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Relations between ecological, sociological and economic factors affecting ranching in the North Western Transvaal.

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2.2.2 Choice of sampling site

The limits of the selected vegetation type (Combretum apiculatum woodland) were obtained from the Thabazimbi Extension office (based on the work of Coetzee, 1971). The entire area was reconnoitred, and the 42 farm units within the area that met the criteria described on page 12, were plotted on a 1:250 000 topocadastral map of the area.

Each unit was visited, and, whenever available, a map of the farm layout (paddocks, roads, passages, drinking troughs and dips) was examined together with the farmer. Paddocks forming part of a rotational grazing system were randomly selected. Visual inspection followed - "atypical" paddocks (eg markedly hilly topography, drainage lines, vleis, heterogenous soil types, other vegetation types) were excluded, as were markedly smaller or larger than average paddocks, such as maternity and nursing paddocks.

Within paddocks thus selected, intensive vegetation sampling was conducted as described, during the period December 1982 to March 1983. The rest of the ranch was traversed and subjectively rated. Farm size, management systems, physical planning, production systems, number of cattle and certain "sociological" variables (eg education, experience, motivation etc) were also quantified. Detailed explanation of the methods used to quantify these variables is provided in section 3.2.

2.2.3 Veld composition score

In that animal production is the primary objective of land use in the area, veld composition score was determined in a manner that would reflect the relative palatability of each sward measured. Species were weighted on a scale 10, 7, 4, 1, according to their apparent palatability to cattle. This weighting was derived from Vorster (1982), who in turn based the weighting values on the approach advocated by Dyksterhuis (1949). Current wisdom (e.g. Grunow, 1980) and personal observation were the criteria used in assigning species to classes. The following species encountered during sampling were weighted as follows :

Anthephora pubescens	x10
Chrysopogon serrulatus	x10
Eustachys paspaloides	x10
Digitaria eriantha	x7
Panicum maximum	x7
Brachiaria nigropedata	x7
Panicum coloratum	x7
Setaria ustilata	x7
Enneapogon cenchroides	x7
Schmidtia pappophoroides	x7
Sporobolus fimbriatus	x7
Heteropogon contortus	x7
Tnemeda triandra	x7

Eragrostis rigidior	x4
Eragrostis superba	x4
Microchloa kunthii	x4
Urochloa mosambicensis	x4
Tragus berteronianus	x4
Eragrostis gummiflua	x4
Rhynchelytrum repens	x4
Perotis patens	x4
Elionurus muticus	x4
Cymbopogon excavatus	x4
Trichoneura grandiglumis	x1
Pogonarthria squarrosa	x1
Bothriochloa insculpta	x1
Aristida spp	x1
Cyperus spp	x1

Weighting values were multiplied by the relative percentage frequency of each species, and summed for each site to obtain a veld composition score. The potential maximum would be 1000 if all species were highly palatable (weighted 10). Bare ground was not encountered in any quadrats.

In order to determine whether a gradient of composition indicating past grazing history existed, and whether farms could be separated on the basis of such a gradient, use was made of Detrended Correspondence Analysis (Hill, 1979). The

programme DECORANA, modified by R.H. Westfall and G. Dednam, Botanical Research Institute, Department of Agriculture, Private Bag X250, Pretoria was used. The calculated veld composition scores for each site were correlated against the corresponding values obtained from the first axis of the DECORANA output.

2.3 Results

2.3.1 Herbaceous composition

The result of the ordination on herbaceous species is presented in Figure 2.1. The following interpretation is attached to the ordering of species:- The group of grasses comprising Elionurus muticus, Heteropogon contortus, Cymbopogon excavatus, Themeda triandra and Perotis patens represents species which predominate under low levels of utilization (similar to the Increaser I group, Tainton, 1981).

The centrally located group, comprising Aristida sp, Urochloa mosambicensis, Rhynchelytrum repens, Eragrostis rigidior and Panicum maximum is one in which species tend to predominate under heavier use (corresponding to the Increaser II group).

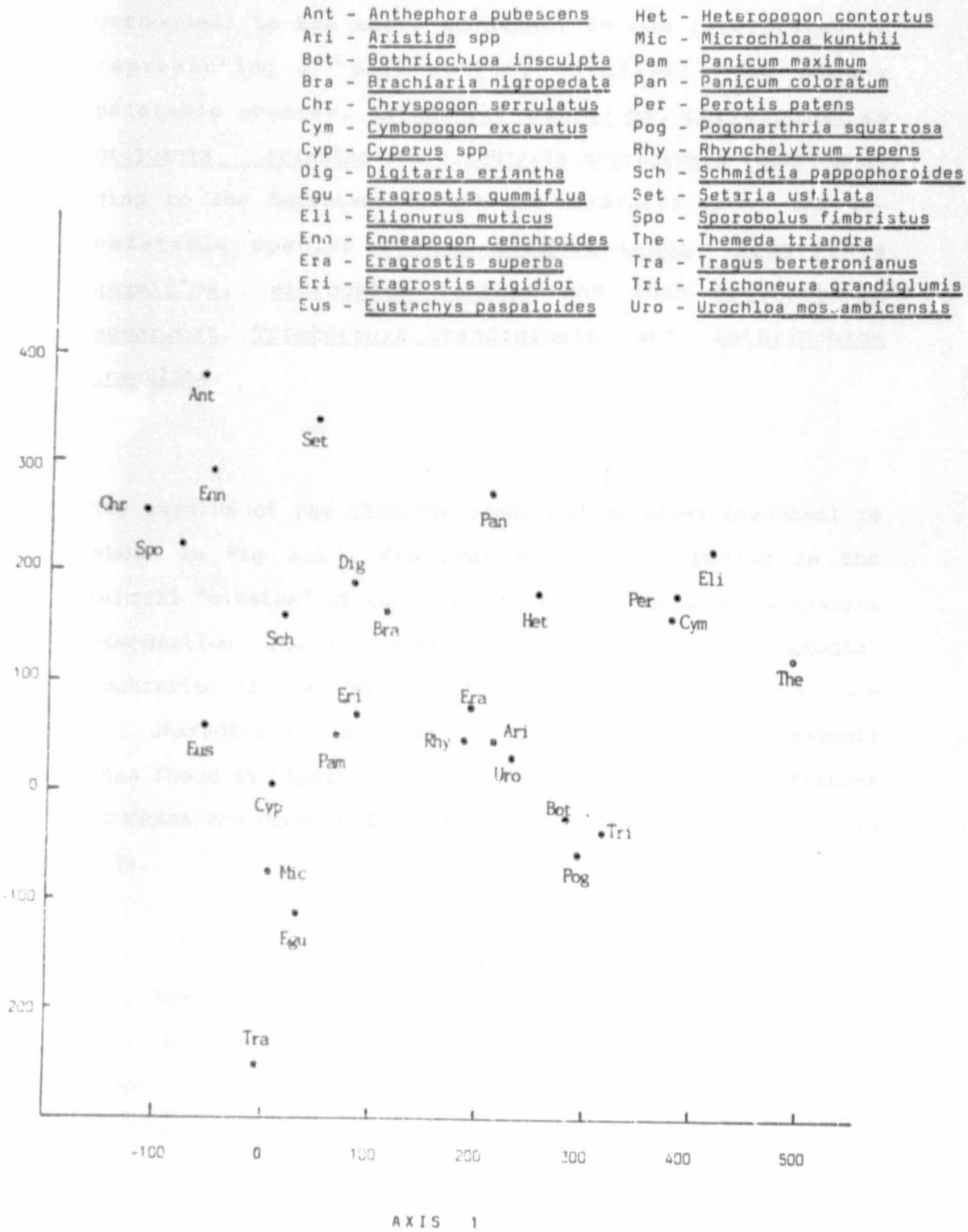


Figure 2.1. DECORANA of herbaceous species sampled on 42 ranches in the Thabazimbi district

Orthogonal to the above gradient, is one interpreted as representing a "palatability" gradient. The highly palatable species, Anthephora pubescens, Chrysopogon sp Digitaria eriantha and Brachiaria nigropedata (corresponding to the Decreaser group) are separated from the unpalatable species Tragus berteronianus, Eragrostis gummiflua, Microchloa kunthii and then Pogonarthria squarrosa, Trichoneura grandiglumis and Bothriochloa insculpta.

The results of the DECORANA conducted on sites (ranches) is shown in Fig 2.2. The most noteworthy finding is the central "cluster" of ranches with similar herbaceous species composition. The interpretation attached to the horizontal separation on the right hand side is that these sites are all characterized by heavier soils (higher clay content) than those in "typical" Combretum apiculatum veld. A further DECORANA was conducted after eliminating these outliers (Fig 2.3).

Only few ranches could be regarded as being at the extremes of either "very good" or "very poor" veld composition. Veld composition score ranged from 280 to 755 but more than 70% of ranches had a VCS in the narrow range between 375 and 500.

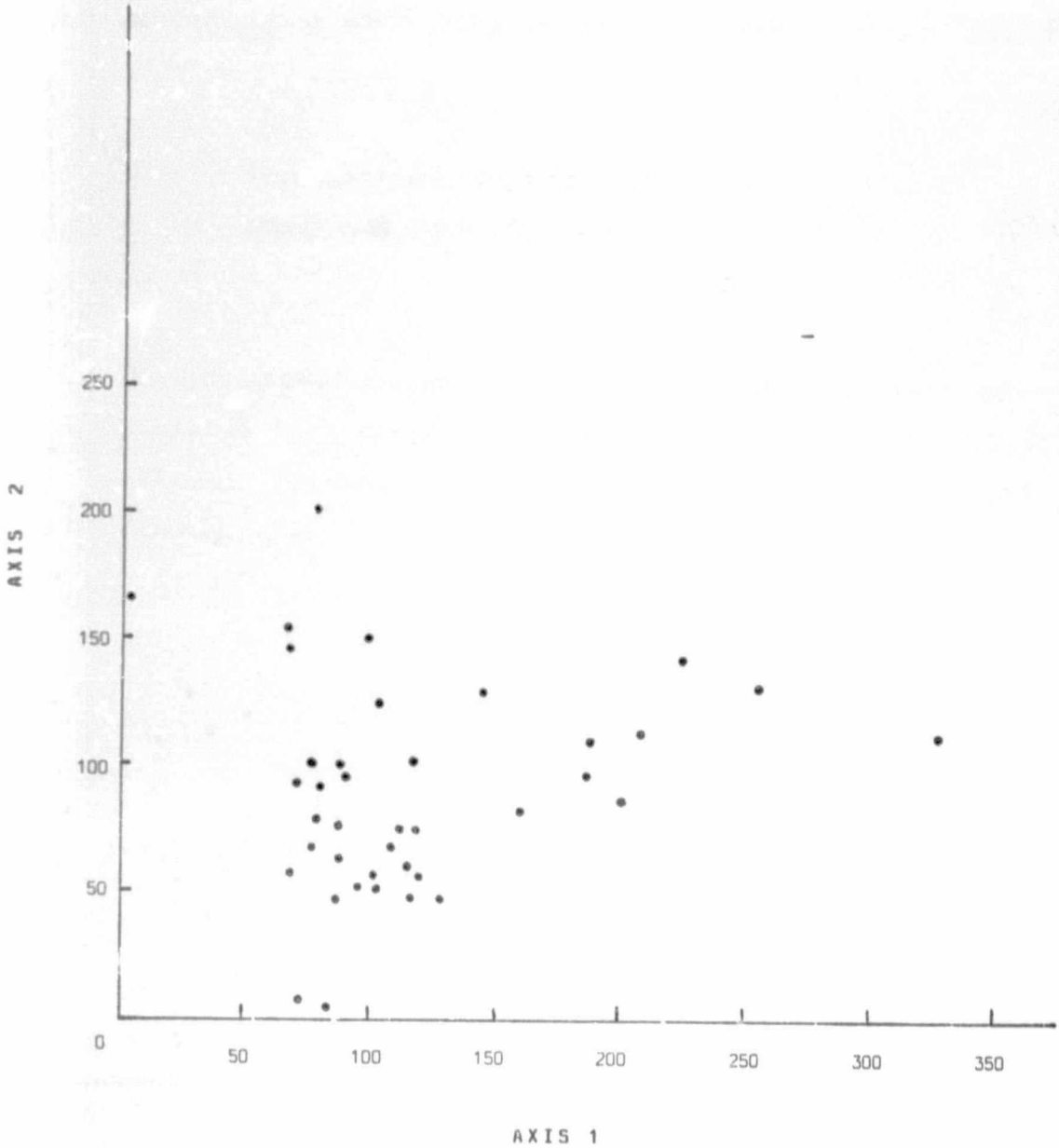


Figure 2.2. DECORANA of ranches in the Thabazimbi district

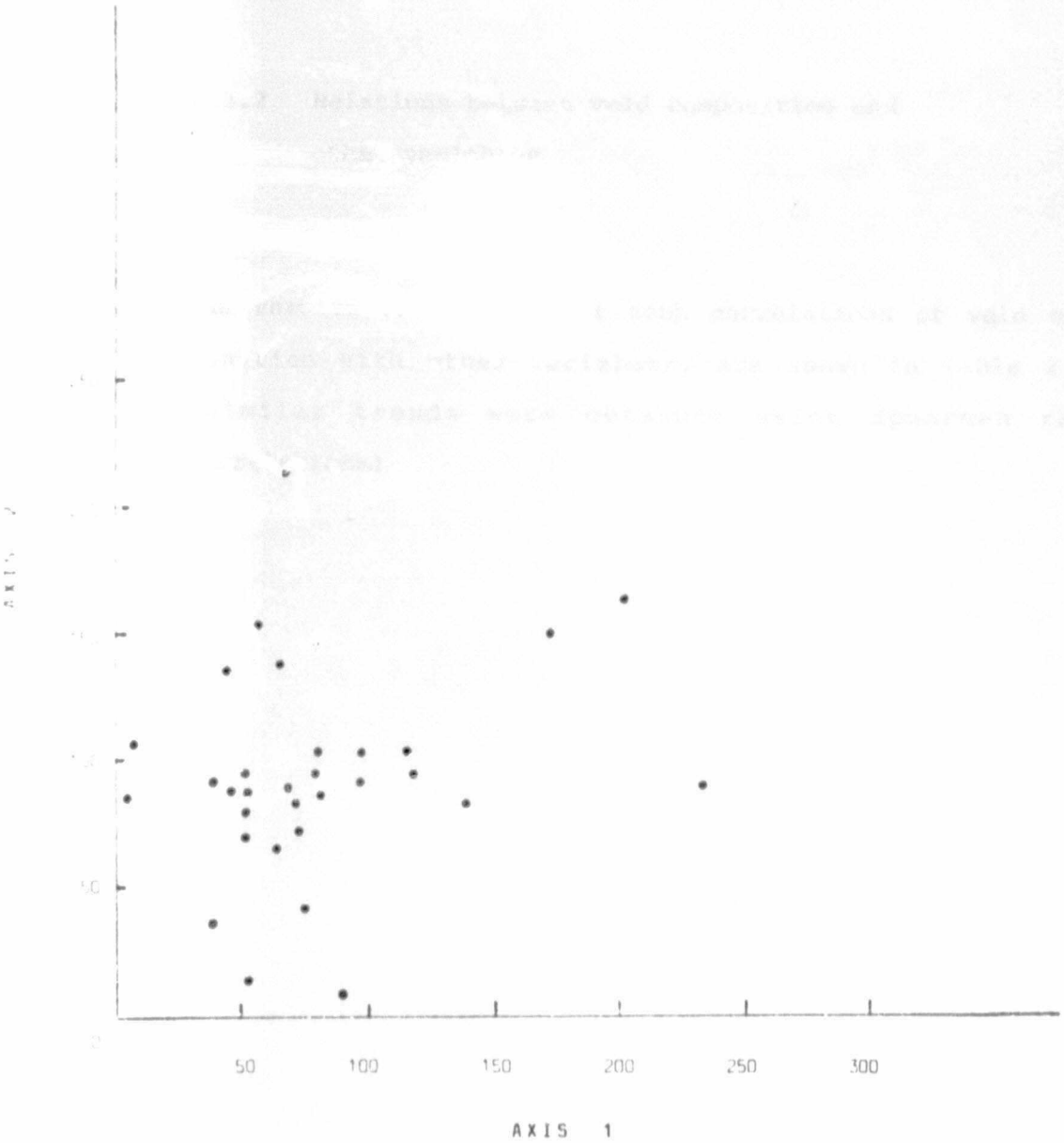


Figure 2.3. DECORANA of ranches in the Thabazimbi district after elimination of "outliers" on heavier soils

The results of the regression of veld composition score for each farm, against the corresponding value obtained from the first axis of the DECORANA output, are shown in Fig 2.4. The correlation (r^2 = 0,77) is highly significant ($P < 0,01$). This would seem to substantiate the use of the method chosen for calculating veld composition scores.

2.3.2 Relations between veld composition and other variables

The results of the Kendall rank correlations of veld composition with other variables, are shown in Table 2.1. (Similar trends were obtained using Spearman rank correlations.)

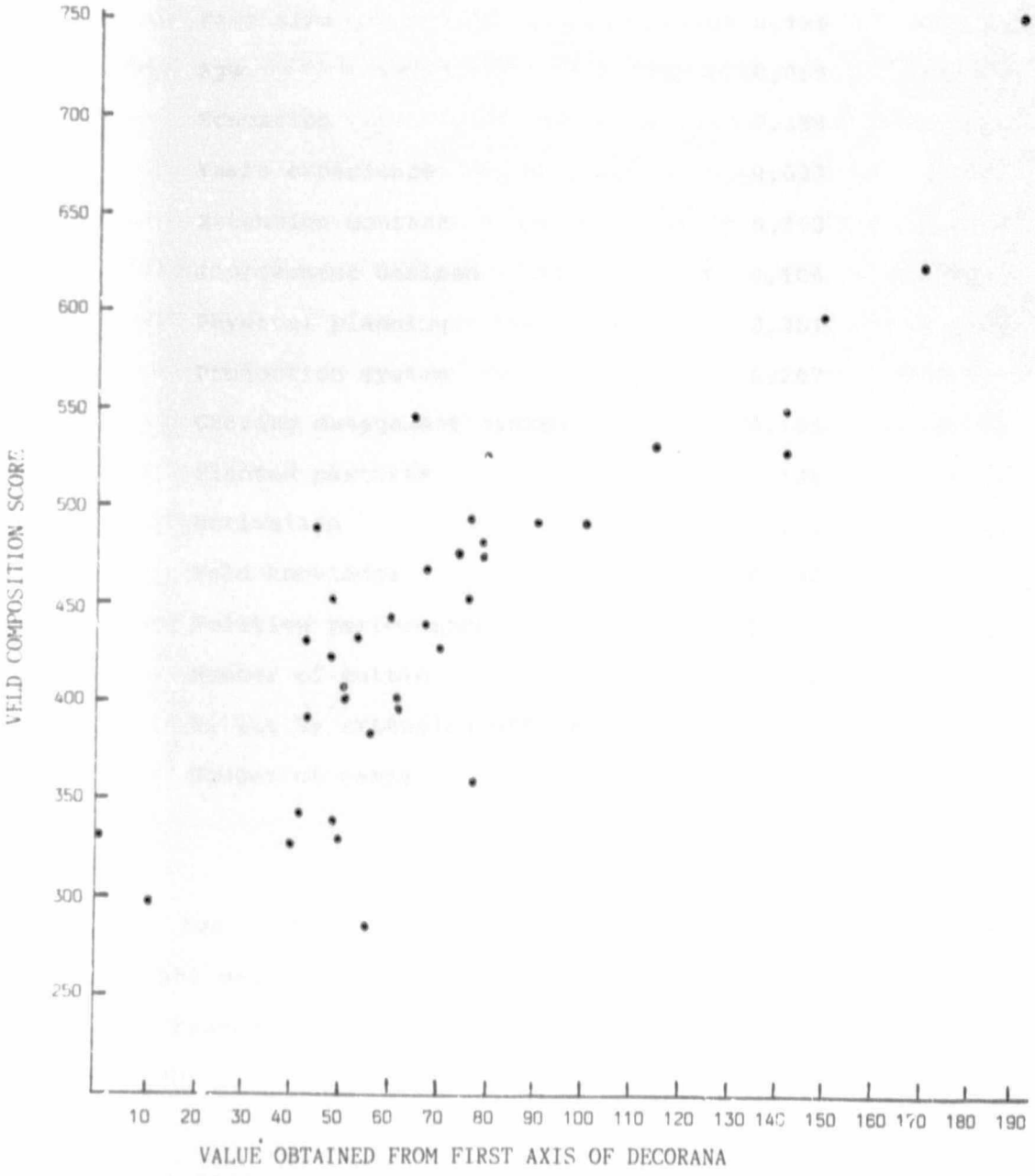


Figure 2.4. Correlation of veld composition scores and values obtained from the first axis of DECORANA for each ranch

Table 2.1 Kendall rank correlation of veld composition with other variables.

Variable	Correlation co-efficient
Farm size	0,124
Age	-0,069
Education	0,356
Years experience	-0,037
Extension contact	0,153
Improvement desired	0,104
Physical planning	0,281
Production system	0,287
Grazing management system	0,159
Planted pastures	0,138
Motivation	0,203
Veld knowledge	0,132
Relative performance	0,140
Number of cattle	0,036
Rating by extension officer	0,208
Number of camps	0,360

The two highest rank correlation co-efficients (0,360 and 0,356) were with number of camps and level of education of the rancher. These findings are elaborated on below.

Farm size, often regarded as the single most important

cause of veld deterioration (despite the absence of local quantitative evidence in support of this assertion) was very weakly correlated with veld composition score (r = 0,124). The "relative performance" also correlated weakly with VCS contrary to current opinion (e.g. Danckwerts & King, 1984). Age and years of experience of the ranchers were poorly correlated with veld composition score, as was the degree of contact with the local extension officer (see section 3). It is furthermore noteworthy that neither the grazing management system applied, nor the incorporation of planted pastures into the production system were strongly correlated with VCS. In the latter case, however, the very small number of ranches with planted pastures most probably affected the rank correlation. Furthermore, motivation of the rancher, his desires for improvement and his knowledge of his veld were all poorly correlated with the VCS. It is also noteworthy that VCS was very weakly correlated with the number of cattle stocked over the past years. However, the very poor records of farmers in this respect (coupled with an apparent reluctance to divulge exact numbers of cattle, where available) places a question mark on the validity of this finding.

The recommended management strategy for commercial ranching in the study area requires a minimum of six camps per herd (Louw, 1977). During the course of this study, it became clear that a significant proportion of ranchers were under the impression that the mere division of veld into a number

of camps, would, per se lead to improved or 'desirable' veld composition. In order to assess the accuracy of these ranchers' perception, veld composition of each ranch was correlated with the number of camps per herd. The relatively low rank correlation coefficient (0,360) indicates that the division of rangelands into paddocks does not, per se, result in "good" rangeland composition. It is doubtful whether the advocates of multi-camp systems intended subdivision as an end in itself, but it would appear as if this attitude is prevalent among ranchers in the study area.

2.3.3 Tree canopy spread cover (CSC)

Tree canopy spread cover was found to be fairly consistent throughout the study area. Mean CSC for all farms was 36% with a range of 28% to 43%. This variable was not significantly correlated with VCS or other variables such as stocking rate, grazing management system or number of camps per herd. The inference drawn is that in this particular woodland, rangeland management has an undetectable, if any, effect on woody density. The use of fire is actively discouraged by the extension personnel, and, indeed, only a handful of incidents of the use of fire was encountered in the entire study area (mainly on game-only ranches). In the study area, bush clearing, by mechanical or chemical means, is generally only conducted in Acacia erubescens thickets. Isolated cases of ranchers using mechanical means to

eliminate Grewia spp were also encountered.

It would appear that woody density in Combretum apiculatum woodland is thus primarily a function of driving forces such as water and nutrient availability. Not even in extreme cases of "overgrazing", was "bush encroachment" detected, this phenomenon more usually occurring on fine-textured soils.

2.4 Discussion

Interpretation of the veld composition results will obviously be influenced by the method used in calculating such scores. As stated, classification of savanna grass species into the Decreaser/Increaser categories has not received the attention that has been devoted to this topic in other biomes, particularly the humid grasslands. It is questionable whether species with wide distributions will react to grazing in a similar manner throughout their range of distribution. The grouping of species according to their apparent palatability, as expressed by animal feeding preferences, is considered a reasonable basis for constructing a meaningful index of veld composition for purposes of inter-site comparison.

The most significant finding was the fact that the vast majority of farms form a central "cluster" having similar veld composition indices. Only in a few extreme cases were farms separated along what could be interpreted as being a gradient resulting from grazing intensity. This fact supports the hypothesis that, in semi-arid savanna regions, grazing may be best regarded as a "minor modifier" of herbaceous composition (O'Connor, 1985). (Apart from cases at either extreme - severe and continuous heavy grazing, and exceptionally "light" utilization). The implications for management, and for the extension effort, need to be carefully evaluated. Does the construction of multi-camp systems, each requiring capital outlay for purchase of fencing material and provision of water, achieve a major goal of "improving or maintaining veld condition"? The results of this study, together with the findings of O'Connor (1985) and, to a certain degree, of Booysen (1969) tend to indicate that multi-camp systems do not, per se, achieve the above goal. The precise role of past stocking densities proved difficult to evaluate due to reluctance (on the farmers' part) to divulge figures. Record-keeping was not common. In several instances, ranchers could not even easily provide a figure of the current number of cattle on their ranch. In view of the fact that cattle are the very basis of the enterprise, this somewhat lackadaisical approach can only be described as surprising.

Much of the theory underlying rangeland management in South

Africa is strongly Clementsian in nature (Mentis, 1982). Although Clementsian theory does not necessarily imply rigidity, or uni-directional trends, it would seem as though the popular notion holds that the climax (or, for example, fire sub-climax) vegetation is a state that can be managed for and maintained. This view is contrary to the dynamic nature of especially semi-arid systems, and evidence increasingly supports the importance of episodic and stochastic events (e.g. Dye, 1983; Matthews, 1984; O'Connor, 1985; Noble, 1986; Walker et al 1986) in determining the state of the system and its components. To accommodate the effects of largely unpredictable events such as drought, termites, locusts, accidental fires, the approach suggested by Walker, Matthews and Dye (1986) would seem appropriate. These authors suggest that management of rangelands in which the dynamics are dominated by an external factor should be event - orientated. This approach demands insightful and knowledgeable management - the manager must be able to "track" the state of the system and adapt management as conditions dictate. The use of expert systems may prove an invaluable aid in this respect, and their development and use by the extension service deserves the necessary attention.

There is therefore solid evidence supporting the hypothesis that veld composition is determined in the first instance, by factors other than those directly related to the actions of the manager. In that the actions of the manager are an expression of his perceptions, attitudes and aspirations,

modification of these factors by extension may thus have only limited effect on the status of the resource. Since the objectives of the Department of Agriculture and Water Supply state, inter alia, that land use must be in harmony with, and not at the expense of, the natural resources, a fundamental rethink on the extension message towards extensive ranching in this and other semi-arid savanna regions, seems to be indicated. In addition, the widespread use of veld composition as sole indicator of resource status can rightfully be questioned.

The low positive correlations obtained may in certain instances reflect a measure of interaction or confounding effects. Interaction is tested in section 3, but the main finding, that neither farm size, number of camps nor management system individually resulted in "good veld", remains.

In conclusion, the current study does not support hypotheses H1 (limiting farm size results in veld deterioration) or H2/H3 (poor management results in veld deterioration / recommended management results in good veld), (contrary to current opinion).

3. SOCIOLOGICAL AND ECONOMIC FACTORS

3.1 Introduction

The objective of this section is to determine the array of psycho-sociological factors and interactions operative in the decision process, which ultimately gain expression ("gestalt") in the management strategy applied. It must however be emphasized that it is not suggested that the complexities of human behaviour can be fully elucidated and understood by identifying and describing single factors or even simple relationships. Furthermore, factors affecting and influencing behaviour in a particular region may bear no relation to factors operative in other regions. However, given that all ranchers are theoretically exposed to essentially the same extension and information messages, the question as to why different ranchers allegedly continue to implement different management/production systems, nevertheless still needs to be addressed.

The entire rangeland extension effort of the Department of Agriculture and Water Supply is geared towards trying to influence the management strategies adopted by ranchers. However, as has been claimed by Young (1980), in the final

analysis it is the rancher himself who determines management strategy, and hence the pressures which are placed on the land resource. Any attempt to persuade ranchers to adopt a particular approach to management should then be formulated with due cognizance of those factors influencing the ranchers' decision making process. In attempting to reach the objective of this section, it is appropriate to examine the nature of the South African farmer, as reported in previous studies. Against this background, the approach to the current study will be elaborated. (N.B. The review that follows is presented in an uncritical manner. The immediate purpose is to establish the commonly perceived view and to use this as background for the data-based critical assessment that follows later in this chapter.)

The numerous enquiries into the alleged deterioration of the veld have been described in an earlier section. The practices of the extensive ranching industry, past and present, were generally held to have contributed to the degradation of the land resource. The poor economic position of the extensive rancher, low crisis tolerance and sensitivity to economic and bio-physical factors were investigated by, inter alia Naude (1933), Commission of Enquiry into European Population of Rural Areas (1959), Commission of Enquiry into Agriculture (1968-72), Van Zyl (1980) and the Commission into the Economic Position of the Farmer and Agricultural Finance in General ("Jacobs" Committee of 1979). The main findings of these investigations, were essentially similar and may be summarized as follows:

i) low incomes, uneconomic farming units, inflated land prices, crippling debt commitments, marketing problems, lack of infrastructure were said to be the main economic problems;

ii) stock disease, inappropriate farming techniques and complete disregard of environmental factors were alleged to be the most important agricultural problems;

iii) factors such as ignorance, resistance to innovation, and sub-division of land by bequest were cited as major sociological problems.

The status quo of European agriculture in savanna regions, in terms of the factors mentioned above, is the result of some three centuries of historical development. Many of the present day problems have, as their origins, events and circumstances operative over this period.

3.1.1 Origins of European agriculture

The first permanent European settlement in South Africa, was established at the Cape of Good Hope in 1652. The purpose of this settlement was to provide fresh agricultural produce to ships of the Dutch East India Company. The

colony gradually expanded and the first independent European farms were initiated by groups of "Free Burghers".

A combination of several factors resulted in increasing dissatisfaction among settlers during the period 1836/38, resulting, for the first time, in large scale permanent migration into the northern regions of the country. These "voortrekkers" moved into and occupied, over the ensuing years, most of the savanna regions. The mode of life of these pioneers was essentially pastoral. Agricultural self-sufficiency predominated. Hunting, both for need and sport, gained in signifance. Domestic stock became, increasingly an integral part of the way of life. Families moved continuously, in search of fresh pastures. The semi-nomadic existence prevalent for several decades has been cited as a reason for the "restlessness" characteristic of sections of the farming community even during the twentieth century. This restlessness was coupled with an "almost reckless and fatalistic attitude to the environment and natural resources" (Second Report of the Commission of Inquiry into Agriculture, 1970).

3.1.2 Development of a market economy

During the last quarter of the nineteenth century, diamonds and later, gold were discovered in the South African

interior. The resultant industrial development and demand for agricultural products initiated the development of commercial agriculture, in contrast to the situation in several other countries, where agricultural development preceded industrial development. "The agricultural sector, however unprepared it might have been, was... drawn into the rapid development at a pace dictated by these (mining and other) industries" (Second Report of the Commission of Inquiry into Agriculture, 1970). The sudden transition from a subsistence to a commercial production economy had profound influences on the resource utilisation philosophy of most farmers, the resultant land use practices and ultimate fate of the environment. The semi-nomadic existence characteristic of the era before the discovery of minerals was replaced by permanent occupation of privately owned land.

3.1.3 Development of land tenure systems

3.1.3.1 Original systems

According to Thom (1936), the first Free Burghers in the Cape colony were granted arable land and grazing rights on unoccupied land.

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In reality, "the occupier of a loan-farm was as certain of its continued occupation as if it was his personal property" (Thom, 1936). In 1748, the following system of "loan-ownership" was introduced: on payment of a fee, the lessee of a loan-farm obtained ownership of his grange and the surrounding 60 morgen. This system was rejected by the burghers, particularly so by the stock farmers who did not wish to be restricted to a particular place. As a result, the more flexible loan-farm system, in accordance with the circumstances pertaining to stock farmers, remained in force. Although the system of loan-farms was intended to provide temporary rented grazing lands, more and more permanent dwellings and fixtures developed. The lessee could not however sub-divide these loan-farms, nor bequest them to heirs. In 1813 the system of hereditary tenure was introduced: right of ownership which had developed through habitude, was granted legal recognition. The form of land tenure developed in the Cape Colony was practised in the northern Voortrekker republics. Each inhabitant was entitled to apply for unoccupied land to be surveyed and registered in his name. An annual fee was payable on each farm.

3.1.3.2 Development of private ownership and the desire to own land

In contrast to many other countries, where leasehold is a

significant form of land-tenure, less than 10% of all European farming land in South Africa is leased (Second Report of the Commission of Inquiry into Agriculture, 1970). Leasehold is resorted to, generally, as a method of generating sufficient capital to purchase land. The desire to own land developed historically in South Africa, to the extent that in 1963, only 5,8% of all agricultural land in European areas was not privately owned (Second Report of the Commission of Inquiry into Agriculture, 1970). Cilliers (1968) observed that land ownership became a strongly developed tradition. Land-ownership, the prerogative of the nobility in their countries of origin, became possible for every European farmer in South Africa. Because all in South Africa could become land-owners, they could and did regard themselves as being the local nobility. Before the development of industry, farming was the major occupation. The desire to own land became intense. The status and eminence associated with full land ownership, while contributing to a class of farmers with high values and principles, nevertheless is conventionally purported to have had certain deleterious results.

(i) Land ownership was so valued and sought after, that this end was pursued with much urgency and when realized, clung to steadfastly, regardless of the implications and consequences.

(ii) Virtually all available agricultural land was oc-

cupied by 1930. The traditional system of bequething land to offspring was strongly entrenched. As unoccupied land became scarce, farms became smaller due to sub-division (Second Report of the Commission of Inquiry into Agriculture, 1970).

(iii) Speculation, unrealistic prices for land, selling of portions of farms, purchasing of land by city dwellers and abuse of tax concessions granted to landowners, all interacted and allegedly resulted in numerous uneconomic farming units;

(iv) Associated with private ownership of land, was the perception that the owner had a democratic right to exploit and utilize the resources at will. This view, coupled with ever increasing demand for agricultural produce, led... "not surprisingly, to the systematic overexploitation of rangeland as well as arable land and... ultimately to the extensive soil erosion which is such a formidable problem today" (Ross, 1963).

(v) Permanent settlement of privately owned land contributed to the ending of the system of "trekking" with stock either in search of fresh pastures or to escape seasonal droughts and grazing shortages. The scarcity of unoccupied land, in combination with fenced roads and controlled access, further compelled the rancher to maintain his stock on his own farm. Her-

baceous vegetation was thus subjected to prolonged periods of grazing.

3.1.4 Economic factors

Despite the fact that South Africa has a limited agricultural potential, agricultural production is said to have increased markedly over the past decades ("Jacobs" Commission, 1979).

However, increasing production and marketing costs, affected by increased fuel prices, rail tariffs and wages, have interacted to reduce the profit margins of the agricultural sector in general and the meat producer in particular.

3.1.4.1 Financial situation of the extensive cattle ranching industry in savanna regions

"The (financial) situation of the extensive beef cattle industry in the bushveld areas of the northern and north-western Transvaal, gives cause for extreme concern" ("Jacobs" Commission, 1979). Naude (1933) reported that, during the period 1927-30, the Net Farm Income per R100 capital investment (NFI/R100 capital) of 4,14% was lower

than could be obtained by farmers investing their capital elsewhere. During the most recent survey (Van Zyl, 1980) NFI/R100 capital was found to be R1,45. Further comparisons between the surveys are shown in Table 3.1.

Table 3.1 A comparison between results of two economic investigations into the extensive ranching industry of the north and north-western Transvaal (1933 and 1980).

PERIOD		1927-30*	1978/79**
Parameter			
NFI***/R100 Capital (%)		4,14	1,45
NFI/LSU**** (Rand)		35,30	13,42
LSU/Farm		197,9	293,6
Cattle Percentage of LSU		70,4	99,2
Percentage of NFI derived from	(1) Stock	72,5	36,9
	(2) Crops	21,1	62,0
	(3) Other	6,4	1,1

* Naude, 1933

** Van Zyl, 1980

*** NFI = Net farming income

**** LSU = Large Stock Unit, taken as being equivalent to a 454kg steer.

It is noteworthy that the net income per large stock unit

showed a marked decrease over the fifty years between surveys. Furthermore, crop production has become increasingly important as a source of income, an observation confirmed by other sources (Coetzee, 1971; Second Report of the Commission of Inquiry into Agriculture, 1970). Van Zyl (1980) reports that the average net income per farming unit for 1978/79 was - R787 in the case of cattle ranches, compared to R8 801 obtained by crop farmers in the region. The Director, Transvaal Region of Agricultural Technical Services (quoted in Second Report of the Commission of Inquiry into Agriculture, 1970) stated that only 5,6% of the north and north-western Transvaal was under cultivation. However, in that a minimum farm size of 2,000 morgen (1 712ha) was regarded as being necessary for a farmer to make a living out of cattle ranching (Tomlinson, 1966; Coetzee, 1971), it can be seen that only 12% of all farms in the area could be regarded as being viable cattle ranches (see Table 3.2).

Table 3.2 Farms in the north-western Transvaal Bushveld, divided into size classes (from Second Report of Commission of Inquiry into Agriculture, 1970).

Size (ha)*	Number of Farms	Percentage
101 - 850	1 135	30,7
851 - 1 712	2 110	57,1
1 713 - 2 568	336	9,1
Greater than 2 568	116	3,1
Total	3 697	100,0

* Original sizes (in morgen) have been converted to hectares.

As has been shown, the profitability of beef ranching is generally low. In Table 3.3, it can be seen that, within the same region, crop production was found to be a profitable enterprise although there is a high risk factor attached to crop production in savanna.

Table 3.3 A comparison between the results obtained on cattle ranches and on crop farms in the north-western Transvaal bushveld, 1978/79 (Van Zyl, 1980).

Parameter	Average cattle ranches	Average crop farms
Average size (ha)	2 436	975
Total capital investments per ha (R)	117,51	186,70
Gross income per farm (R)	14 070	70 353
Gross income per ha (R)	5,78	72,16
Farming expenses per ha (R)	6,10	63,12
Net farming income per farm (R)	- 787	8 801
Net farming income per ha	- 0,32	9,03
Net farming income per R100 capital (R)	- 0,27	4,63

Marketing problems and increasing cost have been cited as further problems facing the rancher (Lubbe, 1980). Between 1970 and 1979, the price index of combined farming input expenses rose by 253%. The fuel price index rose from the 1970 base of 100, to a phenomenal 850 in 1979. During the same period, the beef auction price index rose only 154% (Abstract of Agricultural Statistics, 1980). The commercial

agriculture sector is subject to the general economic conditions prevailing. In the past, the extensive farming areas have thus also been affected by macro-economic circumstances. Periodic recessions, high interest rates, costs and inflation have been partly responsible for decreasing profits. Since farming furthermore depends on natural factors, and a succession of bad years requires sufficient reserve capital for maintenance, the rents (in the economic sense) are of a low order and far from compensate for the high risk involved.

Many farmers have insufficient reserves to be able to maintain solvency when faced by, for example, successive drought years. The remoteness of the average farms presents an added burden to the extensive cattle ranching industry. Although partially subsidized, transport costs have increased steadily. Roads in the areas are generally poor, infrastructure poorly developed and the purchase of consumer goods demands travel over distance. In many areas, electricity was until very recently absent, preventing vertical expansion. In attempting to increase the turnover required to maintain a standard of living, stock numbers have been increased. Apart from possibly leading to "overgrazing", (as often alleged) problems involved in the marketing of products have arisen.

3.1.4.2 Problems involved in marketing

Louw (1975), Van Zyl (1980) and Lubbe (1980) regard marketing as one of the major problem areas facing cattle ranchers in the extensive savanna regions. In the first place, the best time, agronomically, to market cattle is dictated by climatic considerations and not by consumer demand. Coetzee (1971) stated that cattle were generally in prime condition for marketing from January to April. Reducing stock numbers during this period is also desirable from a range management point of view. This practice ensures sufficient winter grazing for breeding herds. However, Louw (1975) stated that during this period (January to April) low meat prices prevailed. Peak demand for meat generally occurs between October and December. Ranchers, under the quota system, require permits to market cattle in controlled areas. In cases where stock reduction is insufficient, because of the expectancy of a quota or permit, increased pressure on the land resource inevitably results. The high price of supplementary feed detracts from its widespread application, and cattle which should have been marketed are thus kept on the veld. The periodic occurrence of drought compounds the situation.

A second marketing problem relates to the high transport cost and to the abattoir and slaughtering fees. Between 1970 and 1977, abattoir fees rose 883%, slaughter fees rose 178% and transport costs rose 350%. (In 1980, rail tariff rose a further 10%). Transport and marketing costs amounted to 20% of the farmers gross income, on average (Lubbe,

1980).

Lubbe (1980) stated that a further factor contributing to the poor financial position of the extensive beef ranching industry, was the differential between consumer and product prices. He calculated that the farmers share of the consumers price in 1979 was only 43%. He further speculated that the probable reason for the price differential was as follows: physical marketing restrictions in the form of limits on slaughtering capacity and freezing facilities, control on flow to abattoirs and controlled retailed outlets and selling hours. The result was that consumers were subjected to an "artificial shortage", restricted access and relatively high prices, while the farmer, at farm level, was prone to oversupply and relatively low prices (Lubbe, 1980).

3.1.4.3 Uneconomic farming units and high land prices

Uneconomic farm sizes consistently emerged as one of the main reasons suggested for the poor financial situation of the extensive beef ranching industry. The sub-division of land resulted from the "national characteristic", the deep-rooted traditional "craving" to own land. As more and more land became occupied, so did the scarcity value increase, resulting in increasing land prices. As horizontal expansion became more difficult, vertical expansion became

necessary. Improvements, such as water supplies, cultivated land, fencing, etc. further contributed to the increase of land prices. This is compounded when land formerly used for extensive ranching is purchased by non-agriculturalists for hunting areas, capital appreciation, tax avoidance, status symbol or any other reason. The net results of high land prices are that horizontal expansion becomes even more difficult for existing farmers and prevents young potential farmers, lacking the necessary capital, from devoting their energies to productive farming. (This point is of particular significance in terms of the present age structure of the farming community - see below).

3.1.4.4 The burden of debt

The "Jacobs" Commission (1979) stated that the low profitability of extensive beef ranching offered no prospects for new farmers or for those with significant debts.

In the agricultural sector as a whole, net farming income, expressed as a percentage of total debt, was 5% during 1978. In the case of the extensive ranching enterprise in the north-western Transvaal, NFI was in fact less than the annual interest repayments on long, medium and short-term loans (NFI = R - 787, annual repayments of long-term and

necessary. Improvements, such as water supplies, cultivated land, fencing, etc. further contributed to the increase of land prices. This is compounded when land formerly used for extensive ranching is purchased by non-agriculturalists for hunting areas, capital appreciation, tax avoidance, status symbol or any other reason. The net results of high land prices are that horizontal expansion becomes even more difficult for existing farmers and prevents young potential farmers, lacking the necessary capital, from devoting their energies to productive farming. (This point is of particular significance in terms of the present age structure of the farming community - see below).

3.1.4.4 The burden of debt

The "Jacobs" Commission (1979) stated that the low profitability of extensive beef ranching offered no prospects for new farmers or for those with significant debts.

In the agricultural sector as a whole, net farming income, expressed as a percentage of total debt, was 56% during 1978. In the case of the extensive ranching enterprise in the north-western Transvaal, NFI was in fact less than the annual interest repayments on long, medium and short-term loans (NFI = R - 787, annual repayments of long-term and

medium-term loans = R3,996, annual repayments of short-term loans = R9,066, Van Zyl, 1980). Lubbe (1980) stated that debt had become a method of obtaining working capital and of replacing capital lost. As a result, the creditworthiness of the farmer decreased and insolvency increased. Loss of control and ownership of their properties by farmers is the ultimate conclusion of such tendencies.

3.1.5 Sociological factors

It is a matter of course that the efficiency of resource exploitation influences the status of the environment. The manner in which the land user adapts agricultural practices to the prevailing physical and biological circumstances, directly influences the viability of the enterprise and the plight of the land. As the demand for agricultural produce increases, so too do the demands on the capabilities of the farmer. The Commission of Inquiry into Agriculture (2nd Report, 1970) concluded that although the farming community had contributed immensely to the welfare of the country, there still existed a section of the community which had neither the initiative nor the determination required to farm successfully. Deep-rooted traditions, inherent conservatism, fatalistic and over-optimistic attitudes to climatic factors, little education and political interference were cited as major factors contributing to the precarious position of farmers.

3.1.5.1 Structure of rural settlements

Grosskopf (1932) stated that, apart from the earliest agricultural settlements at the Cape, "...the prevailing and traditional form of (white) rural settlement was that of separate, isolated farms, often many miles apart and with practically no kind of common bond of organisation." This differed markedly from the system of agricultural community group settlement in the countries of origin of many colonists.

As a result of this form of settlement, infrastructural development (e.g. communication and transport networks and power supply) was hampered and was relatively expensive to supply and maintain (Cilliers, 1968). Schooling presented a problem, and the opportunities for social intercourse and entertainment were limited (Cilliers, 1968). This scenario could contribute to the slow diffusion of the extension message. Lubbe (1980) suggested that the relatively higher cost of living and lack of facilities contributed to the loss of the more able farmers from the extensive cattle ranching areas. The more conservative tradition-bound element remained. Because of the isolated nature of the regions, agricultural extension activities may be further complicated - extension officers serve large areas and are unable to devote sufficient time to individual farmers. Those farmers who most need extension inputs are thus often

completely ignored, and a low level of management efficiency could become entrenched.

3.1.5.2 Community age structure

Although age per se need not always be indicative of attitude or ability, the age structure of communities in the extensive ranching areas has been analysed previously. Coetzee (1971) found that the average age of farmers in the north western Transvaal was 50,9 years. Some 82,3% of the farmers were older than 40 years and 24,1% were older than 60 years. According to Coetzee (1971) the age structure of communities in such extensive cattle ranching areas restricted the development of more modern farming methods and limited the application of systems suitable to the particular environment.

The tendency for a shift from rural to urban areas is characteristic of a developing economy. An urban bias, in terms of development, has been suggested by Lipton (1973). He stated, in broad terms, that almost all resources and energy available for development were devoted to the urban sector, at the expense of the rural sector. As industrialization increased in South Africa, migration of people from the rural, agricultural sector to the urban environment increased. Between 1958 and 1968, migration

occurred at an average annual rate of 6,15% (2nd Report of Commission of Inquiry into Agriculture, 1970). Mostly the younger, more able people were lost from the farming sector.

3.1.5.3 Education

Modern farming techniques require knowledge of production, marketing and management concepts. Formal education, while not always providing such knowledge, at least provides a basis for the attainment of such knowledge. Van der Riet (1974) stated that significant positive correlations existed between level of education and acceptance of improved innovative techniques. He reported that over 60% of farmers surveyed in the central Transvaal bushveld had ten years education or less (note: Standard 10 is taken as 12 years of education, corresponding to the attainment of the matriculation certificate). Almost 33% had 12 years of education, while 8,7% had university education. The average level of education of the farmers surveyed was 9,7 years. Coetzee (1971) reported a similar average level of education of farmers in the north western Transvaal bushveld. He found that less than one-third of these farmers had received more than 10 years of formal education. He concluded that in the light of the low level of education, it would be extremely difficult to introduce meaningful improvements.

The Commission of Inquiry into Agriculture (2nd Report, 1970) stated that the educational system in South Africa was largely "city-orientated". As a result, it increased the alienation of the rural agricultural environment. Young farm children became exposed to this system at an early age, and lost their interest in and "attachment to the soil and to the farm". Other interests developed, and the young came to regard the rural environment as being "backward and inferior". Well educated youngsters were unlikely to return to the farms after completing their education. This further contributed to the structure of the community in the extensive savanna regions, namely a community dominated by poorly educated, older farmers.

3.1.5.4 Human traits

The background of the South African farmer has, according to Grosskopf (1932) produced hardy, self-sufficient individuals. The Commission of Inquiry into Agriculture (2nd Report, 1970) stated that the role of agriculture extended beyond the material contributions, to the "spiritual contribution which agriculture has made to the nation". The South African environment, with its harsh and unpredictable climate, with its droughts and diseases, had "taught our farmers to persevere, to be courageous, so that a 'never-say-die' spirit of optimism developed". The phenomenal growth in agricultural production, coupled with wide media

and official advertisement thereof, have fuelled this traditional optimism. The farmer feels that he is contributing to the well-being of the country, that his production is in the national interest. However, this spirit of optimism may have potentially negative results. During periodic dry years, farmers are reluctant to reduce stock numbers to realistic levels, expecting that "it will soon rain" (Commission of Inquiry into Agriculture, Interim Report, 1968). Seasons experiencing above average rainfall are regarded as being the norm, and production strategies are set according to this criterion. The natural resources are regarded as being infinitely renewable. Stocking rates are less a reflection of the inherent carrying capacity of the rangeland than of the farmer's optimism. In the north and north western Transvaal, recommended carrying capacities range from 8 ha/LSU to 20 ha/LSU, depending on vegetation type. Reported average stocking rates are higher, eg 6,6 ha/LSU (Coetzee, 1971), 6,7 ha/LSU (van Zyl, 1980) and even greater.

That the majority of farmers in the savanna regions were in need of an extension service was illustrated by Coetzee (1971). He stated that the vast majority of farmers surveyed in the north western Transvaal bushveld had very little insight into even the most basic requirements of rational land use. Coupled with this lack of insight was an ignorance of such fundamentals as grazing preferences and grass species identification.

The 2nd Report of the Commission of Inquiry into Agriculture (1970) stated that farmers often lacked the essential characteristics required of successful farmers. Organisation and management capabilities, sound judgement, initiative and financial acumen were lacking, and records weren't kept. Farming enterprises were often left in the hands of unskilled labourers, and ranchers were not always in complete control of their enterprise. Van Zyl (1980) stated that accurate results of beef ranching enterprises in the north western Transvaal were not easily obtainable. The majority of farmers in the area kept no physical records of cattle numbers, ages, deaths, births or breeding selections.

The low level of ranching efficiency is further illustrated by the poor calving percentages obtained. A high calving percentage is of prime importance in cattle ranching, as it determines financial results, turnover and herd composition. A low calving percentage makes breeding selection more difficult and, consequently lessens the likelihood of herd improvement. In the north western Transvaal bushveld, calving percentages were on average 61,1% (Coetzee, 1971). Calving percentages of 99% have been reported on farms where a high level of managerial efficiency is practised, emphasizing the generally poor achievement by most ranchers.

Finally, the personnel shortages in the extension services, together with the fact that generally the more able farmers

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