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EXPLOITATION OF BOTSWANA'S FOREST RESERVES: A CAUSE FOR CONCERN?

By Colin Millar, Director FAB

ABSTRACT

A brief description of the definition, location and designation of the six gazetted forest reserves in the Chobe District of north eastern Botswana is given. The main vegetation types and their protection are described. Exploitation by the concessions granted is reviewed and concern is expressed about the lack of knowledge of, and provision for, regeneration of the source.

DEFINITION OF FOREST RESERVES

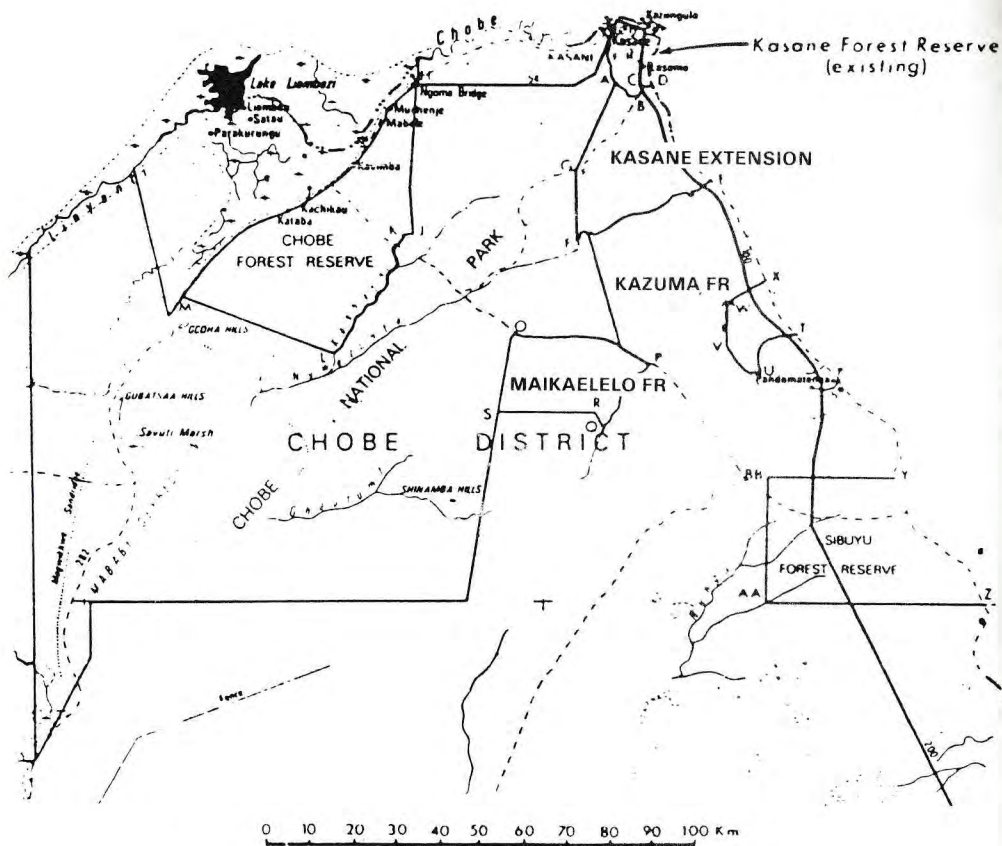
The present Forest Reserves in Botswana are areas of closed forest and open woodland declared by the President by notice in the Government Gazette, with a view to their commercial exploitation for valuable timbers. Declaration introduces certain restrictions. Under the Forest Act (cap 38.04 1968), within the Reserves the felling of trees, burning of grass, hunting, grazing of livestock or cultivating without a licence is prohibited and local people may collect wood or other tree products only for their own use and not for sale. Within a Reserve it is an offence to contravene any of the above restrictions or the terms of any licence granted and to refuse to assist in firefighting if called upon by an authorised forest officer.

The management and policing of the Reserves is vested in the Government Forestry Unit which is a sub-section of the Division of Land Utilization, within Field Services in the Ministry of Agriculture. This Unit, with a professional staff of less than ten to cover the whole country, is charged with the supervision of all exploitation licences, fire control and the collection of any revenues from royalties which may be levied on forest products from the Reserves.

All six Forest Reserves declared to date are in the Chobe District in the north east of the country (Map 1).

Declared	Name of Reserve	Area (hectares)
1968	Kasane FR	16,250
1981	Kasane Extension	47,500
1981	Chobe FR	188,000
1981	Kazuma FR	23,750
1981	Maikaelelo FR	62,500
1981	Sibuyu FR	<u>117,500</u>
		<u>455,400</u>

Note: It proved difficult to obtain consistent figures for the areas of the Forest Reserves. The areas above are from the Chobe District Report to the National Conservation Strategy in 1986 and seem to equate to the areas shown as Forest Reserves on published maps.



MAP 1 — BOTSWANA'S FOREST RESERVES 1987

CLIMATE, SOILS AND VEGETATION

The climate in Chobe District is sub-tropical with distinct summer and winter seasons. Temperatures range from freezing to +39 C and the summer rainfall (September to April) from 500mm in the S and SW to 750mm in the NE. Soils vary from deep Kalahari sand ridges to plains of black cotton type and thin soils on outcrops of limestone and basalt.

Vegetation

Accounts of the vegetation of the Chobe District are given by Blair Rains and McKay (1967), Child (1968), Simpson (1975) and Sommerlatte (1976). Descriptions of the woody vegetation are contained in Henry (1966) and Henry (1978).

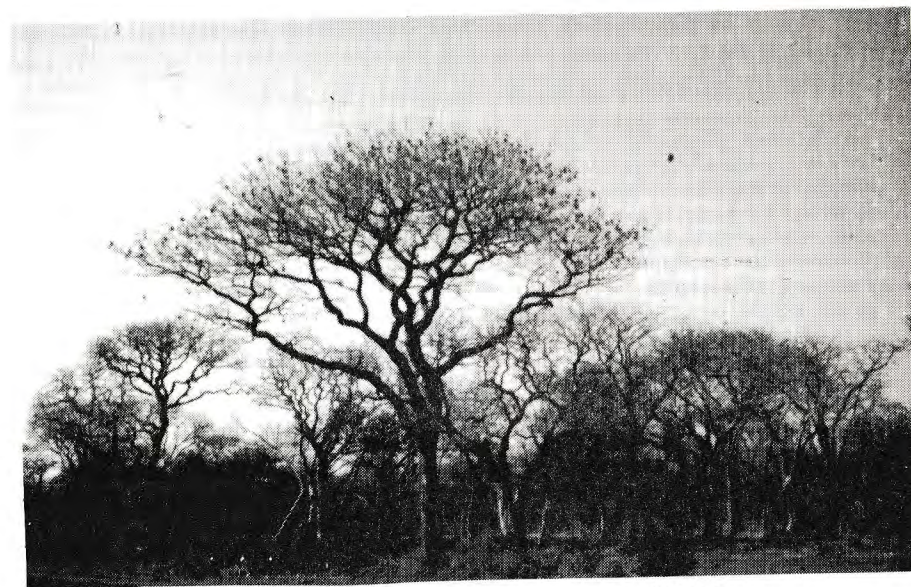
The main vegetation of the Chobe District Forest Reserves is open woodland with *Baikieae plurijuga* (mukusi or teak) in the north and east and *Pterocarpus angolensis* (mukwa) in the south. The mukusi which occurs mainly on deep sand ridges, is part of the Zambesi teak forest which stretches in a narrow belt from Angola and Namibia to Zambia and Zimbabwe (See Maps). Mukusi occurs both in dense stands and as scattered trees. It is associated with the following timber species listed by Henry (1966 and 1978).

Timber species

Pterocarpus angolensis
Ricinodendron rautanenii
Erythrophleum guineense
Afzelia quanzensis
Guibourtia coloesperma
Burkea africana
Kirkia acuminata
Amblygonocarpus andogensis
Brachystegia spiciformis
Entandophragma caudatum

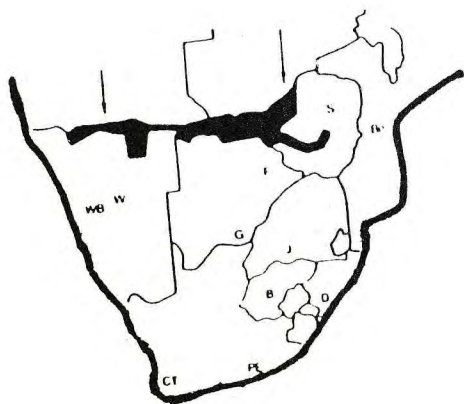
Vernacular names

mukwa	morotomadi
mongongo	mugongo
mmako	
mwande	motshibi
tsaudi	monato
mosheshe	muzumina
modumela	
mbaimbi	
muvombo	
motlhokomoti	



MUKWA FOREST IN THE CHOBE DISTRICT

Mukwa is a much more widespread species which can be found also in Namibia, Zimbabwe, Mozambique, RSA and countries to the north. It too can be found in dense stands but is mainly scattered with only a few trees per hectare.



DISTRIBUTION OF MUKUSI

(from *Trees of Southern Africa*, Coates Palgrave, K., Struik, 1983)

The Chobe FR contains mainly *B.plurijuga*, *P.angolensis*, *G.coleospermum*, *E.caudatum* and *A.quanzensis* with an exploitable volume of over 200,000m³ for timber purposes.

Kasane FR and the Kasane Extension contain both typical teak forest and also a type of miombo woodland dominated by *Brachystegia* species in mixture with *Julbernardia globiflora* and other sub-canopy tree species. In 1978 it was estimated to contain about 36,000m³ of royalty logs. By mid-1986 about 30,000m³ of teak plus mukwa had been extracted by Chobe Forest Industries.

The Sibuyu Reserve is on a series of sand ridges. It contains about 100,000m³ of high quality timber which is subject to damage by fire and elephants.

No data are available for the detailed composition of the Maikaelele and Kazuma Reserves in which no concessions have yet been granted.

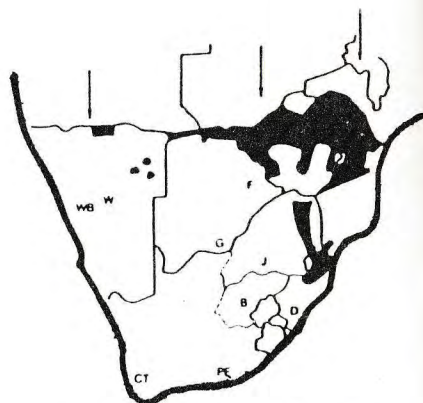
Estimates for standing volume of desirable timber species of royalty earning size range from around 1,5m³/ha to 4m³/ha giving a possible total resource of over 1,000,000m³ with current market value of at least P300 million (Wagner 1987).

PROTECTION

Protection of such a valuable resource is necessary and takes the form of protection from damage by humans, game and fire. There is currently no protection from pests and diseases.

Humans

Under section 11 of the Forest Act, five timber trees and three fruit trees are protected on



DISTRIBUTION OF MUKWA

State Land in the Chobe District. (Table 1). A licence is required to fell, cut, burn or remove a protected tree for whatever purpose.

Table 1 Protected trees on State Land in Chobe District

Timber trees	Vernacular name
<i>Afzelia quanzensis</i>	Pod Mahogany, Mwande
<i>Baikia plurijuga</i>	Zambezi teak, Mukusi
<i>Guibourtia coleosperma</i>	Tsaudi, Motshibi
<i>Pterocarpus angolensis</i>	Blood Wood, Mukusi
<i>Entandophragma caudatum</i>	Brown Mahogany, Mopomena
Fruit trees	
<i>Adansonia digitata</i>	Baobab, Moana
<i>Berchemia discolor</i>	Motsntsilala, Mozinzila
<i>Diospyros mespiliformis</i>	African Ebony, Mokochoong

Source: Laws of Botswana, Forest Cap 38:04 1968

All the Forest Reserves, with the exception that the Kasane Extension is not mentioned specifically, are in the Directory of Afrotropical Protected Areas, drawn up by the Conservation Monitoring Centre of the International Union for the Conservation of Nature (IUCN). As such the IUCN is concerned that they are managed adequately for sustainable utilisation. *B.plurijuga* is one of the species listed by the FAO Panel of Experts on Forest Gene Resources as being in urgent need of attention (Palmberg in Pearce 1986).

Game

The existence of the Chobe National Park and the Mikaelele Game Reserve within the Chobe District and the proximity to several international borders poses problems for game management in the Forest Reserves. Elephants abound in the District and are destructive to several timber trees including mukwa. In 1950 there were only a few hundred elephants in Chobe NP., 5-600 in 1963, 900 in 1965, 6000 in 1976, 25000 in 1980 and possibly 50,000 in northern Botswana in 1987 (Child 1968; Somerlatte 1976; Henry 1978; Calef 1987). The increase exceeds the normal maximum increase due to reproduction by 10% and is attributed to in-migration from contiguous countries and movements within Botswana (Calef 1987).

Elephants damage trees by breaking them to reach leaf fodder, stripping bark and pushing them over. This renders the trees vulnerable to fungi, fire and drought. Decayed and damaged wood is normally useless for commercial purposes.

Whilst elephants are undoubtedly destructive to existing trees, they and other game, especially ungulates, might assist regeneration by removal of understory species and by ground disturbance. In Zambia it is thought that the reduction in regeneration of the mukusi forests is associated with the great reduction in the population of large mammals which would normally suppress the mutemwa or thicket undergrowth.

Fire

Fire is endemic in the dry forests of Botswana. The Forest Act of 1968 states that it is prohibited to set fire to grass or undergrowth or, indeed, to light a fire or fail to extinguish

one within a Forest Reserve. Fires within 1,61km (1 mile) of the boundary of a FR may be extinguished if it is thought that they might become dangerous and a forest officer may call on any able bodied person to assist. Failure to assist is an offence punishable by a fine or three months in prison.

Fire protection in Chobe District started in 1935. Early burning (i.e. May — August) of grass within the forests was practiced and some firebreaks 3,5—7,5m wide were cut. These were destumped initially and harrowed annually. Fire watchtowers were erected at Kasane and Serondela. Early burning was again practiced but serious damaging fires still occurred. Unfortunately differences of opinion arose between the Forestry Department and Game Department in 1966 over the use of fire as a management tool. Fire control was however still applied in 1967-69 but lapsed from 1969-75 when it was again revived using graders in the firebreaks.

In 1983 about 75% of the Chobe District burned scarring many trees. In 1984 a programme of upgrading firebreaks was started covering the Kasane, Kasane Extension and Chobe Reserves and early burning applied west of Pandamatenga. Firebreak upgrading and prescribed burning were paid for from Drought Relief initially but local business also contributed funds. In 1984 a fire burned west of Pandamatenga and at Savuti from mid-September to the end of October covering 20,000ha and damaging many valuable timber trees. The Chobe District report to the National Conservation Strategy instances lack of fire control facilities and bad maintenance of firebreaks as problems associated with forestry in the District. Mukusi, which originated in tropical moist forest, is thin barked and extremely sensitive to fire. By contrast, mukwa shows considerable tolerance of fire.

EXPLOITATION OF THE RESERVES

Historical

In the colonial period an inventory was made of the Chobe forests (Edwards 1934) which resulted in the granting of the Susman Concession of 379km² in 1935. Permission was granted to extract timber from an area just south of the Chobe river and east of Kasane, now part of the Kasane FR. Over 40,000m³ of logs of mainly mukusi were extracted and transported in the round (i.e. without conversion to boards) to Rhodesia and South Africa from 1935 to 1938.

A subsequent enumeration further west along the Chobe river by Major O.B. Miller (Miller 1938) covered an area of about 5000k². Within this, in 1944, the Chobe Concession (Bechuanaland) Limited started extraction as far as Ngoma and operated a sawmill at Serondela from 1945 to 1955. Approximately 150,000m³ of timber was extracted from over 1000km² (Henry 1978).

Further inventory in the Chobe District was made by PWT Henry whilst serving as Forest Officer at Kasane from 1963 to 1966. The object was to determine whether sufficient timber was available to interest companies in re-establishing a forest industry in the District. Henry surveyed the Sibuyu area, (Henry, 1963), and a large area north of the Kukulwane plains and the Ngwezumba river (Henry, 1966). Proposals were then made by the Forest Department for simultaneous game and forestry management over that area but these were rejected by the Game Department. As a result separate Forest Reserves and the Chobe National Park and Mikaelele Game Reserve were created after 1968.

A concession was granted to Mukusi Sawmills Limited in 1968 to extract from Chobe

forest but no agreement was signed and the concession lapsed. Renewed interest by the timber industry led, in 1977, to Henry reassessing the timber volumes in the Kasane FR and the Kavimba block in the Chobe forest to find out if they had changed significantly (Henry, 1978). Volumes of mukusi did appear to have increased in both forests but the increases were not statistically significant. Mukwa appeared to have decreased in volume which was assumed to be due to elephant and fire damage. Henry drew up a draft agreement which forms the basis of the two present concessions.

The present concessions

Exotic Timbers Botswana is a small business operating what is known as the Wallace Concession granted in 1983 over a large area to the west of Sibuyu FR with a sawmill at Borehole 171 in the Sibuyu FR. Permission was granted to extract 2,500m³ of timber per year. Work started in 1984 when about 20 people were employed. The small output of up to 3m³/day concentrates on high quality long logs of mukwa to offset the high cost of haulage to the mill of the widely scattered trees.

Chobe Forest Industries (CFI) is a much larger concern managed by four expatriates from Zimbabwe and employs around 230 people. It is owned privately but Botswana Development Corporation has a one sixth share. The CFI concession granted in 1983 allowed for the extraction from Kasane and Chobe FRs of between 7,500 and 20,000m³ per year of timber of mukusi, mukwa, *G.coleospermum*, *A.quanzensis* and *E.caudatum* above certain minimum stem diameters. In addition, unrestricted amounts and sizes of eight other minor species can be extracted.

CFI set up an unsophisticated (bush) sawmill near to Kasane in 1983. It is powered by a diesel generator. Logging started in the Kasane FR in May 1983 but moved to Chobe FR in April 1985, although the Kasane Reserve was not exhausted, to enable CFI to meet increased orders for mukwa. In the first four years of operation approximately 20,000m³ of timber was produced from 40,000m³ of logs. Royalty at about P12/m³ is paid on logs over a specified size. The table below gives details of volumes in cubic metres of royalty logs extracted by CFI.

YEAR	MUKWA	MUKUSI	OTHERS	TOTALS
1983-84	1488	5835	300	7623
1984-85	1326	6469	300	8095
1985-86	3085	6338	nil	9423
1986-87	4578	3822	11	8311
/	10477	22464	611	33552

The total volume extracted from the concessions is about 15,000m³/annum. Non-royalty logs increase the volume of mukwa extracted by about 12% and mukusi by 30%. The average sizes of royalty and non-royalty logs were for mukusi 0.18 and 0.07m³ and for mukwa 0.25 and 0.12m³ respectively.

The main markets for mukusi are for railway sleepers (P450/m³) and parquet flooring (P150/m³) whilst mukwa fetches from P250-800/m³ for furniture depending upon the quality and colour of the wood and P500/m³ for veneers. Over 90% of production is exported, mainly to Zimbabwe and the Republic of South Africa. Royalties of over P100,000 per year have accrued to the Botswana Government. These are distributed 40% to the Government and 60% to the Chobe Land Board.

Extraction and conversion

In the Forest Reserves the government foresters identify larger trees, which must be left as seed trees, and monitor the cutting of mukwa above 35cm diameter at 1.5m above the ground and mukusi and other species of over 30cm diameter. The trees are felled with chain saws, leaving as little stump as is practicable, and cross-cut into logs of lengths appropriate to their anticipated final use, e.g. railway sleepers of 1.83m. Logs from main trunks and larger branches are graded and marked by the forester for royalty purposes and hauled by tractor to extraction lines where they are loaded onto trailers or trucks and transported to the sawmill, a distance of up to 70 km. Average extraction is 5 trees per hectare.

At the mill they are offloaded for conversion to boards using a large circular saw. For the hard mukusi for railway sleepers this is appropriate but for the valuable mukwa for furniture this is a rough method which results in undue wastage. The recovery rate of saleable timber has been variously estimated at as low as 26% for mukwa and 31% for mukusi (GOB, 1983), 35% (ERL, 1985) or 38-57% (BEMP, 1987).



TIMBER LORRY CARRYING MUKWA LOGS

Residues

Several reports have drawn attention to the potential for using these residues and wood left in the forest as fuelwood or charcoal or for a gasification plant (e.g. ERL, 1985). These options are reviewed in the Botswana Energy Master Plan (Vol. 1, 1987). Assuming an average mill conversion rate of 50%, total residues could amount to around 1700m³/month which, if converted into charcoal, could produce about 700 tonnes per year which is more than enough to satisfy the current charcoal market in Botswana. Chobe Forest Industries is now producing charcoal with the assistance of BEDU.

Alternatively the wood could be transported south to Francistown or Gaborone or places en route. At full transport costs delivered prices would not be competitive with current local prices but if otherwise empty freight vehicles returning from Zambia to Gaborone or RSA were used at fuel cost then prices become very attractive.

The gasification option was introduced by Powergas (Pty) Ltd of RSA when, in 1985, it proposed to use waste from the Chobe forests in a fluidised bed gasifier in Maun to produce electricity to sell to the Botswana Power Corporation but this has not been pursued by the company.

PROPOSALS FOR FURTHER DEVELOPMENTS

There is considerable interest in the potential for further exploitation of the forest resources of the Chobe District. Apart from the existing concessions, which still have up to 6 years to run, Botswana Development Corporation has commissioned a consultancy, to look at the viability and future potential of the reserves, which is to report in July 1987. A large international firm with timber interests has made its own assessment of the potential for development. A consultancy funded by German Technical Aid (GTZ) is developing a programme for the planning of the resource utilisation in the Okavango delta region which includes consideration of the forestry interests.

A number of smaller companies making furniture and construction timbers have shown an interest in the possibility of expansion using local timbers and two companies are reported to be setting up kiln drying facilities. The Chobe District Report to the National Conservation Strategy states that the Chobe forests are underutilised for both the main and minor species and that the demand for timber is not satisfied, thus implying that further exploitation is both practicable and desirable.

Although such interests may be aware of the need for sustaining the resource, they tend to concentrate on the economic aspects and ignore the ecological effects of exploitation. Any new proposal for exploitation of the Chobe resource should contain an environmental impact assessment which will, in particular, examine the proposed method for regenerating the resource. Unfortunately the evidence from the conference on the Teak Forests of Southern Africa (Ed. Pearce, 1986) suggests that we do not yet know enough about the factors which promote or control regeneration of the teak forests to make confident recommendations. Thus, considerable research is still required to ensure that further exploitation, especially combined with lack of adequate control of elephants and fire, will not alter completely the composition of the Chobe Forest Reserves from valuable to relatively useless timber trees.

DISCUSSION

The Teak Forest Conference, held in Livingstone, Zambia in 1984 (Ed. Pearce, 1986), noted that no major concessions are now permitted in the teak forests of Zimbabwe and recommended that serious consideration be given to reducing the allowable cut in Zambia until adequate inventory had been completed, and that similar inventories should be undertaken in other countries. A plea was made for increased expenditure on the management, protection and research in teak forests. Ideas on how to save and regenerate the teak forests included improved sawmilling, utilization of associated timber trees,

research into the role of the fauna in mukusi regeneration, the development of early burning expertise and increased public awareness and cooperation with local residents regarding the use of the forests.

A recent World Bank mission Forestry Sector review, at the invitation of the government of Botswana, is extremely critical of the current government-backed inefficient exploitation of the Forest Reserves and recommends changes in land use, for example to game management, or immediate improvement in forest management of the Reserves with updated inventory and revised concession contracts to better use the resource (Wagner, 1987).

It is thus questionable whether exploitation should be allowed to continue, bearing in mind our present ignorance of methods to ensure regeneration of the forests. At the present level of royalties (about P12/m³) and rate of cutting, revenue from the reserves would be only P12 million over about 100 years which, compared to other sources of income available to the Government, is negligible. On the other hand, forest industries create much needed jobs and if the timber is converted within Botswana giving added value then considerable import savings can be made.

There is, therefore, a case for the carefully controlled exploitation of the Chobe forests for low volumes of high quality timbers to produce high quality goods such as fittings and furniture within Botswana. There is little justification for extracting large volumes for relatively low value products such as railway sleepers and mining timbers until we are sure that successful regeneration of the resource can be accomplished.

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