rhinos, together with fair numbers of lions, hyenas and other carnivores. I made the mental calculation that the wildebeests stood in the same size-relation to the crater floor as would fleas to the flank of a blue whale.

Other habitats in the original Serengeti area ranged from hot and semi-arid level plains to forested volcanic highlands, and its mammalian fauna included no less than 170 species, comprising almost all the most striking large forms, from giraffes and buffaloes to lions and cheetahs. The present populations of Wildebeest, Zebra, Grant's and Thomson's Gazelle are estimated at about 100,000, 60,000, 40,000 and 200,000 respectively, besides some 15,000 other large herbivores and 1,500 ostriches.

Two further points must be mentioned. First that the Masai had traditional rights over the area (though into much of it they did not penetrate owing to its infestation with tsetse or to lack of water for their stock): and secondly that ever since Tanganyika became a British Mandated Territory, the Administration has tended to regard the interests of wild life as subordinate to those of local Africans.

A Serengeti National Park was nominally established in 1940, but a National Parks Ordinance was not passed until 1948, and the Park was not formally proclaimed

until 1951. During 1953-56 a number of reports showed that the Park and its marvellous fauna were being gravely threatened, partly by poaching, but largely by the rapidly increasing Masai.

In 1956 a Government Sessional Paper set forth the Government's policy for the area. This would so clearly and drastically have impaired the value of the Park, that it raised an international storm. The Fauna Preservation Society in Britain commissioned the eminent ecologist Professor W.H. Pearsall to examine the problem, and his report, together with much other scientific and expert evidence, was presented to the Committee of Enquiry which the Government was impelled to set up.

In 1957, the Committee recommended that the plains area in the West, supplemented by an uninhabited northward extension to the Mara River and the Kenya border, should remain as a true National Park, that the Ngorongoro Crater should become a Nature Sanctuary (virtually a small National Park); and that the rest of the area, including the Crater Highlands, as recommended in principle by Professor Pearsall, should become something new in Africa—a "Conservation Area," devoted primarily to conserving the water-supplies, the forests, the grazing potential (and therefore the wild life) of the whole Serengeti region.

In 1958 a Government White Paper stated that the conclusions of the Committee were "broadly acceptable," and proposed a solution which, it said, was to be "simple, clear and final." In point of fact, the solution was not at all simple; it has not (as might have been foreseen) proved final; and several of the Committee's recommendations far from proving "acceptable," were rejected.

Prior to 1958, the National Parks Trustees had spent over £150,000 on the provision of a fine lodge and numerous other facilities for visitors to the world-famous crater of Ngorongoro. In spite of this, and of the Committee's recommendation, Ngorongoro was not proclaimed as a Nature Sanctuary, but simply included in the Conservation Area. The whole eastern sector of the proposed Serengeti National Park was also added to the Conservation Area, and this was to be administered primarily in the interests of its human inhabitants, the Masai, and not primarily to conserve the resources of the entire region.

At the time of my visit, the Masai were bringing large herds of stock to graze in the crater, and were in contravention of the regulations invading and damaging the forests on the crater rim, lighting fires and even setting up bomas there. They were also killing numerous rhinos (over 30 during the last 12 months), always allegedly in self-defence, but pretty certainly with a view to selling the horns. The Warusha were also attempting to start cultivation in parts of the forest area.

Since then, new studies have made it clear that the new boundaries of the National Park ought not to be regarded as final, but should be redrawn, after a renewed ecological survey of the area, including study of the animals' habits as well as a land use survey, to guarantee safe migration and good grazing to the enormous herds of game that annually flood back and forth across the Serengeti region.

Meanwhile, in 1959, the Colonial Development and Welfare Fund allocated £182,000 to the Conservation Authority to be spent over 4 years for the following purposes:— rehabilitation of eroded lands and prevention of further erosion; increase of stock-carrying capacity; forest conservation; and wild life conservation as far as

THE CANADIAN CARIBOU A DISAPPEARING SPECIES

by A. W. F. Banfield

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A relic species from the Ice Age is waging what may be a losing battle for survival against the relentless advance of modern civilization. That species is the barren-ground caribou (*Rangifer tarandus arcticus*) of northern Canada which is closely related to the reindeer (*Rangifer tarandus*) of northern Europe and Asia. It is a mammal particularly well adapted to withstand the rigours of an arctic environment with its long, dense fur, short ears and tall, furred muzzle and feet, and widely splayed hooves. The latter act as snowshoes to bear the animal's weight on the crusted snow in winter.

The time and place of origin of the world's reindeer is quite naturally unknown. However, the geological and anatomical evidence points to the mountainous regions of north-western America or north-eastern Asia. We do know that the reindeer was a characteristic mammal of the colder phases of the Last Glaciation associated with a tundra and taiga vegetation on the edges of the advancing or retreating continental glaciations (about 75,000-10,000 years ago.) Its companions were the woolly mammoth and musk-ox on the subarctic landscape of western Europe. During intervening warmer phases when deciduous forests and meadows covered the land, the reindeer was replaced by aurochs (ancestral cattle), bison, horses and red deer.

The reindeer was closely associated with man during the Early Stone Age of Europe and northern Asia. Early Europeans have left a clear record of the reindeer, bison and woolly mammoth in the powerfully simple cave drawings of the Dordogne Valley of France and Altamira Cave of Spain. Those drawings indicate an intimate knowledge of the reindeer's life history born from their pursuit for the staples of human life. The drawings, models, tools and fragments from those early cultures indicate that reindeer provided food, clothes, fuel, thread and tools for our species so long ago.

At the time that reindeer were so important in the economy of Europe, the ancestors of the American barren-ground caribou were thought to have been penned-up in an unglaciated refugium in Alaska and the Yukon Territory. The gradual eastward retreat of the Keewatin Ice Cap during the past 10,000 years permitted the caribou to colonize the tundra of northern Canada. It is likely that the early Eskimos were quick to follow the caribou and to migrate eastward across northern Canada eventually to reach Greenland.

While the reindeer gradually withdrew northward and disappeared from the economic picture of Europe, the barren-ground caribou continued to serve as the cornerstone of the comparatively Stone Age cultures of the Eskimos and Athabaskan Indians until recent times. The Chipewyan Indians of the Athabaskan language group, who live in the boreal forest region were practically dependent upon caribou for the basic necessities of food, clothing, fuel oil for lamps, sinews for sewing and tools. They earned the name "caribou-eaters."

Modern Eskimos were less dependent upon caribou and more upon marine mammals such as seals, walrus and smaller whales. However, caribou were always cherished game of the chase for winter clothing. The summer caribou hunt held certain connotations of recreation or spiritual renewal. However even among the Eskimos, bands remained inland and were primarily dependent upon caribou.

These races relied upon a primitive hunting culture for their sustenance. They speared the migrating caribou from canoes and kayaks. They captured them in pounds constructed of spruce trees, or guided them to slaughtering points at natural defiles by the construction of long

A SNOW-DEEP PROCESSION
of Canada's barren-ground caribou forms striking silhouette against mountain backdrop.

Photo National Museum of Canada, Ottawa

drift fences (or stone columns on the treeless tundra). They sometimes stalked them with bow and arrow, the hunters disguised in caribou hides and antlers, or constructed pitfalls on caribou paths in the forests or of frozen snow blocks in winter.

Such hunting methods were probably similar to those used by our Stone Age ancestors and could be observed in northern Canada until quite recently. The domestication of the reindeer developed in north-eastern Asia about 3,000 years ago and was brought to northern Europe by the Lapps. However the Eskimos and Indians of North America never developed a similar form of animal husbandry with their caribou.

One can well imagine the sights of natural bounty which greeted the first European explorers to northern Canada in the eighteenth and nineteenth centuries. Great herds of caribou roamed the arctic tundra in summer in seemingly countless numbers. In winter they migrated in massed columns, distances up to 1,000 kms. to the subarctic taiga. While nomadic bands of Eskimos and Indians followed the caribou herds across the forests and tundra for their livelihood.

It is difficult to remember now in highly organized Canada, that a century ago, vast herds of bison and caribou roamed across plain and tundra, rivalling in number the teeming antelope of the African veldt. The bison virtually disappeared from the plains as a result of excessive hunting in the nineteenth century. Saved from extinction it survives in National Park sanctuaries. Its place in the ecological scheme of things has been taken by beef cattle. The caribou still lingers on in its arctic domain in numbers only suggestive of its former abundance.

The advent of Europeans upset the centuries-old





balance which had existed between caribou herds and their human predators. For the primitive weapons of the Eskimos and Indians scarcely gave them any advantage over their swift wide-ranging prey. The introduction of the fur-trade to northern areas indirectly tipped the balance against the caribou. The natives became trappers and for the new pursuit increased their dog teams for winter travel. This led to larger caches of caribou meat to feed both the trappers and the dogs on the trail.

With these changes were introduced the tools necessary to facilitate the killing of caribou—the white man's firearms. For the first time the Indian and Eskimo found themselves able to kill at will. The ease with which the unwary caribou could be killed by the rifle led to great wastage of the resource. The seemingly numberless caribou herds began to melt away, while the northern people seemed unable to adopt the conservation concept.

The remoteness of the caribou range, together with the sparse and primitive human population, hindered a really accurate appraisal of the animal's population. Exaggerated estimates ran as high as 100 million. The famous Canadian naturalist Ernest Thompson Seton estimated the caribou numbers at 30 million in 1911. As late as 1938, the population was estimated at 2 1/2 million.

With the increased post-war tempo of development in Canada's northern regions fears grew for the fate of this important natural resource. Federal and provincial game authorities recognized the urgent need for an intensive investigation and undertook a co-operative preliminary survey in 1948 and 1949.

Previous attempts at estimating the caribou population had been handicapped because of the slowness of the traditional northern transportation methods of dog team and canoe. Now full advantage was taken of the aeroplane

and an aerial survey technique was developed for northern big-game animals. During the spring migrations caribou herds travel in closely packed columns. They tend to follow the frozen waterways and on sunny afternoons rest on the snow covered lakes. At that time they are easily photographed and counted from the air.

The preliminary aerial survey of 1948 and 1949 disclosed an estimated population of about 670,000 barren-ground caribou between Hudson Bay and the Mackenzie River. The annual crop of calves was estimated at 145,000. The number killed every year by hunters, based upon hunting returns, was about 100,000. Wolf predation, diseases, accidents and severe spring blizzards at calving time caused losses that appeared to exceed the annual increment and to result in a declining population. A continuing caribou research programme disclosed a series of poor calf crops during succeeding years and a similar aerial resurvey in the winter of 1955-1956 indicated an alarming drop in the population to an estimated 275,000.

This crisis led to a second co-operative caribou research programme jointly sponsored by Federal Government agencies: Canadian Wildlife Service and Northern Administration Branch of the Department of Northern Affairs and National Resources, the Indian Affairs Branch and the Game Departments of the Provinces of Manitoba, Saskatchewan and Alberta. Whereas the first project had been extensive in nature, the second was an intensive study of all the factors affecting caribou mortality.

One large herd numbering approximately 100,000 animals was chosen for intensive study from April 1, 1957 to August 31, 1958. During that period teams of game biologists, range managers, veterinarians, physiologists and ethologists kept constant contact with the herd as it migrated approximately 2,000 km. between summer and

STRYCHNINE TRAPS FOR MARAUDING WOLVES

winter ranges. The biologists lived in tent camps under Canadian subarctic weather conditions. The scientists leap-frogged after the migrating herds by means of light aircraft. This was certainly the most intensive research programme on any Canadian mammal yet undertaken and significant contributions to our understanding of the caribou decline were achieved.

The human kill was verified as the most important factor in the caribou decline. Although the kill declined to 73,400 in 1955 and to 15,000 in 1957-58, those figures represent the decreasing availability of caribou rather than the effectiveness of conservation methods. The high rate of human utilization was unfortunately coupled with a series of years with low calf crops so that 1956-57 the calf crop was about 8.1 per cent of the herd and the human kill 9 per cent, resulting in a further decline.

Steps have been taken to restrict the killing of caribou in northern Canada to those families living in the remote areas. At the same time a conservation programme has been initiated in the schools and among adults by means of posters, cartoon booklets and filmstrips. Additional sources of meat have been sought to relieve the drain on caribou. In this connexion, bison, whale and walrus hunts have been organized where the stocks were sufficient. Frozen food lockers and natural storage facilities in the permafrost have been developed where practical. Unfortunately conservation programmes are woefully slow and the caribou population has continued to decline to about 200,000 animals by 1960, in spite of two unusually favourable calf crops in 1958 and 1959.

It was not difficult to convince northern residents of the need for increased wolf control. Bounties had not been paid on wolves in the North-West Territories for many years, and the decline in fur prices in recent years has discouraged wolf-trappers.

For that reason an intensive co-operative wolf control programme was organized over the barren-ground caribou winter range. Advantage was taken of the wolf packs' habit of travelling on the broad frozen lakes. Lesser furbearers seldom ventured so far from shore. Strychnine baits were placed at sites carefully marked to protect trappers and their dog teams. The sites were revisited and biological information gathered. During the 1953-58 programme, over 6,500 wolf carcasses were tallied. The wolf population was effectively reduced over much of the caribou range.

Other corollary research programmes have clarified the role of snow depth and texture in controlling caribou movements in winter. It was found that caribou chose areas of shallow, light snowfall. Crusting severely handicapped the caribou's ground feeding habits. It was also confirmed that severe wind chill caused by strong winds at low temperatures could place a strain upon a new-born calf's resistance.

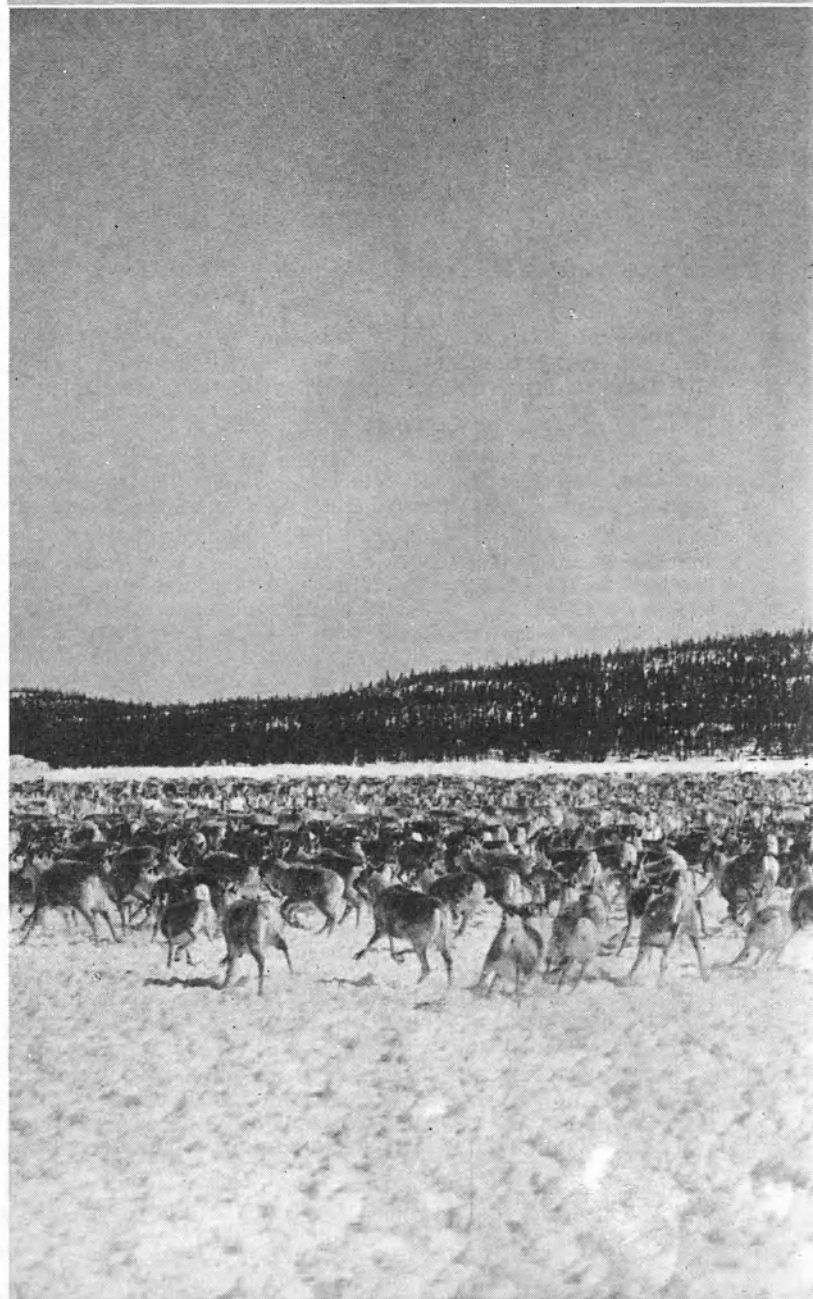
Fortunately some pressure has been taken off the caribou by new economic developments in which Eskimos may participate. Work in mining and military establishments, in government services and air transportation has reduced the need for caribou as the main source of sustenance. This change came at a fortuitous moment, for the disappearance of the caribou herds resulted in starvation in some remote Eskimo camps in Keewatin District, and caused grave hardship over a much larger area of northern Canada.

Some say that northern development has doomed the caribou in any case to a subordinate role. But the stunted subarctic forests and tundra pastures underlaid by permafrost are of little use for modern agriculture or forestry practices. The native caribou is the animal best adapted to utilize this environment and transform it to proteins available for human consumption. The wide-ranging caribou lends itself to an open type of animal husbandry, and if properly managed could continue to provide bounty "on the hoof" to northern people remote from supplies of domestic meats.



BARREN-GROUND CARIBOU spend the summer in the arctic tundra of Canada and the winter in the subarctic taiga (above) some 800 miles south. Below, they are seen crossing the frozen lakes of the taiga, where they often rest on the ice. When migrating, they average 19 miles a day. Hunted by Indians and Eskimos as a source of livelihood, they dwindled from 30 million at the beginning of the century to a mere 200,000 in 1960. Right, abandoned carcasses of slaughtered caribou.

National Museum of Canada, Ottawa



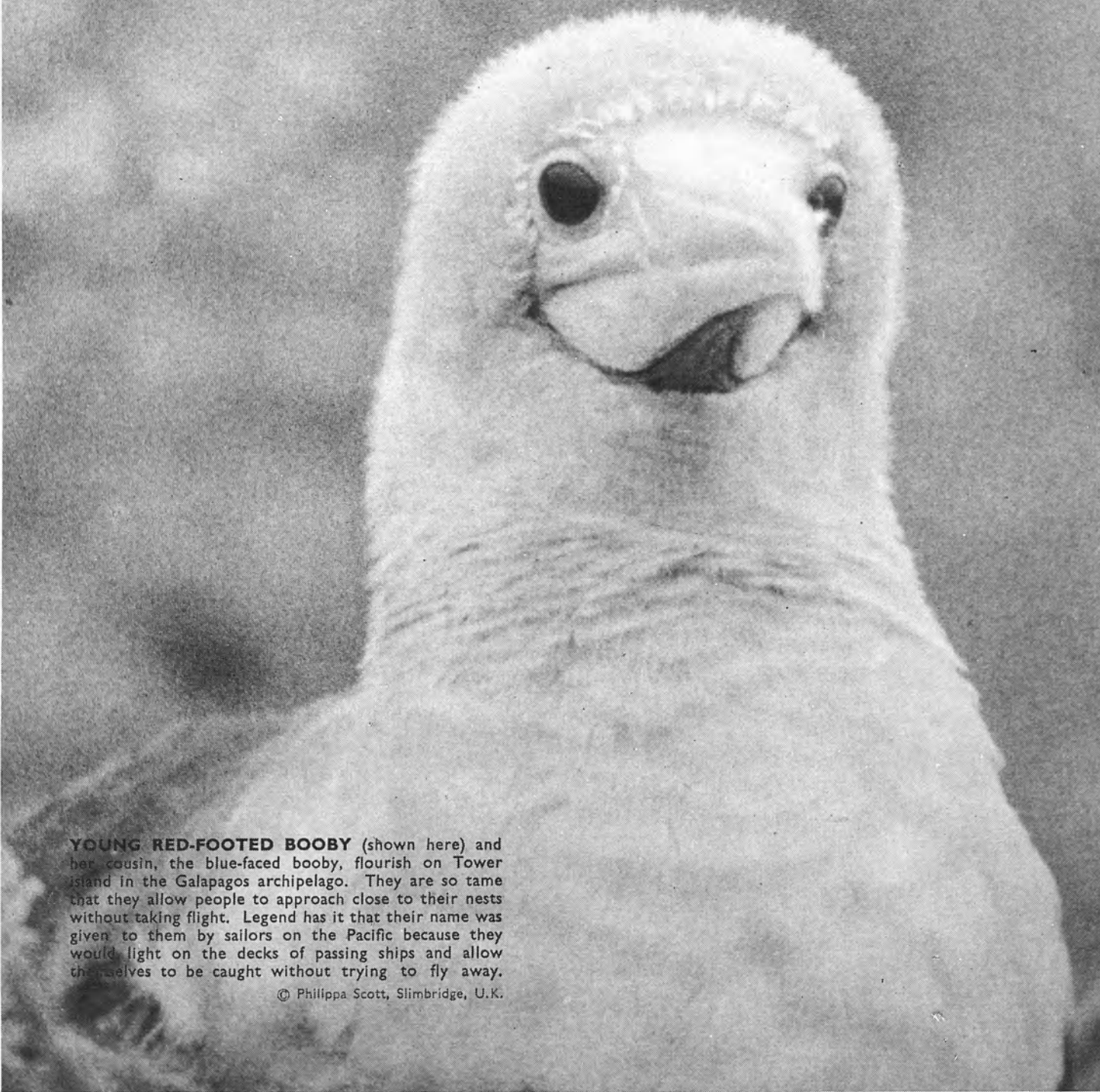


WHERE TIME STOOD STILL

The Galapagos Islands and their prehistoric creatures

by Dr Jean Dorst

Assistant Director, Museum of Natural History, Paris



YOUNG RED-FOOTED BOOBY (shown here) and her cousin, the blue-faced booby, flourish on Tower island in the Galapagos archipelago. They are so tame that they allow people to approach close to their nests without taking flight. Legend has it that their name was given to them by sailors on the Pacific because they would light on the decks of passing ships and allow themselves to be caught without trying to fly away.

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BLACK LAVA CLIFFS are typical of the Galapagos Islands, Pacific archipelago of thirteen main islands and many islets, 600 miles off the coast of Ecuador. To conserve and study the unusual flora and fauna of these islands, Unesco helped found the Charles Darwin Foundation in 1959. The field station's laboratory has now been built and an ambitious biological research programme is expected to get under way soon.

MELVILLE'S DESCRIPTION

Herman Melville, the author of "Moby Dick", visited the Galapagos Islands in 1841, only a few years after Charles Darwin. His description of the "Enchanted Isles", published in 1854 under the title *Las Encantadas*, makes fascinating reading. A few paragraphs are published below.

Take five-and-twenty heaps of cinders dumped here and there in an outside city lot; imagine some of them magnified into mountains, and the vacant lot the sea; and you will have a fit idea of the general aspect of the *Encantadas*, or Enchanted Isles. A group rather of extinct volcanoes than of isles; looking much as the world at large might, after a penal conflagration.

...Cut by the Equator, they know not autumn, and they know not spring; while already reduced to the lees of fire, ruin itself can work little more upon them. The showers refresh the deserts; but in these isles, rain never falls.

...Little but reptile life is here found; tortoises, lizards, immense spiders, snakes, and that strangest anomaly of outlandish nature, the iguana. No voice, no low, no howl is heard; the chief sound of life here is a hiss.

On most of the isles where vegetation is found at all, it is more ungrateful than the blankness of Atacama. Tangled thickets of wiry bushes, without fruit and without a name, springing up among deep fissures of calcined rock, and treacherously masking them; or a parched growth of distorted cactus trees.

In many places the coast is rock-bound, or, more properly, clinker-bound; tumbled masses of blackish or greenish stuff like the dross of an iron-furnace, forming dark clefts and caves here and there, into which a ceaseless sea pours a fury of foam; overhanging them with a swirl of gray, haggard mist, amidst which sail screaming flights of unearthly birds heightening the dismal din.

Nor would the appellation, enchanted, seem misapplied in still another sense. For concerning the peculiar reptile inhabitant of these wilds—whose presence gives the group its second Spanish name, Galapagos—concerning the tortoises found here, most mariners have long cherished a superstition, not more frightful than grotesque. They earnestly believe that all wicked sea-officers, more especially commodores and captains, are at death (and, in some cases, before death) transformed into tortoises; thenceforth dwelling upon these hot aridities, sole solitary lords of Asphaltum.

From Complete Stories of Herman Melville, Random House, New York, 1951.

RECENT celebrations marking the centenary of Charles Darwin's famous work, *The Origin of Species* (published in London in 1859), turned a world spotlight on the Galapagos Islands. On this occasion people in all parts of the globe heard about these islands whose scientific importance had, in any case, long since become known to a wider audience than that of the world's biologists.

The Galapagos Archipelago, lying on and near the Equator, some 600 miles out in the Pacific to the west of the coast of Ecuador, to which it belongs, directly inspired the famous British naturalist. As early as 1837 Darwin wrote in one of his journals: "In July I opened my first notebook on transmutation of species. Had been greatly struck from about month of previous March on character of South American fossils and species of Galapagos Archipelago. These facts origin (especially latter) of all my views."

There is no doubt that the Galapagos Islands were a determining factor in the development of Darwinism. But what were the reasons for this profound influence?

Superficially, this tiny archipelago appears to have nothing of particular interest to the scientist. A handful of dots on most maps (their total area covers less than 3,000 square miles), the 13 islands of the Galapagos group include five which are fairly large (the largest is Albemarle Island, 60 miles in length), numerous islets and rocks. Of volcanic origin, they are the peaks of a range of submarine volcanoes thrust up from the sea by successive eruptions. It is more than probable that they were never joined in any way to the American continent. The visitor finds mountains of black or red lava which has poured out of the archipelago's 2,000 craters. Some of these mountains are over 5,000 feet above sea level.

Curiously, the Galapagos Islands, though so close to the equator, are washed by fairly cool seas. Unusual oceanographic conditions exist in the east Pacific because of the famous Humboldt Current, which brings cold water from the Antarctic along the coasts of Chile and Peru, then turns west at the equator and runs towards the Galapagos Islands, after which it loses itself in the ocean depths.

The low temperature of the water—in the region of 14°C—produced far-reaching effects in the climate of the islands. As along the shores of Peru, and for the same reasons, rainfalls are sparse, occurring only between January and March, and drought conditions often prevail.

The vegetation is in keeping with this arid climate. The lowlands are covered with a vegetation adapted to dry conditions, with an abundance of giant cacti (*Opuntia* and *Cereus*) and spiny shrubs which lose their leaves in the dry season.

CONT'D ON NEXT PAGE

LIVING LABORATORY OF EVOLUTION

The hilly slopes exposed to the more humid south-east winds and often shrouded in fog are clothed with thicker vegetation and, in a few areas, veritable forests of trees laden with parasitical vegetation. This natural environment makes a sharp contrast with the more usual landscape in the islands—a barren prospect of naked lava with nothing but a few cacti here and there.

The fauna living in the archipelago is limited to very few species. The reason for this is quite simple. As these species were isolated by large stretches of ocean right from the beginning, they form what is, in fact, a world on their own—which has followed its own evolutionary laws shut off from the world outside. Plants and animals arrived there from the American continent as best they could, swimming, flying or borne forward by the winds on natural rafts composed of a tangle of tree trunks and deadwood like those often carried along by many big tropical rivers.

TAKING into account the theoretical existence, at one period, of an American continent jutting out further into the ocean than it does today, it is reasonable to assume that these means of locomotion were then easier than they are now. But even so the ocean crossing would have been a difficult enterprise and, in fact, only a limited number of creatures made the voyage safely. This explains the startling paucity of the Galapagos fauna and flora, especially as compared with the luxuriance of tropical America.

It may thus seem surprising that biologists regard these apparently barren islands as a scientific wonderland. But the scientists are right, for the Galapagos Islands are no less than a natural laboratory in which evolution has been made manifest. As the botanist, Howell, so rightly said they are the workroom and show-window of Evolution. They are important for the study of this fundamental problem for three reasons.

Being so remote, the Galapagos Islands have served as a refuge for animals of an archaic type and for a biological complex which has disappeared everywhere else in the world. As mammals could not reach these islands, the reptiles developed unhindered by their natural competitors and the animals to which they fall prey.

A visitor setting foot on these shores for the first time feels as though he has gone back to the secondary period, the age of the reptiles. Along the beaches live marine iguanas 3 1/2 feet long, the only sea-bound sauria still in existence. They feed on sea-weed, grazing at low tide, and bask in the sun in colonies sometimes running into hundreds.

In the interior, land iguanas of a different type live amongst the cactus along with the giant tortoises which are such a characteristic sight that their Spanish name, "Galapagos", was applied to the islands. These giants, whose shells alone measure 3 1/2 feet, are now found only in the Galapagos Islands and the Seychelles, though fossilized remains extend over a vast area encompassing North America and Europe. This example is typical of the prehistoric character of so much of the wild life of the Galapagos Islands, which are truly a Noah's Ark for animals that have disappeared from the face of the earth.

But this is not all. On the Galapagos Islands an evolutionary differentiation occurred isolated from the currents in evolution taking place on the continents. This explains the presence of such a high proportion of endemic animals—sometimes over 50% in one single group.

Owing to the remoteness of the archipelago, the number of ancestors is of course very limited. Hence a simplification in the fauna which makes the laws of evolution much easier to distinguish than in the rest of the world, where the complexity of natural phenomena and the multiplicity of ancestors complicate inextricably the tracing of relationships. The Galapagos Islands thus stand out as Nature's experimental station.



THE ANIMALS of Galapagos are unique in the world. The islands, now believed to be of oceanic origin, received flora and fauna that either drifted there on ocean currents or flew there through the air. Thus isolated, the animal and plant life has followed evolutionary patterns of its own. The photo below of the Galapagos iguanas basking in the sun might have come from the earth's reptile age. They are found exclusively in this tiny archipelago. The giant tortoise above is found in only one other place in the world—the Seychelles. At right a flightless cormorant, also found only in the Galapagos, regards a sea lion as a marine iguana retreats from the water. The most surprising thing about Galapagos animals is their lack of fear of humans.

Photos © Philippa Scott, Slimbridge, U.K.





REPTILES OUT OF THE PAST

This is particularly true of the famous Darwin finches, or *Geospizidae*, sparrows indigenous to the Galapagos Islands and belonging to the *Fringillidae* or finch family. The Islands' 14 species are all derived from a common ancestor, which obviously arrived there at a time when there were no other birds. Several lines then evolved in such a way as to make the fullest use of available food-stuff. The group as a whole thus fills all the ecological niches normally held by birds of very different families.

Accordingly some Darwin finches resemble granivorous sparrows with their big beaks for crushing seeds, while others are not unlike warblers with their tiny pointed beaks and insect diet. The Darwin sparrows illustrate in striking fashion the whole process of the evolution of sparrows. Such an evolution was of course made possible by the absence of any competitor. It will be readily understood that the study of these birds lends weight to Darwinian theories.

So the Galapagos Islands are an ideal spot for studying the dynamics of evolution. A more recent evolution may also be witnessed. Owing to the paradoxical conditions of the natural environment—mainly due to the presence of cold currents at the equator alongside masses of warm water—fauna of very diverse origins has mixed in the islands.

Here penguins, usually connected with Antarctic climes, rub shoulders with frigate and tropic birds and other avi-fauna found near warm tropical waters. The combined presence of creatures having such widely different origins and ecological preferences is an important factor in the evolution now taking place. These peculiar circumstances enable us to study at first hand the adaptation of animals to their environment.

Here are but a few of the research possibilities of the Galapagos Islands, though they already give some idea of the importance of the islands to biology. Discovered (in terms of science) by Charles Darwin in 1835 when he made his famous voyage on the "Beagle", their scientific value has in no way diminished. Yet the situation of their fauna and flora is so precarious that this unique biological complex is threatened with extinction. Up till the sixteenth century the islands remained untouched by man. Then came successive waves of pirates, buccaneers and settlers—mostly mutineers or ex-prisoners.

FORTUNATELY the present population is made up of law-abiding and friendly settlers, but like many elsewhere, they are not always aware of the imperatives of nature conservation. Furthermore, they have thought fit to introduce animals previously unknown in the islands, most of which are now overrun with goats, pigs, dogs and cattle bred from domestic animals turned wild, not to mention the rats and mice introduced accidentally. So in addition to the direct depredations of Man, the natural fauna finds itself up against the vigorous competition of animals better equipped for the struggle for life than are reptiles.

Everywhere in the islands the reptiles have regressed—especially the tortoises. In former times they were massacred for their fat; now their eggs and young are devoured by the dogs and pigs. Some species are already extinct, while others are in a perilous situation. The fauna as a whole is seriously threatened. We are in danger of seeing a priceless natural heritage disappear before our very eyes.

As early as 1934 this state of affairs alarmed the Ecuadorian Government, which passed laws placing the Galapagos fauna and flora under its protection and setting aside much of the islands as national parks. Unfortunately these regulations were hardly applied at all. So, after the Second World War, Ecuador contacted Unesco and the International Union for the Conservation of Nature and asked them to send a mission to study





© Philippa Scott, Slimbridge, U.K

IN DANGER of extinction is the colourful Frigate bird on Galapagos. The males of the species display brilliantly red inflated throat sacks during the mating season (above) and seem to compete for the attention of females with this flamboyant show. Because these birds breed in only one or two concentrated areas and frequently nest on the ground, they are quite vulnerable.

A NATURAL COMPLEX UNIQUE IN THE WORLD

the islands, and to suggest how best the Galapagos fauna and flora might be preserved.

Dr I. Eibl-Eibesfeldt, an expert named by Unesco, and Dr. R. Bowman (University of California) went on a mission to the islands in 1957. On their return it was decided to set up a field station on the Galapagos Islands to be run by an international body with the support of Ecuador, which declared its intention to promulgate more effective laws and to see that they were respected.

Following a mission on which I was sent by Unesco in 1958, a preliminary agreement was reached with the Ecuadorian Government and construction of the biological station began in 1960. The site chosen was on Indefatigable Island (Santa Cruz) close to the little village where most of this island's settlers live. The work, a large and complicated scientific and technical task, is being supervised by M. Raymond Lévêque, a biologist entrusted with the mission by Unesco in 1960.

The Charles Darwin Foundation for the Galapagos Islands was formed in Brussels in 1959, under the presidency of Professor V. Van Straelen, to put all these plans into effect. Sir Julian Huxley, who was one of the first to defend the cause, became its honorary president, and Dr L. Jaramillo, permanent delegate of Ecuador to Unesco, accepted the vice-presidency. All countries directly concerned in research in this part of the world are represented on the executive board.

The Foundation immediately set about collecting funds to defray the cost of building the Charles Darwin Station. It succeeded so well that we now have two buildings—one to be used as a laboratory, the other as residential quarters—as well as basic equipment, purchased largely with the credits made available to us by Unesco.

32 The first research-workers are now able to begin their investigations. However, there are still many improvements to be made in the present organization. Additional buildings, scientific equipment and an oceanographic-

research vessel are urgently required to enable scientists to work effectively in a difficult natural environment.

Following close consultations with the Charles Darwin Foundation, satisfactory legislation has now been introduced by the Ecuadorian Government. Large areas have recently been decreed natural reserves, notably Narborough Island (Fernandina), which has retained its original appearance, and the western part of Indefatigable Island (Santa Cruz), where tortoises are still fairly numerous. The foundation will continue to suggest to the Ecuadorian authorities measures aimed at protecting and conserving a natural complex found nowhere else in the world.

The Foundation has mapped out an ambitious research programme. It includes geological and pedological studies, which thanks to the structure and origin of the islands, should yield interesting findings. In the biological field, the work has hardly begun insofar as soil biology and invertebrata are concerned. It may eventually reveal some hitherto unknown aspects of the laws of evolution. This fertile field of investigation is now open to scientists from all over the world thanks to the founding of the new biological station.

Economic aspects will not be forgotten. The seas around the Galapagos Islands abound in marine life, especially fish, which could provide Ecuador with much-needed proteins. Our biological station, though primarily devoted to basic research, will thus play a part in the economic development projects for the Galapagos Islands without compromising the survival of their natural wealth.

The combined efforts of scientists from all over the world will in this way make up in some measure for the depredations committed by other men. The Foundation will also stand as a monument to Charles Darwin, whose evolutionary theories were conceived on the desolate shores of this tiny volcanic archipelago.

Letters to the Editor

UNESCO'S CALENDAR

Sir,

In THE UNESCO COURIER I read about the UNICEF Greeting Cards and the success they have. I wonder if there is also a UNESCO Calendar (for instance with photographs about UNESCO's work in different countries). Perhaps a lot of people or institutions (schools, offices) would be interested in such a calendar, and besides, I can imagine it would help in spreading the ideas of UNESCO, as a calendar is a thing one looks at quite often.

R. Kats
Voorburg, Netherlands

UNESCO is considering the publication next year of a calendar or desk agenda in English and French.

FOOD AND PEOPLE

Sir,

I am afraid that Mr. McNicholas (letter to the Editor, February 1961) views the problem of food and population in a different time dimension than I did. He wrote: "The real problem we are facing in the world today is that of distribution, not overpopulation" (my italics). I can agree with this thesis when it is put in the present time. But the present generation has to think about and to plan for tomorrow as well.

As to his homely example: ("If ten people need hats and there are only eight hats available, the common sense solution is to get two more hats from somewhere, not to cut off two people's heads") he interprets my point of view in a rather free manner. I'll try to translate it in terms of his own (dangerous) analogy: if you are not quite certain about having more than eight hats, try to prevent to provide for more than eight people.

It may be (and sounds) easy to get another two hats, and that's why this analogy is a dangerous one. It may, however, become progressively difficult to find enough food for, say, another 1,000,000,000 people. Am I going against the facts? In India alone the population increased by 80,000,000 persons within the last ten years. Is Mr. McNicholas quite sure that the fast eroding earth-surface can feed such an explosive population increase the coming millenium?

On the probability of the answer to this question rests the common sense (or non sense) character of his solution. So far my experience as a student of geography reaches, the scientists are not as optimistic as my opponent suggests. I hope that THE UNESCO COURIER in the issue on population and food production will lend an ear to those who are pessimistically minded as well.

P. Kloos
Amsterdam, Netherlands

THE RACISM ISSUE

Sir,

Assuming that the letters to the editor you publish are in quantitatively proportionate ratio to those you receive on a given issue, I must say I have seldom read anything so discouraging as the reactions to your Racism issue. To think that this represents the readership of a magazine devoted to international understanding!!! My sympathy and best wishes.

Eva Schiffer
Kew Gardens, N. Y., U.S.A.

'MORE POWER TO YOU'

Sir,

I am not sure which type of UNESCO COURIER issue is most satisfying and stimulating—the kind devoted chiefly to one important topic such as "Racism" or the richly varied kind exemplified by the recent March issue. The latter kept me nailed to my chair until I reached the final letter on the Letters-to-the-Editor page and read the charge of inadequate subject coverage and resemblance to "Life." Then I rose to brandish my typewriter to hoot down such criticism.

"More power to you"—as my Irish grandmother used to say. I think you bring the world to my home better than half a dozen other periodicals and newspapers I subscribe to. Thank you.

Fredericka Martin
Cuernavaca, Morelos, Mexico

VELAZQUEZ A LA PICASSO

Sir,

It takes all sorts of tastes to make a world and for that reason I would be loath to regard myself as the custodian of the absolute truth in matters of art. I simply wish to offer you the opinion of an average Frenchman, which is what I am in spite of my Spanish origins. The Picasso mural in the Unesco conference building is, in my view, awful. As for Velazquez, he has nothing to gain through interpretation by this painter blessed with "extraordinary imagination." As you had available a double page you would have put it to better use had you offered us—preferably in colour—a true reproduction of *Las Meninas* (Ladies in Waiting).

At this rate, Picasso or Dali will soon be asked to provide the Venus de Milo with arms or to replace the missing head of the Victory of Samothrace.

As Unesco has its headquarters building in France, a French painter

worthy of the name could have been asked to produce a work for the space allocated to Picasso. There is no shortage of good painters and designers in our country.

Leaving aside this question, I may say that I find your magazine most interesting.

François Ribera
Toulouse, France

A SPANKING IN TIME...

Sir,

I read every issue of THE UNESCO COURIER with great interest and profit. Your April 1961 on "Accidents Need Not Happen" was exceptionally good. Wisely, there was emphasis on teaching the young child to avoid certain known dangers as well as on his protection by adults. But nowhere was it suggested that parental application of pain to teach the little word No! is essential in teaching safety to the tot—no mention of obedience. May I call to your attention *Obedience Means Safety for Your Child*, published recently by the American Academy of Pediatrics.

To quote: "The prick of a pin, a kitten's scratch, a broken dish, a bruise or bump, some such natural consequence of disobedience may make a child hesitate to repeat a performance. But when nothing happens, as is often and happily the case, you will do well to render punishment of some kind. What kind of punishment does not matter as long as it serves to influence future behaviour. A spanking is quick, often effective."

Garry Cleveland Myers
Editor, Highlights for Children
Honesdale, Pennsylvania, U.S.A.

FOR HARMONY & UNIVERSALITY

Sir,

With reference to your March 1961 edition, I feel unable to agree with the views of Mrs. Robert Clark, of Bristol, Gt Britain.

THE UNESCO COURIER has to cater for a wide range of people and interests. However that need not mean that the result is what we derogatorily call "mass appeal." Topics are generally treated interestingly and adequately, as befits UNESCO. In addition many of them point to further and more detailed material on the topics.

The great value of your magazine lies in the way it brings the peoples of the world together, directly and indirectly, and in its wide scope serves towards the harmony and universality of Mankind.

Terence Wainwright
London, England

THE VANISHING HERDS (Cont'd from page 6)

Wild African ungulates are capable, on poor natural grazing land, of reaching a biomass as high or almost as high as domestic cattle on excellent artificial grazing lands. What is the reason for this?

The principal one, already suggested by Lebrun in 1947, is that wild grazing animals really use all the food resources of their environment. Some species, like the elephant, eat practically anything, leaves, grass, bark, roots and even graminaceous plants on which other animals do not graze. The various species of ungulates inhabiting the savannahs use absolutely all types of vegetation: young shoots (many small antelopes), thorny bushes (black rhinoceros), foliage of average sized trees (giraffes, elephants). The total load of grazing animals is therefore spread over the whole plant biomass.

The natural resistance of wild ungulates to many parasites also gives them a great advantage over their domestic competitors. The same applies to their better adaptation to high tropical temperatures. All this no doubt explains why the assimilation of food and the rate of growth are generally higher among wild herbivores. Riney observed that the Cape eland can attain a weight of 320 kg. in two years on pastures where domestic cattle would literally starve to death.

These facts have led ecologists to wonder whether it would not sometimes be economically more profitable to "manage" this wild ungulate population, adapted for thousands of years to the hard conditions of its natural surroundings, rather than try to acclimatize domestic cattle, at great cost, in areas ecologically unfavourable to them, where they use only part of the meagre resources available and where they also do much to accelerate the processes of erosion.

The great objection to this view has, until now, been the obvious practical difficulty of "managing" wild animal populations. To take a sufficient number of head annually for the production of a large quantity of meat, while maintaining the herds at a constant level, in balance with the food resources of the environment, is easy in theory, but infinitely more difficult in practice. The cost price of this "wild" meat might for the most part

be higher than that of "domestic" meat, because of the bad transport facilities and preservation difficulties.

But new techniques are now under study which will probably change the whole basis of the problem. Longhurst has shown that it is perfectly possible to use light aircraft to head back certain large species such as elephants, thus making it possible to guide them, at certain times of the year, to corrals where the selection and slaughter of the animals would be easier than in the heart of the bush. The development of drugs immobilizing large ungulates at a distance, for a certain period of time, without danger for them or for the consumer, also offers new possibilities of transporting live animals to zones which need restocking or even to slaughter houses with modern equipment and cold storage.

The research done in Uganda by Buechner, Harthorn and Lock is highly encouraging in this connexion. Field spraying with antibiotics in order to help preserve meat is also being studied. It is therefore not unreasonable to envisage rational exploitation of the large wild ungulate population in the near future, and under profitable conditions. A few "pilot operations" are now under way in Kenya and Uganda; their outcome is eagerly awaited.

In what areas can this new conservation policy for African ungulates be applied? First and foremost, in all marginal areas where agriculture and stock breeding are possible only by heavy investment over a long period. Such zones cover vast stretches of Africa: Fraser Darling estimates that 90% of Northern Rhodesia cannot, because of the poverty of its soil, support intensive agriculture and stock farming, and this is, unfortunately, not the only example. This means that the traditional source of animal proteins represented by large game animals may therefore play a great part in feeding Africa tomorrow.

The establishment of areas of fauna exploitation around the national parks is also quite conceivable. The parks would then, in addition to their invaluable services as natural laboratories and tourist attractions, become restocking grounds for neighbouring regions.

Thus a dynamic and radically new conservation policy is being worked out for the large animals of Africa, opening up prospects undreamed of until recently.

THE DRAMA OF SERENGETI (Cont'd from page 23)

compatible with the reasonable interests of the African pastoralists. The Nuffield Foundation gave a further £20,000 for pasture research in the area.

With these large funds made available to the Conservation Authority, it might have been thought natural to give it more power and more adequate membership, to place it under competent scientific direction, and to provide it with a well-thought out management plan (such as is given to National Nature Reserves in Britain); but nothing of the sort was done for two years. However, it now appears that a radical reorganization of the Conservation Authority is contemplated, and a draft for a management plan has been prepared.

As a result of my visit—and of discussions with numerous people both in Africa and in England, I came to the following main conclusions. (1) That it would be wrong and indeed immoral to jeopardize the future of the Serengeti National Park area, as the most outstanding wild life region left in the world, by undesirable restriction of its boundaries in the supposed interests of the Masai or of economy. (2) That it would be equally wrong, and indeed egregiously foolish, not to give National Park status to the uniquely spectacular Ngorongoro Crater with all its wild life. (3) That high priority should be given (a) to projects for improving road and air access to and accommodation in the Serengeti National Park and Ngorongoro; (b) to scientific surveys and research projects concerned with conservation and basic ecology in the area. (4) That stricter measures should be taken against poaching and illegal killing of animals, not only in the Serengeti-Ngorongoro area but throughout Tanganyika. (5) That the Olduvai Gorge, with the unique exposure

of Pleistocene history, including human origins, revealed by Dr. L.J.B. Leakey's excavations, should be accorded National Park status. (6) That the Masai should be encouraged to co-operate in every way in a policy of conservation for the region, by constituting the Ngorongoro crater and that part of the Serengeti plains within the Conservation Area as Masai Tribal Parks, by giving them a share of the financial benefits accruing from tourists, and by educating them to appreciate the importance of habitat conservation for their own future. (7) That the Conservation Authority should be thoroughly reorganized so as to give it greater autonomy and greater efficiency.

The Authority's objectives should be redefined so as to include conservation of soil, water-resources, forest cover and wild life for the entire Serengeti-Crater Highlands area. It should be furnished with a scientific management plan; and the specialists on the Authority should include scientists and experts from other territories and countries, including representatives of the East African Agricultural and Forestry Organization (EAFRO); the corresponding Veterinary Research Organization (EAVRO); the newly-constituted University of East Africa; F.A.O.; and the International Union for the Conservation of Nature (I.U.C.N.). The closest possible liaison should be maintained both centrally and locally with the Tanganyika National Parks organization.

Only by some such means can the Masai lands in this region be salvaged from progressive ruination, and the area's unique heritage of wild life and spectacular scenery be preserved in perpetuity for the benefit of Tanganyika and the world at large.

current trends in scientific research

by Pierre Auger, special consultant



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This remarkable rump-view of an elephant was taken by Swiss photographer, Oliver G. Wackernagel of Basel. The world's largest four-footed mammal, it roams Africa from lowland bush country to high mountain forests. A type apart from other wild life in Africa, it eats anything—herbage, foliage, fruit, seeds, bark and roots.