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MAKING OPTIMUM USE OF THE LIMITED AGRICULTURAL RESOURCES OF THE TRIBAL AREAS OF S.W. MATABELELAND

P. Hawkins*

The title of this paper requires that it should at least:-

a) Define the area under consideration.
b) Outline its physical characteristics so that its agricultural resources may be established.
c) Outline its socio-economic environment in order to discover what pressures there are on these resources, and to establish the development needs of the region.
d) Propose how to make best use of the resources in the light of (c) above.

1. DELINEATION OF THE REGION

The region includes all those TTLs which lie south and west of the Plumtree-Bulawayo-Beit Bridge road, but with the main emphasis on that group of contiguous TTLs which border the Ramekwabane and Shasi Rivers.

2. PHYSICAL CHARACTERISTICS

Most of the region lies in the altitude range of 750 - 1000m - appreciably higher than the S.E. Lowveld. Its climate, however, is more "lowveld" than "middleveld" as reflected in its vegetation.

2.1 Climate

The climate is one of extremes. In summer, the maximum temperatures compare to those of the Sabi Valley, whilst in winter, the minima are comparable to those for Marandellas. Frost is common and the area is more prone to devastating black frosts than any other part of the country.

Rainfall is both low and erratic. At Tuli Breeding Station (TBS) for example, the 30 year average is 413 mm with a recorded range from 129-898 mm. A rainy pentad analysis for TBS shows a main rainy season of only 85 days from 1st December - 25th February. During this time there is only a 30% chance of a significant amount of effective rainfall during any particular pentad (5 day period). Evaporation on the other hand is high and often extreme - up to 25 mm on a single day has been recorded at Ngwesi, though average evaporation during dry spells is usually about 10 mm/day.

The Meteorological Department have summarized the climate of the area as follows:-

> The area has a relatively low and extremely variable rainfall with hot summers and cold winters. The

* Lecturer in the Regional and Urban Planning Centre, University of Rhodesia.

incidence of frost as stated would appear to exclude all but the most frost tolerant perennial crops. The area lies within that belt of Rhodesia which experiences cold "over-lander" winds during the winter season, hence the high frost incidence. The area lies south of latitude 20°S beyond which the humid "Congo Air" does not normally penetrate, giving rise to erratic patterns of rainfall. The climate is generally dry with a mean moisture deficit of 1 270 mm p.a. The prevailing dry winds in the area aggravate the moisture deficit problem, especially as the winds are at their greatest in the dry months when water is at a premium.

2.2 Geology and Landform

Four main groups of rocks occur in the region as follows:

a) The Gold Belt rocks which occur as a discontinuous northern fringe near Mphoengs, Marinogha, Antelope and Gobatema with outliers at Nkuluba, Ratanyana, Sun Yat Sen and Legion Mine. These rocks, which are upwards of three million years old, consist of ancient sediments and lavas which have been metamorphosed into a complex arrangement of strata such as banded ironstone, greenstone and serpentine. Although of only limited extent these rocks are economically important, for even though most of the old mines have been abandoned they have already yielded varying quantities of gold, silver, asbestos, copper and nickel. These rocks are also important because they frequently give rise to the better soils in the region.

b) The Granites, which surround the Goldbelts and extend to the south, are the most extensive group of rocks. They vary in age and composition, but have not been associated with mining. Most of the soils derived from these rocks are coarsely sandy, and often poorly drained.

c) The Gneisses are confined to the southern part of the region in a zone known as the Limpopo Metamorphic Zone. They also vary in mineral composition giving rise to generally heterogeneous soils which tend to occur as long narrow strips.

d) The Karroo rocks, which are confined to the country around, and to the east of, the Tuli Circle. Except for a fringe of sandstone, this area consists of basalt which, under the arid climate, has given rise to only skeletal soils.

From the point of view of economic geology, the Tuli coal-field is of potential interest, as is the deposit of pyrites at Mphoengs.

As regards landform there are two main units: the broken hilly ground in the north, which is associated with the Goldbelts and which provides the sites for the Ngwesi, Shashi-Antelope and Tuli-Makwe dams; and the generally flat plain to the south with its isolated kopjes. On closer

examination this plain is found to be undulating rather than flat with quite deeply incised watercourses. It is in fact regarded as an old pediplain which is now being subjected to a rejuvenated erosion cycle due to a lowering of base level of the Limpopo and its tributary rivers.

2.3 Soils

The soil pattern of South West Matabeleland shows the dominance of three soil forming factors: climate, parent material and relief. The main effects of each are as follows:

a) Climate : Under the semi-arid conditions the process of weathering is slow. There is thus little leaching, and the rate of soil formation is retarded. The resultant soils are generally shallow, coarse-grained (due to the presence of gritty rock particles that are still weathering) and of relatively high nutrient status.

b) Parent Material : Here the main effects are on the soil's colour, texture, drainage, and mineral content. The basic rocks usually produce red, medium-textured, well-drained soils. The acidic rocks give rise to pale, sandy soils which are often poorly-drained and chemically impoverished or sodic.

c) Relief : The main effect of relief is on soil depth. As explained in the previous section, there has been a lowering of the base levels of the main rivers so that practically all the tributary watercourses have now become deeply incised and erosion is active. It is therefore only along the main watersheds and at certain protected sites that deeper soils have been allowed to develop. Elsewhere the soils tend to be shallow and stoney.

From the point of view of land selection, it will be obvious that the best soils will be found where the presence of basic parent rocks coincides with the absence of deeply incised watercourses.

An excellent example of such a combination occurs along the southern side of the Antelope Goldbelt Hills, where the Goldbelt provides both the basic rock and a barrier against accelerated erosion. The coincidence of watershed topography and a predominance of basic parent rock at Makokwe is another example of the desired combination of land selection.

Apart from variations in depth, the soil pattern is remarkably uniform throughout the region, where 4 basic soil units recur again and again. The general characteristics of the main recurring soil units are summarised below:-

i. The reddish, medium-textured soils:

Typically dark reddish brown loamy sand to sandy loam over sandy loam to sandy clay loam onto rubbly weathering rock at 600 - 700mm. Structureless and friable. Permeability throughout the profile is rapid, perhaps excessive, and adequate drainage appears to occur through the underlying rock.

ii. The highly calcareous soils:

These usually occur on lower ground adjacent to the red soils, or as an aureole around the red soil where it is surrounded by sand.

The typical profile consists of dark brown sandy loam with an 'organic' feel over dark brown sandy clay loam and sandy clay with scattered to numerous calcium carbonate concretions. These soils are fertile, but are imperfectly drained.

iii. The brown granite sands:

These soils are generally shallow, and show very little increase in texture with depth. The well-drained variant becomes reddish in colour with depth, but the subsoil texture is seldom heavier than loamy sand. Many of these soils are, however, poorly-drained, pale in colour, and often show diffuse iron mottling in the lower subsoil. Both variants have low water-holding capacities and are very pervious.

iv. The "Sikwakwa" and solonetzic soils:

These soils are variable but usually consist of coarse grey, slightly mottled, impermeable sandy clay loam or sandy clay, often with calcium carbonate concretions. Most of these are either saline or sodium affected, and are quite unsuitable for irrigation.

It will be obvious that, of these, only the reddish, medium-textured soils can be considered suitable for sustained irrigated crop production.

2.4 Hydrology

Seven main rivers drain the region: all flowing in a southerly direction from the national watershed towards the Shashi and Limpopo Rivers. From east to west, these are the Umzingwane, Tuli, Shashani, Simukwe, Sansukwe, Ingwezi and Ramakwebana Rivers.

In general terms, it may be said that as one progresses from east to west, these rivers decrease in both total yield and reliability. This is because their catchment areas tend to decrease both in size and quality. Thus, according to the A.D.A. report, the estimated yields (at 10% risk) decrease as follows:-

River	Total Yield (10% risk)
Umzingwane	7,56 cumec (267 cusecs)
Tuli	5,49 cumec (194 cusecs)
Shashani	1,36 cumec (48 cusecs)
Simukwe	1,13 cumec (40 cusecs)
Sansukwe	0,34 cumec (12 cusecs)
Ingwezi	0,20 cumec (7 cusecs)

The above figures give a clear and valid comparison between the various rivers, but it is important to stress that the estimate of yield assumes large storage works. Without these there is no meaningful yield from any of these rivers since all of them normally cease flowing for a large part of the year.

Some storage is, therefore, essential to obtain any significant volume of continuous yield. Nor can this be in the form of numerous small structures,

for it is a characteristic of all these rivers that they carry large quantities of sand. Small storage works, therefore, simply silt up.

Large storage works are thus essential. In any case, large-scale storage is necessary because the total volume of flow is extremely erratic as the following data for the Ingwezi River show:-

TABLE 3: Total Run-off as gauged upstream of Ingwesi Dam from a catchment area of 60 600 ha.

Year	Total Flow ($10^6 m^3$)	Average run-off
1966/67	35,1	58 mm
1967/68	5,0	8 mm
1968/69	26,5	43 mm
1969/70	1,3	2 mm
1970/71	7,8	13 mm
1971/72	31,8	52 mm
1972/73	0,8	1 mm
1973/74	68,2	113 mm

When these figures are related to the yield as given in the A.D.A. Report of 0,20 cumec (equivalent to some 11,5 million cubic metres per annum) the need for the equalising effect of large-scale storage becomes obvious.

Clearly then, the cost of water development works will be high and will compare very unfavourably with the higher rainfall regions such as Mashonaland, or with those regions such as the South East Lowveld which are watered by rivers coming off high rainfall country.

2.5 Vegetation

This falls broadly into Vincent and Thomas' Mixed Bushland category, and conforms to their division into sub-types related to soil factors.

The main trees are Colophospermum mopane, Commiphora spp. , Combretum apiculatum, and Acacia spp., with an understory of Grewia and Euclea bushes. The main grasses are Aristida and Eragrostis spp.

In most of the TTL, however, the vegetation has been severely disturbed, with much of the bush having been cut out, and with much bare or only sparsely grassed land.

The carrying capacity of the veld, as assessed by Vincent and Thomas, ranges from 1 LU : 8 ha to 1 LU : 16 ha depending on rainfall. At TBS, for example, the carrying capacity has been assessed at 1 LU : 12 ha.

It is interesting to note that Conex, as the result of grazing trials at TBS, have established that, certainly in better rainfall years on cleared land under good management, a stocking rate of 1 LU : 5 ha has proved to be feasible. In fact both livestock weight gains and improvement in the grass sward would appear to command the higher stocking rate. It should

be noted, however, that the higher stocking rate has applied mainly to better rainfall years. Therefore some form of fodder bank against drought is indicated by the following comparison of rainfall and grass yield off cleared veld.

Year	Total Rainfall (mm)	Total Yield (Kg/ha)
1971/72	688	972
1972/73	129	173
1973/74	548	455
1974/75	567	945
1975/76	680	665

Given adequate fencing and watering facilities, good management, and a fodder bank to contend with drought years, it would seem that a substantially higher stocking rate is feasible than that currently being advocated.

3. THE SOCIO-ECONOMIC ENVIRONMENT

3.1 Population

No recent figures are available. 1969 Census figures extrapolated at 3,6% p.a. give TTL total population estimates for 1975 of:-

Bulalima-Mangwe (South)	34 569
Matobo	60 930
Gwanda	77 930
	173 429

If up-dated to 1977 the figure would be approximately 190 000, but since population under stress usually show increased growth rates, these figures may be conservative.

Population density ranges from 8,5 p/km^2 in Shashi TTL to 27,9 p/km^2 in Tshatshani TTL. The regional average (1975 estimate) was 16 p/km^2.

The main features of the population structure are:-

that there are 3 main tribal groups - Ndebele, Karanga, and Venda; that the age-sex structure is typical of most TTLs with 50% of the total population under 15 years of age, and a high proportion of adult males absent. (e.g. 66 men per 100 women in Bulalima-Mangwe) Average family size is 6 persons.

3.2 Communications and Infrastructure

Roads : The basic pattern is one of watershed roads running southwards from Plumtree, Kezi and Gwanda, with two main E-W links: from Mphoengs via Antelope to Gwanda, and the security road in the south.

Road Transport : The ubiquitous African bus services provide the basic transport system for small goods as well as passengers. They penetrate to the furthest parts of the TTLs, at least on a weekly service, and there are few points more than 10 km from a bus route. Antelope forms the focal point for services to TTLs in the Matobo and Gwanda Districts.

Telephone Lines : Like the road network, PTC party lines reach southwards into the area from exchanges at Plumtree, Kezi and Gwanda, to Warmley, Dube Ranch and Manama Mission respectively. Seven TTLs have no telephone service at all.

Electricity : Apart from a 11 Kv line to Embakwe Mission on the edge of Ramakwebane TTL, the only distribution is from Gwanda. A 33 Kv line runs south to Tilcor Tuli Estate and Manama Mission; another runs west to Antelope where it splits into two 11 Kv lines running north to Kezi and south to Legion Mine.

Schools and Hospitals : There are approximately 150 primary schools, more than half of which are upper primary schools to Grade 7, and 4 secondary schools. There is also a Teachers' Training College at Mtshabezi and a Homecraft school at Empandeni.

There are Mission Hospitals with resident doctors at Brunapeg, Mtshabezi and Manama, and without resident doctors at Empandeni, Embakwe, St.Josephs and Motopo.

3.3 Land Use

Livestock rather than crops are the focus of tribal farming in this region. As at 31.12.74 the breakdown of livestock by districts was estimated to be as follows:-

District	Cattle	Goats	Sheep	Donkeys
B - Mangwe (S)	39 748	184 793	54 449	3 549
Matobo	48 246	162 673	32 760	13 146
Gwanda	91 008	118 961	28 125	13 831
	179 002	466 427	115 344	30 256

Although the stocking rate varies widely, the average is of the order of 1 LU : 5 ha.

Cattle sales, in 1974, ran at $1 375 million, the corresponding numbers sold being:-

B - Mangwe	3 792	
Matobo	3 430	
Gwanda	10 264	17 486

The standard of livestock husbandry, and especially of veld management, is very low. Livestock deaths, in good years, run at about 2%, but in drought years may reach 25%. Thus, in 1960 it was estimated that 50 000 cattle died in this region, a further 12 000 in 1969/70, and in the lower Gwanda District alone - some 12 000 in 1972/73. Many of these animals, it is believed, die of thirst rather than of starvation.

Crops are grown despite the low rainfall. During 1974/75 for example, the "average"family of six planted the following areas (ha):

District	Sorghum	Munga	Maize	Beans	G'nuts	TOTAL
B - Mangwe (S)	2,6	1,9	1,8	0,1	0,2	6,6
Matobo	1,9	1,7	0,7	0,2	0,2	4,8
Gwanda	0,8	0,3	0,5	0,2	0,1	1,9
Average	1,5	1,0	0,8	0,2	0,2	3,8

Yields, in a good year, are of the order of 5 bags/ha. Per capita production in bags for the same season was thus estimated as follows:-

District	Sorghum	Munga	Maize	Total
B - Mangwe (S)	4,1	2,5	1,7	8,3
Matobo	0,6	0,8	0,8	2,2
Gwanda	0,7	0,2	0,8	1,7
	1,4	0,9	0,8	3,1

It is clear, therefore, that even in a good cropping year most cultivators cannot produce the average requirement of 2½ - 3 bags per capita for subsistence.

3.4 Employment

In 1969, of 37 500 adult African men in the region, approximately 12 500 were employed. An overall breakdown by occupations, for the male adult population for 1969, may be summarised as follows:-

a)	Employed :	in TTL	4 500
		in local European area	5 000
		outside the region	4 000
b)	Traditional:	Stockowners/cultivators	13 000
		Cultivators only	4 500
c)	Un- or Under-employed:		6 500
			37 500

3.5 TTL Economy

Item		Good Year (1974/75)	Bad Year
1.	Capital		
	Livestock	11 000 000	11 000 000
	Housing (brick and trad.)	1 750 000	1 750 000
	Possessions	5 000 000	5 000 000
		17 750 000	17 750 000
	Changes to capital	+ 3 815 000	- 680 000
2.	Income		
	Livestock sold	2 200 000	1 500 000
	Crops sold	100 000	-
	Wages (Government, etc)	1 800 000	1 800 000
	Remittances	900 000	1 000 000
		5 000 000	4 300 000
	Expenditure		
	Livestock bought	145 000	-
	Crop supplies	100 000	100 000
	Self-employed remuneration	310 000	200 000
	Wages - employees of African farmers etc.	30 000	30 000
	School fees	300 000	300 000
	Food	1 500 000	2 250 000
	Retail, services, sundries	600 000	400 000
	Transport	200 000	150 000
		3 185 000	3 430 000
	Balance: Income less Expenditure	1 815 000	870 000
3.	Subsistence Production		
	Livestock increase (add to capital)	2 200 000	200 000
	Crop production (consumed)	2 000 000	250 000
		4 200 000	450 000
	Less: Livestock deaths	200 000	2 000 000
		4 000 000	- 1 550 000

Since the TTL economy is of such modest size, the injection of capital by Tilcor, as proposed in Parts II - IV, will have a proportionately large effect; much more so than appears on first consideration of such a large region.

3.6 Assessment of Needs

The most important conclusions from the foregoing may now be summarised as follows:-

a) The total human population of over 175 000 relies overwhelmingly on the land for its sustenance. This land is unsuitable for normal crop production, so that there is almost invariably a shortfall in food production. Food is then imported and sold, often at exhorbitant prices.

b) There is a total livestock population equivalent to at least 200 000 LU on, at most, 1 million ha of grazing land, i.e. a stocking rate of 1 LU : 5 ha, versus the recommended rate of, say, 1 LU : 12ha. This condition is aggravated by poor veld management and lack of facilities, especially fencing and water. Degradation of the land is thus inevitable, and is appallingly evident. This degradation, combined with inadequate watering facilities leads to severe stock losses during drought years.

These facts may now be analysed to indicate the main needs of the region. These, it is submitted are:-

(i) The creation of job opportunities to reduce population pressure on the land.

(ii) The provision of equitably-priced human food, especially maize, to meet the local shortfall.

(iii) The provision of better watering facilities for humans and livestock alike, particularly in watershed areas.

(iv) A vigorous campaign to upgrade livestock and veld management practices in the TTLs.

(v) The provision of a means of securing the livestock industry against drought.

4. THE DEVELOPMENT PLAN

The main objectives of a regional development plan to meet the foregoing needs may now be defined as follows:-

a) In order to create maximum employment opportunities, focus the local economy, and bring other benefits to the region; to select the most suitable site for development as a potential Growth Point.

b) As the basis for developing this Growth Point; to select those types of agricultural and industrial production best suited to the region.

c) As a catalyst for development of this Growth Point; to establish a viable primary industry at site.

d) In order to rectify the problem of inadequate watering facilities, especially in Watershed locations; to provide for piped water along all main watersheds as recommended by the A.D.A.

e) In order to improve the poor standards of livestock and veld management; to launch a vigorous extension programme aimed at establishing grazing schemes throughout the area.

f) In order to curtail stock losses during drought years; to build up a regional fodder bank.

Translating these objectives into specific proposals, the components of the development plan become:

1) The selection of Shashani Antelope as the potential Growth Point because of its commanding geographical location; its cross-roads position; its uniquely large and uniform tract of good soil; its existing and potential water resources; its existing development and infrastructure; its proximity to major mines in the region; its potential command of the Shashani-Tuli Watershed; and because an embryo town already exists there.

2) The selection of food production and processing as the basic industries because livestock production is both the natural and the main existing form of agricultural production for the region; and because the growing and processing of food crops fulfills a fundamental need. Moreover the area is suited to vegetable growing and the industry builds on a sound base of experience in the region - as regards both growing and processing.

3) The establishment of a Tilcor estate at Antelope as the primary industry to get the Growth Point started. This estate will produce food crops and, as a bread winner, cotton.

4) The harnessing of the Estate Irrigation system as a means of supplying water to the Shashani-Tuli watershed so that a pipe-line scheme for stock-watering will need to meet reticulation costs only, and not those costs normally connected by storage and abstraction.

5) The use of the grazing resources of Crown and Warmley ranches, and of part of the irrigation resource at Ngwesi to build up a regional fodder bank.

The creation of a Growth Point at Maphisa (Antelope) combining a large irrigation scheme with a town, will at first be gradual. The town will eventually have abbatoirs, canning and dehydration factories, a tannery, a mill, and other attendant industries and services.

Initially, however, the objective will be simply to establish a viable agricultural estate and expand it progressively to provide employment and generate wealth, whilst focusing urban functions and services at Maphisa. With 2 000 - 3 000 ha of good irrigable land it will not be difficult to rectify the regional food crop deficit, and the scale

of employment will quickly make a meaningful impact on the need from local job-seekers.

Meanwhile the other existing Tilcor development in the region will be put to use in the form of satelite schemes as follows:-

a) At Tuli the emphasis will be on horticulture and crop processing, so that when Antelope is ready for those industries the necessary expertise will have been gained.

b) At Ngwesi and the nearby ranches the emphasis will be on integrating the TTL livestock industry with irrigation, and on building up a fodder bank.