This technical note is one of a series of working papers, technical data or interim reports prepared during the course of the UNDP/SF/FAO Botswana Project. The conclusions and recommendations given in this note are those considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the Project.

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UNDP/FAO/SF/359 (BOT 1)

SURVEYS AND TRAINING FOR THE DEVELOPMENT OF WATER RESOURCES AND AGRICULTURAL PRODUCTION

VEGETATION AND GRAZING CONDITIONS IN THE GHANZI - KALKFONTEIN - MAMONA - MAKUNDA - KULI - NOJANE REGIONS IN WESTERN BOTSWANA.

by

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FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS.

Gaborone 1971

C O N T E N T S

TERMS OF REFERENCE

This Survey was undertaken by the Project at the request of the Ministry of Agriculture with the following terms of reference.

1. To confirm that the stocking rate of 1 A.U. : 40 acres, proposed by Blair Rains, is feasible, indicating how it might be varied in different farm areas and on commonage areas, and what might be the best form of stocking or rotational grazing.

2. To indicate what further ecological investigation are required.

3. To examine the proposal to develop fenced cattle ranches in areas at present hardly used, to define village commonage areas, and to attempt to control grazing to improve the already devastated areas and prevent the spread of further devastation.

ITINERARY FOLLOWED:

4.2.71	Gaborone - Morwamusu.	
5th	Morwamusu - Kalkfontein via Ghanzi.	
	Discussions:	Mr. Williams V.O. Ghanzi and Vickerman Brothers.
6th	Kalkfontein - Kalkfontein	
	Discussion:	Messrs. L.C. and J.J. Sharp. Mr. Babish.
		Inspection of the Nogodimo area along the Ukwa Valley.
7th	Kalkfontein to Mamona:	by following the territorial boundary fence from where it joins Mr. J.J. Sharp's farm.
8th	Mamono - Makundu :	Inspection of village areas.
9th	Makundu - Kuli:	Discussion with Mr. Bond and inspection of Tshukudu Pan area and land along the S.W.A. boundary fence North-West of Kuli. Discussion with Elder Ramoshwaane and visit the pan.
10th	Kuli - Matlho-a-phuduhudu via Nojane.	
		Inspection of grazing areas South-West and North-East of Nojane. Discussion with Mr. Paxton Moleta, Veterinary Assistant.
11th	Matlho-a-phuduhudu - Kang, via Lehututu and Tshane.	
12.2.71	Kang - Gaborone	

A C K N O W L E D G E M E N T S

My thanks are due to the Ministry of Agriculture for requesting the visit and for making transport available and to the Project Manager of the UNDP/FAO Project 359 for permission to carry out the Survey.

Driver Tom Tshweunyane proved most capable, pleasant, willing and helpful throughout the trip.

The District Commissioner at Ghanzi assisted in supplying petrol and I appreciated brief discussion with Government Staff and Private Individuals at Ghanzi and en route.

VEGETATION AND GRAZING CONDITIONS

IN THE GHANZI - KALKFONTEIN - MAMONA - MAKUNDA - KULI - NOJANE REGION.

1. GENERAL.

The area has suffered a number of severe drought years that killed some of the perennial tussock grasses and stunted Grewia Flava and other shrubs. The rainfall during the 1970/71 season has been exceptionally favourable and in some areas grass growth is remarkably good.

Most of the area is covered by sand of various depths. Calcrete occurs in the low-lying areas and depressions. It is a most characteristic formation in and around the numerous pans throughout the area. To the north of Mamona is a large sands - stone ridge that seems to be quartzitic in places. It runs roughly from east to west across the border into South West Africa.

2. BACKGROUND.

The vegetation, soils and climatic conditions of the area are described by Blair Rains and Yalala in a report on the "Central & Southern State Lands, Botswana, 1970". They discuss possible ranching development in several areas and point out that the low carrying capacity of the area necessitates a high level of investment in boreholes and pumping equipment to avoid overgrazing. They estimate the carrying capacity to be in the region of 35 to 40 acres per head, and consider that successful development would only be possible with the application of great skill.

The Mission sent from the Commonwealth Relations Office in 1952 to investigate the possibilities of economic development in the Western Kalahari, felt that it was necessary to urge development in this vast empty region but they were very conscious of difficulties which existed.

Inadequate communications over difficult terrain, inavailability of water supplies, poor and erratic rainfall, unstable pasture conditions and other factors were among some of the major obstacles mitigating against economic development.

They emphasised that operating expenses would have to be kept low, that the dividend on capital invested will, for many years, be low and that the capital itself will only be recovered at the end of a very long time even if everything possible were done to run the enterprise efficiently under sound management. The probability of developing land with a carrying capacity of less than one beast to 30 acres was doubtful and it was considered that care would have to be taken not to burden such land with excessive capital costs.

On Page 11, of the report for an application by the Government of Botswana for a loan to finance a livestock industry development project, 1970, the main aspects and problems of the livestock industry are briefly summarised.

In the outline of the project area proposed for the

Western/.....

Western State Lands on pages 14 to 18 the structure envisaged is briefly described. Existing conditions relating to climate, soils, hydrology, vegetation and the condition of used land are not favourable.

The units of land proposed for the ranches are enormous and the livestock numbers relatively small for the very substantial capital investment required. Overhead capital and management costs will undoubtedly be extremely high.

3. VEGETATION PATTERN.

The vegetation pattern is relatively simple. It consists of a relatively small number of local dominants, following a catena sequence which may be fairly regular or most confused, depending upon topography and local conditions. There is considerable intermingling of species in the transition zones or in areas with irregular features.

3.1 Acacia lenderitzii/Acacia giraffae along flat crests.

Flat crests of ridges frequently support Acacia lenderitzii and Acacia giraffae. The dominant grasses include Anthephora pubescens, Digitaria milanjiana, Schmidtia pappophoroides and Brachiaria dura Schmidtia occurs extensively as one of the dominant grass species.

3.2 Terminalia Sericea along upper slopes.

Terminalia sericea grows abundantly along most of the upper slopes and in places where there is a considerable depth of sand, Bauhinia macrantha is locally abundant and is widely distributed.

The main grasses include: Digitaria milanjiana, Stipagrostis uniplumais, Eragrostis pallens, Eragrostis lehmanniana and Trichclaena monachne. In areas where selective grazing occurs, stipagrostis is generally dominant.

3.3 Acacia lenderitzii/Acacia giraffae along lower intermediate slopes growing intermingled with Acacia giraffae, Grenia flava, Boscia albitrunca and Lonchocarpus nelsii.

The dominant grasses include: Digitaria milanjiana, Urochloa trichopus, Panicum coloratum, Panicum repens and Schmidtia pappophoroides and individual species which are frequently locally abundant.

3.4 Acacia mellifera along lower slopes fringing drainage zones and pans.

Acacia mellifera characteristically grows along the edges of drainage lines and around calcrete pans. It grows in dense impenetrable thickets and frequently ousts grass growth. It sometimes occurs locally abundant on higher slopes, apparently in places where calcrete is near the surface.

On heavier soils it is generally associated with impervious clay along and adjacent to drainage lines.

Lycium tenue grows locally abundant in association with Acacia mellifera.

The dominant grasses include Cenchrus ciliaris, Urochloa trichopus and Digitaria eriantha. Different species may occur in local abundance. Annuals such as Chloris virgata, Dactyloctenium aegyptium and Tragus racemosus occur frequently. Bare ground is a common feature.

3.5 Catophrates alexandri along calcrete drainage lines and in pans.

Catophrates occurs commonly on calcrete in drainage lines and pans. It is frequently associated with Acacia mellifera and seems to increase with uncontrolled grazing. It is browsed to some extent.

Common grasses include Cenchrus ciliaris, Chloris virgata, Dactyloctenium aegyptium and Tragus racemosus. There is frequently a preponderance of Acanthaceous shrubs. The soil is generally very shallow. Calcrete frequently protrudes above the soil surface.

3.6 Boscia albitrunca, an excellent browse tree is widely distributed throughout most communities. Ziziphus mucronata grows in some pans and also occurs throughout the region.

A number of other woody species and grasses are prominent; they are widely distributed and locally abundant and include:

3.7 Dicotyledons:

Grenia Flava, excellent for browse.
Grenia refinervis, excellent for browse.
Clerodendrum uncinatum, an undesirable spreading weed.
Elephantorrhiza elephantina.
Tylosema fassoglensis - Seeds are removed from large green pods for roasting.
Ehretia rigida - a palatable browse shrub.
Otoptera burchellii, a useful pasture legume.

3.8 Grasses:

Schmidtia pappophoroides.
Digitaria milanjiana.
Stipagrostis uniplumis.
Anthephora pubescens.
Urochloa trichopus.
Diplachne fusca.

4. GRAZING CONDITIONS.

4.1 Areas away from Villages and Settlements.

Grass growth in a few areas is good but the ground cover generally s poor. Vigorous growth and dark green herbage was generally associated with an abundance of Urochloa trichopus that re-seeded very well, particularly along fire breaks and road sides. There was a good growth of grass between No, 1 Ghanzi farm, Happy Valley, belonging to Mr. J.J. Sharp and Karakobis. The grasses observed included Schmidtia pappophoroides, Digitaria milanjiana, Anthephora pubescens, Brachiaria dura, Tricholaena, Monachne, Urochloa trichopus and Stipagrostis uniplumis.

In the area/.....

In the area North West of Karakobis and north of Mamona the pastures were very poor. The perennial grasses have suffered severely from drought, insufficient grazing and exclusion of fire. The grass tussocks were largely completely dead and moribund with very little re-growth or re-seeding. In areas which had been burnt there was a considerable amount of re-growth from portions of Anthephora pubescens and Digitaria milanjiana tussocks which were still alive and there was good re-seeding of Digitaria milanjiana and Urochloa trichopus.

Similarly, poor pasture conditions prevailed in most of the area observed between Mamona and Nojane and in the Ukwi Valley between Kalkfontein and Nogodimo near Gobololo, Stipagrostis uniplumis tussocks and other grasses were largely moribund and the ground cover extremely poor.

To the north west of Nojane in the area adjacent to the South West Africa border fence, pasture growth was fairly good. The dominant grasses included Schmidtia pappophoroides and Digitaria milanjiana. From Nojane westwards to Matlho-a-phuduhudu conditions were variable and the grazing was mostly of reasonably good quality, after some excellent stands of Urochloa trichopus and other grasses.

4.2 Village and Settlement Areas.

The village areas, without exception, are characterised by bare ground, soil erosion, encroachment of undesirable bush and the most objectionable weeds of every description. Grass growth is either absent or represented by a sparse growth of Tragus racemosus, Aristida adscensionis and Chloris virgata. The dismal picture, with minor variations is repetitive from village to village.

The most noticeable bush and annual weed species include:

Acacia stolonifera.
Acacia fleckii.
Acacia mellifera.
Commiphora pyracanthoides.
Dichrostachys cinerea.
Elereodendrum uncinatum lanceolatum.
Lycium tenue.
Catophractes alexandri.
Gnidia polycephala.
Crotalaria lotoides.
Tribulus terrestris.
Solanum panduraeforme.
Sericorema remotiflora.
Limeum linifolium.
Talinum crispatulum.
Cassia Italica.
Asparagus africanus.
Heliotropium steudneri.
Alternanthera repens.

The area of destruction and desolation around each village extends for a radius of approximately 5 miles. Beyond that limit there is a zone of selective grazing characterised by large tussocks of Stipagrostis uniplumis. Anthephora pubescens and Schmidtia pappophoroides have disappeared.

Further away from the villages these latter species gradually increase in prominence and dense bush growth correspondingly decreases.

5. INSECT PESTS.

5.1 Army Worm.

In the Mamona area and at Manyane 50 miles north of Tshane Army Worms were abundant eating Urochloa trichopus, Chloris virgata, Panicum maximum, Schmidtia pappophoroides and other grasses. Tribulus terrestris was also defoliated.

5.2 Caterpillars.

Large numbers of thick green caterpillars 2½ inches long were defoliating Acacia mellifera trees in the Mamona, Kuli, Nojane areas. They also attacked Boscia albitrunca, Grewia retinervis, Acacia giraffae and Boscia albitrunca.

In the Kuli, Nojane areas Grewia flava bushes were completely defoliated by small greenish grey caterpillars about one inch in length. Grewia flava is the main browsing bush in this region and there is very little other grazable herbage on the badly denuded land.

6. POISONOUS PLANTS.

It is very difficult to obtain positive information on poisonous plants and about actual cases of plant poisoning. Dichapetalum cymosum and Pavetta harborri do not seem to occur in the area but it is believed that Dichapetalum cymosum grows further north towards Maun.

6.1 Moraea sp.

At Kuli six cattle died in the previous week after eating some plants in the local pan. Apparently they died soon after drinking water. A bulbous monocotyledonous plant that resembels Moraea polystachya was located. It grows locally abundant around the wells in the pan. Unfortunately, it was not in flower and could not be identified with certainty; but is seems that it might have been the source of the trouble.

6.2 Tribulus terrestris.

Mr. Paxton Moleta at Nojane stated that there are periodical outbreaks of what seems to be severe photosensitisation in sheep. The animals suffer from swollen jaws and heads. The trouble occurs soon after the onset of the rains, and is probably caused by Tribulus terrestris.

6.3 Crotalaria lotoides.

This plant is very abundant in the Kalkfontein, Mamona, Makunda are. The worst incidents of laminities observed in Botswana were seen near Kalkfontein. A large number of cattle were affected. It was probably due to Crotalaria poisoning.

6.4 Urginea sa guinea

This plant which is poisonous to stock occurs widely distributed throughout the area.

6.5 Other Poisonous Plants.

There are other plants, even among some of the popular browse species that cause poisoning.

6.6 Other Diseases.

Cattle in the Nojane area are said to be contracting malignant cattarh (Snotsiekte), when in contact with calving wildebeest.

7. DROUGHT.

The effect of drought was very noticeable throughout the north western region. In some places Stipagrostis uniplumis tussocks died completely. Moribund tussocks were observed over large areas north of Mamona, along the Ukwi valley south of Kalkfontein, between Makunda and Nojane and further south.

Information obtained in Ghanzi indicates that the death of the grass on some farms was due to burning. Observations, however, indicated that in areas which were not burnt the grass tussocks also died. In fact, fire helped to rejuvenate grass growth. Parts of Anthephora pubescens plants which were still alive produced vigorous young growth. Digitaria milanjiana produced young growth and long runners and there were many grass seedlings. This green growth formed a marked contrast to the dry dead tussocks.

8. STOCK.

In every village the tale of the drought was related with varying but staggering figures of cattle deaths due to lack of pasturage. It was estimated that cattle deaths in the area might have exceeded 4,000. In the villages some cattle were still showing ribs and they had not yet fully recovered.

In spite of the excellent rains there was very little recovery of pastures in the village areas and the stock still had long distances to walk to find grazing.

Stock losses were also experienced on some of the Ghanzi ranches but Brahma cattle and various crosses seen on farms were in excellent condition.

9. GAME.

Very few game animals were seen in the areas between Ghanzi and Nojane (12 Hartebeest, 3 Wildebeest, 1 Steenbuck and 1 Gazelle) probably the combined effect of excessive hunting and several years of drought.

Larger numbers were observed between Nojane and Matlho-a-phuduhudu and west and south of Kang (76 Hartebeest, 66 Wildebeest, 3 Oryx, 28 Ostriches, 4 Duikers, 5 Steenbuck and 1 Gazelle).

A number of Wildebeest skeletons were seen.

10. OBSERVATIONS.

10.1 Development.

It is recognised that there is a responsibility towards these remotely situated communities and there is

an urgency to provide assistance and guidance. The distance from Mamona to Lobatse is 625 miles.

Ranching improvements anticipated would not easily be achieved. The condition of the ranches are likely to deteriorate in respect to bush encroachment and denudation. Too much emphasis should not be placed on likely beneficial effects of destocking land denuded from pasture and where there has been excessive bush and weed encroachment.

It would, however, be desirable to develop water supplies in selected areas to encourage individual farmers to apply improved practices which can be supervised under the district extension programme.

10. Stocking.

Grazing pressure cannot readily be related to a given number of acres per livestock unit because other aspects, mainly related to management practices, become overriding factors. Apart from within very wide margins the number of acres per livestock unit means nothing unless it is related to availability and distribution of water and to grazing management, also allowing for other variable factors such as rainfall. Land wiich can adequately support 1 livestock unit to 10 acres under one level of management can be hopelessly overgrazed at 1 livestock unit to 40 acres without adequate control.

It is probably better to view the problem in relation to production potential at different levels of management. It should be related to the amount of herbage produced on the land and its utilisation in relation to available water, taking into consideration provision of fodder in the form of a carry over from favourable to less favourable periods.

A relatively small area of 5 acres or less may on the average produce sufficient fodder for one livestock unit. The exact way in which the herbage is utilised and the amount wasted will actually determine the acreage required or the extent of deterioration that will follow in the form of pasture denudation, loss in condition of stock and numbers of deaths during drought periods. It is a vicious cycle that can only be broken by sound management which must also be accompanied by reclamation, and improvement of existing conditions; and by maintaining improved standards.

10.3 Ecological Investigations.

Useful observations could be made on the farms where improved management is practised; and there should be

valuable /.....

valuable comparisons with other areas. The region is too remote, however, for the establishment of a network of experiments under present circumstances.

Although rainfall conditions at Lephephe are more favourable, results obtained there on bush control, pasture management and grazing rotations should largely be applicable throughout the western region.

The main criterion for assessment should be livestock production on an improved and sustained basis.

Observations on general pasture conditions should be carried out with particular attention on the state of grazing and browsing; on bush encroachment of species such as Acacia stolonifera, Acacia mellifera and Dichrostachys cinerea and on weeds such as Tribulus terrestris and Crotalaria lotoides and to find and adopt suitable control measures.

11. REFERENCES.

Blair Rains, A. & Yalala, A.M. 1970 — The Control of Southern State Lands, Botswana Directorate of Overseas Surveys, Tolworth, Surrey, ENGLAND.

Commonwealth Relations Office 1952 — Report of a Mission to the Bechuanaland Protectorate to investigate the possibilities of economic development - the Western Kalahari.

Ministry of Agriculture. — Her Majesty's Stationery Office, London. An application by the Government of Botswana for a loan to finance a livestock Industry Development Project. Government Printer, GABORONE.

12. LIST OF PLANT NAMES.

12.1 Grasses (Grass = Bojane, Mobujane (Kal.))

Anthephora pubescens Nees.
Aristida adscensionis L.
Aristida congesta Roem Schult - Seloka
Aristida meridionalis Henr. - Seriri, seriri sa tau
Brachiaria dura Stapf
Cenchrus ciliaris L. - Mosekangwetsi
Chloris virgata Sw.
Dactyloctenium aegyptium (L.) Beauv.
Digitaria eriantha Steud. - Moseka
Digitaria milanjiana (Rendle) Stapf - Namele
Diplachne fusca (L.) Beauv.
Eragrostis echinochloidea Stapf
Eragrostis lehmanniana Nees
Eragrostis pallens Mack. - Motsikiri
Panicum coloratum L.
Panicum maximum Jacq. - Mhaha
Panicum repens L.
Pogonarthria squarossa (Licht.) Pilg. - Seloka
Rhynchelytrum repens (Willd.) C.E. Hubb. - Sanyane
Schmidtia pappophoroides Steud. - Tsube, Bojang ba Dipitse (Horse Grass)
Sporobolus pyramidalis Beauv.
Stipagrostis uniplumis (Licht.) De Wint. - Tshikitsane
Tragus racemosus (L.) All. - Segwana, Maganapudi
Tricholaena monachne (Trin.) Stapf & C.E. Hubb.
Urochloa trichopus (Hochst.) Stapf - Phoka, puka

12.2 Other Plants.

Acacia fleckii Schinz - Mhahu
Acacia giraffae Willd. - Mogotlho
Acacia lenderitzii Engl. - Mokha
(Acacia gillettiae Burtt Davy)
(Acacia uncinate Engl.)
Acacia mellifera (Vahl) Benth. - Mongana
Acacia stolonifera Burch. - Setshi, Sejehing
Aloe zebrina Bak. - Kgaphane
Alternanthera pungens H.B. & Kunth - Sepodise
Asparagus africanus Lam.
Bauhinia macrantha Oliv. - Mokoshi, Mogosa, Mopondopondo
Boscia albitrunca (Burch.) Gilg & Ben. - Motlopi
Bulbostylis burchellii C.B. Cl.
Cassia italica (Mill.) Lam. ex F.W. Andr.
Catophractes alexandri D. Don. - Motshwarachukudu, Leshagali, Matsantsau, Ditshatsha. (Kal.)
Citrillus naudinianus (Sond.) Hook F. - Mokapane, Mogapu, Mokawa Mokapani

Cleome sp./.....

Cleome sp.
Clerodendrum lanceolatum Gurke - Logonyana
Clerodendrum uncinatum Schinz
Coccinia rehmannii Cogn. - Malosaka, Mogaba (Kal.)
Commiphora pyracanthoides Engl. - Seroka
Crotalaria lotoides Benth
Crotalaria Spartioides DC. - Monnatlasela
Cucumis sp. (Wild melon) - Mokate, Kganewe (Kal.)
Dicerocaryum zanguebarium (Lour.) Merrill - Tshetlho, Sengwaparile (Kal.)
Dichapetalum cymosum (Hook.) Engl. - Mogau
Dichrostachys cinerea (L) Wight & Arn. - Mosihapoo
Gnidia polycephala (C.A. Mey) Gilf. - Kongwane, Kungwane
Grewia flava DC. - Moretlwa
Grewia retinervis Burrett - Motsotsojane
Heliotropium steudneri Vatke
Hermannia sp.
Hirpicium bechuanese (S. Moore) Roessler
Indigofera daleoides Benth
Limeum linifolium (Presl.) Fenze
Lonchocarpus nelsii Schinz Meering & Grimme) Mhata-wa-Motlhaba
Lycium tenue Willd. - Mlalatau
Moraea sp.
Oxygonum alatum Burch. - Motswee, Motswetswe
Pavetta harborii S. Moore - Logonyana
Pergularia extensa (Jacq.) N.E. Br.
Portulaca oleracea L. - Serephe
Rhus tenuinervis Engl. - Morupaphiri, Lekomane
Sericonrema remotiflora Lopr.
Sesamum angustifolium (Oliv.) Engl. - Mosuwene, Pikenine
Solanum incanum L. - Morolwana, Tolwa
Solanum panduraeforme E. Mey - Tholwana, Tolewane
Talinum crispatulum Dinter - Nbine
Tephrosia purpurea (L.) Pers. - Mamuyati
Terminalia sericea Burch. ex DC - Mogonono
Tribulus terrestris L. - Mosetlho
Tylosema fassoglensis (Kotchy ex Schweinf.) Torrie & Hiilcoat - Morama
(Apparently similar to Tylosema esculenta or Bauhinia esculenta Burch)
Urginea sanguinea Schinz - Kgalegeikwe
Ziziphus muncronata Willd. - Mokgalo

It has not been possible to check the names with herbarium specimens and some corrections are probably necessary.

Terminalia sericea Burch. ex DC. - Mogonono
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