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Timothy A. Greenhow
University of Windsor

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THE TATI RESETTLEMENT SCHEME OF BOTSWANA:
A STUDY IN NATURAL RESOURCE PLANNING AND
IMPLEMENTATION WITHIN A SOCIAL, ECONOMIC
AND POLITICAL FRAMEWORK

by

Timothy A. Greenhow

A thesis submitted to the Faculty of Graduate
Studies through the Department of Geography in
partial fulfillment of the requirements for the
degree of Master of Arts at the University of
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Department of Geography
University of Windsor
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Windsor, Ontario Canada

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ABSTRACT

The growing world-wide concern with conservation and wise utilization of natural resources, has led to greater emphasis being placed on the environmental aspects of development. A danger exists of stressing this conservationist approach to the exclusion of important social, economic and political factors and creating a new complex of socio-economic problems.

This thesis studies a case in the North East District of Botswana in which a set of inter-related environmental, cultural, technological, economic, and political factors has led to a serious state of overgrazing and deterioration of grazing land. The reaction to this has been a narrow approach aimed at solving the land resource problem, but inadequately dealing with the social, economic and political root causes. The present situation is analysed and the proposed solution of acquisition of alienated land, and resettlement elsewhere investigated, leading to an indication of the extent of overstocking and the suitability of the proposals.

The conclusion reached is that there is unlikely to be a short-term solution to the grazing problem, and that a long-term solution is only possible through a much broader, holistic approach to the entire developmental process, encompassing from the beginning social values, aspirations, economic constraints and official policies.

On a wider scale, the implications suggest that all regional, national and even international planning should use this comprehensive approach to avoid unwanted spinoff effects and unnecessary problems in the future.

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CHAPTER ONE

INTRODUCTION

The implementation of natural resource management programmes presents special problems and demands particular care if the envisaged goals are to be achieved. Instances of resource misuse may be easy to identify and optimal situations are often relatively simple to describe. The technological know how may exist to enable, at least in theory, the move from the present situation of misuse to the more optimal one. But the realisation of desired goals itself presents additional problems because it must take place within a social, economic, and political framework.

In other words, it is fairly straightforward to achieve a harmonious relationship between one man and his physical environment. It is a far more difficult thing to effect the same harmony when there are two men, for there are additional factors involving the relationships between them, which reflect on the use of natural resources. The problem of man's relationship to his environment has been a topic of considerable discussion for some time. As the world's population grows it becomes increasingly evident that much care must be taken in the development and use of the finite resources on which mankind relies.

The level of technology has improved vastly in the past century. Hitherto inaccessible resources have been made

available. Advanced technology has also led to much greater use of resources, often in wasteful measure and with far-reaching side-effects. It is often maintained that resources should be managed for the greatest benefit of the greatest number of people. There can be little argument with this at a moral level, and there are no insurmountable technical problems in achieving it. The problems are chiefly problems of implementation introduced by the existence of other, less tangible, factors of a cultural nature.

Stamp (1960), for example, maintains that present technology is such that "the world can support many times its present population" and cites several instances of areas which support 4,000 persons per square mile. He adds, however, that the technology of modern agriculture puts it out of the hands of the vast majority of small land holders, and increasingly into the hands of large, and even corporate, agriculturalists. The world food shortage may be alleviated, but those most directly dependent on arable land are dispossessed probably to migrate, to urban centers and exacerbate social problems there. What is technically possible may not be socially, economically, or politically acceptable. It may even be impracticable.

Natural resources are not distributed evenly around the earth's surface. Nor are the consumers of those resources. As a result there are concentrations and imbalances in the production, distribution and consumption of resources. These

are due as much to historical and political factors as to basic resource distribution patterns. There are not only variations in the quality of life from place to place; there are also differences in cultural values and perceptions of resources (Ackermann, 1959). Changes in technology often result in alterations in the relative values of inputs in the production process. The greater the technical change, the greater will be the impact on value perceptions, and the greater will be the danger of serious side effects in the cultural landscape. These cultural side effects then enter the next cycle as determinant factors in resource utilization and management. It is vital therefore to understand the inter-relationships that exist in planning and implementing natural resource management programmes.

It is not surprising to find some of the most complex resource management problems in developing countries. Here the technological changes from traditional, often subsistence level human systems, to modern materialistic societies is immense. The changes are not only rapid, but occur simultaneously on all fronts: health, education, agriculture, transportation and communication, economic exchange systems, politics, religion, to name only a few. But the changes do not occur uniformly in time or space, so that developing countries must cope with the additional problems posed by dual economies. Furthermore innovations often originate externally (in the developed world) so that on a global scale the rate of change is often

affected by international political relationships.

These political factors require some consideration here because of their importance to resource development and utilization, for it is at the political level that the most far reaching decisions are made (Dasman, Milton and Freeman, 1973). It is at this level that policies are formulated affecting national and sub-national resource management, and legislation drafted affecting the use of all resources. Financial resources, an indispensable requirement in all modern style developments, are generally scarce in the less developed nations. It is the politician who must set the priorities and make the allocations of this vital resource. But by the nature of their occupation political leaders tend to favour decisions that will lengthen their tenure of office, usually on a short term basis, preferring to meet each political crisis as it arises. "If they can protect themselves or advance their personal interests by advocating development projects which promise quick results and have a mass appeal, they can be expected to do so...The 'practical' attitude towards ecological consequences (if they are even considered) is to meet them if and when they arise" (L.K. Caldwell, 1972, p.935).

Internal political factors are complicated further by the politics of international development aid. In the past international aid has been notoriously "tied," if not materially (through requirements to purchase technology from the donor country) then usually ideologically - only those programmes which are politically palatable to donor countries are funded.

This type of external pressure on domestic decision making has a strong bearing on the development and management of natural resources, either directly or by influencing the allocation of financial resources.

Developing countries are very much aware of this external pressure and the desire to achieve economic independence itself enters the decisions relating to priorities (eg. Botswana National Development Plan, 1973-78, 1973). Projects which hold out the promise of quick financial returns become desirable for that feature alone, often to the detriment of long term social goals. The natural environment usually suffers in the process since conservation and wise management generally require greater expenditure and therefore give lower percentage returns on investment in the short term.

At times internationally approved projects, that may even have substantial economic value, meet opposition at the local or subnational level because of social values. This is often true, for example, in developing countries where preservation or conservation of wildlife is proposed. In the traditional view wildlife is often seen as a competitor for scarce grazing land, or may be a more direct threat to human settlements (e.g. elephants destroying cropped lands and villages). It seems absurd to the traditionalist that he should conserve his nation's wildlife resources for the long term benefit of his country and of the world. To bring him to an understanding and acceptance of the value of wildlife resources requires a carefully programmed approach,

beginning with an understanding of his frame of reference, his value system and providing for his fears and aspirations. At times it must be accepted that during the period of this change over in values some of the wildlife resources will continue to be depleted.

Similar problems arise when dealing with land. Land, as a resource, is often neglected. This is more true of sparsely settled regions than of densely populated areas. The pressures of increased population tend to increase the awareness of the land's importance. This may then lead to the acceptance of improved land use techniques. But in sparsely settled areas, such as arid or semi-arid regions and tropical forests, traditional views of the land belie a quite different attitude to its management. Greater political stability and improved health facilities in developing nations are leading to rapidly growing populations. These populations continue to remain for the most part tied to the land in rural settings. This leads to increased pressure on this resource. But the change in pressure is sometimes faster than the necessary change in social attitude to the land, so that the land tenure reform required to raise productivity is hindered by lingering value systems. Imposed land tenure reform leads to greater social problems. To be successful reform must be approached from within the socio-cultural environment, starting with existing value systems, understanding their rationale, and demonstrating the ability of the proposed changes to achieve social goals.

Land, and more particularly a society's perception of land, is often a major factor in problems of development and change (see Koo, 1968 for study of importance of land reform in economic development). In some instances the general change from a traditional to a modern economy, and technological innovations necessitate a change in tenure systems. In other circumstances, it is the land itself, its tenure and management, that is at the core of the problem. Following is a brief description of some of the reactions to land problems in Africa. This will serve as a background introduction to a case study of one particular area in Botswana, a country in southern Africa, where land resource problems are the focal point of a complex knot of social, economic and political inter-relationships.

Land problems of various types have led to numerous schemes in Africa. Colonial administrations, during their final years of existence, seem to have spawned endless settlement schemes in an attempt to show their dedication to the development of their dependencies.

The specific motivations for settlement schemes varied. Often the primary interest was increasing agricultural production. The Gezira scheme, probably the grandest pre-Independence scheme in Africa, was aimed specifically at providing irrigated plots for the cultivation of crops, primarily cotton. It was undertaken in "a spirit of paternalism and a paramountcy of native interest" (Gaitskell, 1959) but was characterized by careful planning and a cautious start.

a feature absent from most later schemes (Chambers, 1969). The Sukumaland Cotton Development scheme in Tanganyika, undertaken in the early 1950's was likewise aimed at increased cotton production, but with less success (Malcolm, 1953), and the Urambo and Tumbi Settlement Scheme, also of Tanganyika, were programmes to improve general crop production by the local people (Ruthenberg, 1968).

At times settlement, or resettlement, schemes were seen as a method of solving the related problems of overpopulation, land pressure and soil erosion (Chambers, 1969). The case study in this paper relates to a scheme in this category, that never quite reached implementation stage. Other schemes were basically for resettlement of displaced persons, such as in the construction of the Volta and Kariba dams. Usually however, in these schemes the opportunity was taken to incorporate new agricultural practices, methods and bases, e.g. land consolidation and tenure reform (Chambers, 1970).

Frequently, development schemes were of a partial nature, ignoring by choice or lack of understanding some aspects of the Africans' agricultural system. For example, while a few schemes have made allowances for livestock most projects have viewed stock production as of secondary importance and given it inadequate planning attention. The inability, or unwillingness, to accept the traditional value of livestock has in these cases led to a continuation of land resource problems, albeit of slightly different nature. The Nyanyadzi in Rhodesia is a case in point. Here livestock

were seen as of minor importance, but given some communal grazing space. This became severely overgrazed in the early stages of the project - mainly because the stock question was given little planning consideration and no stock control was incorporated in the original agreements with settlers (Gregory, 1967).

The sensitivity of the world's grazing land to abuse has long been known but there seems to be little or no record of colonial administrations attempting to combat problems of range deterioration, certainly not to the degree in which they approached arable land problems. This writer has been able to locate records of only two areas where projects have been worked out specifically to increase animal production while conserving range resources. These areas are Botswana and Kenya.

The project in Botswana was undertaken by the Colonial Development Corporation as a profit making enterprise. As such it had no elements of resettlement and very little in the way of encouraging local cattle owners to practice wise range management techniques.

In Kenya much more recent (post-independence) schemes have livestock production and range conservation as their primary goals. In 1973 these local projects came under the Kenya Livestock Development Project, a comprehensive plan for national range development (Lele, 1975). In this project there has been a definite attempt to build around social and cultural value systems instead of imposing foreign ideas and

techniques that have not yet proven themselves in this particular environment. An attempt was made to identify affiliated groups of people who could operate together on large ranches. Other aspects of traditional practice, such as wet and dry season pastures, were to be maintained to allow customary migration to continue (Davis, 1971). The recent inception of this project precludes the possibility of a thorough evaluation at this time, however.

A characteristic of most early schemes was the lack of thorough investigation of land resources prior to planning. This was true, for example, of the Tanganyika Groundnut Scheme (Wood, 1950) and of the Colonial Development Corporation's Northern Bechuanaland Ranch project (Greenhow, Lecoge, and Speed, 1975) where the lack of proper soil and range surveys led to overestimated potential, grandiose plans, unnecessary and wasteful expenditure, and mismanagement. Both schemes failed.

Lack of study into social attitudes and aspirations also led to frustration and failure of settlement schemes (Gregory, 1967). And political factors influenced the success of pre-Independence projects, as nationalist politicians urged resistance to colonial administrations on the grounds of foreign exploitation and trickery (de Wilde, 1971).

Experience has shown quite clearly that large schemes aimed at natural resource management, either to increase production, or to reduce land pressures, require careful study of all factors: natural ecological systems, social

values and aspirations, political climate, economic patterns, and so on. It also illustrates that while natural resource management is required it cannot be shaped by technical or scientific considerations alone. It necessarily takes place within a socio-economic and political environment no less real than the physical world. Planning resource management programmes must recognize the importance of cultural value systems and political realities existing at any one time, and must aim at an ecologically sound solution within the existing human system and not directly against it.

This paper seeks to present a case study from Botswana to illustrate the difficulties inherent in seeking such a solution. It will show the complicated knot that exists as a result of conflicts between very important cultural and economic, political and environmental factors, between the desired long term national goals and the immediate needs of a small proportion of the nation's people. It will highlight some of the methodological difficulties encountered in trying not only to see the problem as it exists, but in trying to satisfy the almost incompatible goals at different political levels.

The case study will be approached in the following manner. First, a general description will be given of the nation as a whole, presenting in brief its physical geography, its basic cultural, economic and political pattern. Second, a description will be given of the problem area. This will present in more detail the environmental, social, historical, and political background to the problem, and will include

statistical data on the present situation. The Government's specific proposals for solving the land problem by acquisition of freehold farms, and resettlement will also be presented. The third part of the study is an investigation of the proposed resettlement area with a view to determining the wisdom of this aspect of the solution. This will illustrate the need for adequate investigation of all aspects of any proposed solution, and contrast it with the political pressure for immediate action. Finally, conclusions will be drawn and an alternate approach suggested, with more generalised implications given on the implementation of natural resource management plans within an overall physical and human environment.

The study draws heavily from the personal experience of the writer as a civil servant involved in land use planning in Botswana over the past two years (October 1974 - October 1976). Much of the information presented derives from extensive field work in the study area, as well as close contact with other personnel in the Government service, particularly in the Ministry of Agriculture and the Ministry of Local Government and Lands. These are the two Ministries most intimately involved in seeking a solution to the problem. Where information is drawn from a specific source outside the context of the writer's personal experience and professional contacts, its source is footnoted.

The paucity of quantitative data is a problem common to many studies in less developed countries and this case study is no exception. Wherever possible it is used, but

where it is unavailable or non-existent a more qualitative approach is necessitated and employed. The nature of the problem and the purpose of the study, however, allow an adequate analysis to be done. The more detailed work called for in the final section of the study will definitely require much more quantified data, surveys, economic analysis and so on, but that is beyond the scope of this paper, and need not be discussed here.

In brief, the case study is an attempt at one level to present a problem, analyze the proposed solution, and suggest an alternative approach. It cannot at this point claim to present an alternate solution. It is an attempt at a second level to illustrate the complexities that do exist in seeking to implement wise, scientifically based, natural resource management plans, within a rapidly changing, unstable socio-economic world.

CHAPTER TWO

BOTSWANA: A NATIONAL PERSPECTIVE

The Republic of Botswana is a relatively little known nation in southern Africa (Fig. I), about 570,000 square kilometers, a little larger than France. It is an entirely land locked state, its western border 560 kilometers from the nearest ocean port. It is entirely surrounded by European dominated States, South Africa to the south, South West Africa to the west and north, Rhodesia to the east, a situation that has strongly influenced the development of Botswana.

This Chapter will look at the country's physical and cultural environments. In describing the natural setting emphasis will be given to those resources which have the greatest bearing on the largest proportion of the people. The problems and possibilities of developing these resources wisely will be shown. Again, in presenting the cultural setting, the description will concentrate on those social, economic and political factors which have the greatest impact on shaping the development and utilization of the natural resources.

The Natural Setting:

Botswana lies on part of the vast southern African plateau with altitudes varying generally between 900 and 1400 meters (3,000 and 4,000 feet). Geologically, it lies in an ancient depression of the shield, which has been

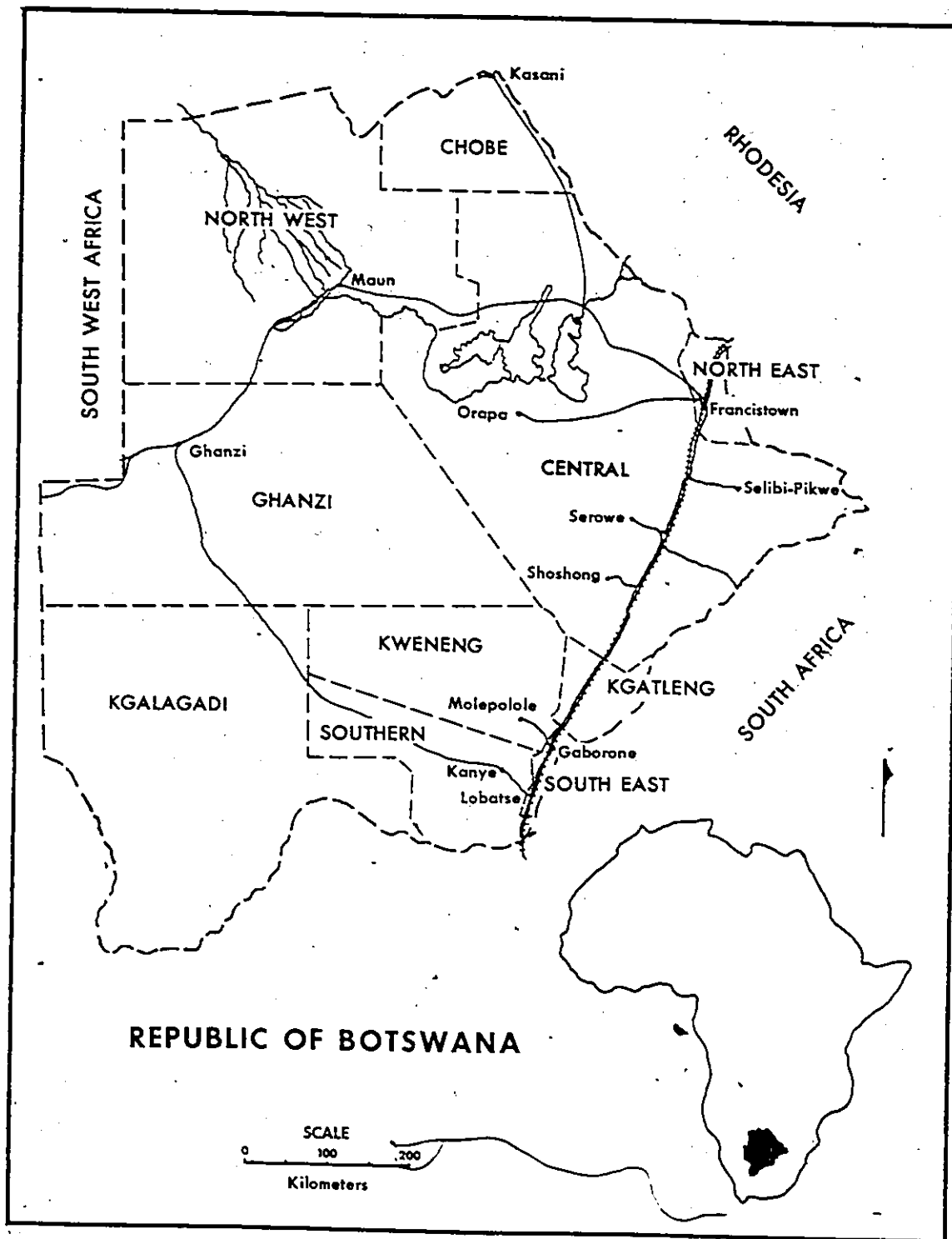


Figure I

"filled at various stages, from the Middle Precambrian upwards, with sedimentary and volcanic deposits culminating in the accumulation of the Kalahari sands" (Boocock, 1969). The country could be divided into five physical regions; although the distinctions in some cases are not totally clear. The entire western portion of the country is a gently undulating to flat landscape commonly known as the Kalahari sand veld, covered as it is with sand deposits that reach depths of over 400 feet in places. The Ghanzi Limestone ridge lies within this region, bearing generally north east to south west. Because of its greater water retaining properties this limestone outcrop area has received relatively more development attention than the surrounding Kalahari.

Also within the Kalahari sand veld, but with an otherwise unique environment is the Okavango swamp or delta. This large expanse of swampland is the result of a geological uplift which interrupted the flow of the Okavango River into the Makgadikgadi depression (Botswana Government, 1966). At times rainfall is plentiful enough to allow some spill over into the Botletle River and onto the Makgadikgadi Salt Pans. This has been aided in recent years by active dredging of the spill-way channel. The Okavango swamp forms a huge water reservoir which has drawn the attention of development planners who must constantly face problems of water shortage elsewhere in Botswana. However, the hydrological details are not known at present, and studies are underway to establish what role the

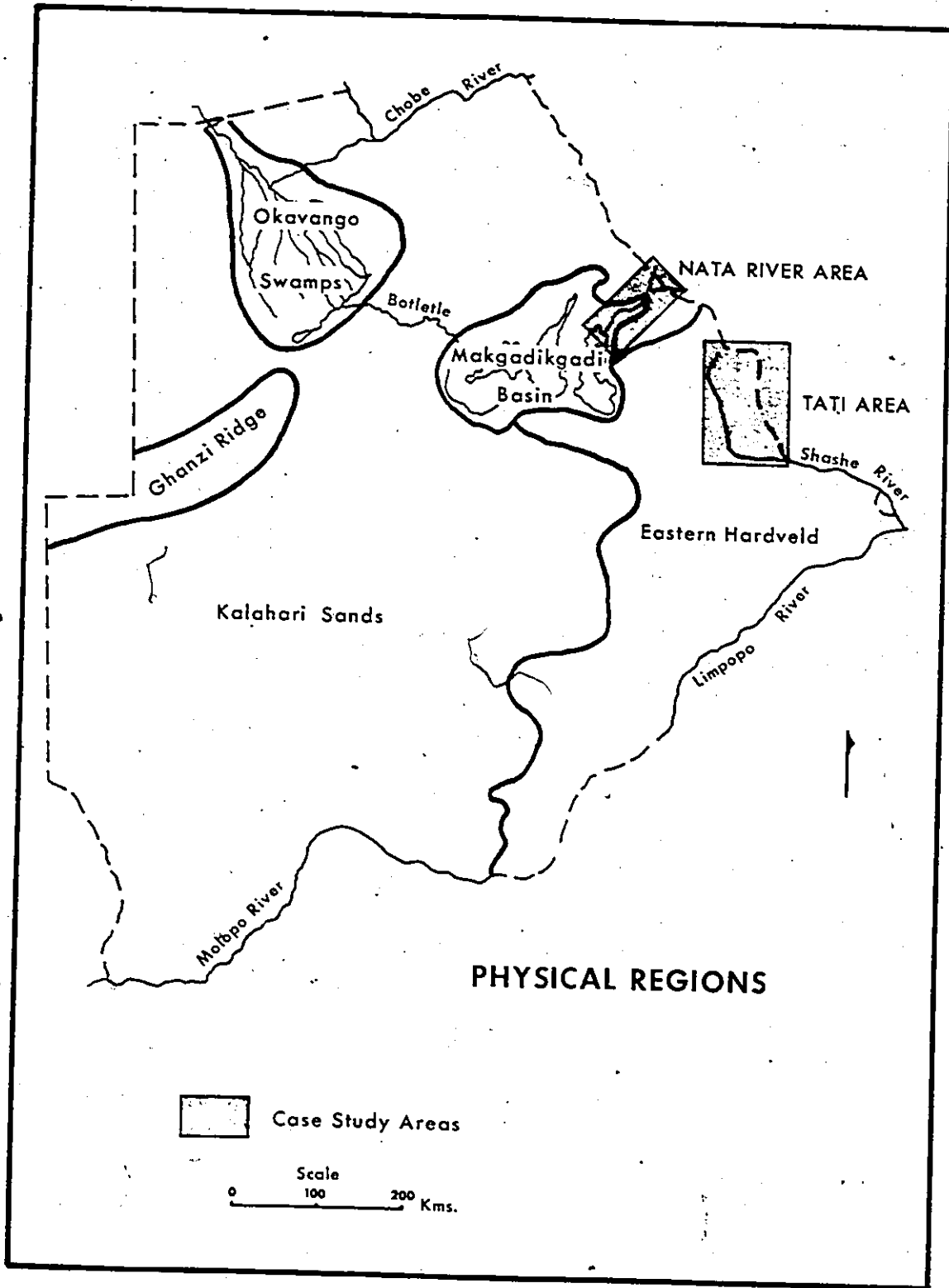


Figure II

swamp plays in the recharge of ground water resources in other areas of the Kalahari. Because of its unique ecology, any major development requiring the withdrawal of large quantities of water from the swamp is being studied carefully, to avoid irreparable damage to the eco-system.

The fourth recognisable physical region is the Makgadikgadi depression. This formed the bed of an ancient inland sea, and parts of it still receive flood waters from rivers in the water shed. Chief of these are the above mentioned Botletle, flowing from the north west, and the Nata, situated to the north east. Large salt pans cover most of the former sea bed, and these are surrounded by hallophytic vegetation associations. Because of the seasonal water supplies in the pans, and the abundant grasslands surrounding them, the region has importance within the migration patterns of wildlife, such as zebra, wildebeeste, kudu, and the like. Away from the immediate edge of the salt pans, and in calcreteous outcrops, ground water is easily accessible, and usually potable. This has attracted a considerable livestock population, which threatens the wildlife and without control leads to serious range and soil deterioration.

The last physiological unit is the eastern "hard veld." This unit shows the most topographical variation, and could be divided into many smaller geological units. Its main characteristic is that the bed rock breaks the surface quite frequently. Mineral deposits are thus more readily explored and developed, water is generally closer to the surface and

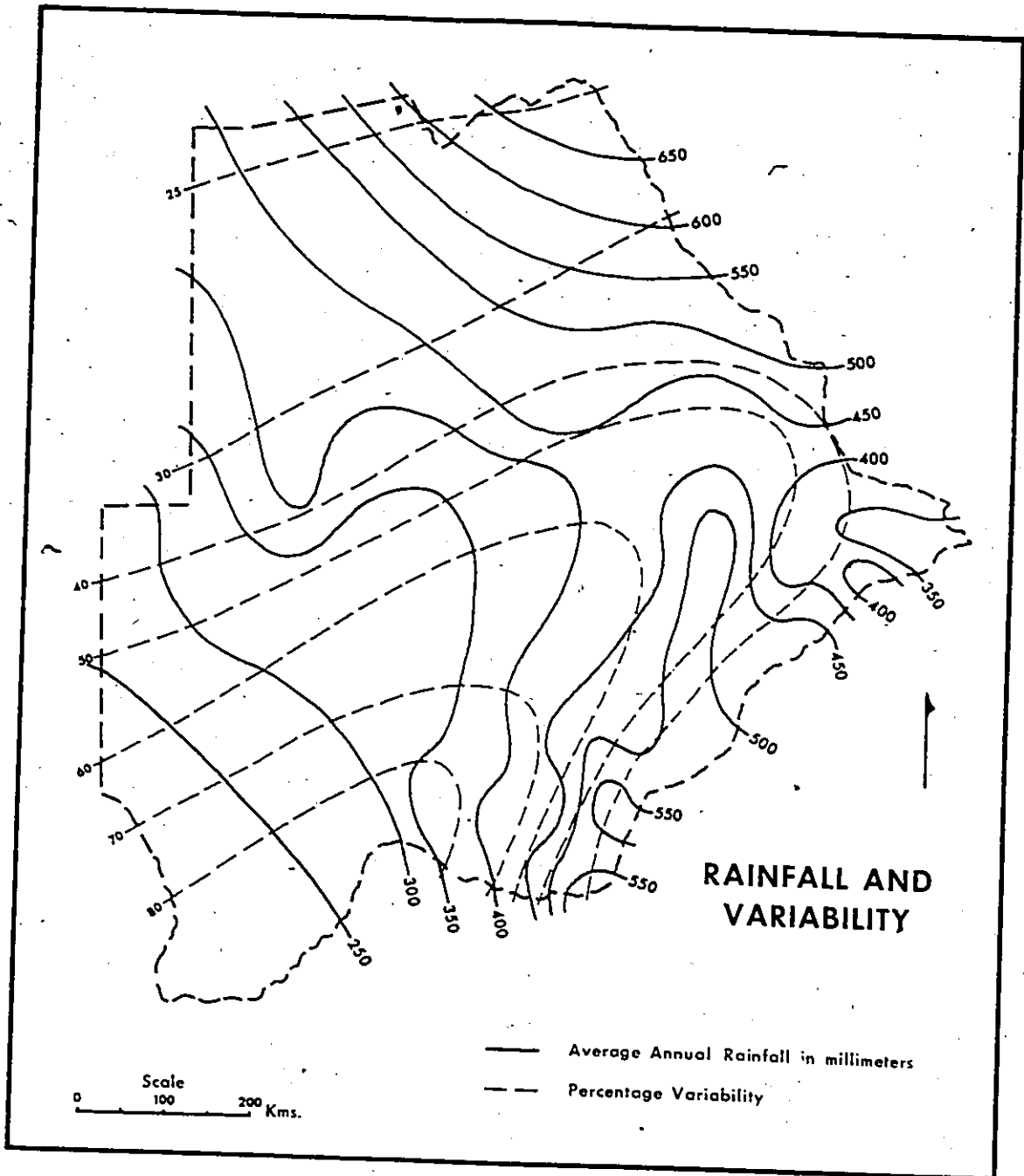
therefore more easily reached. Soils derived from bedrock are more mature than those of the Kalahari sand veld and are richer in nutrients. This has important implications for arable agriculture and for livestock management systems. The availability of water and the better arable soils have affected the historic pattern of settlement as well, with the result that population is concentrated in this region, as are most economic developments, infrastructure and social services.

Drainage in Botswana shows some interesting features. Most of the rivers in the eastern hard veld are part of the Limpopo river system, which flows south east towards the Indian Ocean. A major tributary of the Limpopo is the Shashe which rises in the North East District and later forms the border between Botswana and Rhodesia. The Okavango-Botletle-Makgadikgadi system has already been mentioned. In the extreme north of the country is the Chobe River, which rises in the south eastern corner of Angola. It is also connected to the Okavango swamp by the Selinda spillway, some of whose waters are again diverted through the Savuti Channel into the Mababe Depression (Fig. II). In the Kalahari sand veld there are no rivers, though fossil river valleys do exist. In the extreme south the border with South Africa is formed by the Molopo River which is a tributary of the Orange. The Orange River flows westwards into the Atlantic.

Of all the rivers in Botswana, only the Okavango flows year round. All others are intermittent, unless, as in the

case of the Botletle, dredged by man. Although ephemeral, the rivers are often choked with sand, washed from overgrazed banks. Within this thick layer of sand, water does flow, the quantity depending on the amount of rainfall received and the time elapsed since its fall. The sand is a natural guard against evaporation, and so these rivers continue to play an important role as water reservoirs during dry seasons, attracting large numbers of livestock and human population. Pressure thus increases along rivers, vegetation cover is depleted, soil erosion becomes more wide spread, and additional sand is added to the rivers. Conversations with elderly residents suggest that this process has been quite rapid over the past generation, aggravated no doubt by much increased livestock numbers.

Rainfall over Botswana has two notable characteristics - it is low in quantity at the best of times, and it is highly variable. For example, Francistown's 28 year average is 448 millimetres, but the maximum and minimum annual figures were 834 mm and 246mm, respectively (Smit, 1970). Annual averages must therefore be interpreted with this understanding. The average figures range from about 600mm in the extreme north to less than 250mm in the extreme south west. Variability increases from north east to south west as well. Rain falls seasonally, usually beginning in late October and lasting until April or May. Once again the beginning of the rains shows wide variation, and is an important factor in the



Source: National Development Plan 1973-78

Figure III

agricultural patterns, governing as it does the planting season. Should the rains delay too long, the end of the growing season may be cut short by the possible occurrence of frost in May or June (Atkinson, 1967).

Temperatures vary widely throughout the year. During the dry winter months, skies are cloudless, radiation is high, and night temperatures frequently drop to freezing or below. Day time temperatures however may be fairly warm. The wet summer months are characterized by high temperatures often around 40°C, but with less diurnal range. Temperature variability and range increase southward, and is affected as expected by altitude.

Vegetation is closely tied to the rainfall and temperature changes over Botswana, but is also affected somewhat by soils. Most of the east and north are classified as tree savanna, although the Okavango swamps and the Makgadikgadi Pans have their own peculiar associations. The south western corner of the country is classified as shrub savannah (Smit, 1970 from Bawden and Stobbs, 1963). Acacia species dominate the woody species towards the south, but are replaced towards the north and north east by Colophospermum mopane. Further to the north increasing numbers of Terminalia and Combretum species occur. A few pockets of forest in the Chobe District have sufficient timber trees such as Baikiaea Plurijuge and Pterocarpus Angolensis to warrant small scale exploitation (Langdale-Brown and Spooner, 1968). Of far more economic importance are the grassland associations, which show wide

variation across the country. The eastern hard veld grasslands are generally regarded as being more resilient, and of higher nutritional value than the Kalahari sand associations which often look more promising than they are. Mineral deficiencies characteristic of the Kalahari sand soils are also true of the grasses growing there, and the sensitive soil structure makes overgrazing effects more prominent. More details on this will be given below.

Little detailed work has been done on soils in Botswana. Two main classes are the Desert and Sub-Desert soils; and the Ferruginous tropical soils (Bawden and Stobbs, 1963). The first class occurs mainly in the Kalahari sand veld. "They are very unproductive and respond extremely well to phosphate nitrogen and manure, provided the water factor is adequate. When suitably fertilised they serve as a good medium for suitable crops considered from a climatic point of view" (Van der Merwe, 1963). The ferruginous soils are found on the eastern hardveld. Some of these soils, such as the reddish brown, medium to heavy textured acid soils have considerable aerable potential. There are also halomorphic soils in the Makgadikgadi pans area and young immature soils in the Okavango swamp area (see Smit, 1970).

Mineral resources appear to be more extensive than first thought. Gold was discovered last century in the North East District but the last gold mine closed in 1964. Kyanite, asbestos, and managenese, as well as small amounts of copper and silver, were also mined from time to time in

pre-Independence days. Most of this has ceased, but three major mining developments have taken place since Independence. Copper and nickel are presently mined at Selibi-Pikwe, coal at Morupule and diamonds at Orapa. The Makgadikgadi salt pans with enormous brine deposits are potentially important sources of salt and potash. Gypsum deposits have been discovered and high-grade limestone also occurs. Smaller occurrences of numerous other minerals have been recorded (Smit, 1970).

Wildlife resources are becoming increasingly important as their value in the tourist industry is realised. The Chobe National Park is said to have a wider variety of fauna than any other wildlife sanctuary in the world (Sillery, 1974). Birdlife is also plentiful and of great variety. The Government has realised the potential of its wildlife resources and has set aside 30,000 square miles in National Parks and Game Reserves. Hunting is controlled and legislation has been passed (The Fauna Conservation Act) to protect endangered species.

Of all the natural resources of Botswana water and grazing land are the two that most vitally affect the people and the nation's economy. Water is critically important in every sphere of development, and its availability, both in terms of location and its characteristics (quantity and quality) determine to a large degree the pattern of human settlement and activity.

Technology affects the ability of a people to develop natural resources, including water. Where no technology

exists human activity must be centered on permanent surface water supplies (Stamp, 1960). The technology of well digging and hand or animal powered lifting mechanisms allows a little more freedom from permanent surface water, and extends the frontiers of settlement. This was the level of technology prevalent in Botswana at the beginning of this century, so that settlement was restricted to those areas where water was readily accessible, either in standing pools, sand rivers or by digging wells. This limited permanent settlement to the eastern hardveld, the Okavango-Botletle river systems in the northwestern part of the country, the Chobe River in the north, and to limestone or silcreious outcrop areas, where shallow wells could be sunk. Elsewhere, existence was necessarily nomadic.

The advent of more sophisticated boring techniques, supplemented by mechanical engines and pumps, brought radical change to this settlement pattern. The frontier for settlement was now pushed much farther west into the Kalahari sand veld, where water could be extracted from depths of up to 600 feet or more. Not only has this advanced technology radically altered the settlement pattern, it has had implications for other land based resources, such as the range and wildlife; and beyond them, there have been important socio-economic changes which will be shown in the next section.

Grazing land is an important resource primarily because of the number of people who indirectly depend on it for their livelihood. Grazing land within the semi-arid ecosystems

of the world are vital to global livestock production, and have been a source of livelihood throughout history. Yet grazing lands have been consistently abused by man, being neglected and mismanaged, to the point of serious soil erosion and severe environmental disturbance (Forsling, 1950). Kassas (1970) has described the effects of misuse of the circum-Saharan regions and the desertification that has resulted there. Seshachar (1971) has detailed similar processes in the Thar desert of western India. In both cases improved technologies improperly applied have greatly aggravated the effects of even minor climatic changes. Rangeland deterioration is a major concern in both underdeveloped nations like Turkey (Borgstrom, 1969) and the Sahelian states (Glantz, 1976), and in more advanced nations such as the United States (Fonaroff, 1963). The uncontrolled introduction of advanced technologies into management systems which themselves change little have often brought new environmental dangers and increased the spread of existing ones as a by-product (Ehrlich, Ehrlich and Holdren, 1973). Each time a new element is introduced into the management system the entire operation should be studied to identify the ramifications of the new component. The system itself must then be altered to fit the new situation, and to avoid unwanted side-effects, particularly to the environment (Curl and Schuster, 1971).

In Botswana the grasslands are susceptible to abuse as elsewhere. Verbeek (1968) has shown that the Kalahari sand veld is especially susceptible to grazing pressure, so that

where watering points are poorly distributed or are the center of large concentrations of livestock, severe range deterioration takes place. The introduction of borehole technology has allowed the use of this particularly sensitive range, but controls on the exploitation of this resource did not come in time to avoid serious overgrazing. Only recently have new management programmes been proposed to take into account the environmental side effects of this new technology.

Studies to date have concentrated, on the one hand, on the soil and range itself, and on the other hand on the most appropriate management system to allow sustained production on it. More seems to be known about the former than the latter, particularly in the Kalahari setting.

The general process of range deterioration is fairly clear and appears to be similar throughout the world (Dasman, et al., 1973). Livestock allowed to graze freely over a range in good condition will demonstrate preferential grazing of the most palatable species (Allen and Leonard, 1955). This has led to a classification of grasses according to their response to grazing, as "decreasers," "increasers" or "invaders" (Dyskersuis, 1949). Palatable species, or those most sensitive to grazing pressure are the decreasers and are generally the prime target of selective grazing. This reduces their chances of reaching maturity and producing seed. As a result the proportion of these species in the range decreases over time.

While pressure on the most palatable species continues,

the less favoured "increasers" are given the opportunity to spread and take dominance. These are grasses which are less susceptible to grazing pressure either through high resistability to abuse, or because they are less palatable to the grazers. They will however eventually succumb under severe overstocking at which point the "invading" species, particularly unpalatable grasses, herbs and woody plants take the dominant place (Allen and Leonard, 1955). In extreme cases where extensive trampling (e.g. around watering points) adds to the problem all grass cover may be removed. Woody species alone remain, a final indication of a long history of rangeland abuse (Verbeek, 1968).

Parallel to the deterioration of condition is of course a reduction in the carrying capacity and a lengthening of the time required to re-establish the original state. (Carrying capacity refers to the ability of a range to support livestock, and is usually given in terms of the area required to support one mature cow, or its equivalent). Martin (1971) indicates that if the final stage of deterioration is reached it may take as much as half a century to restore the initial carrying capacity, even on the hard veld of eastern Botswana. Inasmuch as the hard veld is demonstrably more resistant to abuse, the recovery rate on the Kalahari sand veld would be much longer. It therefore becomes quite clear that proper range management is vital if this important resource is to support a major industry in Botswana on a sustained basis.

The Kalahari sand veld has additional problems which

require special attention if livestock production is to be successful. Many of Africa's soils are deficient in phosphates, and the Kalahari sands are particularly so. This is reflected in the fact that often even the best species are unable to provide the basic phosphate requirements for beef cattle. This leads to various illnesses, either directly, or indirectly through weakening the animal. Phosphate deficiency by weakening the cow also reduces her ability to conceive and therefore affects the annual calf drop and herd size increase. Phosphate deficiencies can create a craving in beasts which is then satisfied by licking bones of dead animals. In doing so cattle often pick up botulin toxin produced by bacteria (Clostridium botulinum) in the dead bones. This is usually fatal. Jarman and Butler (1971) also report sodium and chlorine deficiencies in some areas.

In response to the problem of mineral deficiencies researchers have found that supplementary feeding of bonemeal (crushed and burnt bones) and salt gives remarkable results. In south Africa, Theiler, Green and Dutoit, as long ago as 1928, found that supplementary feeding of bonemeal in phosphate deficient areas brought an increase of 51-80 percent in the annual calf-drop. In Botswana studies at ten widely scattered research stations have conclusively demonstrated the benefits of, and indeed the need for, supplementary feeding of bonemeal and salt (Animal Production Research Unit, 1971, 1973, 1974).

A more difficult and controversial task has been the determination of a non-destructive management system for the natural veld. Under traditional management systems the range land of Botswana is subject to constant grazing where livestock are kept. Neither rotational grazing, nor stock limitation is practised. (The reason for this will be explored later, within the cultural setting). Early recommendations (Martin, 1971) for ranching in southern Africa called for a four camp system with the livestock divided into three herds. Each paddock was to be grazed for three years and then left for a year to recover. This, however, did not provide sufficient recovery time, a figure of two or even three years being more realistic under average stocking rates. A present (1976) Botswana's Animal Production Research Unit is initiating studies of rapid 4 and 7 day rotation systems. These time periods are based on the minimum and maximum days required by grasses to reach maturity. Under this system it is hoped that palatable species will actually be stimulated to grow, increasing their dominance in the range and thereby improving the carrying capacity.

If any range management technique is to be introduced capital expenditure will necessarily be high. Fencing is imperative, and water reticulation vital. While expensive, these improvements are feasible, and the time has come when the need for their introduction is critical, if sustained production is to be achieved. There are, however, important social, economic, and political consequences, both in the

short and long terms.

Grazing pressure, especially in the eastern parts of Botswana, has increased to the point where it is leading to extensive soil erosion. It is also leading towards disaster as the inevitable drought approaches. This is itself of great social importance, besides its economic and political implications. But it is not possible to simply move into an area and apply a new management system with its stock limits, its fences and its rotation of livestock. The management techniques exist, but they can only be applied within an existing socio-economic and political setting, and their success depends heavily on these non-technical factors. In any programme to improve range and livestock management in Botswana, the means or the approach, largely determines the ends.

In the next section, the paper presents the social, economic and political setting in Botswana, first in a general format, then focusing in more detail on those particular aspects of this cultural environment that directly influence the introduction of range management. This will serve as an example of the difficulties inherent in applying scientifically derived resource management techniques in a non-scientific society.

The Cultural and Political Environment:___

Botswana's 1971 census showed a population of about 650,000 (Census Report, 1971). Of this number fully ten

percent were absent, the majority of the absentees working as migrant labourers in South Africa.

The people of Botswana are made up of several tribal groups, among the most important being the Tswana, the Kalanga, and the various Bushmen tribes. The Tswana are made up of several tribes, chiefly the Ngwato, the Kwena, Kgatla, the Ngwaketse, the Lete, and the Rolong, the Tawana, the Kalagadi, the Khurutse, and several other smaller ones. They share a common language, Setswana, and similar customs. Their traditional tribal areas of the largest tribes, with a few modifications made up the Administrative units under the British Protectorate. These units have been preserved since Independence as Administrative Districts (see Sillery, 1974, for details).

The non-Tswana tribes have had long historical links with the Tswanas. For example the Kalanga people, whose tribal heartland is in the North East District area, have had long ties with the Ngwato of Central District. They have a distinct language of their own, but demonstrate many similarities in their lifestyles and aspirations. The Bushman tribes who are presently experiencing the transition from nomadism to sedentism, were a source of slave labour for the Tswana for some time previous to colonial rule (Sillery, 1974).

The history of southern Africa over the past few centuries has been complex and tumultuous, even prior to the advent of the Europeans. The Tswana speaking peoples

shared these experiences. During the last century hostile activities by the South African Boers led eventually to three Tswana chiefs requesting British Protection from Queen Victoria. This was given and until 1966 the country was known as the Bechuanaland Protectorate. In 1966 the nation was given political Independence with a Parliamentary form of government.

Since then the Government has aimed at achieving a greater sense of national, as opposed to tribal unity, on the one hand and on the other has been striving for greater economic independence from South Africa. Being a land locked country Botswana must rely upon the transportation systems of the South African Republic, and because of its relatively small economy it is overshadowed by both South Africa and Rhodesia. It depended for several years after Independence on grants from the British Government to meet recurrent expenditures. Thus one of the major aims of the 1973-78 Development Plan was to raise internally derived revenues and thereby achieve financial independence (National Development Plan, 1973-78). To reach greater economic independence the Government has as long term goals self sufficiency in food, and the promotion of secondary industries to reduce imports and provide employment. Another major policy is the more equitable distribution of income among the population (National Development Plan, 1973-78).

In spite of moves towards small scale industrialization and the development of mining centers, only 9.5 percent of

the population live in urban areas (Census, 1971). Most of the population depends directly on subsistence forms of agriculture, and even the majority of urban dwellers maintain close ties with the rural economy (Study of three Peri-Urban Areas of Botswana, 1975).

In the rural areas the traditional lifestyle is still maintained. It relates very closely to the environment in which it finds itself and as a result has a land tenure system similar to many other subsistence economies in Africa. This traditional attitude towards land must be understood if any attempts to introduce management of land-based resources are to succeed.

Land tenure systems do vary from tribe to tribe across Africa, but certain broad generalizations can be said to apply to most regions. Except in a few instances, land is not a scarce commodity so there has been little pressure in the past to claim private, individual, ownership over parts of it. The Tiv of Nigeria view land as a surface on which human activity takes place, but land is not itself an object to be owned (Bohannon, 1963). Any Tiv may have the right to farm the land but the system is one of farm-tenure as opposed to land tenure. Reflections of this concept can be seen elsewhere, including Botswana.

In many regions land is seen as belonging to the king, or tribal head, who holds it on behalf of his people. The extent to which such a leader exercises his authority over land varies. Perlman (1970, p.126) says of the Baganda and

Banyoro of Uganda: "Both societies were monarchical states, each being headed by a king who was the source of all political authority and 'owner' of the land. There was a close connection between political authority and the possession of rights over land so that when a king granted authority over a territory, this also meant authority over the people on it."

There are other cases of land tenure that do come much closer to the west European concept of ownership. Among the Shoa Galla people of Ethiopia all property, including land, is owned individually by both male and female. While inheritance laws require that it be divided equally among the sons of the deceased, it may be sold or traded (Lewis, 1970).

Where cattle are important in the traditional economy further complications arise. In Rwanda, for example, the Tutsi cattle economy has been imposed by conquest on the Hutu agrarian system (Maquet, 1970). The result is a dual administration system. One system handles cattle matters, collecting cattle taxes, the other overseeing agrarian affairs, collecting dues arising from crop production. Land itself is viewed as unproductive in and of itself, requiring as it does, labour inputs in the form of cultivation, if it is to be of use. Livestock, by contrast, are themselves productive, with little labour input, and are therefore seen as more valuable. They have the additional advantage of being mobile. Thus the owner of a large cattle herd is seen as holding a higher social status than a man who tills the field.

This preference for cattle and the higher status that derives from livestock ownership is fairly common throughout those parts of Africa where domestic animals are kept. Roscoe (1923) found that the Bakitara of Uganda despised cultivators of land as being far below the status of cattle owners. The Masai are another tribe well known for their low esteem for agronomy.

Though this extreme view does occur, there are many other tribes that practise mixed farming. Even among these however, it is usually the livestock, particularly cattle, which impart status, self esteem and satisfaction to the owner (Lewis, 1970).

The majority of people in Botswana fall into this latter group of mixed farmers. Land is commonly owned, as elsewhere in southern Africa (Hughes, 1962), that is, title to the land is held by the group and is inalienable. The right of possession and use for arable purposes may however be given to an individual. Such an individual must never treat it in such a way as to imply that it is his personal property (Khama, 1971). A person may be allocated a piece of land for cultivation, and this he can fence to keep livestock away during the growing season. But once the harvest is completed he must open the field and allow anyone's livestock to enter and graze on the stubble (Schapera, 1938). Grazing land is available to all and may not be permanently enclosed under the traditional system. Furthermore, land which has been allocated for cultivation, but which has not

been utilized for such, may be taken back for re-allocation.

People who graze cattle near permanent pools of water generally have the sole right to water their cattle there. However, someone trekking his livestock through the area is seldom refused permission to use such pools. If any one would like to use the pool regularly he must get permission as he would do if he were asking for grazing land. Wells may be dug freely within general grazing areas, but if a man wishes to sink a well in an area where there are already others grazing, he must seek the permission of the local headman. Formerly, it was the rule that a well could be used by any one who had permanent cattle posts in the immediate vicinity, but through the years this has changed so that now the owner of the well must give his permission, and is generally paid for its use (Schapera, 1938). The significance of this will be shown later.

To ease the problems created by mixed farming, and to take advantage (in some areas) of soil differences the Tswana have traditionally separated their land uses. Each family has its 'permanent residence' in its traditional village. Its cultivated lands may be several miles away in an area reserved for that purpose and for that particular village or village ward. At the "lands area" that family maintains a second home, and may keep a few draught oxen for ploughing, and milch cows for milk in the summer months, when planting, and harvesting takes place. The majority of the family's livestock will be at the "cattle post" which

may be many miles away in a totally different direction, again in an area specifically for the grazing of livestock owned by a particular community. Some members of the family, usually the small sons, and possibly a few employees, may be stationed there to care for the cattle. Other family members may visit from time to time.

This three-way split in the family's residential pattern necessitates considerable mobility. Ties with the home village were enforced under traditional rule by the kings or chiefs who insisted that all families return to their homes for certain months of the year (Schapera, 1943). The reason for this was basically to maintain political power over the people and to ensure their participation in tribal affairs.

The Kalanga people, who have had a long history of close association, especially with the Ngwato tribe of Central District, practice a similar system but are far more flexible, and tend to group their activities more closely. The ties with central villages are not as great, and political leadership does not appear to be as strong, with much less centralised control (Werbner, 1969).

In both tribes, allocation of land, for arable and residential, and for communal grazing space, has in the past been the responsibility of the chief or headman. A natural consequence of this was the prestige given to any chief who had ample supplies of both arable and grazing land under his control and for the use of his people (Werbner, 1969). Wherever, for any reason, land was expropriated by a higher authority, all affected leaders suffered political

setbacks and their people may suffer serious shortages of land based resources. And inevitably, as the population grows, pressure on the land increases, resources become over-taxed, serious problems of conservation arise, and eventually change must occur. In recent times, due to peace, improved medical and veterinary care, population growth (both human and animal) has grown more rapidly than before, and the need for change has come more quickly.

In line with its policy to broaden the sense of community from a purely local to a more national view, the Government transferred the traditional power of allocation of land from the chiefs and headman and vested it in Tribal Land Boards under the Tribal Land Act of 1968. This act established Land Boards in each of the Administrative Districts except those made up entirely of State Land (Kgalagadi, Ghanzi and Chobe Districts). These Administrative Districts had been agreed upon during the Protectorate period and were closely aligned with the actual tribal territories, so that the transfer involved little conceptual change as regarded the land under question. Although the chief was no longer responsible for allocation, the new Board continued to be made up of responsible tribesmen belonging to the respective Districts, and allocations within each District continued to be for the residents of that District. Non-residents had to receive special permission from the Minister of Local Government and Lands. Previously, it was relatively more difficult to obtain land in an area reserved for another

village or ward. Now any tribesman could apply for land any where within his District, regardless of traditional local land ties. This provided, at least in theory, for the easing of land pressure differences within any one District, but did not particularly help inter-District pressure differences.

In the past the population density and distribution was such that frontiers could expand to accommodate the increase in pressure. Eventually, however, all available land in the east was under some type of use. In the west the frontier was limited by water scarcity. The same process of land pressure increase has been experienced elsewhere in the world, but reactions have varied. In England communal grazing land was a common feature, and the response to increased pressure was generally to impose limits or "stints" on individual livestock herds using the commons (Hoskins and Stamp, 1963). The limits were often set by the lord of the manor. In early New England a similar pattern emerged in some communities, but here the decisions on herd size limits were often made by the townsmen as a group (Powell, 1963).

In Botswana it is quite possible that some similar response would have developed had not important changes been occurring in social structures. The changes in the local administration system; the decreasing authority of the headman over land matters; the introduction of a new, basically foreign, system of Government, all contributed to an apparent inability to tackle the problem after the west European fashion. The Land

Boards have now been given the responsibility to impose stock limits (White Paper No.2, 1975) and legislation exists to enforce it (Natural Resources Conservation Act, 1972). There is a question, however, of whether the Land Board feels confident enough at this early stage to act within its rights, or whether the local population respect the authority taken from traditional headmen and vested in the Land Board. Limits are to be determined by the range's carrying capacity and the number of livestock holders in any locale (White Paper No.2, 1975) but implementation of realistic limits will depend largely on local willingness to comply. The best way to win this compliance is to involve the livestock holders themselves in the decision. If the environmental factors such as carrying capacity, are to be of any weight in these decisions, a degree of education in range management will be required.

Prior to 1976, 46.7 percent of Botswana was held under direct control of the Central Government as State Land. This derived from the Crown Lands of the Protectorate period. During that period, the Administration had identified and demarcated areas which were to be reserved for particular Tribes. These became the present Administrative Districts mentioned above. However, besides these areas there was much unoccupied land and this was eventually declared Crown Land (Smit, 1970; Sillery, 1974). Now called Stated Lands, these areas are outside the jurisdiction of the Tribal Land Boards. In 1976 Kgalagadi, Ghanzi and Chobe Districts received Tribal land status and Land Boards have been

established. In other areas, especially in the Central Administrative District, these State land areas have for quite some time been viewed as "overflow" lands, for refugee settlement, or for special Central Government schemes.

Besides Tribal and State land, a third type of land tenure is found in scattered pockets around Botswana. This is freehold tenure, which arose out of a variety of individual circumstances, ranging from mineral concessions to land granted to the British South Africa Company for the purposes of building a railway. These areas are also outside the jurisdiction of the Land Boards, and are held under free title, in a fashion very similar to most west European land holding systems. In a few cases, particularly the mining or farming concessions, the expropriation of land for immigrant settlers, has reduced the land available for local people, and increased the pressure on the remaining tribal lands. One such case, the Tati Concession Area, now known as North East District, is a special example of this, and will be the basis of the more detailed case study in the next Chapter of this paper.

With between 80 and 90 percent of the population dependent in one way or another on livestock (Economic Review, 1975 Annual Supplement) it is not surprising to find that the beef industry is a major contributor to the national economy. Beef exports were the major source of foreign exchange earnings for the first five years of Independence, and continue to be of great importance. The Botswana Meat Commission's Lobatse abattoir is among the largest in Africa

with a daily capacity of over 1,000 beasts (Sillery, 1974)..

Since 1970 however, important mineral discoveries, chiefly copper-nickel and diamonds, have led to a more balanced source of export earnings. The development of these mineral deposits has led to the construction of two new towns and many other economic effects. The establishment of Selibi-Pikwe as a copper-nickel mining center necessitated the construction of the Shashe dam and reservoir bringing growth to the villages of Shashe and Tonota. Coal was required to supply the smelter and power plant, so another mine was established at Morupule, just outside Palapye, so the latter village benefited from increased employment opportunities.

The diamond mining center of Orapa has resulted in less impact on its immediate environ. For security reasons access is restricted, indeed only recently have there been moves to "open" the town to outsiders. A new diamond pipe is being opened about 50 kilometers away and the Government has insisted that the village of Letlhakane be developed rather than create another new town.

Francistown, already the commercial hub of the northern half of the country, has received new impetus for growth from these two large scale mining operations, and there are prospects for further developments in the town's hinterland. Meanwhile, Gaborone has continued to grow on its base as the Capital of the country.

This rapid urbanisation has not changed the basic dependence of the population on agriculture. This applies

even to the new urban dwellers. Egner (1971) maintains, in fact, that people migrate to the towns for cash employment explicitly to enhance their livestock purchasing powers, to build up their herds and raise their social standing. The implication here is that urbanisation, instead of relieving pressure on the rural land resources, is ultimately increasing it. It has also been found recently (C. Kerven, 1976, personal communication) in social surveys that urban dwellers maintain close contact with their rural land holdings and indeed look to them for economic support. This complements Egner's views that rural land pressure is still increasing, in spite of accelerating urbanisation.

The natural response to increased land pressure is to extend the frontiers of settlement into previously unoccupied regions. In Botswana this expansion was somewhat hampered by the lack of accessible water in the sand veld, until deep boring technology, supplemented by mechanical engines and pumps made it possible to tap the deep ground water reserves in the Kalahari. With the advent of this technology settlements, albeit small and almost exclusively cattle posts, rapidly moved westwards.

There were other important repercussions. Previously the size of a cattle herd was governed by the ability of the owner or his herdman to draw water by hand from wells, except in those areas where there were large and permanent pools. It was almost physically impossible to adequately water a hundred head of cattle each day, and still have time to perform other necessary duties. Thus the size of the

herds kept at any one water source were relatively small. A man could have more than one herd, but this usually meant that he had to maintain a second cattle post, with additional employees, and so this was fairly rare.

Socially, this tended to reduce the differential between small and large herd owners. Large herds would frequently be broken down into smaller units which would then be given into the care of another man. This man could use these cattle for draught purposes and utilize their milk production. He might even be paid in kind, allowing him to build up his own herd. In this way the benefits of livestock were spread more evenly throughout traditional society, even where ownership might be less equitable.

The new borehole and mechanised pumping technology opened the way for vastly increased herd sizes. It was no longer difficult for one or two men to water livestock in herds up to two thousand, provided the yield of the borehole was sufficient. Not only did this technology give greater opportunity to increase herd sizes, it also encouraged the concentration of these large herds on a few water sources, thus increasing pressure on the pastures immediately surrounding them. The problem of overgrazing and range deterioration increased manifold, because the technology was not tied in any way to necessary improvements in management. The environmental implications of the application of this new technology was not realized until after the effect.

The environmental effects are tied very closely to the social attitudes. The role of livestock in demonstrating an

individual's social standing led quite naturally into a situation where any technology that could enhance one's position would be quickly adapted, with little thought of its other consequences. Besides the serious environmental impact the new technology quickly introduced a new factor into the social system which led to greater disparity between rich and poor. The traditional system of 'mafisa' whereby a poorer man could receive the benefits of livestock through caring for those of a richer man has been declining. Not only are the rich who can afford the new technology getting richer, the benefits of their wealth are being less widely spread than formerly.

Fortunately, the environmental impact was seen before the entire countryside was destroyed, and a partial solution attempted. Tribal Land Boards were directed to allocate borehole sites in such a way that adjacent water sources were at least 8 kilometers (5 miles) apart. This was to prevent a mass proliferation of boreholes and excessive stocking rates. The limit was based on the recommended grazing distance of 4 kilometers from a water source for cattle. A circle of 4 kilometers radius would provide 50 square kilometers of grazing, sufficient for 400-500 head of cattle at 12 hectares per mature beast, or for 300 at 16 hectares per mature beast (Martens, 1971; McKay, 1968).

This spatial limit could only be partially successful because there was no serious attempt to control the number of livestock at any one water source. The limit was based at

least in part on the grazing required by a viable herd, but there was no attempt to enforce or even impose limits on herd size. In practice the only limiting factor was the yield of borehole and the personal views of the owner. "Mining" of the rangeland around boreholes has become fairly common.

Another consequence of borehole technology and Government's "8 kilometer limit" response, has been a de facto change in traditional land tenure. As explained above, tradition forbade the monopolization of grazing land. Water sources could be owned privately since they represented individual labour inputs, and well owners had an accepted right to govern the use of their water source.

Borehole technology introduced the new factor of high capital investment, and previously unknown recurrent costs, in the form of fuel and maintenance of more sophisticated equipment. As a result it was only fair that users of borehole supplies share the higher running costs, and no control was imposed on the owner regarding the price. Any owner could simply refuse to accept other users. As there would be no other water supply within 8 kilometers around his borehole, the owner gained de facto sole use of the grazing around his water point and thereby contravened the concept of communally owned rangeland.

At the same time the traditional concept forbidding the enclosure of range by individuals saved these owners from the need to invest large sums of money in expensive fencing materials and construction. This in turn meant that he could

not adequately control his livestock and manage his most vital resource in an appropriate manner. Privilege was given; no responsibility was imposed, in fact it was actually denied.

In recent years there has been increasing pressure on the Government to change the system of land tenure to allow and even enforce enclosure of grazing land. Chambers and Feldman (1973) in a Report on Rural Development pointed out very clearly the need for range management and the necessity of fencing for this purpose. They also indicated that encouragement of better management techniques would improve Botswana's long term economic stability, by providing a base for sustained and increased beef production.

At the opposite end of the scale a few water source owners have indicated a desire to introduce rotational grazing, but have been forbidden to establish fenced camps to do so. Other cattle owners feel the pressure of grazing and would like to have exclusive grazing rights simply out of a desire to increase their herds and raise their social standing. Still others maintain that the introduction of fencing would reduce the problems of cattle theft and straying. Characteristically it is the larger herd owners that are more amenable to enclosure, because they see the benefits clearly. The less well off are suspicious of the move and see their land rights slowly but steadily reduced. There can be little doubt that the social implications of enclosure in the Botswana setting will be far reaching. Yet there are compelling environmental, economic, and political

reasons supporting the move.

The Government of Botswana has characteristically followed a pattern of gradual though relentless change in dealing with traditional customs. An example is the change from a rigid heierarchical system based on headmen and chiefs, to the present parliamentary democracy. In this change the chiefs continued to have a role through the establishment of the House of Chiefs, a body which advises Government on all matters of Tribal interest. Similarly in transferring the power of allocation of land to the Land Board from the chiefs, an element of the old system remains in that applicants must show written consent for the land from the responsible headman (Tribal Land Act, 1968). There are two basic reasons for this: first the headman is the repository of land data, and his approval indicates that the piece of land applied for has not been the subject of previous allocations. The second reason, though not explicitly stated, is undoubtedly to ease the transfer of authority, not least of all for the headman himself who must suffer loss of some local esteem by the loss of privilege.

At times Government uses other traditional customs to implement its policy. Under the traditional system decision making usually involved a meeting of responsible men at the village kgotla. This was a designated place where customary court was (and still is) held, public meetings are addressed and village elders meet to discuss local affairs. The principle of popular consultation is traditional in this sense, and it has been maintained to the present. Large

national campaigns are usually introduced in a series of large public meetings in Kgotlas of major villages, and response is elicited. Radio has made mass consultation even more widespread, although without definite channels for feedback, the response to radio campaigns is often less dramatic.

In dealing with the land tenure question the Government has again gone to the people with a policy statement (the Government White Paper No.2 of 1975) and requested popular reaction. This White Paper sets out the Government's Tribal Grazing Land Policy. The rationale behind the policy is twofold. First, the policy is Government's response to the increasing problems of range deterioration and soil erosion, in that it proposes methods to control and even reverse the prevalent abuse of the land. Second, the policy presents the Government's views on how best the national livestock industry can not only become a sustained commercial system, but do so with a greater rate of participation by the poorer sections of society thus achieving a more equitable distribution of income.

The proposed methods of reaching these goals are to divide the tribal grazing lands into three classes. Those areas which are at present grazed in a truly communal manner will remain classified as "communal." No individual will be allowed to enclose grazing land here, but communities as groups will be encouraged to do so, and to manage their livestock and range resources in environmentally sound ways.

The second classification of land will be the "commercial" areas. These are those areas where individuals at present exercise de facto sole ownership of the land surrounding their watering points. Such individuals will be required to take out legal leases on their holdings. These leases will set conditions which will include fencing, stock limitation and other management requirements. The land will theoretically remain the tribe's and the individual will have to pay rent for his private privilege of use. This provides some link with traditional concepts and will hopefully ease the transfer from one tenure system to another.

The third classification of land is "reserve." Reserved lands are those lands which are presently unoccupied or are for specific uses other than grazing. Game reserves, forest land, urban land, etc., fall into this category, as does empty land which is to be reserved for future generations.

Range conservation is to be achieved through the imposition of maximum stocking limits in both communal and commercial areas. Individuals whose herds exceed the limits in the communal areas will be required to move to the commercial areas, or break down their herd to be cared for by other people. This latter provision is an attempt to preserve the traditional mafisa custom and spread the benefits of livestock more evenly throughout the society. Ownership of the livestock remains the same, but the limits will apply to holders, as opposed to owners, of stock, and the holders can receive the milk and draught power of their mafisa cattle.

In commercial ranches limits will also be applied. Here the intention is to encourage steady production of beef through increased off take. If individuals insist on merely multiplying their herds for reasons of status, they will be required to move off tribal land and into freehold farms.

The most difficult aspect of the policy will be its implementation and application. To accomplish this the Government is relying on the far reaching Agricultural Resources Conservation Act of 1974. This Act provides for the establishment of an Agricultural Resources Board which is responsible for investigating, assessing and correcting land abuses. It has the legal power to direct any individual or village to undertake any conservation programme. It can direct land use as a conservation necessity, and can impose almost any type of limit. In fact its powers are incredibly wide, and the individual has almost no recourse should he be unable to perform the work required, or wish to contest the Board's directives. At the same time, however, it should be pointed out that the Board has not yet dealt with any serious case, in spite of the great need to do so.

The Government has consistently shown an approach of persuasion rather than confrontation and compulsion. The question remains, therefore, whether the Government will be willing to carry out all the aspects of its own policy should there be any opposition from the populace, even in matters that need immediate action. Conversely, the Government at times appears only too willing to undertake programmes that appear politically popular without at first thoroughly

evaluating the consequences, either physical or cultural.

To summarize; in spite of a growing diversification in the national economy, the majority of the people of Botswana still depend to a greater or lesser degree on the land's resources, both for their arable production and for their livestock. Closely related to the use of these resources, is the development of water sources. The Government of Botswana is well aware of the need to regulate both land and water utilization, and has taken steps to introduce conservation legislation. However, there are always social and economic factors which must be taken into consideration, while the Government is particularly sensitive to political ramifications of its programmes. Being of a political nature the Government is also prone to enter into programmes which appear to be politically popular, often without investigating and assessing the repercussions of such programmes in other directions, particularly their ecological impacts.

The following Chapters outline a particular case in which the Government responded to local political pressure on the one hand and to dire conservation needs on the other, but did not initially fulfill its obligation to study the implications of its proposals. The case illustrates the need for thorough investigation before planning takes place, but shows that it can be politically unsound to wait until such investigations are complete. In this way the study portrays the difficult task of implementing resource management policies and goals within a social and political framework.

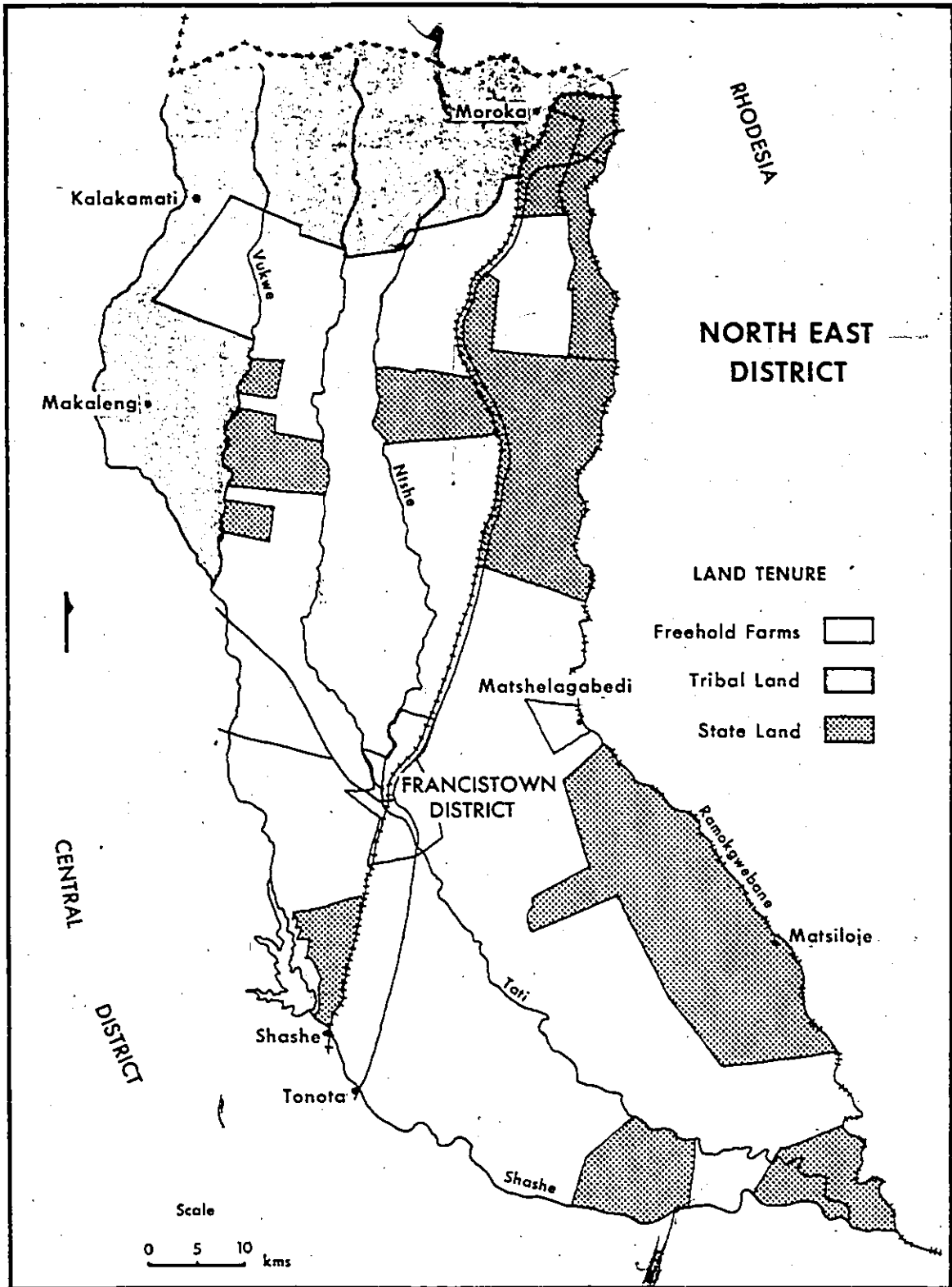
CHAPTER THREE

THE TATI RESETTLEMENT SCHEME

The Natural Setting:

The North East, or Tati, District is the second smallest administrative District in Botswana, other than the urban Districts, with a total area of 5,323 square kilometers (see Fig. IV). Francistown, an administrative unit on its own, lies entirely within the District. It is the oldest of Botswana's "modern" towns, presently the second largest in the country and the economic hub of the northern half of the nation.

The District's topography varies considerably, with a generally increasing elevation towards the north. On the east it borders Rhodesia along the Ramokwebane River, a tributary of the Shashe, across which it faces the Central District to the west. Drainage is from north to south, with other major rivers being the Inchwe, the Tati and the Vukwe. These are all ephemeral rivers, with no running surface water during the dry winter months, May to October. However, beneath the layer of sand that characterizes these larger rivers and their water retaining nature has played an important role in permitting the successful growth of the livestock industry in the District. No sophisticated technology is required to dig down through the sand to reach plentiful water supplies, so even the poorest livestock owner finds a free supply for his animals. This has led to an expected



Source: Tati Settlement Project Maps

Figure IV

concentration of livestock in the relatively well watered North East District.

Rainfall over the District shows the same general characteristics of scarcity and unreliability as elsewhere in Botswana, although the Tati is relatively better off. It receives on the average (calculated over 30 years of records) between 400mm in the south and just over 500mm in the north. Percentage variability is less than 40 percent in the north, rising to 40 percent in the south west. Viewed alone, these figures suggest that arable agriculture is difficult and hazardous without irrigation, but set along side the rest of the country the District has a comparative advantage (see Fig.III).

Temperature varies throughout the year. During the dry winter months, skies are clear, radiation is high, diurnal range is large, and frost occasionally occurs. During the summer months temperatures may exceed 40°C, and diurnal range is smaller.

Vegetation is fairly consistent throughout the District, being for the most part a mopane acacia association, with the proportion of mopane (Colophospermum mopane) increasing northwards. Both the mopane and acacia species are deciduous. The grasses are generally classified as "sourveld" (Bawden and Stobbs, 1963) in that a fair number of poorer species are represented. Mopane sour bushveld increases its predominance over acacia towards the north where rainfall is more plentiful.

Geologically, the District is characterized by numerous

outcrops of granite and basalt, from which loamy sands and clayey soils are derived. Deposits of gold first drew settlers from South Africa, but the ore bodies are no longer economic to work. Recently deposits of copper have been discovered and feasibility studies are currently underway to determine their economic viability.

The Cultural Setting:

There are four significant tribal groups in the North East District as well as the European settlers who have arrived in the past one hundred years. The area has witnessed considerable population movement and some spatial, if not social, integration. These population movements, and especially the arrival of the Europeans have all been contributors to the strange mixtures of land tenure systems, and the present land use problems. A brief history of the area is given below to set the background to the problem and the Government's response to it, which is the subject of this case study.

The early history of the Tati is shrouded in a mystery heightened by ancient rock paintings and stone ruins found on many of the rock outcrops throughout the region. There are definite evidences of links with the cultures and empire centered on Zimbabwe but the extent and nature of these links is not clear.

In the early nineteenth century the northern parts of the District were inhabited by groups of Kalanga speaking people, a section of the Shona group of tribes (most of the

history here is taken from Schapera, 1943). In the south, on both sides of the Shashe River were the Khurutse, a Tswana tribe.

The entire area was invaded and conquered in about 1840 by the Matebele under Mzilikaze, a renegade general of Chaka Zulu, who moved northwards and away from the Boers of the Transvaal. As a result of this invasion, many of the Kalanga and Khurutse fled west and south, seeking protection from Khama, king of the Ngwato, another Tswana tribe. By 1865 there were very few inhabitants in the Tati area, those remaining being scattered widely, and living in hiding.

In 1866 gold was discovered in the Tati River area. Word spread and soon prospectors from all over southern Africa were rushing to the region. Many were soon disillusioned and then became caught up in a subsequent rush to Kimberly in search of diamonds. There was sufficient interest in the Tati area, however, to move a syndicate of prospectors, the Northern Light Company, to ask for and receive a prospecting and mining concession from Mzilikaze's successor, Lobengula. This concession covered the entire area between the Shashe and Ramokwebane Rivers. Originally granted in 1880, its terms were broadened in 1882 and again in 1889 when the Company was delegated the authority to make and administer laws within the area. In 1890 the Tati Concession Mining and Exploration Company (afterwards known simply as the Tati Company) acquired the concession.

Shortly after this the Matebele power was crushed in

Rhodesia and their dominance over the Tati area was replaced by the British Protectorate. This permitted the safe return of the original inhabitants to their traditional home. Upon arrival these people found that the Tati Company held the land and would require rent of any settler. Under these conditions it is understandable that friction broke out and the Resident Commissioner of the Protectorate was asked to intervene.

The dispute was "settled" with the creation of a Native Reserve in the north and northwest (Tribal land on Figure IV). The Kalanga groups were to remain in the northern part while the Khurutse occupied the northwest under their Chief Rauwe. Under the Reserve agreement Africans in the whole concession area were to be moved into the Reserves and the Government would pay 1,000 annually to the Company in lieu of the original rent. The move began in 1903.

It was not long afterwards, in 1913, that Rauwe and a large portion of his followers left their capital at Kalakamati and moved to Tonota in Central District - then known as the Bamangwato District. Internal tribal politics were involved in the move, but the major reason given was the inadequacy of land for ploughing and the scarcity of pasture (Werbner, 1969; Schapera, 1943). A small group of Khurutse remained in the District but moved to Makaleng where they believed the land resources would be more adequate. This indicates that the pressure on the land and range resources had already reached the critical point where resettlement was necessary.

Meanwhile, another complicating situation was in the making. A member of the Rolong sub-tribe of the Tswana, Moroka, had been banished from his people in Orange Free State, and had come to the Tati to settle, in 1899. By 1910 he was approaching the Government to allow additional Rolong to join him, from South Africa. The response was that this would be unwise in view of the scarcity of the land in the Native Reserves. Thereupon Moroka embarked on an ambitious scheme to buy land from the Tati Company on which to settle the newcomers.

The plan failed. But not before considerable numbers of Rolong were firmly established in the south eastern part of the concession, around Matsiloje. Rather than evict them, the Tati Company allowed them to remain on payment of an annual rent. This arrangement was also used with other groups under Siviya, Butale, and Sebele. Individuals also came to the District looking for work on the gold mines, or trying to escape political problems at home. None of this in-migration helped the problem of land shortage.

Even with the emmigration of Rauwe and his followers, the sub-chiefs in the Reserves complained about the lack of adequate space for their traditional practices of arable agriculture and livestock husbandry. The actual situation varied from year to year depending on the amount of rain. Drought years saw more agitation than good years.

It was in the mid 1920's that a plan was first put forward which entailed the wholesale resettlement of people and livestock. It was suggested that all who wished could

move, with the Government's help, to the very sparsely settled Nata River area, in what is now the south eastern portion of the Nata State lands. Reaction varied again with the seasons and with the amount of rainfall from year to year.

In the early 1930's exploratory visits to the area were made by some interested groups. Problems cropped up, first with Ngwato claims over the area, and then an outbreak of foot and mouth disease effectively halted any immediate action. In 1935 an alternate suggestion was made - that of buying land from the Tati Company. This failed because the Company insisted that it would only lease the land and the Government could not accept the unreasonably high rental figure.

This forced the Administration to look once more to the "Nata solution." The only people apparently still interested were those under sub-chief Masunga. The preceding two years drought had decimated the District's cattle population and so relieved the grazing pressure somewhat, although it also impressed on people the need for additional grazing. However, an official investigation by some of Masunga's headmen, made a report to the effect that the Nata area was suitable for grazing just after an exceptionally good harvest by the villagers, who promptly opted to remain in the North East District. So once again the plan was abandoned.

The basic idea of total resettlement was later modified to one which would allow Tati residents to maintain grazing lands in the State lands, while keeping their homes in the

Tati Reserves. This system resembled the traditional Tswana custom, but apparently was not acceptable to the Kalangas, for by 1943 only six Tati residents had cattle posts in the Statelands (Schapera, 1943).

By that year the situation was again critical and Professor Schapera was asked to make a detailed investigation and suggest possible remedies. He noted his findings thus:

"The present position in the Tati Native Reserve may be briefly summarized as follows: It has been recognized for some time that the Reserve is overcrowded: both the District and Veterinary officers have frequently commented on this, especially during the past 12 years, and have urged that measures be taken to relieve the congestion. The soil is on the whole too poor to provide for all the people inhabiting the Reserve; much of the arable land has been abandoned as infertile, or has been rendered unuseable by encroaching quick grass. Grazing similarly has been spoiled by overstocking...the pinch has been felt everywhere."

Little action of a concerted nature took place after 1943 until post-Independence times. The problem of overcrowding and overstocking has continued. The degradation of the natural resources has if anything increased, as the population, both human and animal, has grown. Yet the problem in itself is not insoluble; conceptually the answer is very simple - de-stock - and the technical knowledge to assess and recommend is available. The problem remained unsolved mainly because of its social and political elements. Neither the Protectorate Administration, nor the independent Government of Botswana has been willing to apply any measure of decisive force.

The resettlement issue surfaced again in 1969 after the

problem had reached new proportions. The drought of 1965-66 was severe and the national herd lost an estimated 30 percent of its animals (Sillery, 1974). Among those who lost were the people of North East District. While suffering severely from insufficient grazing, the Tati people could see unused pasture on freehold farms in the District, owned in many cases by absentee, usually European expatriates. Coming at the same time as the euphoria of national Independence it is understandable that political pressure should increase on the Government to buy available freehold land from the Tati Company and turn it over to African residents.

In 1969 the Government did buy 502 square miles of Tati Company land and established the Tati Settlement Project, under Mr. Egner as Administrator. The primary aims of this project were to "induce major social changes and to obtain maximum long term economic benefits from the recent acquisition by Government from the Tati Company of large tracts of rural land in the Tati District, and collect data and information pertinent to Government policy respecting the harmonious utilization of land in the Tati District" (Tati Settlement Project: Terms of Reference, Ministry of Local Government and Lands, Oct. 1969).

In 1971, after a year and a half of study Egner submitted an Interim Report in which he outlined the policy alternatives he believed to be facing the Government. Three statements are made in his summary of findings which relate directly to this paper:

"The initial choice facing Government is between deciding to buy large blocks of Tati freehold land (costing at least two million Rand) in the future; or refusing to buy more land until social attitudes have changed and there has been time to explore the land problem in depth." (para 44.ii)

"Whichever choice is made, destocking will be necessary and at least 500 square miles of State land will be needed for Tati livestock at Nata." (para 44.iii)

"The root cause of the Tati land problem may be the social attitudes of the people toward saving. Most of the land is apparently not farmed but used as a bank for Batswana absentees' savings, which are kept in the form of starving cattle. Action can be taken to change the savings patterns of these urban migrants." (para 44.vii)

The first and third statements provide a good illustration of the inter-relationships between social attitudes, political action, economics, and land use. A new economic system is introduced to the area, but it largely restricted to urban areas. It is based on a monetary exchange system which enables easier exchange of goods. Ruralites, seeking to enhance their social status - after the traditional value patterns - migrate to urban centers to earn cash. This cash is of little direct social value but can be used to purchase cattle, which are. Cattle are bought, and accumulate, increasing pressure on the land. Land pressure leads to political pressure on the Government specifically to provide more land so that additional livestock may be accumulated. There are also elements of the society's perception of the interplay of the environment and social security. Droughts are known to recur, and are expected. Food crops suffer first, so livestock can be sold at such times for food. Hence the

need is to build up herd sizes as security against difficult times. The larger the herd, the better able its owner is to survive drought and famine (Ruthenberg, 1971).

It becomes imperative then to see the whole chain of inter-relationships between the environment, social perceptions of it and the ways of combating its vagarities, other social values, political pressures, and modern economic systems. To simply provide more land does not solve the basic problem of land abuse. Insufficiency of land is not the root cause of the problem. Rather there is a very complex set of issues which combine to eventually result in problem situations. The solution must be found through an investigation of all aspects of this complex. Otherwise, the simplistic solutions proposed will lead to ramifications in each link and result in an even more complicated set of problems. Resource management techniques, no matter how well perfected and formulated must operate within a set of social attitudes. If they are not compatible with those attitudes they cannot be effective (Collinson, 1974; Dams, 1974; Kunkel, 1965). Political unwillingness to act in a dictatorial fashion, employing the use of physical force, makes this conclusion inescapable. Details of any proposed land management programme must be compatible with personal as well as public aspirations.

The first statement of Ogner's quoted above, also cautions against implementing any plan without indepth knowledge of the problem. Treatment of symptoms seldom

produce long term solutions. After fifty years of experience with overgrazing in the North East District, knowledge of the problem is said to be insufficient, and further study urged. Unfortunately, this very wise principle is ignored in the second statement where resettlement at Nata is urged. No detailed investigation had been done on the current situation in Nata, to determine whether or not the area could absorb the resettled livestock. It was simply assumed that since no previous organized resettlement scheme had materialized, that the area was still uninhabited.

Facts and Findings:

Between the submission of Egner's Interim Report in 1971 and late 1974 little was accomplished on the ground. The areas of freehold land purchased by the Government in 1969 were given state land status (Fig. IV), to be administered directly by the Ministry of Local Government and Lands. This was done to prevent an extension of traditional usage and the abuse of land common to the Tribal areas. A system of annual grazing permits was instituted to control the total number of livestock in any one part of the State lands. No detailed land use planning, educational programming, or resettlement was undertaken.

In late 1974 the President issued a Directive calling for the removal of 20,000 head of cattle from the Tati District to be resettled in the Nata State lands (Presidential Directive No.24 of 1974). This writer was asked, after the

Directive, to investigate the feasibility of this programme, and to present his findings. In this section the situation in the North East District which led up to the Directive, will be analysed. In the subsequent section the background and current situation in the Nata Statelands will be presented.

Over stocking, and hence overgrazing occurs where the stocking density exceeds the carrying capacity of the land. Stocking density here refers to the number of livestock actually grazing a given area of land. Carrying capacity refers to the recommended stocking rate that will permit sustained use of the range without causing any deterioration. Both stock density and carrying capacity are expressed here in terms of hectares per livestock unit, where one livestock unit (or 1su) is a mature cow, bull or its equivalent. For example, a young heifer does not get a rating of a full livestock unit, but may be rated at 0.5 1su.

The carrying capacity of any rangeland is dependent on the environmental conditions which result in a particular association of grasses and other vegetation, factors such as soils, climate, and historical patterns are of use. Very little work has been done in Botswana on the accurate derivation of carrying capacities, and only recently has any attempt been made to provide even a first approximation. This work has been done primarily by the Ministry of Agriculture. In 1975 Mr. D. Field, the Chief Range Ecologist in the Ministry, published a handbook on range management in Botswana in which he states:

"In Botswana the rainfall is the overriding factor affecting fodder production on the range...It must be remembered however that...the actual carrying capacity of local areas will have to be modified in the light of past grazing treatment and the present range condition of these areas."

The Land Utilization Division of the Ministry of Agriculture has prepared a map, based on the above statement, showing various zones of potential carrying capacity using rainfall distribution data. It shows potential rather than actual carrying capacity, and gives the greater part of North East District a potential capacity of 16 hectares per livestock unit. A small portion in the south has a rating of 21 hectares per lsu. To calculate actual carrying capacity very detailed and extensive field work would be required. Efforts are being made in this direction but it will be several years before a complete picture is compiled. It is certain however, that in view of the long history of abuse in the Tati District that the actual carrying capacity is less than the stated potential. On the other hand, because no accurate measure of the actual capacity is available at present, the potential capacity figures, based on Field's approximation will be used in this paper.

There has been considerable discussion recently in Botswana on the most suitable method of mapping stock densities. The nature of traditional management does not lend itself to either accurate data collection, or to uniform grazing patterns. It is based on a "cattle post" system where a livestock owner has a "kraal" (corral) and very often

a nearby watering point. Livestock are generally kraaled at night and allowed to wander freely during the day in search of grazing. In an area of uniform range composition grazing tends to be patterned in a circular fashion around the cattle post, with grazing pressure decreasing outward (see Fig. V). This pattern may be distorted by differences in range composition, the areas of better fodder being more attractive and therefore subject to greater use. The pattern may be further distorted by the distribution and density of cattle posts themselves. To accurately map actual stocking rates thus becomes a prohibitive task, compounded by the reluctance of cattle herders to give true total livestock figures to any enquirers for fear of the tax man.

A more generalized system is therefore used by the Ministry of Agriculture. The Veterinary Department has a very extensive inoculation programme carried out through a network of cattle crushes, situated in such a way that they can adequately cope with a large number of livestock, and yet be within 10 miles of all cattle. (Some Veterinary officers have informed me that the Department tries to locate crushes within 7 miles of every cattle post, but this has not been achieved throughout the country). Certain inoculations are required by law (e.g. Foot and Mouth) so that all livestock owners must present their stock at the crushes during the inoculation campaign. At this time livestock counts are made. The Land Utilization Division has used these crushes and their respective inoculation figures to calculate and

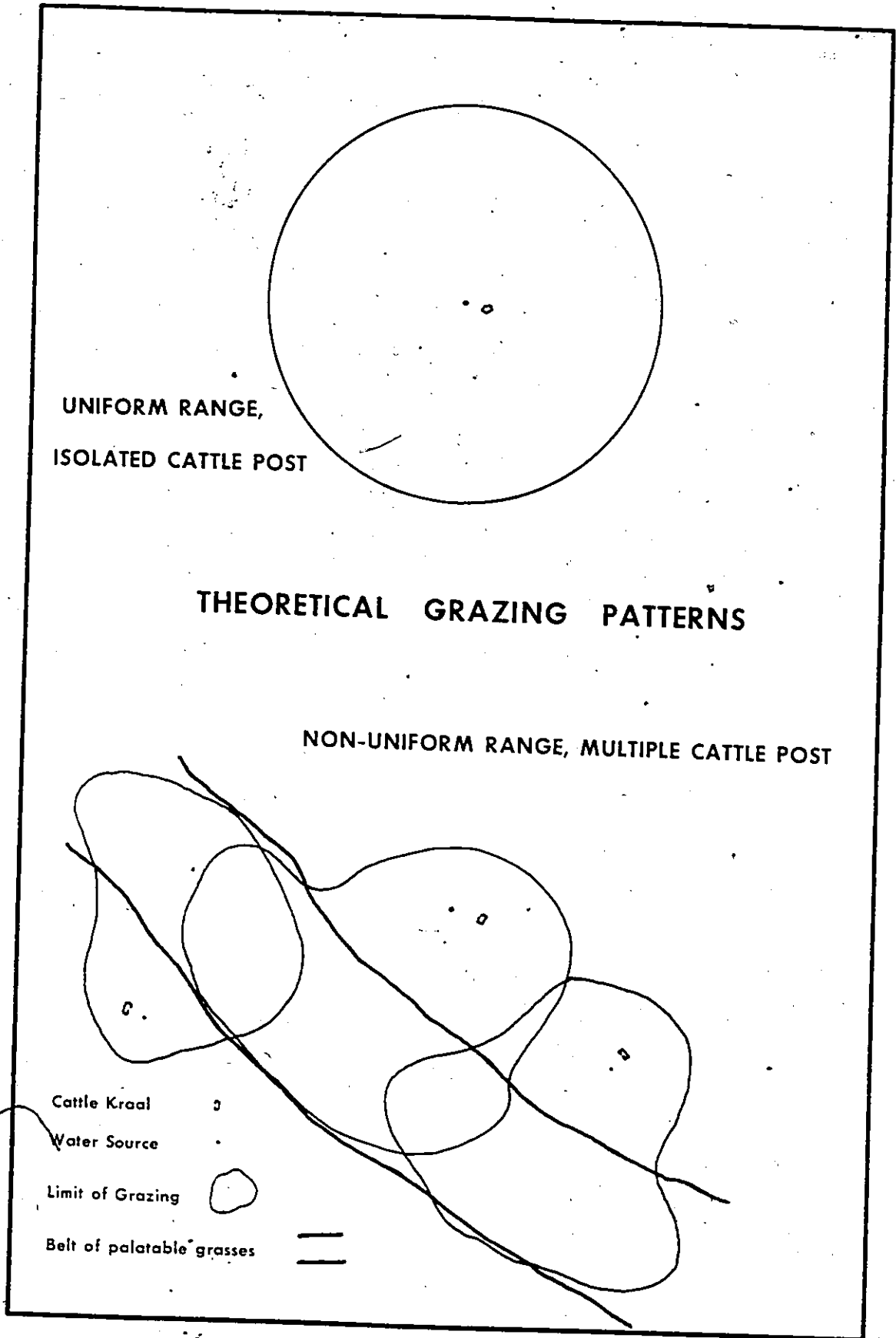


Figure V

map cattle densities and areas of overgrazing. From the crush figures in livestock units, and using the recommended stocking rates (equivalent to potential carrying capacities) the area required by that number of livestock units is computed. A circle of that area is then drawn, centered on the crush, as shown in Fig. VI. Where circles overlap, the area is said to be overgrazed.

This method shows very clearly the relative number of livestock inoculated at each crush, and the area those livestock should have made available to them for proper grazing and range management. But it does not give a true representation of stock densities, nor does it give an accurate picture of the areas of overgrazing. For example, when applied to the North East District, circles would overlap the border into Rhodesia, and it is quite evident that Tati cattle do not graze across the border - those portions of the circles in Rhodesia are not, and cannot be used by Tati livestock.

The method used in this paper attempts to overcome this inadequacy without having to undertake the almost impossible task of censusing individual cattle posts, carrying out detailed grazing surveys of each. The veterinary crush figures are used, but instead of calculating required grazing areas, the actual crush catchment area is mapped, its size computed, and stocking densities derived. Catchment areas are delineated on the assumption that cattlemen will trek their livestock to the nearest crush for vaccination. There are two exceptions

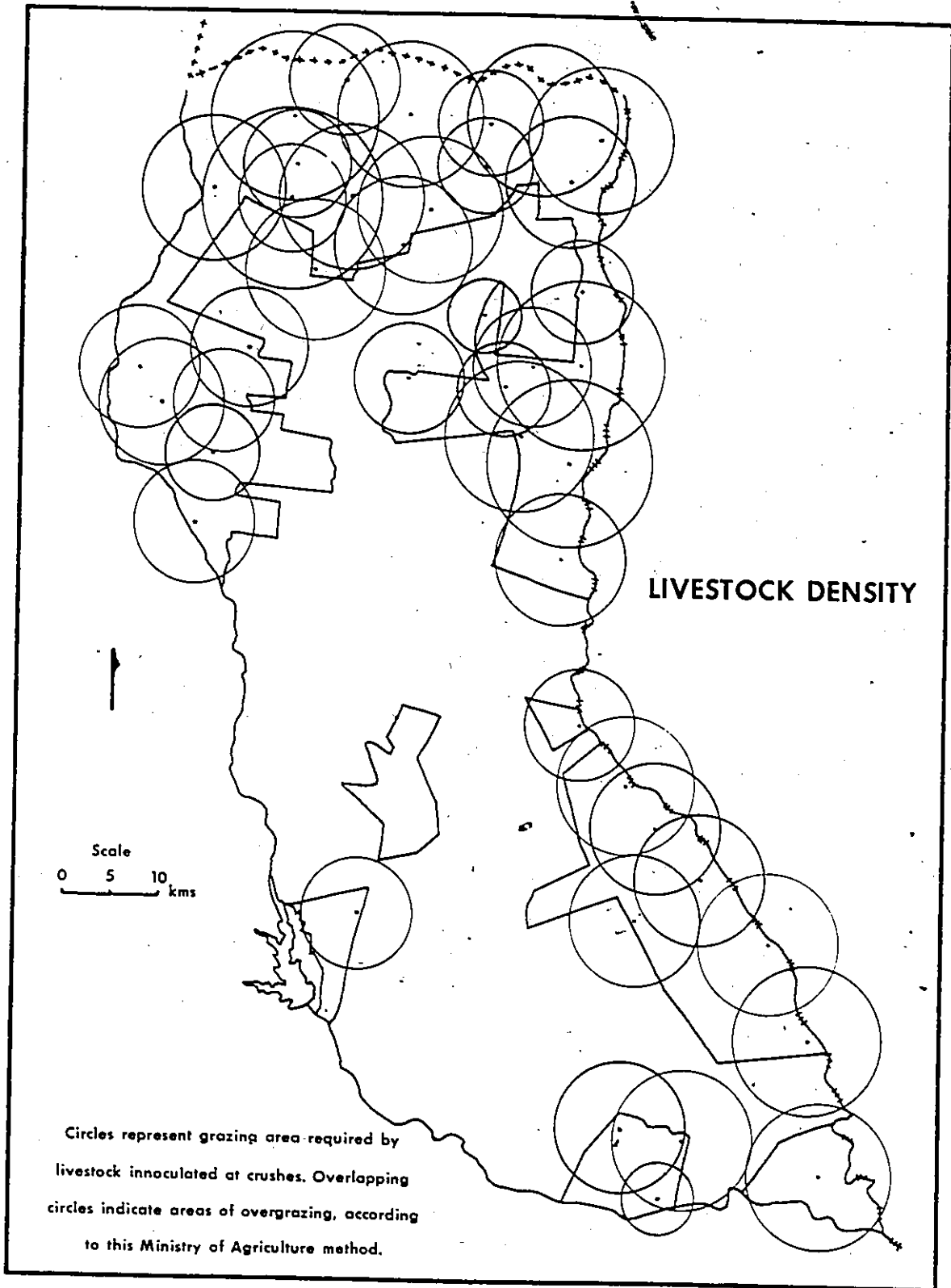


Figure VI

to this rule in practice. Veterinary law does not allow movement of livestock across veterinary cordon fences for inoculation, nor are livestock permitted across District boundaries without special permits, which are not granted for general inoculation purposes. Both of these exceptions are easily incorporated into the drawing of crush catchment areas. In the exercise pertaining to the North East District, catchment areas do not include freehold farms which are actually used by their owners, since such farms have their own crushes for veterinary purposes, and stock density in the freehold farms is not the concern of this case study. In one farm, Matshelagabedi, squatters have taken over the entire farm and a Veterinary Department crush has been established. In this study the farm itself is taken as a catchment area.

Once catchment areas are delineated on a map, their respective areas are calculated with the aid of a dot planimeter, used in the absence of any other aerial measurement system, and adapted specifically for use on a 1:500,000 scale map - the scale used for the study. Several dot counts are made of each crush area and the average taken.

In calculating stocking densities by this method two major sources of error still remain. First, there is considerable doubt, even within the Ministry of Agriculture, over the accuracy of the cattle crush livestock counts. It is common knowledge that many livestock owners do not bring all their animals for inoculations, in spite of the legal requirement to do so. The inability of the Ministry to police

this rule has led to its flouting by many owners. This is often because owners wish to disguise their true livestock numbers and thus escape taxation. Thus, in virtually every case, cattle crush figures are lower than actual populations. The degree of disparity varies widely so that it would be unwise to apply a uniform correction factor at the individual crush level. But the error does not necessarily affect the general outcome of the analysis unless stocking densities are close to, or more favourable than, the potential carrying capacity. Where available figures indicate that overstocking does occur, the presence of uncounted livestock only stresses the fact. The calculated degree of overgrazing will therefore err on the positive side, presenting a happier picture of the situation, but not altering the existence of overstocking. The purpose at this point is to show that there is a problem, and to give some general indication of the minimum number of stock which may need removal.

The second source of error occurs in the computation of available grazing area. The method used to calculate crush catchment areas takes no account of the existence of cropped lands, or of village areas. Were it the case that grazing, ploughing, and village land uses were mutually exclusive, it would not be difficult to calculate grazing land with the aid of aerial photography. However, these land uses are not mutually exclusive. Livestock are often kept in villages, and traditional land use systems, as mentioned above, require that after harvest, cropped lands must be opened for grazing. This has undoubted agricultural advantages,

but means that available grazing space fluctuates widely on a seasonal basis. This problem is compounded by the fluctuations from year to year of the area cropped, ruling out again the possibility of using a correctional factor that might be applied to account for seasonal variations. It is not sufficient to distinguish between good and bad rainfall years, since the second consecutive year of plentiful rain often shows a decline in cropped land. Under the subsistence farming system which is still prevalent in the Tati, a farmer who harvests sufficient crops to last him well beyond the next harvest season, may reduce his cropped acreage the following year, even if that year has favourable climatic conditions. The percentage fluctuation varies from family to family.

This second source of error is again on the positive side, since the entire catchment area, including cropped lands and villages, is used in computing stock densities. Once again density figures are lower than they probably should be. But the main purpose of the exercise is simply to show that over stocking does occur. The degree to which it occurs, while providing a minimum figure for resettlement schemes, is not vital to the basic conclusion.

Livestock figures received from the Veterinary Department are given in terms of total number of cattle, sheep and goats. Under the conversion system used in Botswana to indicate equivalent livestock units, it is generally accepted that sheep and goats (small stock) are rated at one fifth of a unit. The equivalent figures for cattle depend on their age. In

this study a coefficient has been derived as follows to convert gross cattle-figures to livestock units:

Assume a calving rate of 30 percent per annum (Central Statistics Office, 1976). A herd of 100 beasts will on the average include 11.54 sucking calves (under six months) rated at 0 lsu because they do not generally graze at this age; 11.54 calves between 6 months and a year old, rated at 0.2 lsu; 8.88 animals between 12 and 18 months, rated at 0.7 lsu; and 59.17 animals over two years rated at a full livestock unit each. This adds up to an equivalent lsu rating for the entire herd of 72.12. On the average then, gross cattle figures can be multiplied by a factor of 0.72 to give equivalent livestock unit ratings. This figure is comparable with those used by various officers in the Ministry of Agriculture, which vary from 0.7 to 0.8 (Personal communications).

Thus the total livestock units at each cattle crush are calculated as follows:

$$\text{Lsu} = 0.72x + 0.2y$$

where Lsu is livestock unit equivalent
'x' is the gross cattle figure
and 'y' is the number of small stock.

Table I lists the cattle crushes of North East District, together with their cattle and small stock figures (supplied by the Senior Veterinary Officer, Francistown, in July 1976), their equivalents in livestock units, the size of the crush catchment areas in hectares, and the calculated stock densities, given in hectares per livestock unit. Fig. VII shows the location of all cattle crushes in the Tribal areas and State lands, which are under study, and their catchments. Numbers within each area relate to the number in the left hand column of Table I.

From the Table it can be seen that there is not one catchment area with a stock density equal to or lower than the

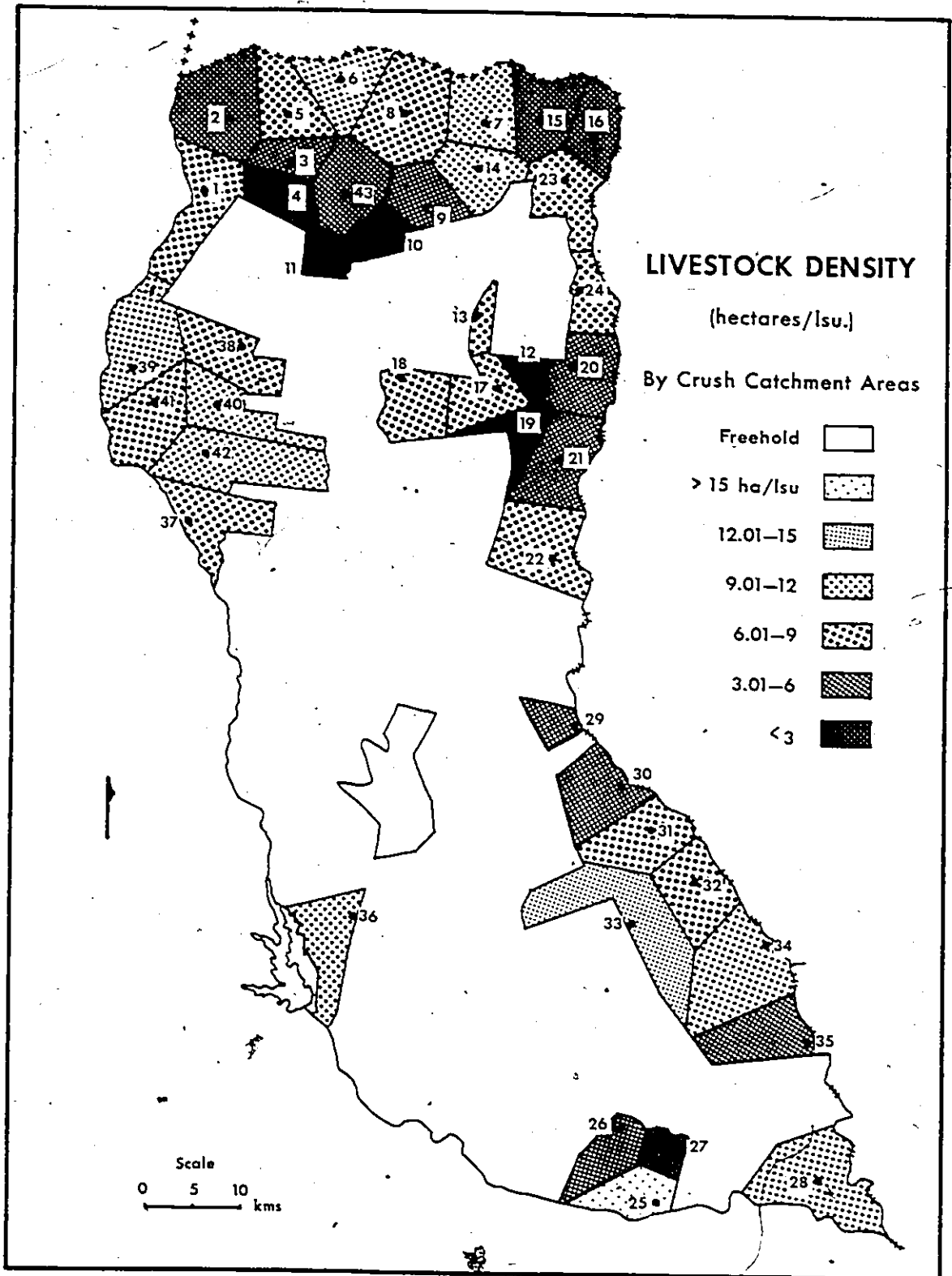


Figure VII

recommended potential carrying capacity. Crushes numbered 25-28, all fall within the area where the recommended rate is 21 hectares per livestock unit.

There is only one anomaly that requires special explanation. This is the Morotole crush area (No.25), which shows a shocking density of 16.75 hectares per livestock unit. The neighbouring areas (No.26 & 27) show densities of 4.37 and 1.74, among the worst in the District. The wide divergence may be due to the shape of the catchment area and its specific location. Many cattle owners who are situated in the northern half of the Old Tati State land (Crush areas 25, 26, and 27) would water their cattle in the Shashe river and therefore graze their livestock as much in the south as in the north. However, they would probably take their stock to the crush nearest their cattle post. When the three crush figures are grouped, a total of 2,136.56 lsu's are found to occupy 9700 hectares, giving a stock density of 4.54 hectares per lsu - much closer to the District average. This explanation is only a suggestion, and the actual circumstances should be investigated to confirm it, or to find the real cause of the disparity, if it does indeed occur. Such an investigation would also serve to indicate the reliability of the nearest neighbour principle used in delineating catchment areas.

Thekwane (No.33) shows a relatively favourable rate of 12.18 ha/lsu. Most of this catchment area lies to the west of a range of hills; which cut it off from the Ramokwebane River, the main source of water for stock. Thus it is a

TABLE I

North East District Stocking Densities

<u>Crush No.</u>	<u>Crush</u>	<u>Cattle</u>	<u>Smallstock</u>	<u>Lsu's</u>	<u>Area (Ha)</u>	<u>Density</u>
1	Kalakamati	1334	765	1113.48	6833	6.14
2	Gungwe	1832	1174	1553.84	8367	5.38
3	Shulotjena	640	620	584.8	3083	5.27
4	Tjibudzand	1935	1561	1705.4	3367	1.97
5	Zwenshambe I	625	864	622.8	5183	8.32
6	Zwenshambe II	559	813	565.08	5250	9.29
7	Mapoka	595	751	578.6	5667	9.79
8	Lepou	1027	1452	1029.84	6833	6.64
9	Pole	1068	1253	1019.56	4266	4.18
10	Mosojane	1112	829	966.44	2567	2.66
11	Letsholatebe	1075	1146	1003.2	2350	2.34
12	Diname	863	620	745.36	1900	2.55
13	Tshesebe	289	206	249.28	1507	6.05
14	Kgari	493	482	451.36	5016	11.11
15	Moroka	1450	819	1207.8	5420	4.49
16	Jacklas I	1287	407	1008.04	3967	3.94
17	Mowaba	636	383	534.52	4300	8.04
18	Themoshanga	801	161	608.92	5117	8.4
19	Tsamaya	1405	623	1136.2	2983	2.63
20	Senyawe	2021	195	1494.12	5350	3.58
21	Seviya	1593	1516	1450.16	6217	4.29
22	Jackalas II	1144	487	921.08	7417	8.05
23	Bethani East	1072	481	868.04	5240	6.04
24	Butale	557	639	528.84	3500	6.62
25	Morotole	335	-	241.2	4040	16.75
26	Mabeta	1160	308	896.8	3920	4.37
27	Maramanne	1373	50	998.56	1740	1.74
28	Matopi	1271	482	1011.52	9180	9.08
29	Matshelagabedi	825	186	631.2	2007	3.18
30	Mfhatane	1272	215	958.84	5520	5.76
31	Pobepobe	1261	54	918.72	5850	6.37
32	Raykop	1174	339	913.08	5700	6.24
33	Thekwane	1106	396	875.52	10660	12.18
34	Matsiloje	1281	284	979.12	9060	9.25
35	Marokung	1526	184	1135.52	5700	5.02
36	Tati Siding	728	186	561.36	5360	9.55
37	Gulubane	962	457	784.04	5800	7.40
38	Sechele	1018	132	759.36	5200	6.85
39	Toteng	1001	320	784.72	8240	10.50
40	Mambo	724	94	540.08	5340	9.89
41	Makaleng	1041	344	818.32	6560	8.02
42	Masingwneng	586	101	442.12	4560	10.31
43	Nyewele	1059	1668	1096.08	6083	5.55
	Totals	45,116	24,866	37,456.72	222,220	5.93

relatively sparsely settled area, the only residents a few wealthier stock men who can afford to maintain diesel pumps on disused mine shafts (borehole drilling is not strictly allowed in this area, so these men have adapted their equipment for use on abandoned mine shafts).

The Table also indicates that although the entire Tribal and Stateland areas of the District are overstocked, there is still a wide range of stock densities. There does not seem to be any clear rationale for explaining the difference. There are probably numerous factors involved. It is interesting to note that the State land areas, where stock limitations were to be applied, are not particularly better off than old Tribal areas. It is possible that the better figures at places such as Zwenshambe (No. 5 and 6) and Mapoka are due to wide occurrence of land areas used for cropping, while the figures in the Matsiloje State land (No. 30-35) where 'lands' are fewer, reflect a more accurate density. It is recommended that more detailed studies be done throughout the District to investigate the local situation and its causes, so that appropriate measures be taken in each location.

Looking at the Total figures, it is seen that the Tribal and Statelands of the District are supporting at a minimum 37,456.72 livestock units, in 222,220 hectares. The recommended stocking rate, based on potential carrying capacity, for this total area is 13,607.8 livestock units. Actual carrying capacity is probably much lower because of a long history of misuse. At this rate, however, there is an excess

of at least 23,848.92 livestock units which should be resettled elsewhere. This is equivalent to an average herd of 33,123² head of cattle. It is unknown how many holdings this number of cattle would represent. To learn this it is recommended that a study be undertaken of the herd size distribution in the District. Only in this way can it be determined how many families would be affected by any resettlement scheme, and the social disruption such a scheme might entail. Such a study would also throw light on the possible political and economic ramifications.

Egner, when submitting his report in 1971, suggested that Government might wish to purchase additional freehold farms and add them to the tribal grazing land. He noted the dangers of such a purchase in its psychological support of the traditional savings systems, and the need to impose strict limits on stock. But such a purchase would have positive political support among the people, who still view the free hold farms as an odious relic of colonial times. Assuming then, that all freehold farms were cleared of existing stock, purchased by the Government, and then added to the tribal grazing space, the average stocking density for the entire District (area 5232 sq. kms.) would be 13.97 ha/lsu at best. this is a vast improvement on the present situation, but is still worse than the recommended stocking rate. If the entire District had a potential carrying capacity of 16 hectares per livestock unit, there would still be a need to resettle at least 4,756.72 lsus, to achieve this level.

It is therefore very clear that the problem of overstocking

in the Tati is serious. The assumptions used above have in every case been favourable to the District. Yet the number of cattle which must be resettled to achieve an environmentally sound range management plan is greater than the 20,000 head of cattle specified in the Presidential Directive 24, of 1974.

The region most commonly viewed as the panacea of the Tati land problem is the Nata Statelands, an area over 150 kilometers to the north west of the North East District. From the 1920's until the present when resettlement has been put forward as part of the solution to the land shortage problem, it has been the Nata Statelands which has been in the minds of the administrators as the area to receive the surplus livestock. The next section of the paper looks at the problems and possibilities for resettlement in this area. The environmental conditions are presented first, followed by a description of existing human land use. The implications of both for resettlement are shown, with a view to establishing the feasibility of such a solution.

CHAPTER FOUR

THE NATA STATELANDS

The area known today as the Nata Statelands is shown in Figure VIII. It lies in the northern part of the Central Administrative District, between Rhodesia and North West District, and is bounded on the north by Chobe District.

Rainfall in the area varies from an average of 55mm in the south to about 600mm in the north (see Fig. III) (from National Development Plan V, 1973-1978). Variability of rainfall is less here than towards the south west but remains at about 30-40 percent. Temperatures are less extreme than in the south with minimum temperatures infrequently below 0°C and with average maximum temperatures below 40°C. Diurnal range is greater in the dry winter months when skies are clear, than in the wetter summer months (Blair-Rains and McKay, 1968).

In spite of the higher rainfall, drainage systems are poorly developed. The only significant river in the area is the Nata with its tributaries the Maitengwe, Nkange, Dzibanene, and Tutume. All of these rivers originate in the higher regions to the east in the hard veld. In many other parts of the Statelands the extremely flat topography occasionally leads to widespread flooding.

The southern half of the Statelands lies within the Makgadikgadi basin, and shows numerous vestiges of the ancient inland sea. The most prominent of these features are the vast salt flats, and raised beachlines. In the eastern part

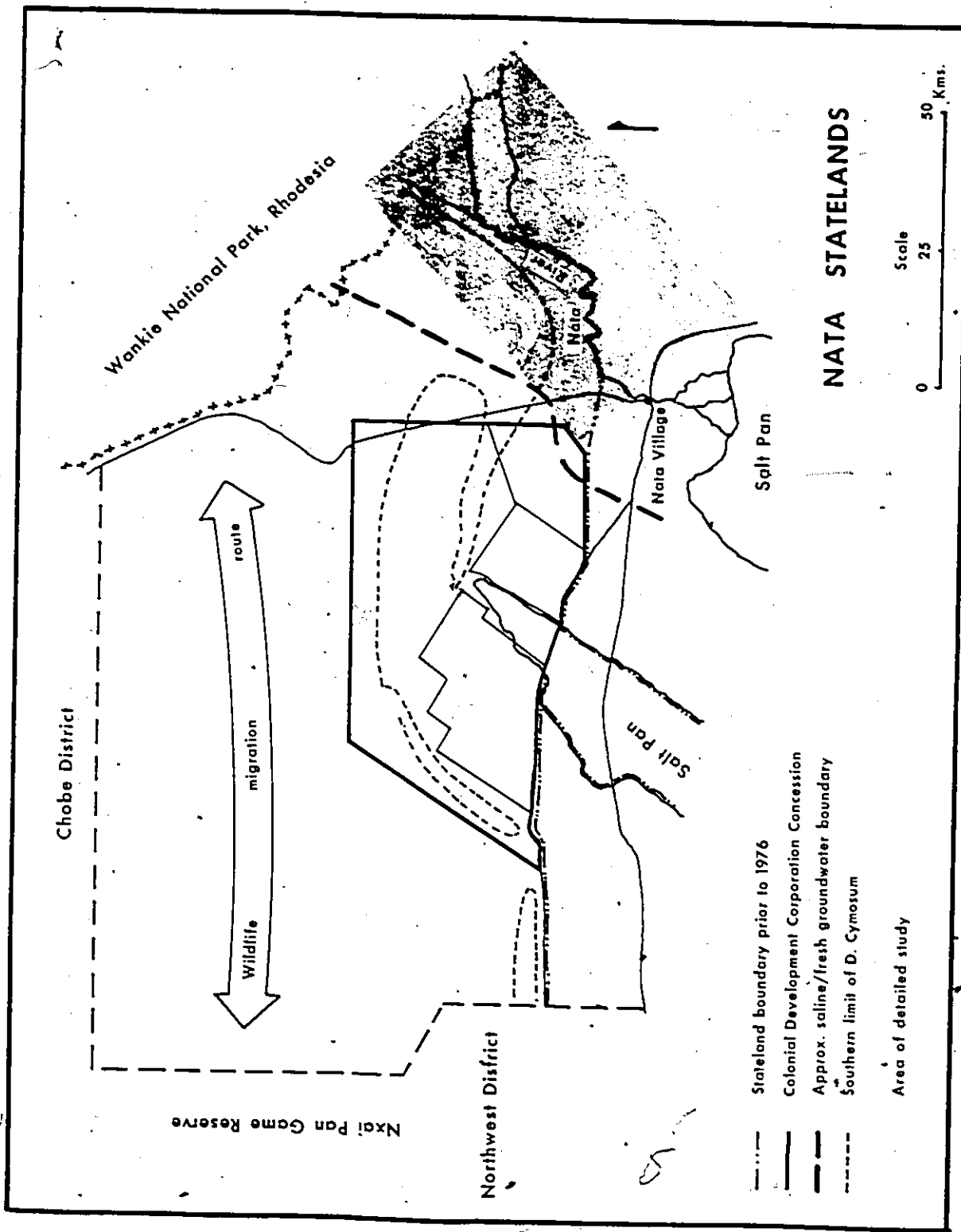


Figure VIII

there are dry valleys, and large dune field which extends across the border into Rhodesia. The troughs between the dunes are lined with small water pans, which play an important role in the large wildlife migration which exists between the Wankie National park in Rhodesia and Nxai Pan Game Reserve in Botswana. Nxai Pan lies inside North West District but adjacent to the Nata Statelands.

In the south calcrete bedrock lies close to the surface, but sand cover increases towards the north, particularly as one passes beyond the remnant beaches. The calcretes act as shallow aquifers, and in the south west portions of the State land potable water is fairly readily accessible by means of shallow wells. However, towards the east brackish, and then saline, ground water becomes predominant, and there seems little chance of depending on underground supplies for useable water. Little is known about the water quality in the northern part of the Stateland.

Vegetation varies with soil type and water quality through the Statelands. Along the borders of the salt pans, and in depressions, saline ground water and halomorphic soils have led to a predominance of salt tolerant grasses and in some areas some species of palm, and baobab trees. Further away, and particularly towards the north Terminalia and Combretum species of trees, and more mixed grasses are common (Blair-Rains and McKa 1968). There are some commercial species of trees, but these are not found in sufficient quantity to warrant exploitation.

One species of plant which has had great impact in determining land use is Dichapetalum Cymosum, a small poisonous shrub which is fatal to livestock, particularly in the spring season. It is avoided by wildlife. Because of its very extensive root system and rhizomenous nature it is practicably impossible to eradicate. Its distribution is shown in Figure . The extent of its occurrence in the south forms a natural barrier to the expansion of the cattle industry northwards.

Until the post World War II years there was virtually no human economic activity in the area, except in the form of subsistence agriculture along the Nata River, which forms the south eastern boundary of the Stateland. This River is the most important natural feature in the region as far as human activity is concerned. Some bushman hunting and gathering has always been practised, but this is an extensive land use, and the human impact that results is minor. There were a few Ngwato cattle posts in the area, but these have been deserted for some time, due to predators and poisonous plants.

In the late 1940's an exploratory mission visited the area from Britain and proposed a massive ranching scheme (Greenhow, Lécoge and Speed, 1975). The basic idea was to purchase local beef cattle from the stock owners of North West District, fatten them up and trek them via Pandamatenga to what was to be the Federation of Rhodesia and Nyasaland, and the Belgian Congo. Three individual ranches were established originally; one at Bushman Pits to the west, one in the Nata area, and a third at Pandamatenga. The first was for collection of local livestock. The second, at Nata, was to be a breeding

and fattening operation, while the third, at Pandamatenga, was to be a final receiving, fattening and shipping center.

The operation was a failure, of a similar nature to the Groundnut Scheme of Tanganyika (Wood, 1950). It failed for numerous reasons: grandiose plans based on virtually no ground knowledge, poor management, very high overhead costs due to such things as difficult communication and high maintenance costs, environmental and ecological factors, and in the end a change in the original marketing network which resulted in the area being cut off from its original market center, and far from its new market.

Only one part of this scheme, the Nata Ranch, lies within the Nata Statelands with which this paper is concerned. The ranching experiences learned during this period, and the subsequent impact on the public's views of the area have had far reaching effects, particularly for the Tati Settlement Scheme.

It was found that ranching on a commercial scale would be very difficult in the area. The grazing appeared to be spectacular, but later proved to require considerable nutrient supplementation. The Colonial Development Corporation who were responsible for the scheme, found that ground water became very poor towards the east of their concession, and that good groundwater was not found in the same location as good grazing. Furthermore, the expansion of their fenced camps was barred on the west and north by the occurrence of D. Cymosum. Predators caused some hardship, and the large herds of wildlife made fence maintenance very expensive.

By the time the operation closed down in the early 1960's with the sale of the developed ranch to the Government, the area had received a very bad reputation among the local livestock owners. The experience of the Colonial Development Corporation only supported the findings of the earlier Ngwato cattle posts. The Government has attempted to lease out the fenced and equipped camps on an economic basis, but it has been found that the only lease applicants have been the already wealthy stockmen. These are the only ones who could adequately handle the management and marketing problems of a commercially viable ranch in the area. The Government, on the other hand, is opposed to the idea of leasing the ranches to these men on the grounds that such a move would be against their policy of social equity, and reducing the income differential between rich and poor.

The Government is caught between two of its policies in this case. While opposed to leasing the ranches to the rich, the Government is also opposed to the idea of subsidized rents. It would prefer to see livestock management groups, or cooperatives taking up the leases. Once again the problems are of a practical nature - the poorer sections of society being the least prepared to commit their livestock into the hands of a strange management system in a strange and feared place. Present experience with group management in Botswana is showing that it is a difficult concept, given the prevalent social views. Small groups which have social or traditional ties are beginning to formalize themselves, but there is definite hesitation, and this increases when the concept of

cooperation is compounded by a change in location.

The implications for the Nata Statelands are that for all practical purposes, the developed ranches are at present out of the question for any resettlement scheme involving groups of small herd owners.

When all the limiting factors - saline ground water, occurrence of D. Cymosum, management of commercial ranches by groups, - there is very little land available for an resettlement of livestock. Figure VIII shows the area that is available. The only area of possible use is the region bordering on the Nata River itself, based on water supplies from the river, and on grazing northwards to the southern limit of D. Cymosum. This was the area Egner had in mind when he proposed the resettlement of Tati livestock in the Nata Statelands (personal communications). Unfortunately, Egner was not able to mount a thorough investigation of this area before he submitted his Interim Report in 1971. This task was left until the beginning of 1975, after the Presidential Directive for resettlement. The findings presented in this section pertain to studies that have been done in the area since that time.

In evaluating the potential of the Nata River valley a similar approach will be taken to that used in the previous section on the North East District. Some variations occur.

The River forms the boundary between Tribal lands and Stateland. The Tribal land to the south of the river is under the jurisdiction of the Ngwato Land Board, while the Stateland falls directly under the Ministry of Local Government and Lands. Traditionally the Tribal land boards

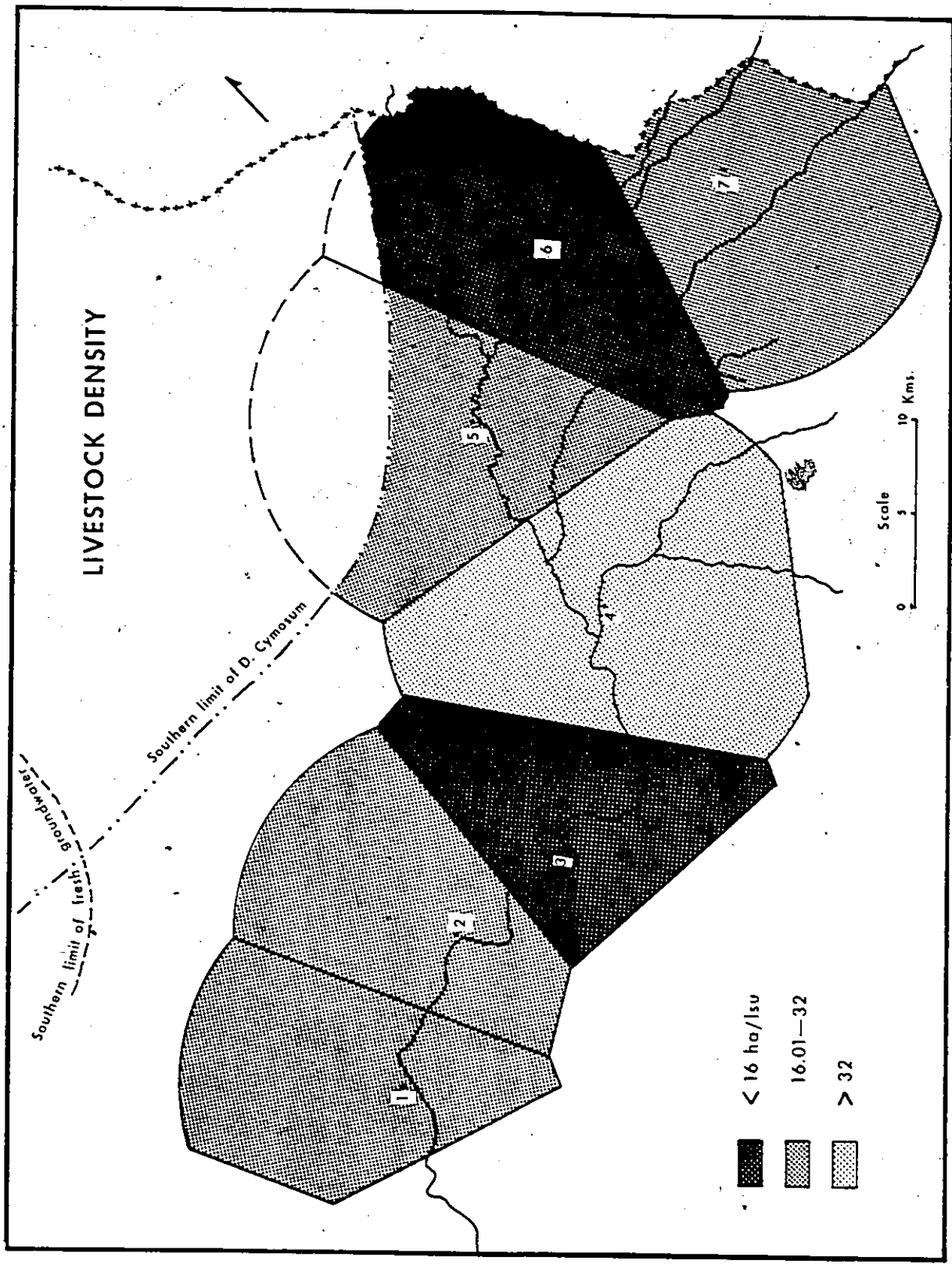
throughout the country have opposed the granting of land under their authority to members of other Tribes. There is a further historical complication involved in the use of the Nata Statelands as a resettlement site for North East District residents. Originally the area was known as the Francistown Crown Lands and administered by the District Commissioner resident in Francistown. This led to the view by Tati residents that the area was set aside for their use. This attitude was reinforced by the numerous attempts of the Commissioner to resettle Tati people there. At present however, the area is administered by the Central District Council and not the North East District Council. While the Tati residents view the Nata area as their land, Central District Council is reluctant to give up its use to Tati residents. The Government, while seeking to move away from this mentality has not in the past made an issue of it by directing any Land Board to allocate land to nontribesmen, although the Government does have this authority. Applied to the Tati settlement proposals involving Nata, this means that the Government restricts its plans for settlement to the Stateland side of the Nata River. Therefore, in this study, only that side of the river should be used in determining present land use, stock densities, etc.

The data, on the other hand, lends itself to an approach that involves both sides of the River. Cattle crushes are situated in a linear pattern along the river, and cater to animal populations on both sides. It is therefore impossible

using these crush figures, to identify those cattle which graze on one side of the river or the other. In fact, cattle are not restricted to either side and there is considerable movement back and forth, though the distance travelled on the "far side" from the cattle post is generally not great. To determine stock densities the same system will be used, and both sides of the river will be included. However, only those crushes whose catchments include parts of Stateland will be used. In delineating catchment areas the nearest neighbour principle is used again. Because of the linear pattern of settlement and crush location, the northern side of the catchment areas must be closed on the basis of some other rationale than the nearest neighbour principle.

Along the Nata River no cattle post is farther than seven kilometers from a cattle crush (see Fig. IX). On the Stateland side of the river no cattle post is more than two kilometers from the river; most are within one kilometer. Personal communication with the majority of livestock owners living on the Stateland side indicate that while grazing does occur at some distance from the river, this very rarely exceeds ten kilometers. Summer grazing may extend farther with cattle drinking from seasonal pans, but this is not common because owners prefer to kraal their stock at night as protection against predators. A distance of twelve kilometers has therefore been chosen as being an outside limit to grazing, to allow for the seasonal differences and to account for those few individuals who may graze their stock farther away.

As the Rhodesian border is approached the northwestern



Data Source: Vet. Department, Francistown

Figure IX

limit is determined by the southern limit of the occurrence of D. Cynosum. Livestock owners avoid the use of this belt for fear of heavy losses. The north eastern limit is the International border itself. In the south crush catchment boundaries are shown but adjacent catchment areas are not included on the map, as they fall outside the scope of this paper.

Table II lists the cattle crushes found along the Nata River together with their livestock figures, equivalent lsu's catchment areas, and stock densities, in hectares per livestock unit. Again the Crush Number corresponds to the numbers of the map in Figure IX .

Field (1975) suggests that this area has a potential sustained carrying capacity of 16 hectares per livestock unit. This corresponds to the findings of Rattray (1957) in the adjacent sections of Rhodesia, and extrapolated by Bawden and Stobbs (1963) for Botswana. Using this figure it would appear that taken as a whole the total crush catchment area was virtually at capacity in 1975. Even a one percent increase in total livestock numbers in 1976 would result in over stocking. Furthermore, this presents the optimal picture, assuming as it does a complete livestock count. The presence of wildlife in the area should also be borne in mind, so that grazing pressure is actually heavier than indicated by stock figures (Bawden and Stobbs, 1963).

The stock density figures show wide variation. Basotho is supporting almost twice its recommended livestock population,

TABLE II

Nata River Valley Stocking Densities

<u>Crush No.</u>	<u>Crush</u>	<u>Cattle</u>	<u>Smallstock</u>	<u>Lsu's</u>	<u>Area (ha)</u>	<u>Density</u>
1	Modala	885	331	703.4	17400	24.74
2	Chihubu	1284	389	1002.28	17425	17.39
3	Tshaasthumtshaa	1557	329	1186.84	14800	12.47
4	Saxa	768	-	552.96	25725	46.52
5	Madinoga	1180	223	894.20	14095	16.43
6	Basotho	3408	364	2526.56	20448	8.09
7	Sematlaphiri	1825	-	1314.00	22033	16.77
	Totals	10,907	1,636	8,180.24	132,526	16.20

TABLE III

Nata River Valley Potential Carrying Capacities

<u>Crush No.</u>	<u>Crush</u>	<u>Area (Ha)</u>	<u>Potential Capacity @ 16ha/lsu</u>	<u>Shortfall</u>	<u>Years to Capacity @15% @25%</u>	
1	Modala	17400	1087.50	384.1	3	2
2	Chihubu	17425	1089.06	86.78	<1	<1
3	Tshaasthumtshaa	14800	925.00	261.84	overstocked	
4	Saxa	25725	1607.81	1054.85	8	5
5	Madinoga	14695	918.44	24.24	<1	<1
6	Basotho	20448	1278.00	-1248.56	overstocked	
7	Sematlaphiri	22033	1377.06	63.06	<1	<1
	Totals	132,526	8282.87	102.63	<1	<1

while Saxa could theoretically support almost three times its present population. Basotho is an area of relatively long settlement and has a high reputation as a tick free, water abundant region (personal communications). It derives its name from its origin as a customary land grant to Basotho servicemen working under the BambaNgwato Tribal Authority during the early years of this century. Saxa was an old cattle post of the Ngwato royalty, which was abandoned in 1973 in favour of a freehold farm in the North East District. The vacancy left by this move has not yet been filled by other tribesmen, and so the area shows a relatively low density at present. Modala's density of 24.74 ha/l su is somewhat surprising, situated as it is fairly close to Nata Village, the center of a large cattle population. It could be an indication of range exhaustion as the area has been settled for many years, bush encroachment is extreme, and bare ground fairly common.

The total figures presented in Table II indicate that there is in fact no space for additional stock. Within the region redistribution could lead to a more even pattern of grazing, but it is evident that the valley as a whole is fully stocked and may become a duplicate of the situation found in North East District. Table III shows the potential carrying capacity of each catchment area and the difference between potential and actual densities (under Shortfall). This indicates the number of years from 1975 to full stocking densities at 15 and 25 percent natural annual herd size increase. These figures were selected somewhat arbitrarily

but suggest the reasonable upper and lower limits based on an annual calf drop of 30 percent and an off take of 10 percent of the herd.

The results are based on 1975 figures so that the Table suggest that the area has already reached capacity, with the exceptions of Modala and Saxa. The region taken as a whole has passed its recommended stocking rate. Instead of pressing for the resettlement of additional livestock in the area from North East District, the Government should be taking steps to introduce cattle management projects here, before the situation worsens and the overgrazing problem of the Tati is duplicated.

In view of the reluctance in the past on the part of Tati residents to move to the Nata River valley, and Egner's apparent assumption that there was indeed space available, it is interesting to look at the history of the settlement of the valley. A brief enumeration of the north bank was undertaken in early 1975 and residents were asked when they settled in their present location and where they had moved from. Table IV indicated the temporal pattern of settlement of the 108 respondents while Table V indicates the original homes, grouped by region.

A comparison of Tables IV and V indicates that there has been considerable movement within the area. More than half of the residents interviewed had moved from one location to another within the Nata River region. Only 45.4 percent came from outside the area, and only 30 families (27.8 percent) had migrated from North East District. Unfortunately

TABLE IV

Temporal Pattern of Settlement Along Nata River's North Bank

<u>Period Settled</u>	<u>Number of Families</u>
before 1935	1
1935-1940	3
1941-1945	1
1946-1950	2
1951-1955	12
1956-1960	4
1961-1965	4
1966-1970	6
1971-1975	26
Born here	27
Don't know	22
Total	108

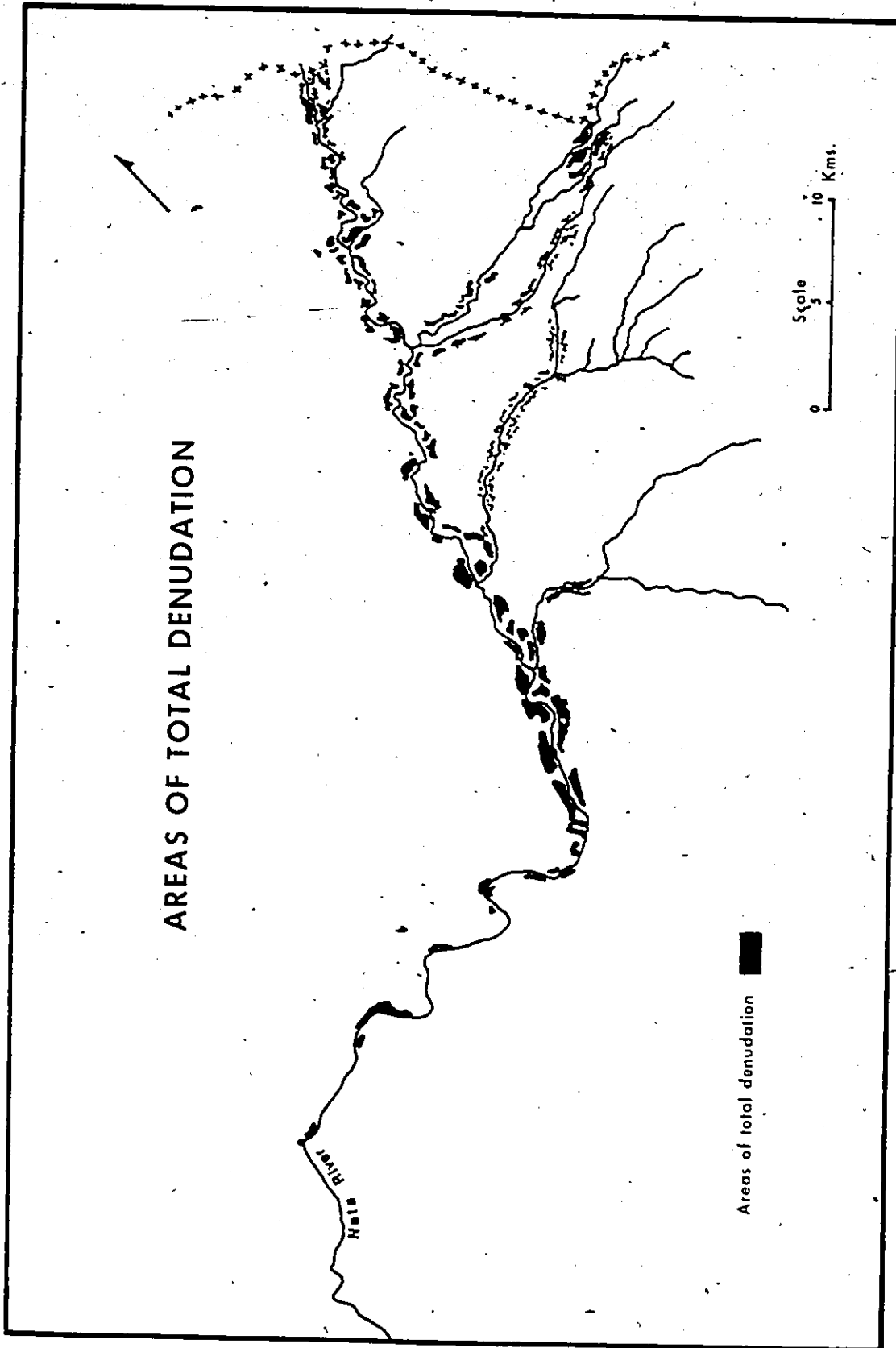
TABLE V

Original Home of Migrants to Nata River North Bank

<u>Original Home</u>	<u>Number of Families</u>	<u>% of Total</u>
Nata River Area	59	54.6
North East District	30	27.8
of which Masunga	8	7.4
Chobe District	1	0.9
Bokalaka (in Central)	12	11.1
Rest of Central District	3	2.8
Foreign	2	1.9
Not answered	1	0.9
Total	108	100.00

no data exists on families which emmigrated from the area, or on those who came and left again.

There is also very little known about the past history of land use in the valley, a factor which is important in more detailed studies on actual carrying capacities. Figure X shows areas of complete denudation along the river. These



Source: Field Survey and Air Photo Contract BT 139

Figure X

areas are clearly visible on aerial photography (1973) and have been ground checked. This serves as one indication of heavy utilization in the past, and suggests that immediate action must be taken to protect surface level vegetation along the river banks to avoid serious erosion problems. It also shows the heavy pressure that is exerted on the veld close to water sources in the traditional, free ranging, management system. Much more control of grazing around watering points needs to be exercised to reverse the present trend.

The conclusion from a purely environmental stand point seems clear. The Nata Statelands cannot absorb additional stock from the overgrazed Tati District, and itself needs prompt action to conserve its own range land, and to save the country from a duplicate of the North East District problem.

CHAPTER FIVE

IMPLICATIONS AND ALTERNATIVE APPROACHES

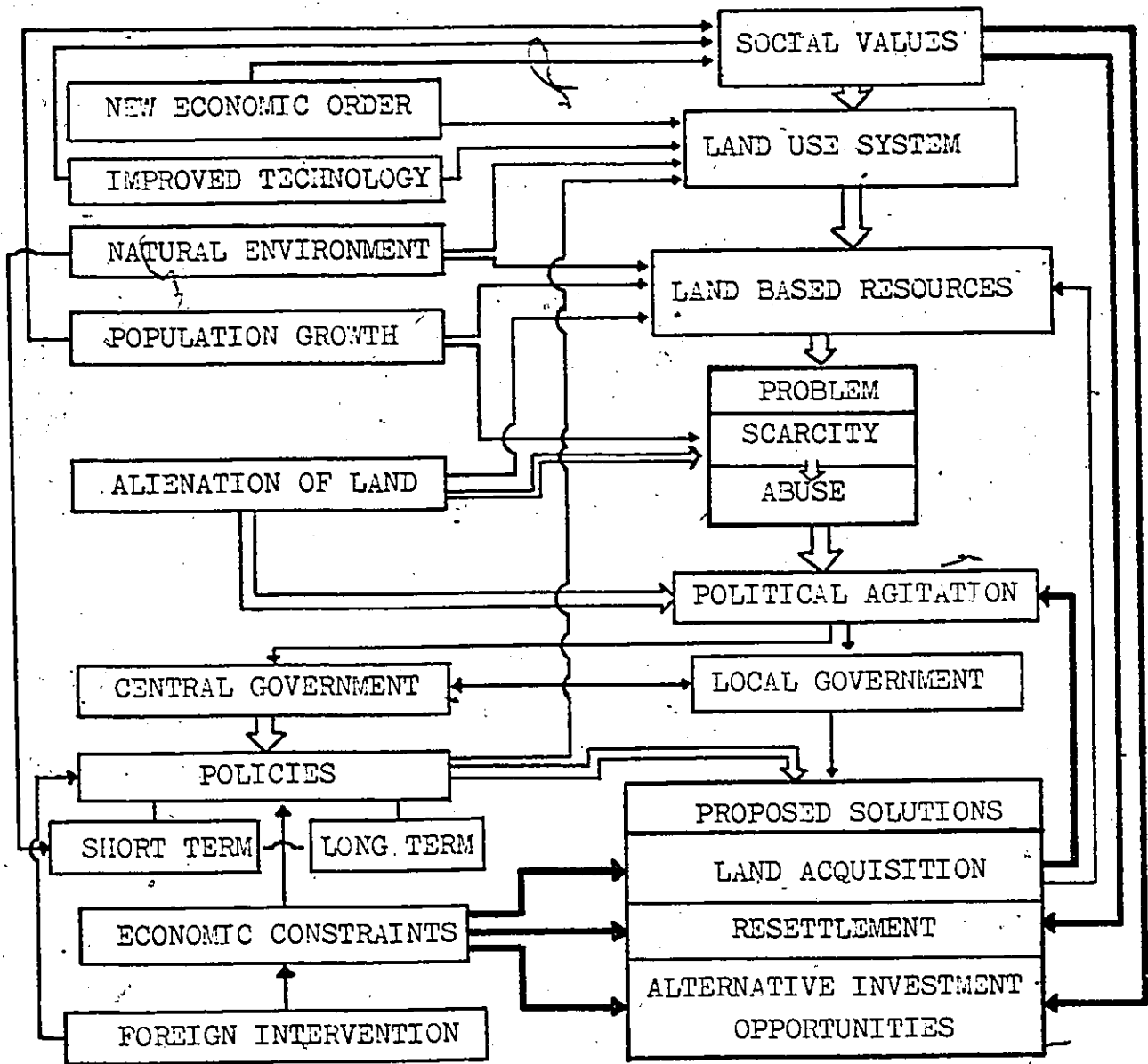
The findings of the previous section clearly indicate that the Tati land question will not be answered by resettlement of livestock in the Nata River valley. It is open to doubt whether resettlement of livestock anywhere, if carried out without additional programmes would solve the basic problem.

Egner (1971) maintained that the root cause of the problem was the savings pattern of the Tati residents, and urged that programmes be undertaken to change this pattern. This problem is not one of the Tati alone. Land pressure caused by the same mentality towards livestock occurs elsewhere in Botswana. It is only that Tati is an extreme case that it has received so much attention.

The case study illustrates the tangle of social, economic, environmental, and political factors that are involved in trying to solve a resource management problem. A flow diagram (Fig. XI) shows some of the basic ties and inter-relationships.

Prevailing traditional values originally determined the attitudes towards land and cattle, and led to a savings pattern based on the accumulation of livestock and a peculiar land use system. These value systems evolved partially from environmental factors, primarily climate, and were to some extent a method of trying to overcome natural hazards and to

FLOW DIAGRAM ILLUSTRATING THE INTER-RELATIONSHIPS BETWEEN FACTORS INFLUENCING THE DEVELOPMENT OF, AND REACTION TO, THE TATI LAND PROBLEM



Acts towards



Acts against



Influences one way or the other



Figure XI

provide a measure of long term security. Thus the environment has influenced the land use system as well as the productivity of the land resources themselves. A measure of dynamic equilibrium was achieved under this purely traditional system. Values did not change rapidly and innovations were not frequently introduced.

The equilibrium was then upset by the introduction of a new economic order, based on money and exchange, and the introduction of improved technologies. The new economic order allowed a rapid accumulation of wealth (livestock) while improved veterinary care and water supplies reduced some of the environmental hazards (disease and drought). These innovations arrived in rapid succession and social attitudes did not keep pace, but remained basically the same as previously. The effect on the land resources has been much greater pressure leading to severe range deterioration and soil erosion.

Increasing relative scarcity of land, due to this build up in livestock, reduced carrying capacity, and alienation of land to the Tati Company, resulted in increased population pressure. Human population was also benefitting from better health care, so the number of people with visions of wealth in the form of livestock also increased.. Population pressure coupled with great expectations led to political pressure to provide relief.

The popular political pressure had very definite goals in mind - the acquisition of previously alienated land. This at once gave new scope for personal aspirations through

provision of more land, and gave satisfaction over the return of traditional home land. The local government, the District Council, being closer to the scene of political pressure demanded action very much in line with that requested by the general public. The council is much less happy about the prospect of resettlement of Tati residents outside the District because of the loss of a political base and financial revenue. If the Nata Statelands were placed under the jurisdiction of the North East Council this attitude might change, but such a move is most unlikely to occur inasmuch as the Central District represents much greater political force than the Tati, by virtue of its larger size and population. Resistance to resettlement in Nata Statelands is also opposed by the Central District Council who prefer to keep this area for its own people's use.

The Central Government had to balance these popular demands against economic constraints and overall policy objectives. Central Government policies are based primarily on the new economic system and aim at a transition from traditional economic systems to modern ones. There are both long term and short term considerations. Short term considerations include the desire to please and thereby stay in power. Long term factors include the survival of the beef industry as one of the nation's major foreign exchange earners. At times the short and long term goals conflict. Very often it is the short term goal that takes precedence. The different perceptions of the problem, and varying constraints at different

Governmental levels also led to some inter-Governmental friction - a common occurrence in multi-level administrative systems.

The Government's policies are also affected by foreign interference of one sort or another. Reliance on expatriate skilled manpower leads to the influence of alien values and attitudes in decision making. Foreigners involved in planning are often insensitive to the social ramifications of their proposals, assuming perceptions and reactions that do not in fact pertain to the situation. Foreign economic aid determines to a large degree the type of economic programme the Government must adhere to, by supporting specific projects, and by affecting thereby the allocation of domestic funds. External pressure groups may also influence Government policy, as may the foreign business community.

The Government must propose solutions within the framework of these influences and constraints. The popular demand, in the Tati case, for more land could only be partially met because of financial constraints. The effects of the purchase of freehold land was to temporarily relieve political agitation and land pressure. Unfortunately, the move taken alone also ~~reduced~~ faith in the traditional saving system, by holding out the promise of additional land on demand. The other half of the proposal, resettlement elsewhere, was also of a temporary nature, relieving pressure in the Tati for a short period, but increasing it elsewhere. Neither resettlement

nor purchase of additional freehold land, represent long term solutions. In fact social attitudes towards traditional home sites and fears over the proposed resettlement area led to opposition against resettlement, while the returning of alienated land reinforced traditional attitudes.

Egner's answer to the root cause of the land problem was to attempt to force a change in savings patterns. He proposed to do this by increasing the risks and costs of animal husbandry. Risks could be increased by the refusal by Government to purchase additional land, allow livestock to accumulate, and wait for the inevitable drought to decimate the herd. This would lead to a rethinking on the part of livestock owners and a change to investment in more secure institutions, such as banks, building societies, post office savings, etc. This approach may well be the one that succeeds, but it will do so only by default. To take this as official policy would be extremely unpopular, but the lack of any other more positive approach leaves this one in effect.

Egner proposed increasing the costs of animal husbandry by introducing mandatory minimum wages for cattle herders, including all family members. This supposedly had the additional advantage of wider distribution of wealth. In the same report Egner complained about the apparent unwillingness of the police to deal with illegal immigrants. The stock limitation programme introduced by Egner himself in the newly acquired Statelands has not been effective either. It is difficult to see any possibility of imposed wages being adhered to. It certainly could not be enforced, and would be politically

unpopular.

Another proposal was to use the limited finances to develop Francistown and encourage urbanization as a solution to rural land pressure. The social and economic ramifications of such an approach are extremely complex and more problems would be created than solved. The difficulties of urban centers in developing countries are well known (Breese, 1969).

There is a basic problem with the overall approach used by the Government in the Tati land case. The starting point used until now has been "the overgrazing of the Tati District." Great concern is expressed over the conservation and wise utilization of the range as a natural resource. All attempts have had the solution of this one problem as their ultimate goal. The root cause of the problem has been identified as being one of social attitude. The impact of the problem has been seen as primarily environmental but with future economic, social, and political consequences. All proposals put forward have had at their heart concern for the environment, other factors are viewed as secondary and must be shaped to suit environmental conservation.

There is no doubt that environmental conservation is necessary. But the apparent trend in world thinking towards saving the environment at all costs has its own dangers, as illustrated in the Tati case. What is needed is a new holistic approach that fits environmental considerations within, and as part of, the total natural-cultural framework. Pre-occupation with any one factor leads ultimately to imbalance and the creation of problematic side-effects (Glantz (ed.), 1976).

In the North East District of Botswana, the Tati land problem is only one of many development issues, and should be tackled as just one part of an overall development programme. Livestock production is but one aspect of agriculture in the District, and agriculture is certainly not the only economic activity, even in rural areas.

Rural development is a very popular concept in Botswana as elsewhere. The Africa Regional Conference on the Intergrated approach to Rural Development, held in 1969, was but one conference convened to discuss issues related to economic advancement of rural areas (see also Mosher, 1969 on the creation of a "progressive rural structure"). Such attitudes betray an acceptance of the divergence between rural and urban economies. In Botswana it is clear that ties between rural and urban areas are very close (Central Statistics Office, 1975). An approach that incorporates both urban and rural, industrial as well as agricultural development, should be used to maintain and even strengthen these links rather than to widen the economic gap (see Nurul Islam, 1974).

The approach suggested by Birch (1972) for resource management planning is a start. In this approach goals are identified, as are public needs. Alternate solutions to current resource problems are formulated and strategy for achieving the goals and needs is chosen. This approach recognizes the need to be aware of popular perceptions and value systems and the importance of these factors to success (see also Kunkel, 1970; Johnson, 1970; Ong, 1969), but it remains narrow in the sense that its primary aim is natural resource management.

It is the contention of this writer that the conservation and wise utilization of natural resources is vital, but is only one factor in a much broader complex of social, economic and political inter-relationships. Therefore any approach that focuses on any one factor will lead to imbalance.

The problems of such a holistic approach to planning are plain. Identification and description of social aspirations, of future social needs, of environmental factors, of economic and political constraints, and the inter-relationships of all these factors necessitates much research and time. The planning of strategies that provide optimum solutions is another complex procedure. Problems do not generally wait until ideal solutions are found, and political pressures often require short term solutions that may be counter-productive over the long term. One ingredient of all long term planning should be the formulation of short term programmes that are compatible with the final goals.

In the case of the North East District, a broader approach to the land problem would include attention to credit and marketing systems for arable crops, as a stimulus to more intensive utilization of land resources (Cleave, 1974; Collinson, 1967). It has been pointed out above that North East District has relatively good arable soils, and fairly good water resources. Arable agriculture produces higher returns per hectare than livestock production, so from an economic point of view arable land use is preferable, provided that adequate inputs are available. Agronomy is not despised among the people of the Tati, so there would be little general

opposition to increased emphasis in this sphere. The land tenure system provides enough security to land holders. As a result a more responsible attitude towards care of the land is engendered. Grazing land by contrast is used communally, and responsibility for its wise utilization is not delegated to anyone. Conservation measures are therefore more easily implemented in arable areas than in grazing lands. Arable agriculture is not only a more intensive land use form, from a production view point: it is more intensive in its use of labour than the present livestock management system. Although some improved techniques should be encouraged, a large degree of mechanization is not essential to the economic viability of arable agriculture.

Crop production is in fact common in North East District. Bawden and Stobbs (1963) state that in 1956 141,000 acres were either cultivated or under recent fallow. The purpose of farming however, remains subsistence and the methods employed are basically traditional. Among the reasons for this is the problem of disposing of surplus production. The subsistence farmer limits his production to his own future requirements and ability to store his production. There is little point in producing a surplus if it cannot be stored in safety, or profitably disposed of. Marketing problems which include wide fluctuations in prices, little or no market information, poor transportation, even the lack of reliable workers, act as further disincentives to increasing production (Bawden and Stobbs, 1963). The effects of these marketing problems are

not limited to Botswana, but are found elsewhere in similar subsistence economies (Schultz, 1964; Johnson, 1970; Lanyane, 1974; Lele, 1974). Improved marketability of crops is therefore a necessary factor in upgrading the present, basically subsistence level of agriculture, and altering the land use pattern in the North East District to one which utilises the resources more responsibly.

Improvement of marketing systems is by itself not sufficient to effect rapid change. If traditional methods of farming are adhered to low yields per labour and time inputs will continue and surplus production will be minimal. There is a need to introduce more advanced techniques which will bring higher results for given labour inputs. Tools which are more effective than present ones, and yet which are within the reach of the majority of farmers must be made available. Techniques which conserve soil moisture, and overcome the problems of encroaching quick grass (mentioned by Schapera, 1943, and still a major difficulty) must be introduced as well. Improved seeds, fertilizers and insecticides should also be available in rural areas. There must be a realistic credit system which will permit the participation of the small operator as well as the large (see Cleave, 1974 for further comments on the importance of credit to agricultural development).

Finally, the attitudes of the people themselves must be taken into account. It is not enough to provide credit facilities and good marketing opportunities if the attitudes of the people are not amenable to change (Johnson, 1970).

Profit is not always the only consideration in the subsistence farmer's life. Indeed it may not even be a major one (Chayanov, 1966). In some areas land tenure security is of more critical concern (Ong, 1969) although this is unlikely to apply to the Tati. In other areas where farmers "put a high premium on leisure" there is reluctance to practise the technical knowledge they possess to the full, and thereby produce more than their immediate wants (Gregory, 1967). These human aspects of the problem are just as critical to the success of any development programme as other more technical factors. Much more study is needed in the North East District on these social attitudes, and approaches to agricultural improvements should be developed around them.

The Government of Botswana must be the prime mover in overcoming these problems of production and marketing. A credit system, operated by a marketing cooperative, similar to systems used in East Africa (Collinson, 1967) should be investigated, and with appropriate modifications be instituted in the North East District. Such a credit system should provide working capital for small operators, preferably in the form of farming requisites. The marketing cooperative should handle this credit system so that repayment losses can be kept at a minimum. Full and intimate knowledge is also maintained of the credit worthiness of individual farmers (Cleave, 1974). A pilot project of this type is underway in the Southern District of Botswana, so the applicability of this approach within Botswana's social structure should soon be known.

The Government is responsible for provision of communication systems, especially roads. Transportation within the North East District is poor, but steps are being taken to upgrade and spread the road network. This will have immediate effects on accessibility and will vastly improve marketing links. But it must be accompanied by marketing and storage facilities. An attempt is being made to develop the Botswana Agricultural Marketing Board (National Development Plan, 1973-1978, 1973) whose responsibility it is to buy, store, and resell agricultural produce and so stimulate arable production. At this time however, the Board does not have any facilities in the North East District, due to financial constraints. Cooperative marketing systems are also encouraged but these societies lack trained management personnel, so further implication is the expansion of the present management training programme.

Besides attempting to encourage wider utilization of land for arable agriculture as opposed to livestock production, an overall strategy requires investment opportunities in small scale, village level, industries. These may be geared to supplying village demands for household goods, or could be agricultural processing businesses such as maize, sorghum, or millet milling, vegetable oil extraction plants. Some forms of investment already appear to be popular and carry an element of social status. These are the small general dealerships and "bottle stores."

Beer brewing is a common industry, which is complimented

by travelling music peddlers (record players for rent). This suggests that there may be a market for entertainment services. At this stage little is known about the various demands at village levels. Further studies of investment opportunities in rural areas of the Tati are urgently required. Institutions to investigate and advertise these possibilities should be established, supplemented by service institutions to provide management training and extension advice in a manner similar to that used by the Agricultural Extension Division.

The above mentioned possibilities are by no means a complete list and the comments are not to suggest that the Government is unaware of the problems, or inactive in encouraging rural development. There is however a need within Government planning circles to take a comprehensive approach. The present system is one of individual projects or ministerial programmes with little overall coordination of planning and implementation. This results in bottlenecks, and short term crises of one type or another, or even greater needs completely overlooked. There are definite financial constraints at this stage of the country's development but this only reinforces the need to take a holistic approach in which priorities can be identified and pursued.

In summary, studies are needed in the following fields: social attitudes towards savings systems other than livestock, and towards arable agriculture as a commercial enterprise; urban-rural links which should be maintained or strengthened to reduce the disparities between the two; all forms of rural investment opportunities and the institutions and infra-

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structure required to encourage their realization; continued basic environmental research towards the development of practicable modern farming techniques and range management systems; possibilities for communal ranching systems. Finally, a close study of planning systems within the Government should be undertaken towards advising on a more comprehensive and coordinated approach to planning and implementation. This study of the planning system itself is probably the most critical. "It has become evident that while there are benefits to be realised from further research the overriding need is for the refinement of integrated approaches to the planning and management of development programmes" (UNESCO, 1975)."

Unfortunately, none of the above suggestions include a short term solution to the overgrazing problem. Attempts are being made under the new Tribal Grazing Land Policy to encourage communal grazing schemes that will be in a better position to introduce range management practices, but this is at best a medium term prospect. It may well be that the environment itself will be the only force able to impose a solution involving destocking, and bring about a fundamental change in social attitudes.

CHAPTER SIX

SUMMARY AND CONCLUSION

This paper has argued that natural resource management programmes must be developed within an existing framework of environmental, social, economic and political factors. It has done this by presenting a case study in which social attitudes to land and its use, influenced by technological, economic and political occurrences, have brought about an imbalance between man and the land. Attempts to achieve a new balance have again been thwarted by similar social, economic, and political factors, including a reluctance to change original values. The approach used to combat resource abuse, has itself often ignored other relationships which are intimately involved, with the result that social opposition causes project failure, or additional problems are created by unforeseen side effects.

The methodology employed in the case study was necessarily unsophisticated. Data is scarce and often unreliable. While sophisticated quantitative analysis is undoubtedly useful, there are often cases where it is not essential to achieve a basic understanding of a problem. Indeed in cases where social attitudes are important-quantitative analysis used alone often fails to achieve adequate solutions.

In view of the paper's concern over proper use of scarce resources, it is fitting that the approach taken is in

itself an attempt to utilize a research opportunity wisely, within a particular set of existing conditions. It is this writer's view that the geographer, with his exposure to a wide range of disciplines, particularly environmental sciences, sociology, history, economics, and to some degree political science, is in an ideal position to approach practical problems realistically and comprehensively. It is also my view that the geographer, or geography graduate student, as a research resource, should concentrate to a greater degree on existing problems of man/land relationships. The fact that "at present less than 1 percent of world research and development takes place in developing countries" (Dahlberg, 1974), where some of the more pressing problems in this field occur, should suggest a greater emphasis of studies in those areas.

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VITA AUCTORIS

- 1948 Born December 12th, at Oicha Beni, Belgian Congo.
- 1966 Senior Matriculation from Walkerville Collegiate Institutet, Windsor, Ontario.
- 1973 Honours Bachelor of Arts in Geography from the University of Windsor, Windsor, Ontario.
- 1977 Master of Arts Degree in Geography from the University of Windsor, Windsor, Ontario.