

THE EQUATORIAL FOREST OF AFRICA : ITS PAST, PRESENT AND FUTURE¹

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THE forester who for the first time penetrates into the primeval equatorial forest is overcome by a feeling of surprise which rapidly turns to despondency. He is astonished and disconcerted by the numerous storeys of the vegetation, with its profusion of palms, tree-ferns, lianes and epiphytes, and the almost unlimited variety of the tree species notwithstanding superficial resemblances of leaf and bark. While in France there are not fifty species, large and small, the equatorial forest contains more than a thousand: Delevoey quotes more than five hundred in his fine book on the forests of Katanga—a little corner of the Belgian Congo. Hedin gives more than 250 genera in his work on the forests of the Cameroons—at the other end of the equatorial forest belt.

To put the number of tree species actually identified in Central Africa at a thousand is perhaps an underestimate. Of this total it is evident that only a few are really utilisable for the needs of man. Moreover, as will be seen later, one of the characteristics of the equatorial forest is the difficulty with which it is exploited and its very low yield.

Primeval forests are closed formations, that is to say, formations in biological equilibrium, in which no space is available for the invasion of foreign species. Their almost infinite complexity safeguards them against the majority of natural calamities such as epidemics of insect or fungal pests. The prevalent moist conditions prevent the spread of fire. The density of the forest, its several storeys, the variety of

¹ We are indebted to M. Jean Collardet, Technical Director of the Comité National des Bois Coloniaux, Paris, and to the translator, Miss Kathleen Allison-Brown, B.A., of the Imperial Forestry Institute, Oxford, for kind permission to publish this paper by the late M. Louis Lavauden, which was delivered before the Committee's General Assembly on July 4th, 1934.—
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² Among M. Lavauden's principal publications on forestry are *Les Forêts du Sahara*, 1927; *Recherches Techniques sur les incendies en Forêts*, 1929; *Le problème forestier colonial*, 1931; besides numerous papers. He was also a distinguished zoologist. His premature death in 1935 was deeply regretted in French colonial and scientific circles.

its components, the flexible stems and foliage of the palms and the anchoring lianes make the whole forest proof against the most violent storms : the primeval forest does not contain within itself the seeds of its own decay.

It is a commonly held opinion that in wooded regions the finest forests must indicate the richest soils. This is an error. There is no connection whatsoever between the quality of the soil—considered from the agronomic point of view—and the distribution or luxuriance of the primeval forest that grows on it. Such a connection certainly seems to exist in our European forests ; but there the crops are pure, or almost pure. In the name of Management, our foresters have worked towards the constitution of high forest or coppice composed of a single species. In terms of output of wood, the results obtained have been satisfactory, but it has been taken for granted that forests so constituted are capable of surviving indefinitely on the same soil. It is now beginning to be realised that this assumption may not be true, and that whereas mixed forests, by reason of their very complexity and of the fact that there is a spontaneous rotation of species in progress on any given area, can remain in being indefinitely, the life of pure crops is essentially limited. This is undoubtedly the cause of the decline of the oak high forest in eastern France. The theory of crop rotation, traditional in agriculture, must needs be recognised as no less applicable to forests.

In any case, primeval forests are in no sense the product of the soil. Very poor soils in equatorial regions often bear magnificent forests, capable of persisting and remaining productive indefinitely. If these areas are denuded of forest they degrade very rapidly and irremediably towards absolute desert. Their apparent fertility owes its existence to the forest and disappears with it. In temperate or cold countries, where insolation is low and rainfall well distributed, a high proportion of the available land can be cleared with economic gain. Agricultural fertility is maintained for long periods and there is little depletion of plant food materials. In the tropics it is otherwise. As will be clearly shown later on, the idea is

mistaken that tropical forest will continue almost indefinitely to provide new land for colonisation.

The equatorial forest would appear to be of immense age. The extensive and more or less pure coniferous forests of Northern Europe only date from the end of glacial times, when, with the retreat of the glaciers, they colonised the denuded moraines thus produced. From the palæontological point of view, these forests are of recent origin. But what of the forests covering part of Central Africa, established on soils which have been forming since the beginning of the secondary era? Schuster has proved that forests of a tropical character existed from cretaceous to mid-pliocene times in the neighbourhood of Cairo and in the Libyan desert. Englehart has described, from the tertiary deposits of the Fayyum, a whole series of equatorial trees; these two writers assign a common origin to these fossil floras and those of Indo-Malaya, lending some probability to the hypothesis of the prolonged persistence—perhaps until tertiary times—of the continent of Gondwana, uniting the north-east of Africa with India, Ceylon and the north of Malaya.

In the north-west of Africa, the influence of the glacial periods is clearly manifest. There would appear to have been some small glaciers in Morocco. But there is no doubt that, during the period of great glacial extension in Europe, the Sahara was the scene of abundant rainfall. There was vegetation everywhere and, no doubt, forest.

The final retreat of the glaciers brought about in turn a period of dryness which has gradually increased in intensity to the present day and seems to be getting more acute. To it are mainly attributable the formation of the Sahara and the relative desiccation of the Sahel (the western edge of the Sahara, *Trs.*) and Guinea zones, though human action has greatly accelerated the process.

Though the retrogression of the equatorial forest in Africa goes far back in geological time, there is no doubt that at the beginning of *historical* time, this forest was infinitely more extensive than it is to-day.

Actually, there is very little information as to the extent in antiquity of the African equatorial forest. The expedition of Cornelius Balbus cannot have gone beyond Fezzan (Mourzouk). Septimus Flaccus and Julius Maternus, who crossed the Sahara about A.D. 90, certainly never reached the Niger or Lake Chad. The country of Agisymba—"where there were rhinoceros"—reached by Maternus, seems to have been the mountains of Aïr, and the equatorial forest did not extend as far as that. The only indications we possess are those given in the account of the journey of Nero's envoys who followed the course of the Upper Nile, and whose information has been handed down to posterity by Pliny and Seneca: and Seneca's speculations on the source of the Nile detract greatly from the value of his narrative. These envoys penetrated as far as the huge marshes of the Bahr-el-Ghazal. Pliny, the most explicit writer on the region of the Upper Nile, tells us that Ptolemaïs on the Red Sea was surrounded by woods: that in the neighbourhood of Meroë, a few forests were to be seen; and that further south the entire country was covered by immense forests. The equatorial forest seems, therefore, to have extended so far. Even admitting, as seems highly probable, that the Meroë of Pliny is not that of Herodotus, who places this town to the south of the bend of the Nile a little north of Khartoum, one realises that in twenty centuries the equatorial forest has retreated almost ten degrees southwards. To-day, the country round Khartoum is desert. This retreat is almost as great as that which took place between the end of the pliocene and the dawn of history, an interval probably two or three hundred times as long.

The actual limits of the equatorial forest are approximately shown on the map prepared by Max Moisel (1905), which requires local modification in the light of the observations of Mildbread (1912), A. Chevalier and the author (1925 and 1931). These data show the extent of the forest to be appreciably less than has been generally imagined.

It is only quite recently, moreover, that the retreat of the equatorial forest has begun to arouse interest. At the First

International Congress for the Protection of Nature held in Paris in 1923, there was no mention of the phenomenon, and it has been passed over in complete silence in important publications, even of quite recent date. Yet the process is obvious and extremely rapid.

In the Belgian Congo, Stanley found virgin forest at Kasongo, a locality now lost in the midst of a savannah and thirty kilometres away from the actual border of the forest.

In Kivu, the banks of the Lake and all the non-mountainous country have been entirely deforested, notwithstanding an announcement by the authorities in Brussels that in this area all that was necessary was to "supervise clearings". That task is ended, for there is nothing left to clear.

In Ruanda, forest now occupies only one-twentieth of the country, yet there is reasonable certainty, from native evidence, that seven generations (about two centuries) ago twelve-twentieths of the region were under forest. It would be easy to find parallels in Uganda and Kenya, and the same applies to Angola, little as is otherwise known of that territory.

The influence of man hardly suffices to explain the steady diminution in area of the equatorial forest and the alarming rapidity of its retrogression in recent centuries. This forest is, in fact, a relic of itself. It is evidence of a previous set of conditions, having maintained its habitat while the world around it has changed. The situation connotes a state of delicate equilibrium. In the midst of the vast changes which have taken place in Africa, the equatorial forest has remained almost unaltered. As is aptly remarked in a contribution by Monsieur le Conservateur Salvador to the *Revue des Eaux et Forêts* (1921, p. 161) apropos the forest of Sainte-Baume (Department of Var):—"When a forest succeeds in attaining full development thanks to favourable climatic conditions, it creates around itself the habitat necessary for its maintenance and is thenceforward capable of existing indefinitely in its primeval form, despite subsequent modification of the general climate, always provided that the equilibrium established is not upset by the intervention of man"; and this

statement might equally apply to the equatorial forest of Africa. This concept of a plant association at once stable and fragile can be fully understood only by those who have lived in close familiarity with tropical forests.

The conclusion is obvious, that forest of this type must be treated with care. The action of Man must never be opposed to that of Nature. The situation calls for a more intelligent and far-sighted view than one circumscribed by the interests of an individual, a village or a financial company. How often one sees clearings made in a spirit of hopefulness that, from the agronomic standpoint, has no justification in fact. The forest has been destroyed—and destroyed irretrievably—for a meagre and ephemeral profit.

Taking into account the huge distances separating the different points of the equatorial forest (it is as far from the Ivory Coast to Ituri as it is from the Pyrenees to the Caucasus) it will be easily understood that the composition of the forest flora, and the processes of change in forest vegetation cannot be everywhere the same; yet they are analogous. The retrogression is from virgin forest to Couch grass prairie, the latter constituting a definite stage called by the phytosociologists a sub-climax, in contrast to the primitive climax. It is the same everywhere. Intermediate stages may be secondary forest, savannah forest with more or less woody vegetation, and Elephant grass prairie. The occurrence of these stages depends on the nature of the soil and on biotic factors. If fires occur often enough—annually for example—over the same area, there may be a direct transition from primeval forest to prairie.

The accidental destruction of primeval forest or the abandonment of cultivation is usually succeeded by second growth characterised by *Acanthis*. These spiny shrubs, with their lovely pink flowers, are the distinguishing features of a secondary formation much more easily penetrable by fire than primeval forest, which in fact is not inflammable. There are no data available to show how long this formation persists, but actually primeval forest once destroyed never re-establishes

itself. In Africa there is no material proof of this, for nowhere is there a century's experience to draw upon ; but the case of Angkor, where the forest is a secondary forest of *Ficus*, may appropriately be cited in support of this conclusion.

Acanthis scrub does not appear everywhere. Towards the west may be seen *Musanga*, Bracken and other species of the secondary forest, an extensive formation locally encountered throughout the equatorial zone.

The secondary growth may be directly replaced by Bracken (*Pteridium aquilinum*) which succeeds native cultivation. This stage has a duration of about thirty years. Actually, Bracken on cleared land and exposed to full light is unable to reproduce itself by spores. The latter are fertile only under shade, while the rhizomes of this fern can hardly survive for more than thirty years.

Bracken is succeeded by the tall Matétés known as Elephant grass in English, and as *Pennisetum purpureum* by botanists. This giant grass lives for about seventy-five years. It is gradually killed by fire and gives way to Couch grass (*Andropogon* div. sp.), which establishes itself as a definite formation constituting, as we have seen, a sub-climax. Its method of propagation by underground stolons, suffering little or no injury from annual fires, enables it to maintain this hold on the soil. Sometimes, however, Couch grass is replaced by *Imperata cylindrica*.

The entire vegetative transition from forest to Couch grass or to *Imperata* described above cannot have taken more than a century and a half. Its duration can be established with sufficient accuracy from native evidence, which is very reliable in cases where it is not necessary to go farther back than seven generations (say two centuries). It is possible, moreover, to observe the different stages of the transition and even in some cases the passing from one stage to another.

With areas thus degraded, the reconstitution of the forest is clearly impossible by natural means and seems impracticable even by resort to artificial methods. The influence of fire necessarily results in the progressive and gradual impoverishment of all vegetation. The death of the soil must inevitably

ensue, owing to the destruction firstly of its humus layer, and secondly of its micro-flora.

But there are cases where the process of deterioration is even more severe and complete degradation may be sudden, almost instantaneous. In the Upper Uele, lateritic blankets occur: absolute deserts, completely sterile, and extending over the countryside for several square kilometres. Only a few years ago they were covered with dense bush.

The laterisation of the soil, due partly to insolation, partly to intense leaching, and no doubt also to other little understood causes, is a phenomenon peculiar to tropical countries. Subject to certain exceptions¹ laterisation almost always ends in sterility: *physical*, because the surface of the soil becomes indurated to a hard and impervious shell, *chemical*, by reason of the leaching of the soluble elements and the decomposition of the absorbing complex, and *biological*, owing to the destruction by fire of the soil micro-flora and the development of its aridity indicator. These considerations should make one hesitate before destroying a forest to derive benefit from the thin layer of humus that has accumulated in geological ages. A few crops may be wrung from the soil before it is condemned to final sterility, but, judged from the standpoint of the general welfare of the community, it is certainly not a profitable enterprise.

The equatorial forest still covers a large part of the Belgian Congo, a large extent of the southern part of French Equatorial Africa (Middle Congo, Gaboon) and of the Southern Cameroons: it occupies the south of Nigeria, and is only interrupted opposite Dahomey where the savannah extends to the coast. It begins again in the Gold Coast and covers a considerable part of our Ivory Coast Colony. It is said to occur throughout the

¹ The parent rock of the Laterites is of great importance. In Indo-China, where the laterites originate from the decomposition of the Basalts or the Rhyolites, the *red soils* can be very fertile. It may be the same in Africa when the laterites originate from recent lavas (Kivu). But if they originate by the alteration of Granites, Gneisses, or even the Sandstone of the Karoo—as is generally the case in Central Africa—they are wholly or almost entirely barren. It should be noted that in mountain areas (towards 1,800 or 2,000 metres) laterisation of soils does not occur.

