

THE MUKUSI FORESTS OF THE BECHUANALAND PROTECTORATE*

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INTRODUCTION.

A CONCESSION of the timber rights over an area of some 150 square miles in the extreme north-eastern corner of the Bechuanaland Protectorate was granted to a Northern Rhodesian firm in 1935, and it was then decided that a survey of the Territory's forest resources should be made. This, thanks to a grant from the Colonial Development Fund, was arranged; field work began in October 1936 and was completed in April 1938.

GENERAL DESCRIPTION OF COUNTRY.

The area dealt with was about 3000 square miles in extent and lies between the parallels 17° 30' and 18° 45' South and the meridians 24° 10' and 25° 10' East. Outside this area reconnaissances were made to the south-west to Maun and to the south-east to Francistown.

The area is Crown land and adjoins on the north-west the Caprivi Zipfel of South-West Africa; on the east the Colony of Southern Rhodesia; while for a hundred yards or so at Kazungula it marches with Northern Rhodesia in mid-Zambezi.

ROCK AND SOIL.

For the most part the country consists of a loose deep sandy sheet, a portion of the enormous Kalahari sand tract which ranges over parts of Angola, North-Western and Southern Rhodesia, and South-West Africa. The sand sheet itself is flat or undulating and almost continuous. It is, however, broken in places by drainage channels, of which the most important is the Ngwezumba River. The other prominent feature is the basaltic hills of Gcoga (Goha) which rise some 500 feet above the general level of the sheet (*). On the west the sheet is bounded by the valley of the Chobe River, by the broadening flood plain of this river, and by the Mababe Flats.

The Kalahari sands, which were formerly considered to be of aeolian origin, are indeed only in part a blown sand, and in part

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derived *in situ*, or partially so, from the underlying rocks of the Stormberg Series, the topmost horizon of the Karroo System. Frequent outcrops of limestone, "surface" quartzites, basalt and basaltic lavas occur.

The sand sheet is of considerable depth, at least of over 100 feet in places. Two fresh, almost vertical, profiles have been made by the usually dry Ngwezumba River. These reveal about 50 feet of red-brown rather coarse sand which differs very little below the humus horizon either in colour, size of grain, or as regards compaction. The sand sheet lies at about 3000 feet altitude.

CLIMATE.

The mean annual rainfall calculated from figures kept at Kasane, the only recording station in the area, is 25.01 inches on sixty-one days. The maximum rainfall was 35.85 in 1929 and the minimum 14.86 inches in 1931. During the period May to September almost no rain falls. The mean maximum temperature for the hottest month at Kasane, October, is 94.9 degrees Fahrenheit. Frosts occur during the winter, and trees, especially on the edges of glades, are affected. Hoar frosts are occasional on the lower-lying open spaces and will cut back, probably year after year, the coppice growth made on destroyed forest land.

RECONNAISSANCE SURVEY.

The area to be reported on was unsurveyed, but three points on the western edge of the forest had been fixed astronomically. The boundary between Bechuanaland and Southern Rhodesia had been beacons but not surveyed. The forest survey map was therefore built up on these three astronomical beacons.

On this flat forest-clad terrain, triangulation was impossible and the survey was carried out by traverses tied on to the three fixed points. The main traverses were run along the motor roads and the Ngwezumba River.

The main difficulty, once the survey moved away from the Chobe River, was that of water, and camps had to be arranged to take advantage of pools in otherwise dry river beds, pans and water holes, most of which dried up or yielded an insufficient supply as the winter advanced. This caused gaps in the continuity of the survey which had to be filled in during the rains.

The camp was shifted by ox wagon, which also had to draw native rations, horse feed, etc., from the base camps. A Ford V.8 vanette was also used for this purpose and to go out from camp to work where roads existed, also to visit the timber concession which was directly supervised by a Forester. Where there were no roads, a

horse or a saddle mule took one out to enumeration lines or on reconnaissance.

Many miles of rough wagon track were cut through the forest, and even the motor roads in this sandy soil could not be used for wagon traffic as it cut them up too badly. Pack donkeys were used for water supply, and a shooting boy kept the camp more or less supplied with meat.

For enumeration purposes, lines were cut more or less at right angles to the roads from a quarter to four miles apart, depending on the quality of the forest.

The traverse started from a fixed point, and temporary beacons were erected from which the cut enumeration lines were to run. The cutting was done by a gang of boys under a native foreman who worked with a prismatic compass and a perambulator. Each line was four miles long and sufficiently wide to obtain a clear view along it. Its centre was marked with straight sticks and every 1/10 mile marked on a stick.

All merchantable trees within 33 feet on either hand were recorded, the measurements being taken with calipers and a pole graded in feet. A tape was rapidly taken out to any tree whose position in regard to the 33 feet strip was in doubt. This method gave a sample plot of thirty-two acres. Notes were taken on all alterations in the forest types; the return journey to the camp was made on a previously worked out magnetic bearing and further notes taken. During the heat of the day the data obtained were reduced to cubic feet and all details were plotted on a 1/50,000 scale map.

As the timber concession had now been working for over a year it was possible to fix the minimum yield for exploitable forest at 30 cubic feet per acre. Anything over this limit was called Grade I. Grade II included such forest as could be economically worked if near enough to the forest railway, and was plotted to show areas of 20-30 cubic feet and 10-20 cubic feet per acre. Grade III contained no, or almost no, timber at all.

It was found that a well-defined block between Kabulabula and Kachikau contained about 3,000,000 cubic feet, 108 square miles averaging 43.2 cubic feet per acre, and a further 75 sq. m. with 23.4 cubic feet per acre. Otherwise the forest was too poor for serious consideration.

TIMBER SPECIES.

The timber species recorded were :

Baikiaea plurijuga (native name Mukusi). Used for sleepers, parquet, and to some extent for furniture; air-dry weight 53-60 lb. per cubic foot.

Pterocarpus angolensis (Mukwa). A magnificent furniture wood;

air seasons readily without shrinking or warping ; 30-46 lb. per cubic foot.

Ricinodendron rautanenii (Mungongo). White timber about 11 lb. per cubic foot ; used for patterns, packing cases, packing ; has been unsuccessfully tried for match making ; yields the Manketti nut of commerce.

Entandrophragma caudatum (Mupumena). Meliaceous tree yielding handsome beams and construction wood ; air-dry weight 46 lb. per cubic foot ; also used for furniture.

Azelia quanzensis (Mwande). A good furniture wood ; air-dry weight 41-55 lb. per cubic foot ; Pod or Bean mahogany.

Copaifera coleosperma (Manzauri). Sleeper-wood and makes a very handsome parquet ; 50 lb. per cubic foot.

Other timber species include *Burkea africana*, *Erythrophleum africanum*, *Kirkia acuminata* and *Amblygonocarpus obtusangulus*, but these are mostly small, ill-grown or occur only very occasionally.

FOREST GROWTH.

It is on the deep loose sand described above that the so-called "Rhodesian Teak" forest is found. This tree (*Baikiaea plurijuga*) is neither botanically nor structurally akin to the real teak (*Tectona grandis*), and is locally known by its native name of Mukusi. Mukusi is endemic to the Kalahari Sands and grows wherever the soil is sufficiently deep and loose ; it is, in fact, under these circumstances the typical and dominant species. The strength, resilience and decay-resisting qualities of its wood have recommended it as a sleeper timber to the railways of Rhodesia and the Union of South Africa. Timber concessions, principally for the exploitation of this wood, are being worked in Southern and Northern Rhodesia, the output of the latter being in the neighbourhood of 2,000,000 cubic feet per annum.

The forests may be described as Deciduous Woodland ; the canopy is generally too open for Closed Forest. The dominant trees which are too evenly spaced to form "islands" or groups are 30-40 feet in height. The floor layer varies from 2-3 feet high, dense grass to sparse grass, grass mixed with shrub and perennial herbaceous growth, to a dense woody undergrowth, though the last named never attains the density of Martin's Mutemwa. (*)

Although but three main types have been taken it will be apparent that, given a certain equilibrium between their soil requirements, they can under certain circumstances not only exist side by side, but even intermingle over a large extent of country.

The main types are :

1. Mukusi (*Baikiaea plurijuga*).
2. Musheshe (*Burkea africana*).
3. Mopani (*Copaifera mopane*).

Over the whole sand sheet wherever of sufficient depth, it is Mukusi forest, in one or other of its forms, that is the climax vegetation.

At its best it forms an almost pure consociation with a dense grassless understorey of shrubs such as *Bauhinia macrantha*, *Baphia obovata*, *Commiphora fischeri* and *Popowia obovata*. Or it may be found in association with other timber trees such as *Ricinodendron rautanenii* (Mungongo), *Pterocarpus angolensis* (Mukwa), *Entandrophragma caudatum* (Mupumena), with an occasional *Afzelia quanzensis* (Mwande).

In newer forest it is more likely to be found pure or with the smaller tree *Combretum eylesii* (Molubane); or with large *Acacia giraffae* (Camel Thorn) and other Acacias, earlier occupiers of the site. Areas of Mukusi and *Terminalia sericea* (Mohonono) are probably the result of fire damage. The last-named species with its more prolific and annual seeding and its better method of seed dispersal has taken advantage of the cleared ground; but owing to its more light-demanding habit will eventually disappear, unless the succession is again disturbed.

It is unfortunate that Mukusi is less hardy to fire than most of its associates. In many, one might say almost all, parts the trees have a fire-scar at ground level. Decay makes headway but slowly, and the larger trees seem to survive and put on increment while the decay stays localized. But the prospects of the survival of this type as commercially valuable forest are poor.

Musheshe (*Burkea africana*) is found wherever the loose sand sheet has become too shallow for the requirements of Mukusi. This is not to say that it is not to be found occasionally in the Mukusi association, for, like *Terminalia*, it will come in on badly burnt forest; but where it occupies large areas, pure or with Mukwa, it is on partially denuded lines of drainage. Here possibly, on the more compacted dark grey sand, soil acidity prevents the advance of any other tree species. Again, the floor of Musheshe forest, whether of *Burkea* only or of *Burkea-Pterocarpus*, is usually heavily grassed, and the two last-mentioned species are among the most fire-resistant of trees.

Occasional associates of Musheshe are the two timber trees *Amblygonocarpus obtusangulus* (Mbaimbai) and *Erythrophleum africanum* (Mubako). These, however, are very sparsely distributed and often too faulty for exploitation.

Mopani (*Copaiifera mopane*). This type on the stiffer low-lying soils often forms large consociations, as, for example, "islands" on the Siloko, which extends from Kasuma Pan on the Southern Rhodesia border to the source of the Ngwezumba River, and in the valley of that river, and also on the Mababe Flats. As a wood it is too hard and heavy for most purposes, but as a mining timber it is in the front rank where strength and resistance to decay and insect-attack are all-important. It makes a charcoal of good quality. When not growing pure it may be found with several of the Acacias and in the

neighbourhood of Nyumuga, co-dominant with Mukusi. This last mixture is most surprising; it occurs over several square miles of the country, and is due to the very gradual denudation of the sand sheet. In course of time the Mukusi will disappear.

Mopani forest of large trees has a very clean floor; grasses are absent or sparse, so that the effects of fire are reduced. This form will survive for many years; but when growing as "islands", surrounded by the coarse grasses of the Siloko and the river valleys, it has already been reduced to coppice growth which is burnt down almost every year.

The period when the Kalahari Sands were deposited was one of extreme drought. This was followed by a humid period when the sands began to be fixed by vegetation (*). It must be supposed that the transition from dry to moist conditions was a gradual one and that the pioneers were hardy xeromorphic plants, akin to those of the drier Karroo of to-day; that as the climate became more humid and the vegetation formed a humus layer, the flora progressively improved until forest came into existence. Considering the low and badly distributed rainfall of the region to-day, the forest must be considered as of a very high type. The probability is that the present flora was evolved during much more favourable conditions than obtain nowadays and that by adaptation, such as acquiring a deciduous habit or lengthening the leafless period, and by reduction of transpiration while in leaf, it has accommodated itself to the change.

The Chobe District has not been forest clad so long as the corresponding districts to the north, as is shown by the comparatively few species found along the lower Ngwezumba, and the fact that Mukwa (*Pterocarpus angolensis*) is for the most part yet young or has not even arrived.

But even before the general improvement of soil conditions could complete the evolution, man, accompanied by fire, came in. At first the occurrence of these fires was periodical and their effects more severe. The accumulation of many years of leaf-fall and other debris allowed the fire to make a complete killing-back of all above-ground growth. Regrowth had not time to replace the destroyed forest before another conflagration came along. As the inhabitants increased, the period between the fires decreased until, as to-day, most of the forest was burnt over annually. These almost annual fires, however, were much less severe than the periodic ones, as there was much less inflammable matter to feed them, and to this fact is owed the continued existence of the forest.

Selous records that in the eighteen-seventies it was the practice of the local chief to hold a tribal game drive into the confluence of the Chobe and Zambezi Rivers, burning as the drive went forward. Though organized drives have now ceased, villages of wandering

Masarwa follow the game and burn off the grass to attract it to fresh-grown pasture. These burnings when made early do comparatively little harm ; but the later ones are much more severe, and as long as they are continued the deterioration of the forest progresses.

To control the actions of a wandering half-savage people with no fixed abode is almost impossible, and the only hope for the partial protection of the forest seems to be by controlled early burning. Complete protection from fire, to forests which are remote from markets and of low yield, is an undertaking that few forest owners would care to contemplate.

A fourth type occupies a small area on the west, namely, *Brachystegia*, of which the dominants are *Isoberlinia globiflora* and *Brachystegia boehmii*. These species are found as consociates or growing together or in association with other species, and correspond to the Southern Plateau *Isoberlinia globiflora* and *Brachystegia* woodlands on sandy loams, extending on to the Kalahari Contact Soils of Trapnell and Clothier (?), and possibly indicate a change from Kalahari Transitional to Kalahari Contact loam. (It may be mentioned that the classification of the *Brachystegias* has proved extraordinarily difficult and that their nomenclature is still vague.) Economically speaking, the type is of little importance ; but botanically the area upon which it is found is of considerable interest, for only here are found *Swartzia madagascariensis*, a large Mimosops—a tree of the anthills—and *Monotes glaber*. Here also *Securidaca longipedunculata* is found as a fair-sized white-barked tree to 15 inches d.b.h. and 20 feet of branchless bole ; elsewhere this plant has only been found at the Chobe-Zambezi confluence, and there it is rare and of the usual shrub by habit. Another characteristic tree of this area is the *Dialium simii* (Muhamane). The type is much more self-contained and less apt to mingle with the others, though often sending out outliers on sites slightly above the surrounding country. Its range is probably limited by being more frost-tender and having a shorter deciduous period.

As already pointed out, the forest of the Chobe sand sheet is considerably younger than that on the opposite bank of the Zambezi, and therefore, as might be expected, the present limit of range of several species is found within a few miles of the big river. *Pterocarpus stevensonii* (Mwangura), so common an associate of Mukusi in the Mutemwa forests of the Sesheke District, is represented by a few trees at Old Kazungula and on the rocky escarpment of the Chobe between Kasane and Sidudu. Many Angolan species, such as the well-known *Afrormosia angolensis*, do not occur at all. *Ostryoderris stuhlmannii* does not range more than three miles from the Zambezi. *Pterocarpus angolensis* has not yet invaded the whole of the sand sheet, and in many parts is only represented by immature trees. *Isoberlinia globiflora* and *Brachystegia boehmii*, advancing from the

east, are wholly absent in the south-west. *Monotes glaber* is found to a limited extent only near Sitengu. *Popowia obovata*, a common member of the understorey in the northern Mukusi forest, goes but little west of Kachikau.

Twenty-three trees and other plants were listed as yielding edible fruits; they make an important addition to native diet which is generally of too exclusively a farinaceous character.

INHABITANTS AND THEIR MODE OF LIFE.

With the exception of two small Batawana villages at Kwikamba, all the villages lie west of the sand sheet. This is due to the local system of agriculture which is that of "mashimu" or "water garden", suitable ground for which is found along the ancient channels on, or near, the Chobe River. Consequently shifting cultivation and destruction of forest for this purpose does not occur. Firewood, hut building material and ox yokes are the principal native requirements from the forest, and these at present are negligible compared with the damage done by fire.

Goats are fortunately few in Chobe. Cattle browse in the woods when the pasture outside is very dry, and the large herds of the European cattle speculators do a certain amount of damage to regeneration. These, again, are as nothing in comparison with the forest fires, for which the ubiquitous Masarwa must be held chiefly responsible.

Supposedly a mixture of Bushman and Bantu, this people now occupy a social position between the two. They are to some extent stock-owners and occasionally seek employment from Europeans. They have no permanent villages, but spend their time in wandering from water hole to water hole hunting. They do not cultivate, and rely on bartering game meat with the natives for grain and tobacco. It is significant that there is a tariff for giraffe tails which both natives and Masarwa use extensively for bangles, is. for an average tail, or rd. for a made-up bangle. The Masarwa are mostly armed with old-fashioned muskets or rifles and hunt in an area until the game has disappeared. Then they move on, burning the grass to attract game to the fresh-grown pasture, and thus cause most of the forest fires. Honey, chiefly that of the small stingless bee, with wild fruits and game meat, form their usual diet. These nomads number several hundreds.

FAUNA.

Though the Lonsdale Library *Big Game* volume omits all reference to the game of this part of Africa, the game includes a large number of species and is very numerous. Among the rarer animals are the lechwe in herds of several hundreds in the long-grassed, reedy slopes

of the Chobe; puku on the more open river banks, where is also found a small bush-buck between the harnessed antelope and the Cape variety, which Selous, thinking it to be a new species, called the "Chobe bush-buck".

The commonest buck of the Mukusi forest is the sable antelope, running sixteen to twenty together. Blue wildebeeste form large herds on the Mababe Flats. There are a few hippo on the lower Chobe. During the winter the elephant used to wander within a hundred yards of the Kazungula quarters; they do not run to big ivory, 35 lb. would be about the limit. Eland are occasional and small. Other animals are kudu (some very good heads), impala, water buck, roan, buffalo (not common), giraffe, warthog and ostrich.

Lion are numerous and take a heavy toll from cattle owners. Leopard are occasional.

Geese and duck are plentiful on the backwaters and most of the larger pans carry duck, including the exquisite little Madagascar duck; guineafowl, about five different francolin, most of which do not flush readily, occasional sand grouse, black korhaan and paauw.

Tiger fish are caught on the Zambezi and lower Chobe and, though not very large, give excellent sport.

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