

THE EFFECTS OF CONSOLIDATION OF GRAZING LANDS,  
ARABLE LANDS AND THE HUMAN SETTLEMENT ON  
FRAGILE ECOSYSTEMS : THE CASE OF BAROLONG  
FARMS AREA

BY  
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NAIROBI, KENYA.

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

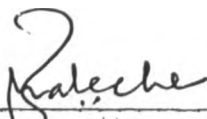
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## ABSTRACT

This study presents an investigation of the effects of consolidation of grazing lands, arable lands and the human settlement on fragile ecosystems. The study, had two basic objectives: to review the existing land uses and identify prevailing conflicts in the Barolong sub-district of Botswana, and, to suggest possible policy measures for resolving the identified land use conflicts. Barolong farms area is a mixed farming region in the Southern District of Botswana. Arable Agriculture is the mainstay of the area's economy. It amounts to approximately 75 percent of the area's economy. The area, is one of the first regions in Botswana where mixed farming became practiced.

The desire to carry out this study, was prompted by the fact that various studies on agricultural production systems in Botswana, attributed low agricultural production to the traditional settlement pattern of the Batswana. They identified long distance travel, cost of travel and absence from production areas for effective management as the basic problems of the settlement system. They recommended consolidated settlement patterns as the solution to low agricultural production since they would provide for effective management of agricultural activities.

This study, set out with an assumption that consolidation of arable lands, grazing lands and the human settlement can result in high agricultural production only if efficient measures of combating environmental degradation are taken into consideration. It was noted that although the trend of settlement is towards the consolidated pattern of settlement; as indicated by the increase in human populations, and the intensified utilization of the area's natural resources, consolidation lays much pressure on the area's physical environment. The study identified two major problems of pressure on land and pressure on water resources. It went further to identify two land use conflicts of: conflict between arable and livestock farming, and conflict between the human settlement and agricultural activities.

In view of the above, the study basically recommends that the government should re-direct its policy outlook to include the conservation of the natural resources in its development programmes. This should include the creation of public awareness on the need to protect the environment from further deterioration for the attainment of sustained development.

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## CHAPTER ONE

### INTRODUCTION

#### Overview

Land is a resource whose availability and non-availability directly affects the life of rural populations. Not only is land a source of livelihood, but also the basis of social stratification and economic power structure. It is its nature as a basic source of livelihood which results in a greater need to control its distribution and utilization for different activities, and lays a requirement for rationalization in its allocation and management for various uses.

Rural land is required to fulfil a wide range of functions and of these, the requirement for settlement, agricultural production and water collection can be considered as the most basic. Although a number of activities can be practised on rural land, the supply of such land remains fixed and any increase in one form of use is inevitably accompanied by a decline in some other form. This raises the question of compatibility of activities most especially in arid to semi-arid areas whose ecosystems are fragile and therefore very sensitive to misuse.

The most important issue therefore, is the



extent to which conservation can be combined with crop production, livestock farming and other basic human needs such as - fuel, building materials, water requirements, compared with the extent to which activity can be catered for on a site specifically set aside for the particular purpose. What is evident is the fact that there are growing demands on rural land and such demands are often conflicting. If no immediate solutions are found, it could result in a reduction in agricultural production due to increased demands that are placed on rural environments, especially soils. There are greater demands on rural areas to continue to produce the bulk of a country's food requirements and yet not much attention is paid to the maintenance of higher levels of productivity in these areas.

In order to establish a fact for proper utilization of rural natural resources, this study undertook to analyse land use activities in the Barolong farms area of Botswana. The analysis lays emphasis on the fact that the area, like the rest of the country, has a sensitive environment due to its semi-arid nature and therefore, any land use activity is a potential source of imbalances. This can result in serious degradation of the natural

resources most especially if proper methods of utilization are not adopted. There is therefore a need to establish a system of utilization of the natural resources that can ensure a continued harmony in the relationship between the environment's exploitation and the societies developmental needs.

### Statement of the Problem

Botswana is a predominantly rural society<sup>(1)</sup> characterised by people living in dispersed village settlements<sup>(2)</sup>, some of which are among the largest in Africa; "The village metropol" (Gwebu, 1986)<sup>(3)</sup> - "Agro-town settlements" (Silitshena, 1980)<sup>(4)</sup>. These are the villages of Serowe with a population of 31,010; Mochudi, 22,350; Kanye, 24,570; Molepolole, 25,000; Maun, 18,140 and Mahalapje 27,150. These villages, act as both modern administration centres and traditional tribal headquarters.

Until recently, the Batswana were characterised as people with three homes:-

- a permanent one in the village (major tribal villages)
- a temporary one used during arable agricultural season at the cultivated lands areas; and

- a make-shift one used by herdboys at the cattle posts (Silitshena, 1980:225)<sup>(5)</sup>.

This pattern of settlement was a successful adaptation to the environmental conditions of the area although it could only provide largely for subsistence levels of production. The format of settlement pattern, was however possible due to smaller sizes of population which accommodated larger sizes of livestock and easy movement of both people and livestock from one place to the other in search of good pastures and water. Long distance travel often had to be involved and by so doing, this pattern of settlement allowed for the environment to recover from any form of misuse which could have taken place. However, growth in both human and livestock populations has resulted in a significant change in the pattern of settlement, though, the traditional pattern of settlement still remains relatively fixed.

There has been a growing realization in recent years that the traditional pattern of settlement is changing. A considerable number of people have now settled permanently in arable lands and grazing areas (cattle posts) respectively. This change in settlement was first realized in 1972 after the 1971

population census when it was discovered that there were not that many people living in the major villages as had been the case all along. This trend of affairs was further highlighted by Silitshena (1979)<sup>(6)</sup> in his study of Kweneng District where he examined the extent to which people had started settling permanently in lands areas. Another study was carried out by Hitchcock (1978)<sup>(7)</sup> in Kgalagadi <sup>(8)</sup> area where he detailed the extent of permanent settlement at the cattle posts. He observed that due to increased sedentism of hunter-gatherer groups, plus the attraction of employment and subsistence opportunities offered by livestock, cattle posts have become small hamlets, with attached land areas (Hitchcock, 1978 :285 )<sup>(9)</sup>.

This change in settlement resulted in the Government's review of its pre- and post-independence policies which laid emphasis on the concentration of populations in the major tribal villages. This was achieved through the provision of social services to these villages and the exclusion or total neglect of scattered smaller settlements. The change in policy outlook was marshalled by His Excellency the late president Sir Seretse Khama in his speech when he opened the Ngwaketse Agricultural show in 1970. He urged people to abandon their traditional villages

and settle permanently at their lands and cattle posts in order to improve on agricultural production (Silitshena, 1980:226)<sup>(10)</sup>. Thus, the 1973 - 1978 National Development Plan laid emphasis on integrated agriculture as the key to development. This led to the Government urging its ministries to provide basic services to small settlement areas, (of about 500 people) in the remote lands and cattle posts.

Although it has been argued that permanent settlement in areas of production can result in higher returns in agricultural output, it however results in the over-utilization of the environment due to increased demands on its use by human and livestock populations for grazing and arable farming activities. It must be realized that the relationship between population and the condition of natural resources is not a simple one. It involves a number of things, such as capital investment for offsetting the effects of large numbers of additional people living on a fixed resource base, and the use of new technologies for purposes of alleviating the problems of resource depletion. Thus, the essentials for successful management under growing environmental stress are knowledge, political will and finance, most of which are often in short supply.

While the relationship between population growth and resource management is a complex one, it does, however, pose some straight forward implications for Governments, such as the need to apply measures for ensuring the balance between population and the resource base. These measures include the control of the carrying capacity and per capita yield as indicators that link resource conditions to the degree of human exploitation.

It is within the above framework that this study aims at looking into changes that have upto date taken place in Barolong farms area with regard to land productivity, resource depletion and agricultural production. It must be noted that Barolong farms area is one of the first areas<sup>(11)</sup> in Botswana where integrated agricultural farming was practised. And, when compared to all other settlements where this system of farming is practised, it is the most successful, resulting in its recognition as the country's granary. This study aims at identifying major environmental problems and conflicts in land use that exist within the area as well as policy measures that have so far been applied towards alleviating them and the success and failures of such measures. The study further intends to look into ways in which identified problems and conflicts in

land use can be resolved with a further aim of identifying possible areas of policy improvement for purposes of improving agricultural production in the Barolong farms. This, it is hoped, will help in the assessment of the suitability of the consolidated pattern of settlement in Botswana and its policy implications using the Barolong farms area as a case study.

The choice of this study was prompted by the fact that a considerable number of studies<sup>(12)</sup> on the economic production systems of Botswana have identified settlement at areas far away from production centres (arable lands and grazing areas) as a major hindrance to increased agricultural production. These studies identified the integrated and or permanent settlement in areas of production as a means towards improved agricultural production. They, however, failed to highlight the implications of such systems of settlement on semi-arid environments. It is this limitation in thought which resulted in the choice of this study.

### Objectives of the study

This study aims at:

1. Reviewing the existing land uses and identifying prevailing conflicts in land use in the Barolong sub-district of Botswana and,
2. Suggesting possible policy measures for resolving the identified land use conflicts.

### Assumption

Consolidation of arable farming, pastoral farming and the human settlement can result in high agricultural production only if efficient measures for combating environmental degradation are taken into consideration.

### The Scope

This study aims at analysing the practices and conflicts of land use in the Barolong farms area of Botswana. Emphasis is to be laid on changes that have taken place in land productivity, resource depletion and agricultural production. 1973 has been chosen as the starting point. An attempt to examine possible means of resolving the conflicts identified will be made with the hope of assessing the suitability



of the integrated pattern of settlement in Botswana and its policy implications using the Barolong farms area as a case study.

The study is organised into five chapters. The first Chapter is the introductory chapter which describes the statement of the problem, outlines the objectives, assumption, the scope and the literature review which outlines the conceptual framework and therefore the method used in carrying out the study and lastly the limitations of the study. Chapter two presents the general background of the Barolong area, its history, the physical environment, demographic features and its economic activities. Chapter three gives an outline of land use practices and policies in Botswana with special reference to Barolong area. Chapter four is the study synthesis presenting the findings, planning implications and recommendations and the last chapter, is the study's conclusion.

### Operational Definitions

Consolidation - in this study consolidation is used to denote the act of practising the three land use activities : the human settlement, arable farming and livestock farming within one area, as opposed to the traditional Botswana practice of having the three in separate locations: the village, lands and cattleposts.

### Integrated agricultural practices:

This refers to the act of practicing livestock and arable farming activities within one unit area rather than having them in separate areas often far apart. This can be referred to as mixed farming practices.

### Permanent Settlement

Settlement on permanent basis at any of the production areas : lands and or cattle posts and part alienation from the major villages by not owning property in them.

### Fragile ecosystem

This refers to an environment characterised by a semi-arid climate. It has a non-luxuriant vegetation cover and is very vulnerable to over-exploitation.

### The village

This refers to the large nucleated tribal villages often referred to as tribal headquarters. There are five such types of settlements in the whole country. These are the villages of Serowe, Molepolole, Kanye, Mochudi, Maun and Mahalapje. These settlements are characterised by populations ranging from 18000 people to 35000 people. They serve as political, commercial and social centres for the tribal populations and also act as regional centres for the surrounding lands and cattle posts areas.

NB: TRIBE ; In this work, the word has been used within the country's context to avoid confusion.

### Lands areas

These are the cultivated areas that are used for arable agricultural production. They are often far from the main villages. They are characterised by a settlement pattern of dispersed homesteads with each homestead located close to its fields. These areas are used seasonally, during cultivation and harvesting.

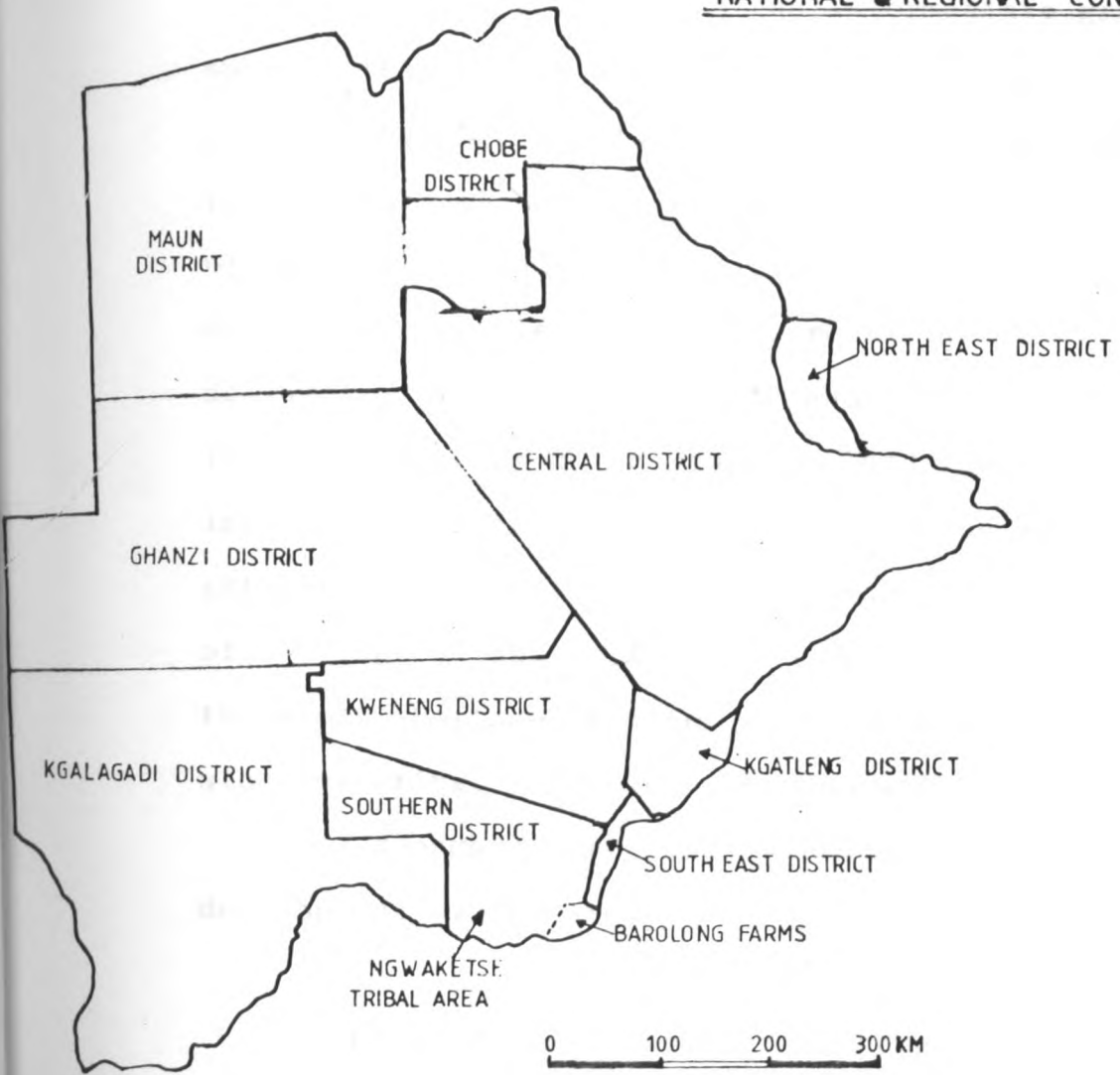
### Cattle Posts

They are areas that are used for livestock herding. Often situated at distances beyond lands areas. Grazing rights in these areas are often communally shared except for areas within a four kilometres radius of a private or a syndicate livestock watering borehole . Temporary make shift huts are normally built in these areas for use by herdboys.

### The Study area

The Barolong farms area is situated in the south-eastern part of Botswana. It is a tribal area for the Barolong ethnic group. It is officially recognised as a sub-district of the southern district, whose headquarters is in Kanye village in the Ngwaketse tribal territory (see Map No.1). It covers an area of 108,647 hectares with a population of 15,471 people (1981 population census). It is a mixed farming area with arable agriculture being practised largely on commercial and highly mechanised basis. A phenomenon which has earned it the status of being called the granary of Botswana. The success of the area in arable agriculture is largely attributed to its fairly fertile soils and relatively wet seasons when compared to the rest of the country. The Barolong also engage in livestock farming both for economic and social purposes.

BARONG FARMS:  
NATIONAL & REGIONAL CONTEXT



BAROLONG DEVELOPMENT STUDY

DEPARTMENT OF URBAN  
AND REGIONAL PLANNING  
UNIVERSITY OF NAIROBI  
MA PLANNING YEAR 11  
1987/88

BY M. KABI

MAP  
NO. 1

The area is presently facing a serious problem of land pressure resulting from an increase in arable and livestock farming practices, and increased demands for land for the expansion of the human settlement due to increase in human populations. Although the area is fairly covered with good and intermediate grass species that have a high potential carrying capacity of 5 - 8 ha./LSU and 12 ha./LSU based on rainfall (Field, 1978) it however experiences serious problems of overgrazing and deforestation due to increased demands for arable land; which result in the destumping of large tracts of land each year. There is also a problem of shortage of land leading to increased conflicts for space utilization by different activities. The area also experiences a serious problem of shortage of space for borehole allocation and therefore shortage of water most especially for livestock watering. All these coupled with recurrent droughts are constraints to the general development of the area.

The study realises that although the area has enjoyed prosperity largely due to the employment of mixed farming practices, its environment (physical) has however degenerated because of improper management systems. It is the opinion of this study that something

needs to be done in order to conserve Barolong farms environment so as to maintain and retain its status as the granary of Botswana whilst at the same time retaining a fair and reasonable amount of livestock as a complementary activity to arable farming.

### Literature Review

Patterns and types of settlement are not static; they change according to people's changes in ways of life and therefore basic developmental needs (Mabogunje, 1980 : 71; Silitshena, 1982 : 31)<sup>(13)</sup>. Thus, the adoption of a particular rural settlement pattern is a result of a long time adaptation system which takes consideration of the changing socio-economic setting and is also subject to spatial market forces aiming at efficient location (Whitby, M.C, 1974)<sup>(14)</sup>. Environmental conditions of an area - whether arid, semi-arid or wet-temperate, also set conditions on the type of settlement patterns or systems that a community is likely to adopt.

When taking a decision on whether to move or stay in a given area, economic and social rewards are normally balanced against each other. Whatever the external objective costs and benefits of each type of settlement, an individual will respond according to

his real or perceived ability to take advantage of the benefits at the least cost to him. This was most evident in the choice of traditional settlement patterns which did not only suit particular ecological conditions, but the existing technologies. Institutions, organizations and value systems that had developed around them. A change in settlement pattern is also dependent on growth in both human and livestock populations setting a demand for more space for expansion and bringing about the dynamic aspect of human populations through constant movement into and out of permanent settlements.

Settlement patterns in Botswana have undergone a series of changes. The traditional Tswana communities adopted the three dimension rural settlement pattern which is still predominant (Schapera, 1943)<sup>(15)</sup>. This type of a settlement pattern to some extent conforms to Von-Thunen's agricultural land use model which he postulated in his "isolated state" (1826)<sup>(16)</sup>. According to Ndebele, J. (1979)<sup>(17)</sup>, the two systems differ when it comes to their levels of complexity resulting from their arrangements. He identifies Tswana systems as being more complex due to the number of dispersed settlements of varying sizes and the large radii involved (Ndebele, J. 1979:20)<sup>(18)</sup>.



Von Thunen postulated an isolated city surrounded by concentric arrangement of agricultural land use zones radiating according to their importance in terms of rent values from the city centre - "Bid rent" which he calculated in terms of distance of each piece of land from the city centre. Central to this model of land use was the postulate that there would be uniformity in soil fertility, one centrally located city, a predominantly rural society and a uniform plain characterised by a poor communication system. Von Thunen further postulated that transport costs would vary with distance from the city centre; With the highest costs going for those areas furthest from the centre. In the same manner, the areas closest to the centre would be utilized for intensive agricultural production in the form of horticulture and dairy farming. The next zone would be that of silviculture followed by intensive arable farming and ranching at the furthest end. This system of agricultural practices would result -in high yields due to the levels of management skills that would be applied to each of the activities depending on their intensity of use.

Chisholm, M., (1984),<sup>(19)</sup> Ndebele, J., (1979)<sup>(20)</sup> and Silitshena, R.M.K., (1979)<sup>(21)</sup> assert that village distance from points of production affect agricultural outputs. It results in low production due to the low levels of management. They further attribute low

production to dispersion and fragmentation of fields , which according to them result in long distance travel and large spending on transportation costs. These factors affect agricultural production.

This system of spatial organization, according to Ndebele and Silitshena, can be recognised as the main factor resulting in low agricultural production in Botswana and can therefore be looked upon as a development constraint. Instead of people concentrating their efforts on more mundane aspects of life such as the improvement of yields, they get involved in long distance travel that is not only time and labour consuming but also costly in terms of money. It is therefore, in the light of this recognised weakness of the traditional settlement system, that they propose an integrated system of land use which according to them will cut down on travel costs and time spent away from the fields.

Silitshena (22) goes further to assert that due to increased population pressure within larger tribal settlements, people have since independence gradually started settling permanently in areas of production. This has set a new demand on the government to provide for their basic social needs. The permanent settlement in areas of production has according to him resulted

in people realising more returns for their inputs in agricultural production. This assertion was a result of his study on settlement patterns in lands areas in Kweneng District in 1978. Reasons for this permanent settlement in lands areas were given as follows: To be able to manage livestock better, to be able to plough in time and to improve on farming. According to Silitsheña, <sup>(23)</sup> the majority of the people see the distances separating the village and areas of production as a major obstacle to practising and improving their farming activities. He therefore advocated for increased government encouragement of permanent settlement in areas of production through the provision of social infrastructure. And he says that whilst post independence policies have shown a positive attitude towards aiding permanent settlement in these areas, there is however a need to develop a co-ordinating inter-ministerial body which would help in the reduction of costs for providing services in these areas.

The theme of the studies cited above is efficient location for increased production per unit piece of land. They do not take into account the general effects of such an undertaking on the environment in the long run. Man's practices be it for agricultural or industrial production have to fit within the requirements of his

physical environment. Modification of traditional systems of farming in favour of modern methods of farming which are aimed at increased production, result in over utilization of the environment. Thus, stabilisation of settlement, arable and livestock farming activities, result in the destruction of an area's ecology. These studies, therefore, fall short of the realization of this important aspect of the relationship between the environment and development and as such do not provide solutions to problems of environmental degradation if it so occurs in their proposed system of settlement. It must be noted that instead of totally abandoning the traditional systems of settlement, a balance has to be reached where the two systems have to be harmonised, in order to allow for the good points of the two systems to compliment each other (World resources 1986; p.35)<sup>(24)</sup>.

Any change in land use must take into account the ecological conditions of the area of concern. Thus, although man's activities and the natural environment are often designed to compliment each other, conflicts and imbalances often arise at various levels due to lack of proper planning and management policies (Edington, 1977).<sup>(25)</sup> Therefore, any desire to change the existing settlement pattern must take

consideration of the existence of such imbalances. The element of friction of use, according to Edington<sup>(26)</sup> is more evident in the case of rural areas, most especially between different agricultural practices. He thus put emphasis on the fact that any change in land use is a potential source of disruption and disharmony which calls for the planner to organize and manage such changes in order to bring conflicts to the minimum.

Cherry (1976)<sup>(27)</sup> says that basic to problems facing rural areas, is the question of lack of proper planning systems, coupled with Government's failure to construct policies that can help solve existing problems of the environment's decline in productivity, which is a result of continued mismanagement of the natural resources. The same view is held by Kulp (1970)<sup>(28)</sup> who identifies lack of planning method as being a problem that leads to poor performance of development projects in rural areas. He thus recognises the importance of the application of the systems view of planning to rural development planning. This, he maintains, can provide the most comprehensive way of looking into problems of resource utilization for the achievement of lasting and balanced development objectives. The application of planning techniques to rural development

is further discussed by Lele, U., (1975)<sup>(29)</sup> and Mabogunje (1980)<sup>(30)</sup> who say that spatial forms, structures and organisations can be used for the concentration of the people's energies in underdeveloped countries on the engagement in their own development.

When referring to agriculture as a major land use in rural areas, Mollett J.A. (1984)<sup>(31)</sup> recognises good management and realistic planning that can be implemented from the basic level up as being crucial and essential for the improvement of agricultural performance in developing countries. This is further emphasised by Weller, J., (1967)<sup>(32)</sup> and Chauhan, D.S. (1966)<sup>(33)</sup> who assert that basic to problems that are facing agricultural development in rural areas, is the amount of pressure exerted on rural land use as generated by internal and external changes. Chauhan further says that agricultural development must be integrated into the whole process of development. Hence adjustments in agriculture must take into account the two aspects of the economics of change being the factor market and product market.

Thus, when further expounding on the issue of compatibility, Edington, J.M. (1977)<sup>(34)</sup> says that although, in theory rural land uses can be combined in a variety of ways, possible combinations show different degrees of compatibility. As a result, the most

important issue to consider is the extent to which conservation can be combined with agricultural practices and other basic human requirements. In this case, the objective of developing an area should be to protect it from environmental degradation so that greater amounts of yields and improved quality of living would be realised. This could at times mean a decrease in the quality of production that an area could yield, but it means an increase in the total values that such an area can contribute to development in the long run (Dasman, R.F., 1984)<sup>(35)</sup>.

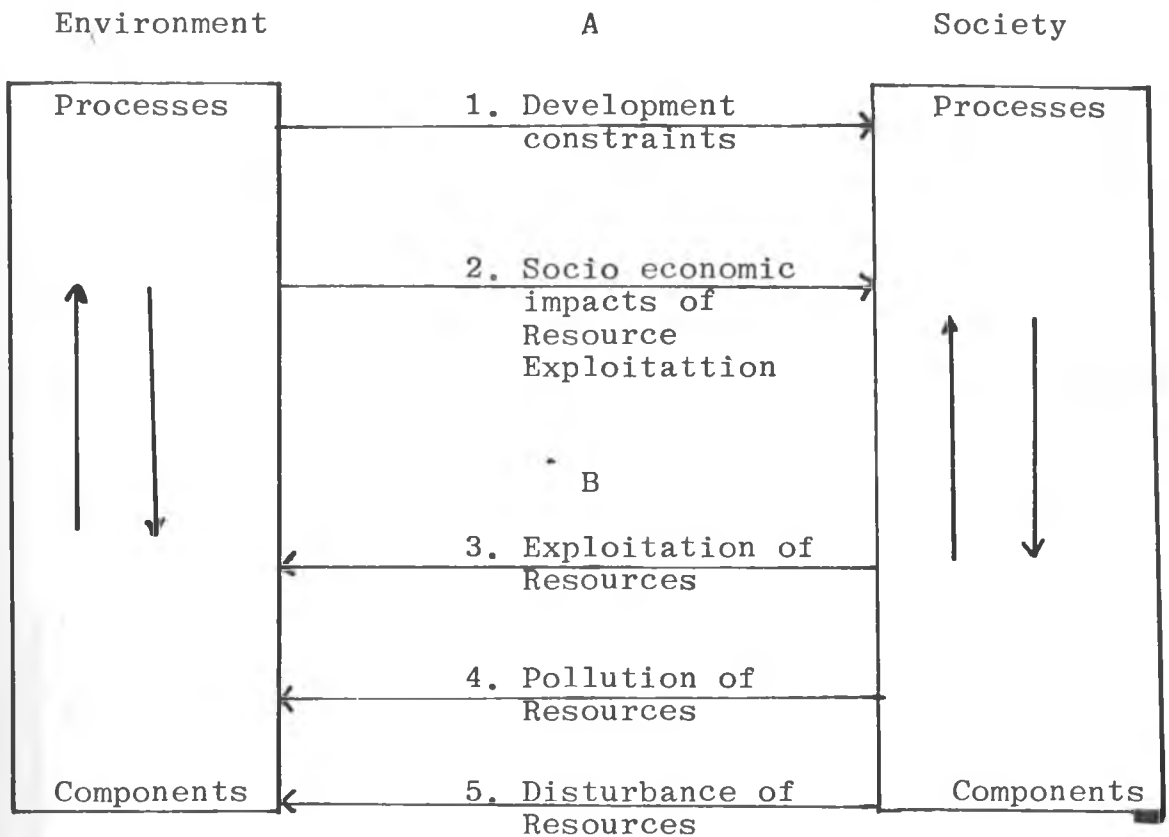
Development has for a long time taken place mostly with short-range economic factors as guides and a minimum attention being paid to the physical and biological realities of the environment. Emphasis, has been placed heavily on quantitative increase of production, aimed at enhancing the material well-being of the people and yet, conservation, while concerned with sustaining quantitative yield also puts a lot of emphasis on improved management of more qualitative aspects of the human environment. Which as Gregory, M.B. (1979:1)<sup>(36)</sup> puts it, can add more depth and meaning to human life. And to use Davies, T.D. et al's words (1976),<sup>(37)</sup> "with both conservation and economic development, it is essential to consider the physical and biological rules within which all life on earth must

operate". However, the consideration of conservation without recognising the political, social and economic forces within which development is taking place would be an abortive exercise (Dasman, 1974)<sup>(38)</sup>. An important issue, is to devise strategies and alternatives on the management of the environment that best promote social welfare. Such, must not be limited in scope, They must allow for future expansion and further modification for purposes of achieving sustained production (Swell, G.H., 1975)<sup>(39)</sup>,

The concept of the environment development linkages is further analysed by Opschoor (1981)<sup>(40)</sup> who asserts that there is a very close relationship between the physical environment and development activities be it producer or consumer's activities. To demonstrate this relationship, he devised a schematic presentation of environment - Development linkages, which highlights the fact that the relationships between the environment and the society, work in two directions with each depending on the other, thus setting conditions on one another. Thus as Arntzen, J.W. et al, (1986 : p,4)<sup>(41)</sup> puts it, "The state of the environment has repercussions on the society and its development". Figure 1.1 is an illustration of the linkages that exist between the environment and development.



Figure 1.1: A Schematic Presentation of Environment - Development Linkages.



Source: Adopted from Arntzen, J.W. et al, 1986<sup>(42)</sup>

From the figure above we realise that there are two ways in which the environment interacts with the society. First, the environment sets constraints to development through a number of processes. In the same manner, the utilization of environmental resources, also has some impacts on the society. The above two processes, may either be negative or positive depending on their effects. It is also apparent from the same figure, that the society through its activities

whether for production or consumption purposes has some impacts on the environment. It is important to note that the environment may set constraints to development by the availability or non-availability of renewable and non-renewable resources. Furthermore natural phenomena such as droughts, floods, etc. may set some development constraints on the society. Table 1.1 below gives an outline of the components and processes in the environment and society as they apply to the process of development.

Table 1. Relevant Components and Processes in the Environment and Society : Arntzen, p.7.

	Components	Processes
Environment	abiotic : land, water, soil, air, mineral, temperature, light biotic : vegetation, animal life.  Cycles, population dynamics, vegetation and animal life.	soil formation, exhausting and erosion, bush encroachment, desertification, ground water processes, rainfall patterns, temperatures.
Society	human population, socio-economic groups, economic activities, technology, culture, legislation, institutions, organizations, education, human settlements	Population growth, seasonal migration, urbanization, economic differentiation, innovations, cultural organizational and institutional changes

This reciprocal relationship between the environment and the society, result in some continued change in their form due to internal and external factors and processes such as droughts, shared rivers, etc. The extent to which such factors can affect an area's form depends on the level and scale of development that a society may have reached and therefore the level of sophistication of its technology together with its cultural background. All the above are further dependent on the type and form of settlement that a society may have adopted. Thus the level and rate of resource utilization in a consolidated type of settlement will differ greatly from the one in a three dimensional system where the activities of the human settlement, arable agriculture and livestock farming are practised at different locations. In this study, an analysis of the Barolong farms area's land use pattern is being attempted for purposes of determining the nature and extent to which the adoption of the consolidated pattern of settlement in Barolong farms has had some effects on the environmental resources. Once some environmental effects have been identified, it is hoped that the study will go further to identify conflicts in land use resulting from the consolidated system of settlement.

The following human activities have thus been identified for detailed analysis:-

- (1) Livestock production
- (2) Crop production
- (3) Wood utilization
- (4) Ground water utilization.

The above conceptual framework will therefore be used in this study to guide the analysis of the above mentioned land use practices and activities in the Barolong farms area with the hope of identifying inherent conflicts within these uses and practices.

#### Research Methodology

The development of the survey design included a review of land use survey methods, reports and the identification of the information required for a land use conflicts study and the best methods for data collection.

Detailed data requirements were specified for the following areas:

#### - Background information

- (a) historical data
- (b) the physical environment

- (c) demographic data
- (d) economic activities.

- Land Use Practices and policies

- (a) the human settlement
- (b) crop production (arable farming)
- (c) livestock farming
- (d) water utilization
- (e) wood utilization.

A socio-economic study was then conducted at the villages of Goodhope and Pitsane. A questionnaire was drafted for the particular purpose and detailed data was collected in the following areas:

- household information
- agricultural activities
  - (a) arable farming
  - (b) livestock farming
- Income
- landuse patterns
- energy
- land conservation measures
- community services and
- community participation.

### Data Collection

The data presented in this paper was gathered through the use of the following techniques:-

1. Library research which was meant to help with the identification of the existing relevant materials and therefore conceptualization of the problem and method of study,
2. Analysis of maps and air photos of the Barolong farms area. This, helped in the identification of land uses and changes that have taken place within the area in terms of resource use since 1977.
3. Questionnaire administration for purposes of assessing people's perception of problems related to environment and development and therefore the utilization of Barolong areas natural resources, and lastly,
4. The use of observation techniques and informal discussions with the Barolong Community and Government officials at the sub-district, district and central government levels.

### Sample Selection Method

Two villages were selected for questionnaire administration. These were the villages of Goodhope and Pitsane. They were selected on the basis of accessibility, population size and an element of nucleation relative to other settlements in the area.

In total, there are 2,408 households in the Barolong farms area. The total number of households in Pitsane and Goodhope is 427 representing 17.7 percent of the total households in Barolong area. The number of households in Pitsane is 277 while Goodhope has 150 households.

The survey sample was selected from the population census list using random tables by first generating 100 random numbers. Fifty (50) households were then selected for interviewing. This represented 11.7 percent of the total households in the sample areas. 18 and 32 households were then interviewed in Goodhope and Pitsane villages respectively,

### Data analysis

The findings presented in this paper represent results from literature review, airphotos and map analysis, formal and informal interviews and observations.

The compilation of data was done manually. This included the analysis of data from questionnaires for which sample percentage tables have been drawn.

### Research Limitations

There are two major limitations to this study : data acquisition and the researchers ability to apply resource assessment techniques. The data acquisition problem relates mainly to the procurement of agricultural production figures (arable farming production figures) for purposes of relating them to the decline in the environment's productivity. This is due to the fact that there is no central recording station for production in the Barolong farms where farmers can register their production figures. As a result, there has been total reliance on estimate figures compiled by the Ministry of agriculture. The researcher's limited knowledge of resource assessment techniques resulted in total reliance on existing resource assessment reports.



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## CHAPTER TWO

### BACKGROUND INFORMATION

#### Introduction:

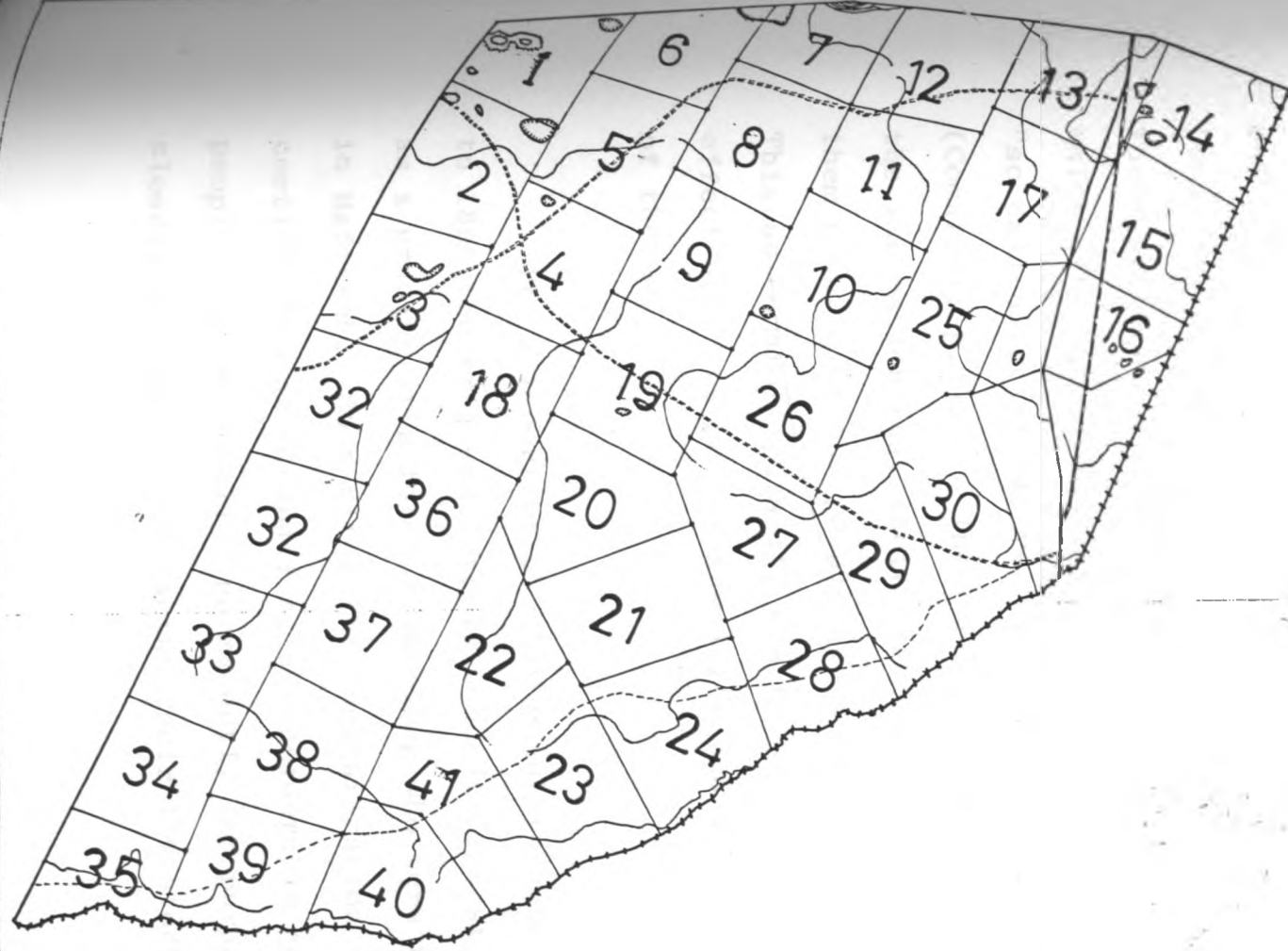
This chapter surveys the main historical, demographic, economic and environmental features of the Barolong area. It is intended to be especially useful in the analysis of the main issues that underlie the interaction of the environment with the society. It is further intended to outline features of the area's environment that underlie its semi-arid character. Lastly, special attention will be paid to environmental and societal problems that constitute constraints to development.

#### Historical Background:








In the 19th Century, the area presently referred to as Barolong farms was in an intermediate region between two Tswana Chiefdoms: the Bangwaketse and the Barolong Boo Ratshidi. The former were resident in the then Bechuanaland territory in an area presently known as Ngwaketse tribal Land (Southern Botswana). The latter were resident in Mafikeng and other parts of South Africa.

The area was one of a number of disputed regions at the time the Bechuanaland protectorate was declared in 1885. The Barolong based their claim on the area north of Ramatlabama on the fact that they had cattle posts in that area and therefore, the area was their pasture. In 1892 an official inquiry into the status of the land was held and it was awarded to the Barolong. The Barolong's Chief Montshiwa I played a significant role in charting the future of the area (Comaroff, 1977,<sup>(1)</sup> Molema, 1966,<sup>(2)</sup> Sehaperera, 1943<sup>(3)</sup>; Staps, 1981,<sup>(4)</sup>). One of Chief Montshiwa's recommendations concerning the area was that it should be divided into farms which would be allocated to individual tribesmen under lease agreement. This land would remain in the hands of the tribe for purposes of allocation and administration, with the Chief being the overall administrator assisted by sub-chiefs and wardheads.

The above recommendation was finally accepted and a total of 42 farms were surveyed (see Map No. 2). Of these 42 farms, 41 were allocated to tribesmen under "certificates of occupation" rights. One was used as payment for survey fees: this is an area presently referred to as Panyane farm - a freehold farm. The 41 farms were then allocated to the tribe as follows.



LEGEND

-  INTERNATIONAL BOUNDARY
-  DISTRICT BOUNDARY
-  RAILWAY
-  TARRED ROAD
-  GRAVEL ROAD
-  TRACK
-  PAN
- 1,2,3..... FARMS

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 1987/88

MAP  
 No.2

still are people who lay claims on pieces of land under that old system. The inception of the Land Boards in 1970 has also not helped to solve the problem as claims of land under the old rights still take place. As in the dispute between the Rolong Land Board and Mr. A. of 1985 (Appendix No.1).

As early as the 1980's, a number of whites began settling in this area mainly as traders and farmers (especially arable farmers) (Schapera, 1943:pp 16-23)<sup>(8)</sup> These settlers occupied the area on leasehold basis which often gave them full control over farms and their "so called tenant natives" or "native squatters". (Comaroff: p.4).<sup>(9)</sup> These settlers also operated under the impression that their rights of ownership gave them power over the people and control over the land. This as Comaroff puts it, was to have a significant effect upon the social and later economic structure of the area.

It is important at this point to note that prior to 1898 the area was largely used for livestock farming as a grazing area for the Barolong who were then settled in Mafikeng. Soon after the regularization of the certificates of occupation, a considerable number of people started settling permanently for purposes of closely and properly managing their livestock. This



4 for himself (Chief Montshiwa 1), 4 for his sons, 3 for surviving brothers, 13 to sons of his deceased brothers and step brothers, and 12 to a son-in-law. 12 were allocated to tribe men who held prominent positions, amongst which 9 were headmen of large wards in Mafikeng. The last farm was allocated to the Chief's Secretary and his Grandson (Comafoff, p. 2;<sup>(5)</sup> Schapera, p. 10;<sup>(6)</sup>).

The allocation of the 41 farms was then regularized in 1898 at the protectorate deeds office in Mafikeng. However, this regularization did not mean that people given such certificates were to exercise exclusive rights over the farms. They were to act as overseers for the tribe. The leasehold rights could be passed to sons following traditional inheritance rules.

The certificates of occupation were later abolished during Chief Kebalepile's reign in 1957. The act of abolition of rights, was based on the fact that those granted the rights, were now treating the area as individual/private property. The area was then declared a tribal communal area with the former certificate holders being deprived of the legal powers that they had been exercising (Dunford; 1974: p. 3<sup>(7)</sup>). It is surprising however, that although the certificates of occupation were abolished as far back as 1957, there

led to the need to practise arable agriculture for subsistence purposes. Resulting in the rise of a mixed farming system which was to later dominate in the area. With the advent of mixed farming, came the problem of disputes over crop damage by livestock. This situation, was to intensify with years of increased involvement in arable agriculture (Schapera, 1943).<sup>(10)</sup> Presently the chief and wardheads get involved in even more complicated disputes over crop damage. This situation has intensified to an extent where the Government has even introduced a fencing package under the Arable lands development programme for purposes of combating the problem of crop damage. (This point is discussed in detail in Chapter Three under the section on agricultural policies). The subsistence method of farming went on until the 1960's when a considerable number of people began to engage in large scale commercial arable farming which had the effects of undermining the importance of livestock farming as a commercial enterprise in the Barolong area (this point is to be discussed in detail under the section on economic activities) (Comaroff 1977).<sup>(11)</sup>

As more people began to settle in the area, the need to build a tribal headquarters then arose. This

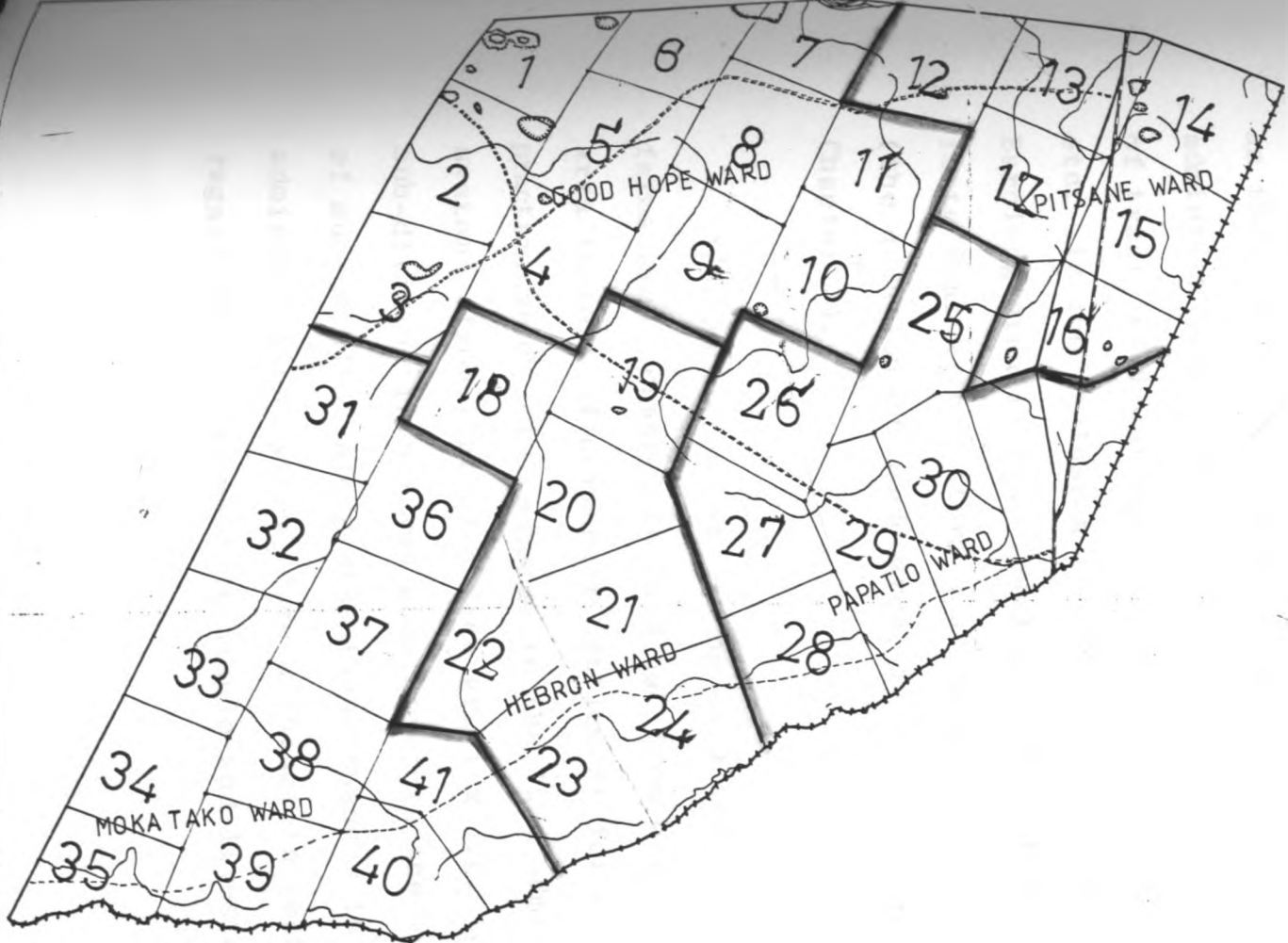
was to help the chief in the management of the area since it had now become difficult to administer the area effectively from Mafikeng. A tribal headquarters was then built at Goodhope around 1940. This was to act as a subsidiary to Mafikeng. It was established for administrative purposes for co-ordinating, the affairs of the 41 farms. A school, a community hall and offices were then constructed. It was from here where the Chief's representative was to co-ordinate the affairs of the Barolong farms.

During independence: 1966, the separation between the Barolong of Botswana and those in South Africa had to be effected. It became necessary for Barolong to decide where they wanted to settle. The same applied to the then Chief - Chief Kebalepile. Kebalepile opted to remain in South Africa and recommended his younger brother Besele to the throne for Barolong in Botswana. This marked a new era in the history of Barolong. Chief Kebalepile relinquished his jurisdiction over the Barolong farms and granted it the status of a separate Chiefdom. Besele was installed as the first Chief of Barolong in Botswana in February 1970, where he became a member of the house of chiefs



Besele's installation coincided with a major change in land administration and management system for

the country. In 1968 the tribal land act was introduced. This act, relieved the chiefs of the power to allocate and manage land, it assigned the role to land boards. From 1970, the chiefs power to control and allocate land was depossessed. Landboards (Tribal landboards) were perceived in their introduction as more efficient and democratic tools in the land allocation and management policy. The landboards were expected to work towards social justice, offering a more secure tenure for facilitating and encouraging investment (Heisey; 1983;<sup>(12)</sup> Mathuba, 1983;<sup>(13)</sup> Schapera, 1943;<sup>(14)</sup> Silitshena, 1979;<sup>(15)</sup>). The setting up of landboards not only removed the power to allocate and manage land from chiefs but also the power to hear and settle land disputes. However, chiefs were to either in person or by representation become members of the landboards. Chief Besele, then became a member of the first Rolong landboard and became its first Chairman.

Within Barolong farms, another major change took place. This involved the centralization of power for administrative purposes into five villages by chief Besele. These were the villages of Goodhope, Pitsane, Papatlo, Hebron and Mokatako (see Map No. 3 and Appendix No. 2. For farms falling under each one of these villages). These areas constituted of five wards



LEGEND

-  INTERNATIONAL BOUNDARY
-  DISTRICT BOUNDARY
-  RAILWAY
-  TARRED ROAD
-  GRAVEL ROAD
-  TRACK
-  PAN
-  1,2,3... FARMS
-  WARD BOUNDARY

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MAP  
 No. 3

within which the rest of the farms would be administered by sub-chiefs (headmen) appointed by the chief and such appointments gazetted. The purpose of this change, was to ease the work of the chief so as to effectively run the affairs of the region.

The institutional framework within which the area is presently being administered, comprises of the chief as the tribal head and therefore responsible for the administration of tribal affairs such as the solemnization of traditional marriages, settling of dispute - criminal etc. in the exclusion of those concerning land. Within Barolong area is also found a Landboard whose main duty is to deal with matters concerning land administration (the question of Landboards, is discussed in detail in Chapter 3).

In conclusion, it can be said that the Barolong farms area changed in land use from being a grazing area to that of permanent settlement for mixed farming practices which led to a change in the land administration system - from that of a free grazing area to its sub-division into farms and therefore the introduction of sub-chiefs. Along side these changes in land administration system, came a change in emphasis with regard the involvement in arable and livestock farming.

Barolong farms area was first a grazing area continued until the late 19th century when it was sub-divided into 42 farms and some people started settling permanently in it. With this permanent settlement, there then arose the need to practise arable farming for subsistence farming which led to the area becoming a mixed farming region. This re resulted in greater emphasis being placed on arable farming for both sub-sistence and commercial purposes. The introduction of mixed farming practices soon resulted in the problem of crop damage by livestock due to the intensification of both arable and livestock farming activities.

The physical environment:

This section presents an analysis of the physical environment of the Barolong area. The environment, will be examined both as a resource for human exploitation and as a source of hazards which man can ignore only at peril to himself and his works. Emphasis will be laid on the rather fragile nature of the areas environment. This, is to be done with the understanding that any attempt to understand the potential for planning resource use in the arid or semi-arid lands, must first understand the nature of aridity itself. Aridity, results from a combination of factors affecting the capacity of the meteorological conditions to supply moisture to an area. These factors, include the basin physics of air movement, the global pattern of insolation and the geometry of land and sea relative to atmospheric movements.

In order to achieve the above objective, the following sub-topics will therefore, be treated sequentially according to their effects on each other. Location and size, climate, geology and soils and vegetation.

Location and size:

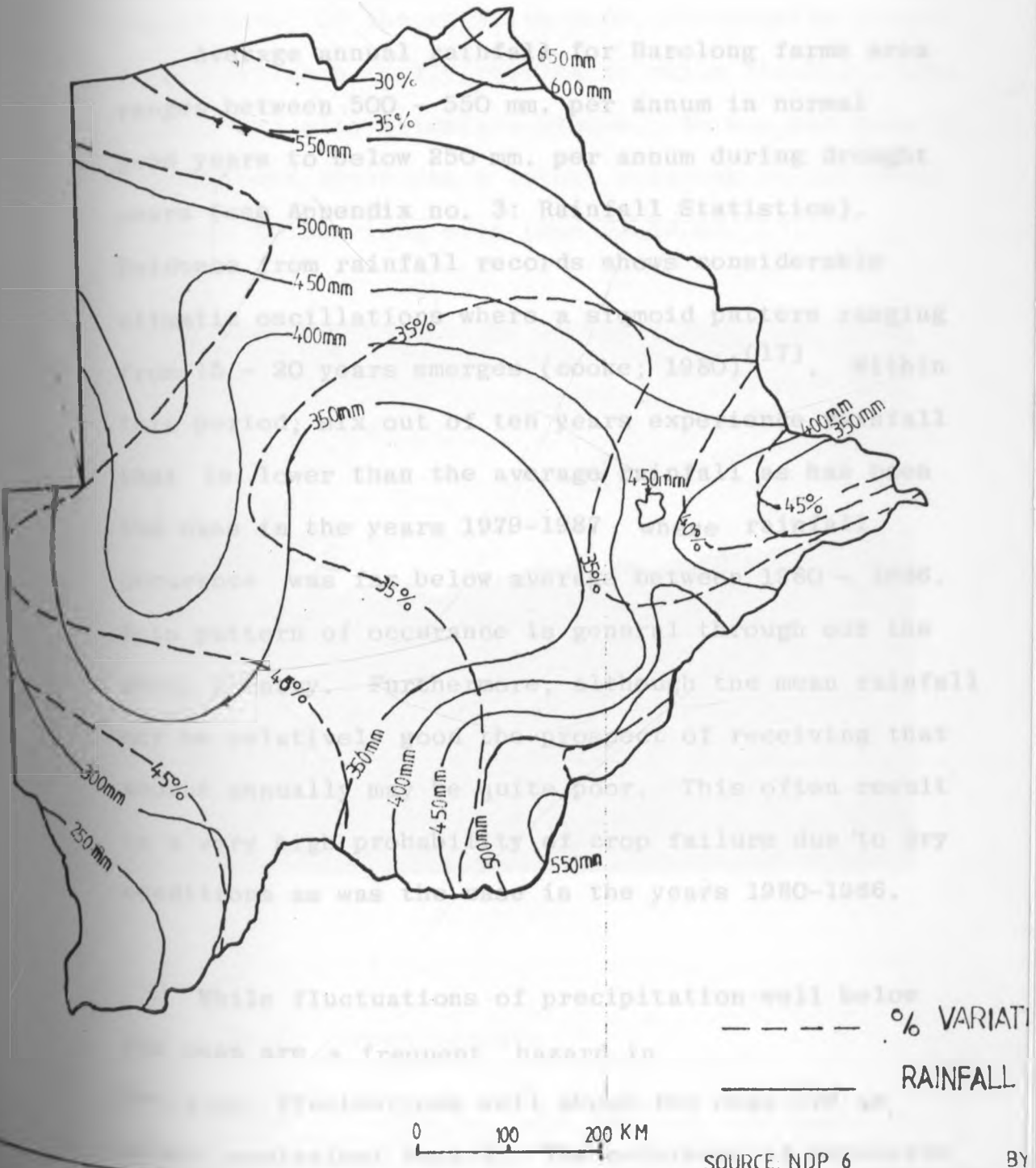
The Barolong farms area is located in the south - eastern corner of Botswana (see Map 1). It is bordered by the Republic of South Africa in the south and it forms part of the southern district. With the other part being Ngwaketse tribal area. It covers a total area of 108647 hectares.

Climate:

The climate of Barolong area like the rest of the country is generally termed sub-tropical semi-arid with rainfall being markedly seasonal, highly erratic and unreliable in its distribution in both space and time (see Map no. :4). The rainy season is divided into three sub-seasons: early rains in October, later in November - December and still later ones in March. Between these sub-seasons there may be prolonged dry spells and often one of the sub-seasons may fail completely with very serious consequences for the crop harvest.



# RAINFALL OF THE REPUBLIC OF BURUNDI



Moreover, the actual distribution of rain within the rainy season is almost more critical than the total seasonal amount, especially for arable agriculture (Cooke, 1978).<sup>(16)</sup>

Average annual rainfall for Barolong farms area ranges between 500 - 550 mm. per annum in normal good years to below 250 mm. per annum during drought years (see Appendix no. 3: Rainfall Statistics). Evidence from rainfall records shows considerable climatic oscillations where a sigmoid pattern ranging from 15 - 20 years emerges (Cooke; 1980)<sup>(17)</sup>. Within this period, six out of ten years experience rainfall that is lower than the average rainfall as has been the case in the years 1979-1987 where rainfall occurrence was far below average between 1980 - 1986. This pattern of occurrence is general through out the whole country. Furthermore, although the mean rainfall may be relatively good the prospect of receiving that amount annually may be quite poor. This often result in a very high probability of crop failure due to dry conditions as was the case in the years 1980-1986.

While fluctuations of precipitation well below the mean are a frequent hazard in the area, fluctuations well above the mean are an almost equivalent hazard. The occurrence of intensive

rainstorms normally bring about both positive and negative effects on the area's ecosystem. On the positive side, these rains normally break a drought spell as such provides soil moisture for the area's vegetation. On the negative side, the massive inputs in a short time normally results in major flooding, soil erosion and also stimulate plague. As was the case in 1986-87 when there was a locust outbreak in the areas adjacent to Barolong area (see Plate no. 1).

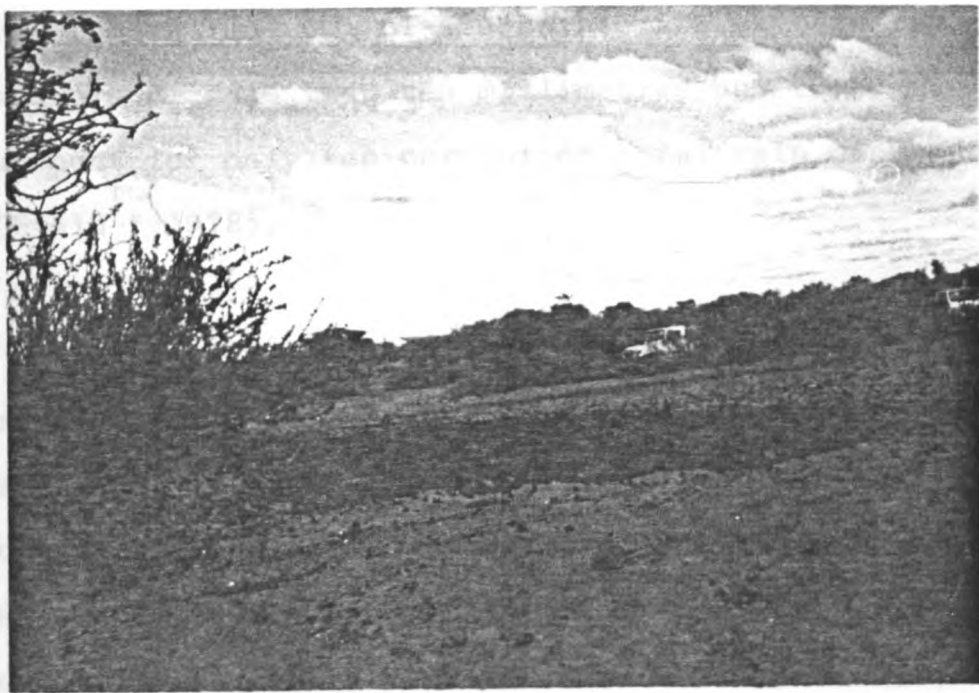


Plate No.1: Brown Locusts

Moreover, if rain occurs whether from the intrusion of a tropical cyclone or local conventional heating, it is often of very poor quality in that it usually falls in heavy showers of short duration, which are often localised. These localised rains are of significance in agricultural production. In that, a local storm may damage crops in one field whilest a neighbouring field may be unaffected. Similarly some paddocks on a ranch may receive more rain than others whereas in the following year the pattern may be reversed. Thus 60% of the total rain may fall in showers of more than ten millimetres but these may account for only ten percent of total rain occurrences (Field : 1978).<sup>18</sup>

It can therefore be deduced that although this area relative to most parts of the country, receives a reasonably high amount of rain, this rainfall is very unreliable and variable in its distribution in both space and time. Secondly, during the best years, early, middle and late rains may occur. However, the failure of any one or more of these rains even if the seasonal total is good, may spell disaster for the farmer such as crop failure due to late planting or drowing of crops. Lastly, these rains are generally of a very poor quality since they usually

fall in heavy showers of very short durations.

The second climatic factor of importance, is the temperature. The area like the rest of the country, receives very high amounts of solar energy input, with the daily average radiation ranging between 13.5 and 27.5  $\text{NJ}/\text{M}^2$  d in June and December respectively (Cooke, 1978).<sup>(19)</sup> Mean daily maximum temperatures range between 30 - 33°C during summer months, with mean daily minimum between 15 - 18°C. In winter, mean daily maximum temperatures range between 20 - 25 and minimum temperatures range between 2-5°C (Timberlake, 1980)<sup>(10)</sup>. Night temperatures are often low in winter and they may reach freezing levels due to rapid radiational cooling in the clear air. The risk of frost is high in this area (Timberlake, 1980:p. 3)<sup>(21)</sup> especially during winter months. The intensity of such frost, is an important constraint to some plant species which cannot tolerate more than a degree or two below zero. As such, the distribution of frosty days is an important aspect of temperature in that, if it occurs at the beginning of the growing season, it might be sufficient to kill or seriously reduce the amount of crop as well as natural vegetation which normally withstands frost by becoming dormant in the winter months.

The presence of high maximum temperatures lead to large water losses through evaporation. Thus although heavy showers may occur, the amount of water stored in the soils quickly get lost due to high temperatures. For instance, soil temperatures normally rise up to  $70^{\circ}\text{c}$  (Bhalotra 1985, )<sup>22</sup> resulting in a quick loss of the moisture for crops. The amount of moisture lost through evapo-transpiration normally exceeds gains from precipitation. Open water evaporation rates are estimated at 1.7 to 1.9 metres, with daily rates of 7.5 millimetres (Cooke, 1980).<sup>(23)</sup> Potential evapo-transpiration for freely watered crops are estimated at 1.4 metres per annum with daily rates as high as 5.5 metres (Field, 1978).<sup>(24)</sup>

Because of the rate at which moisture gained from the short rains is quickly lost through evapo-transpiration distance from lands becomes an important factor for increased production. It thus becomes very important that a farmer locates at a point where he can be able to take advantage of rain occurrences at the quickest possible time. Thus the location of the Barolong farmers at points closest to their fields, has been one advantage they have had over the rest of the country. Leading to their proper and effective utilization of the earliest possible rains. It is also necessary

to mention that because of the erratic nature of rainfall, farmers (Traditional) find it necessary to own pieces of land at different locations. This measure, is taken as an insurance against unreliable rains whose occurrence can be at a very micro level such that areas that are only 5 kilometres apart from each other may receive different amounts of rainfall.

Rainfall is a critical factor even in pastoralism. Without enough rain occurrences, the velds can not generate enough grass growth. Such that both arable and livestock farming become very difficult to run in such types of climates. We realise therefore that water whether from surface or underground sources, becomes the most critical factor in agriculture, yet the rate at which evaporation takes place, is very high at all times during the year resulting in quick loss of surface water that is normally collected in pans, rivers etc. Thus, in the runs of dry years which occur endemically, the failure of these sources as well as the related acute shortage of pasture, normally result in severe stock losses. However when compared to arable agriculture animal husbandry becomes less risky, since for drought conditions to affect livestock severely, it needs to be prolonged through several consecutive years and be widespread in its incidence. Whereas with arable farming, one bad year can mean total crop

failure and several such years, can mean famine and desolation. Therefore if exposed to poor cultivation practice and overstocking, the environment of the area can degenerate very fast resulting in the destruction of the rangelands, vegetation cover (plants), impoverishment of the soil and the reduction of the soils capacity to absorb and retain moisture.

Having thus looked at rainfall and temperatures and their combined effects on the availability of water resources both at surface and underground sources, it is now necessary to look at another important climatic condition which is of critical nature in the utilization of the natural resources. This is the wind component. Wind is also a very significant component of the climate as a resource and a hazard. It functions as a moulder of the landscape, as a carrier of soil particles and dust in sand storms and it can create psychologically stressful atmospheric conditions when its relative humidity is low and very static resulting in very high level of calmness. On the positive side, the very occurrence of wind, can be used as energy for water pumps.

There are considerable differences in the average windspeeds over the course of the year. The lowest



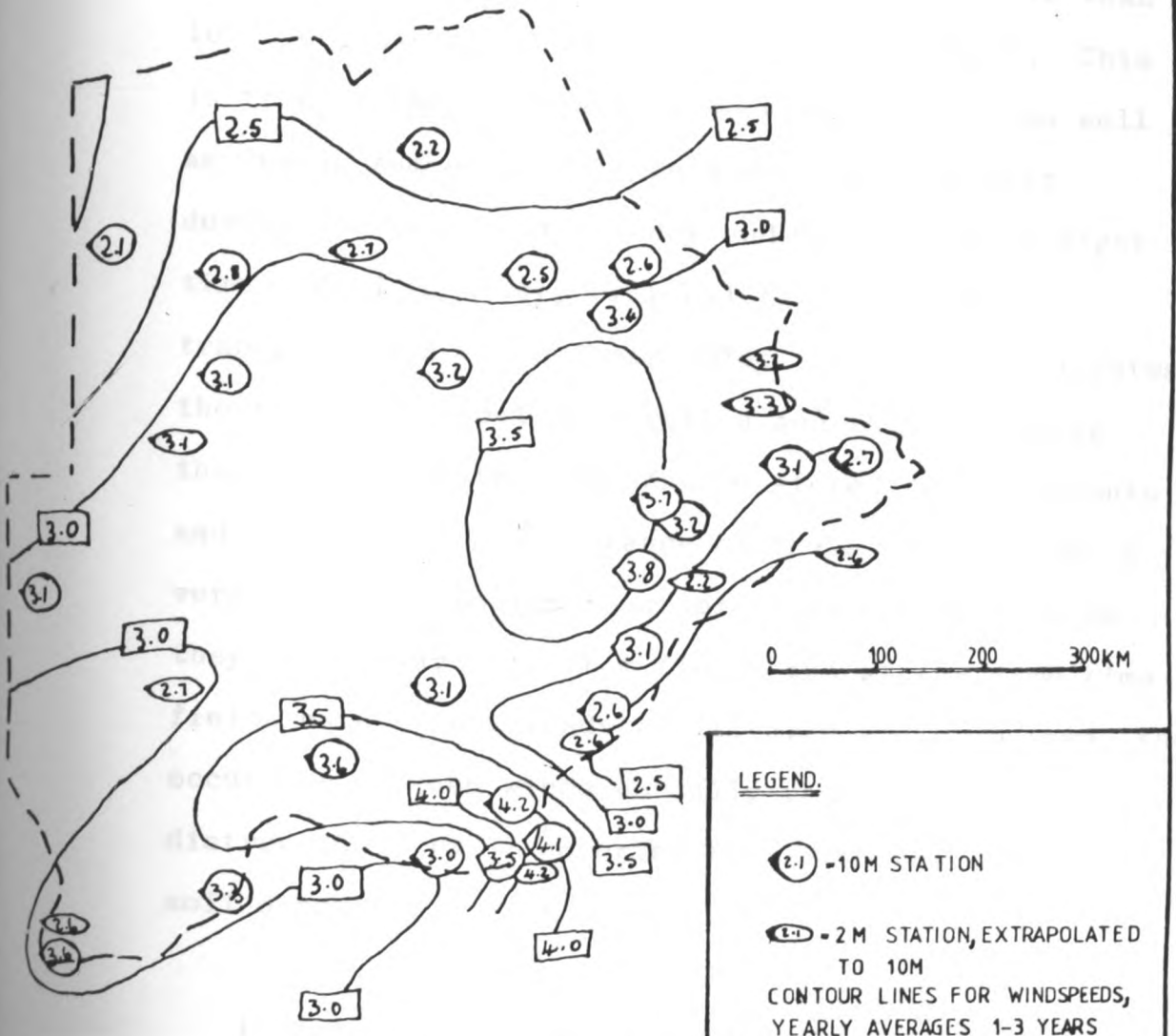
windspeed months always occur during the winter months of June and July and increase as the rainy season approaches. The most critical months are August, September and October which experience very heavy dust storms. When such dust storms occur, almost every activity comes to a standstill as movement becomes next to impossible. The average windspeeds peak during the late months of the year and then begin to deminish as the summer progresses. Average annual windspeeds of 2.5 M/S and above are experienced throughout the country. Table below, shows the yearly average windspeeds at selected areas in the Barolong farms. Whilest Map no. 5 is an illustration of the average windspeeds for the whole country.

Table No.2 Yearly average windspeeds measured at F 10 M stations for selected areas in Barolong.

Station	Topo/Veg	Ubar M/S	Highest	Lowest
Dipotsane	Slope	3.7	4.9 Sept.	2.3 June
Kgoro	Flat	3.7	4.9 Sept.	2.3 June
Mogojogojwe	Ridge	4.2	5.6 October	2.9 July
Pitsane Potlokwe	Slope	3.2	4.3 Sept.	2.1 June
Sedibeng	Flat	3.3	3.9 October	2.5 June
Tlhareselele	Flat	4.1	5.4 Sept.	2.8 June

Source: Adapted from the Energy Plan 1987.

### WIND MAP OF BOTSWANA



#### LEGEND.

⊙ - 10M STATION

⊞ - 2M STATION, EXTRAPOLATED TO 10M

CONTOUR LINES FOR WINDSPEEDS, YEARLY AVERAGES 1-3 YEARS

SOURCE: BOTSWANA ENERGY MASTER PLAN.

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MAP NO: 5

A closer look at both the Map and the Table above, shows that Barolong farms area experiences very high wind speeds during the months of September and October and that on average, it receives speeds of the highest magnitude as compared to the rest of the country. The average monthly windspeeds rarely vary for more than 10% over several years (FritzLausson, 1983)<sup>25</sup>. This is true of the lower windspeed winter months as well as during summer, wind occurances are strongest during the middle of the day and lowest during night time. Wind is a very critical factor in the transportation of soil particles. It also accelerates the rate of evapo-transpiration and thus affecting the amount of water that can be stored by both plants and the soil. The occurrence of these winds become a very critical problem in arable agriculture because they carry away soil from fields and at the same time if fields have been already cultivated and crop sown, the occurrence of such winds normally result in crop distruction by covering them with very heavy soil deposits.

It can therefore be concluded that the combination of high solar input, high temperatures, lack of moisture and high windspeeds are dominant characteristics

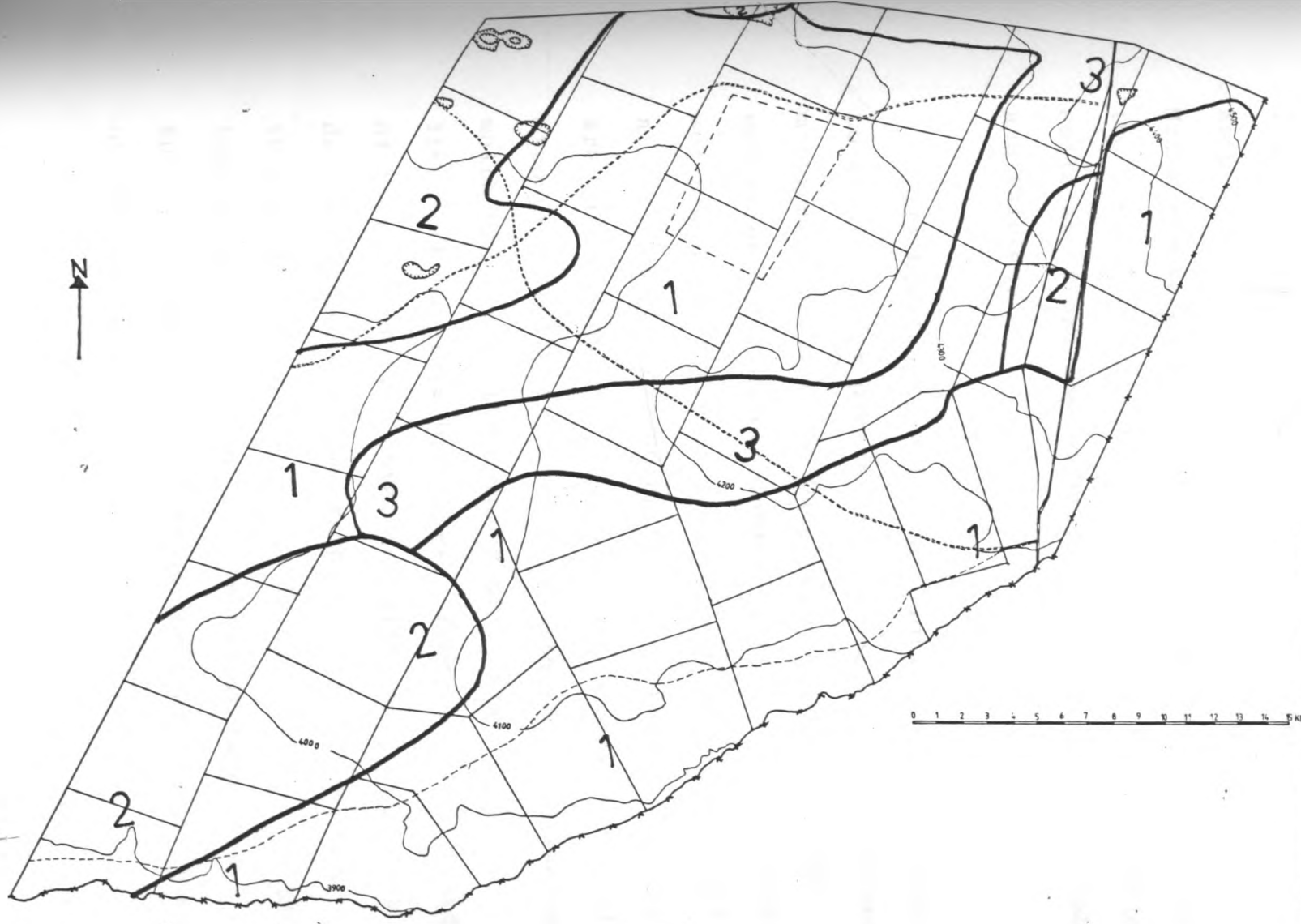
of Barolong farms area's climate. The occurrence of these factors therefore, become very relevant for human resource use. Furthermore, the semi-arid type of climate poses severe constraints on man's activities. Most especially agricultural activities which rely heavy on the availability of water resources.

#### Geology and Soils:













The area is largely featureless with a small concentration of hills at Kgoro at the north western part and occasional rock out crops between Malokaleganyane and Pitsane. Around these hills, soils are shallow and stony. Generally two types of soils can be said to be characteristic of Barolong farms. These are the Limpopo unit soils and the Kalahari unit soils. The latter type of soil is found around Makatako, Itlojatau, Motlhaba and Maletwe areas in the south western part of the area. The Kalahari unit soils, are of fine sandy nature susceptible to heavy erosion by either runoff or wind, if subjected to extreme stress such as over grazing, deforestation and over-cultivation, they easily degerate both in form and nutrient content. For instance, the area around Mokatako is presently overgrazed and as such approaching a critical point of desertification. The Limpopo unit on the other hand is spread throughout the rest of the region (FAO: Soils Map, 1972).<sup>(26)</sup>

Limpopo unit, is characterised by dark reddish brown, medium textured soils of varying depth associated with dark coloured clay soils and medium to fine textured brown - grey mottled soils in depressions, with inclusions of Lithosols and very sandy soils (Sims, 1981).<sup>(27)</sup> Kalahari unit on the other hand, is characterised by reddish, brown, yellow and grey mostly deep soils of sandy texture. These soils, are often underlain by Calcrete with inclusions of dark coloured, fine textured soils mainly in depressions.

In a generalized description, this area can be said to be characterised by sandy-loam soils of low fertility. At a very localised level, the soils of Barolong area are of varying capability ranging from those with high arable agricultural potential to medium and marginal potential soils. Map no. 6 shows the areas soils capability and therefore the use to which each type of soil should be put under normal or ideal conditions. However the actual situation is that the types of land uses that are being practised on each of these areas, are not always the ones that should be practiced. On the national scale Barolong farms is of high arable agricultural potency. Forming part of the country's 5 percent arable agriculture region. It falls within the eastern hardveld which is



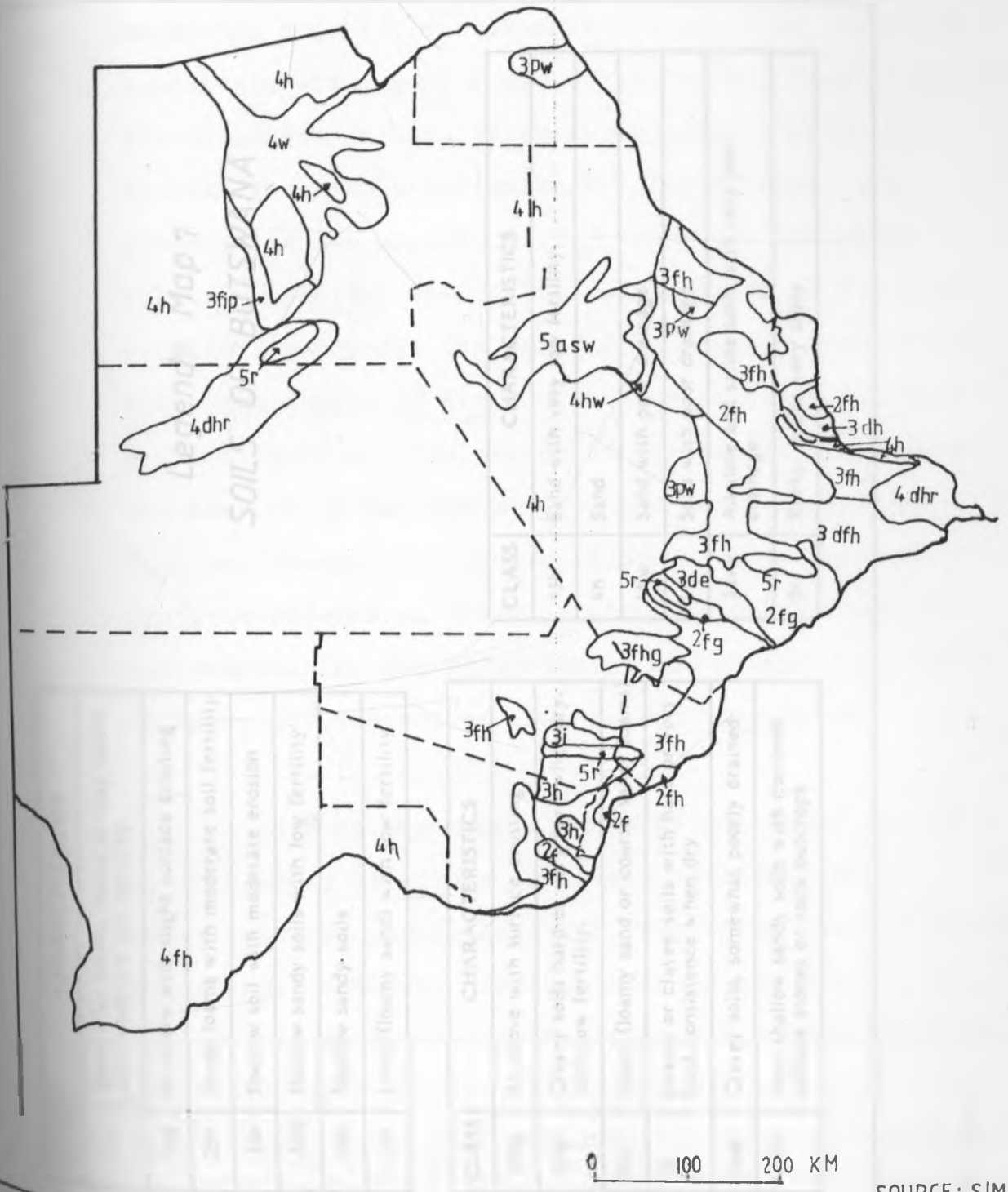
**LEGEND**

-  INTERNATIONAL BOUNDARY
-  SUB-DISTRICT
-  RAILWAY LINE
-  PRIMARY ROAD
-  SECONDARY "
-  MINOR "
-  PAN
-  1 CULTIVABLE
-  2 MARGINALLY CULTIVABLE
-  3 GRAZING NON CULTIVABLE
- 
- 

composed of hard, clod farming soils that have a naturally high density bulk and also have a high potency for surface capping (Sims, 1981).<sup>28</sup> Map no. 7 shows the soils of Botswana and their characteristics. Barolong farms area is characterised by the 2fh, 3fh and 4h soils. With 2fh soils being in the areas around Pitsane, MaLokakganyane towards Lobatse town. 3fh soils cover the areas south of Pitsane down to Itlotatau. Whilest 4h soils are found around Mokatako, Itlojatau, Mötllhaba and Maletwe.

All Barolong farms area's soils are vulnerable to erosion under present day climatic conditions and management practices. Dangers resulting from the extention of livestock farming activities onto these soils and their rather fragile vegetation cover whilest at the sametime expanding on arable farming activities, are very expansive. Central to the problem of soil exposure, is the extensive exploitation of groundwater which has led to the sinking of a large number of livestock watering boreholes. Thus, soils stripped of their vegetation cover and with their structure damaged by overuse and trampling have now become very prone to erosion. This is more evident in areas immediately around boreholes where distances of approximately 2 km. radius on the average have been overgrazed. .

# SOILS OF BOTSWANA



SOURCE: SIMS, 19



CLASS	CHARACTERISTICS
2l	Sandy clay loams, loams or clay loams with moderate soil fertility
2fg	As above with slight surface crusting
2lh	Sandy loams with moderate soil fertility
3de	Shallow soil with moderate erosion
3dfh	Shallow sandy soils with low fertility
3dh	Shallow sandy soils
3fh	Sandy (loamy sand) with low fertility

CLASS	CHARACTERISTICS
3fhg	As above with surface crusting
3fip	Clayey soils hard or very hard when dry. with low fertility.
3h	Sandy (loamy sand or coarse sandy loams)
3i	Loamy or clayey soils with hard or very hard consistence when dry
3pw	Clayey soils, somewhat poorly drained
4dhr	Very shallow sandy soils with common surface stones or rock outcrops

Legend Map 7  
SOILS OF BOTSWANA

CLASS	CHARACTERISTICS
4fh	Sand with very low fertility
4h	Sand
4hw	Sand with poor drainage
4w	Soils with poor drainage
5asw	Alkaline and saline soils with very poor drainage
5r	Rocky and/or very stony

As already discussed under the section on climate, this area is characterised by the occurrence of heavy rain and wind storms. These occurrences result in expansive loss of soil most especially the top layer which holds the organic matter which is of course of vital importance with regard to soil fertility and also proportion of the formation of soil structures both of which are crucial for arable agriculture. Furthermore, the presence of the organic matter increases the water holding capacity, assists the workability of the soil, provides energy for the soil micro organisms and facilitates the supply of nutrients. The presence of these properties in soil is essential for vegetation growth and thus the promotion of good and healthy pastures. Thus any changes that occur in soil formation have profound effects on the vegetation cover eg. erosion and degradation due to debushing and overgrazing result in the encroachment of thorny bush vegetation.

Because of the generally sandy nature of the soils in this area, it allows for rapid infiltration of water into the underground for recharging the underlying aquifers. However, although these sands are highly absorptive, percolation to depth is hindered by the fine grain size character of the sand and water held in the upper layers of the soil is able to support a vegetation

cover. Where there is no vegetation cover for the purposes of trapping the water from runoff most of the water simply runoff transporting a lot of soil along with it. In this particular case roads play a major role in the transportation of eroded matter. Such that after each heavy downpour roads are always flooded and acting as streams. This often result in the deposition of thick mud on fields which often destroy crops.

Another aspect of the areas soils which is of importance to farming, is that they respond differently to climatic conditions of the area. It is because of this that for instance traditional farmers prefer their fields to be on different soil types (clay/loam/and sand). Furthermore, these soils respond differently to infestation with weeds. Presently, farmers are facing a serious problem of loss of soil structure, acidification due to loss of calcium and magnesium which are important plant nutrients. Creeping grasses(Cynodon Dactylon or Motlha) have become a serious problems since they spread through fields and hamper ploughing. Another weed which is also a result of the change in the soil structure, is the witchweed (Mollwana) which infest sorghum and maize fields. The occurrence of these plant weeds have led to the abandonment of a considerable

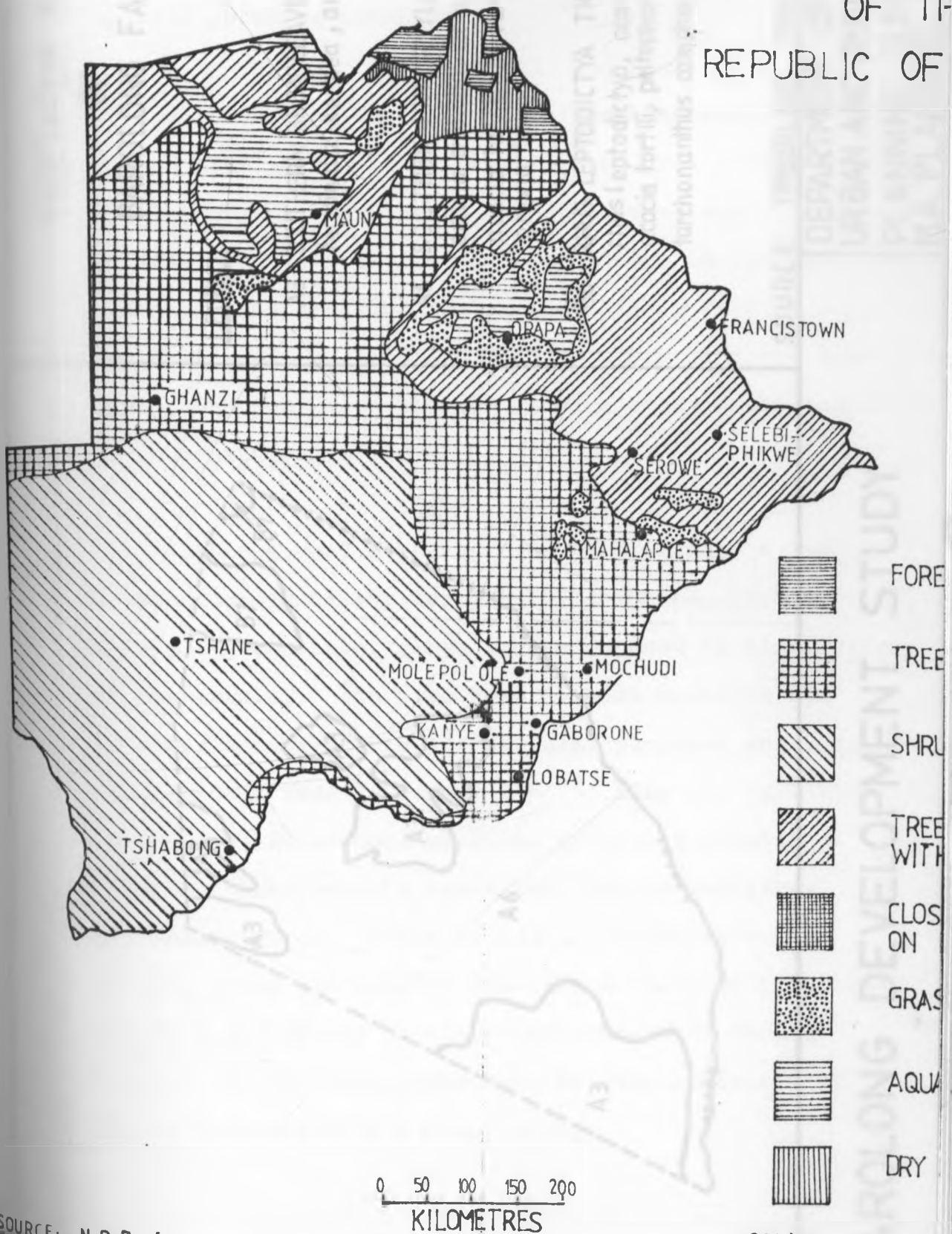
number of fields. At the same time where farmers still insist on ploughing, their output has greatly been affected and has decreased.

In conclusion, it can be said that although Barolong farms' soils have been identified to be of high arable agricultural potential, they are however very sensitive to any form of misuse. Thus, when exposed - through debushing and removal of grass cover, they easily get eroded mainly through runoff and wind erosion. All things being equal, these soils could be best used for pastoral farming. The utilization of these types of soils, whether for arable agriculture or pastoral farming require high levels of management for purposes of retaining their fertility and structure.

#### Vegetation:

The natural vegetation of Barolong farms is a response to climate, soils and its geology. The area falls under the tree savanna type of vegetation as indicated on Map no.: 8 on the vegetation of Botswana. Within the sub-district, three broad categories of the vegetation can be identified. These are - the southern broad leaved savanna, the southern microphyllous savanna and the *Rhus Leptodictya* tree savanna (Timberlake, 1980: 19-20).<sup>(29)</sup> Map no. 9 on the vegetation of

# VEGETATION OF THE REPUBLIC OF BOTSWANA



SOURCE: N.D.P.: 6

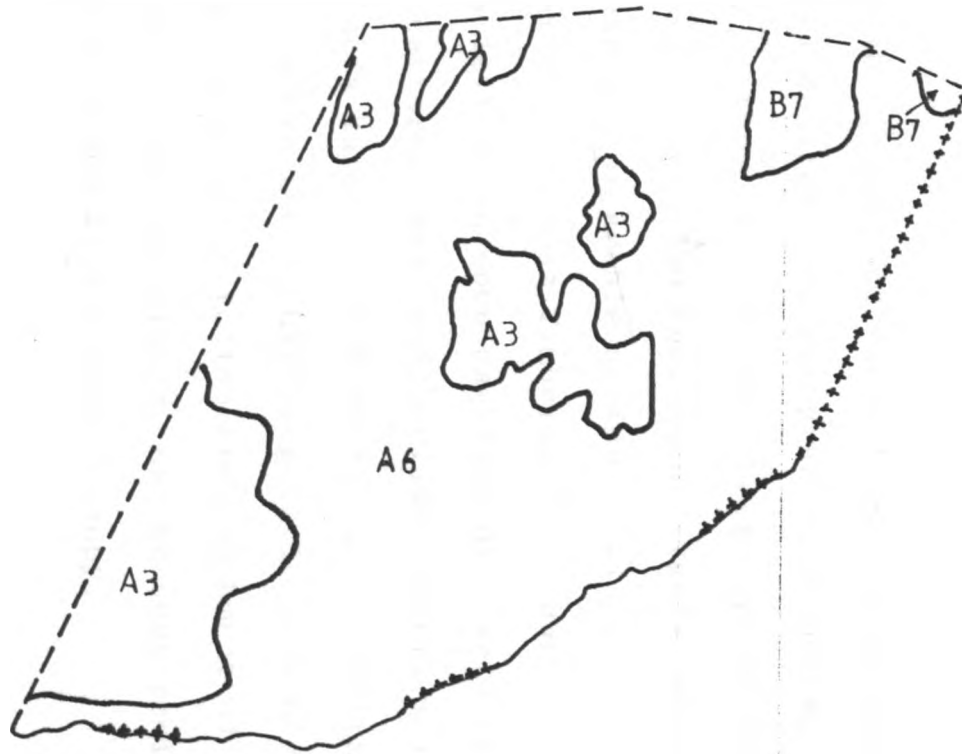
1987/88

B

## BAROLONG DEVELOPMENT STUDY

DEPARTMENT OF REGIONAL PLANNING AND REGIONAL DEVELOPMENT, U.D.N. M.A. PLANNING

# VEGETATION MAP OF BAROLONG FARMS



## LEGEND:

- A3 - SOUTHERN BROADLEAVED SAVANNA  
terminalia sericea, acacia fleckii
- A6 SOUTHERN MICROPHYLOUS SAVANNA  
acacia erioloba, acacia hebeclade  
acacia luederitzii var luederitzii,  
grewia flava
- B6 RHUS LEPTODICTYA TREE SAVANNA  
rhus leptodictya, acacia karroo,  
acacia tortili, peltoporum africanum  
tarchonanthus camphoratus

SOURCE: TIMBERLAKE 1980

BAROLONG DEVELOPMENT STUDY

DEPARTMENT OF  
URBAN AND REGIONAL  
PLANNING UON  
M.A. PLANNING YR 2

MAP  
NO 9

Barolong shows the localities of each of these species as well as their sub-types.

This vegetation, is generally characterised by deep rooted tree species that take long to grow - with a growing season starting from September to April. Most species are less subject to fluctuations in rainfall and can withstand long dry periods each season as well as cope, with intermittent drought since they are deep rooted and they are able to trap much deeper water supplies in underground aquifers.

Although most of these tree species have a low level of desirability for grazing purposes, (Field, D.I., 1978),<sup>30</sup> they have however, been exposed to high rates of overgrazing. And have been largely modified due to clearing for arable agricultural purposes and long occupation. Thus as Timberlake<sup>(31)</sup> puts it, "all that is now left is an open parkland of acacia erioloba with scattered, acacia Hebeclada, acacia mellifera and acacia karoo. Plate no.2 is an illustration of an area where the natural vegetation has been greatly modified giving way to the encroachment of thorny bushes. At the background, can be seen remnants of acacia erioloba with a broad canopy.

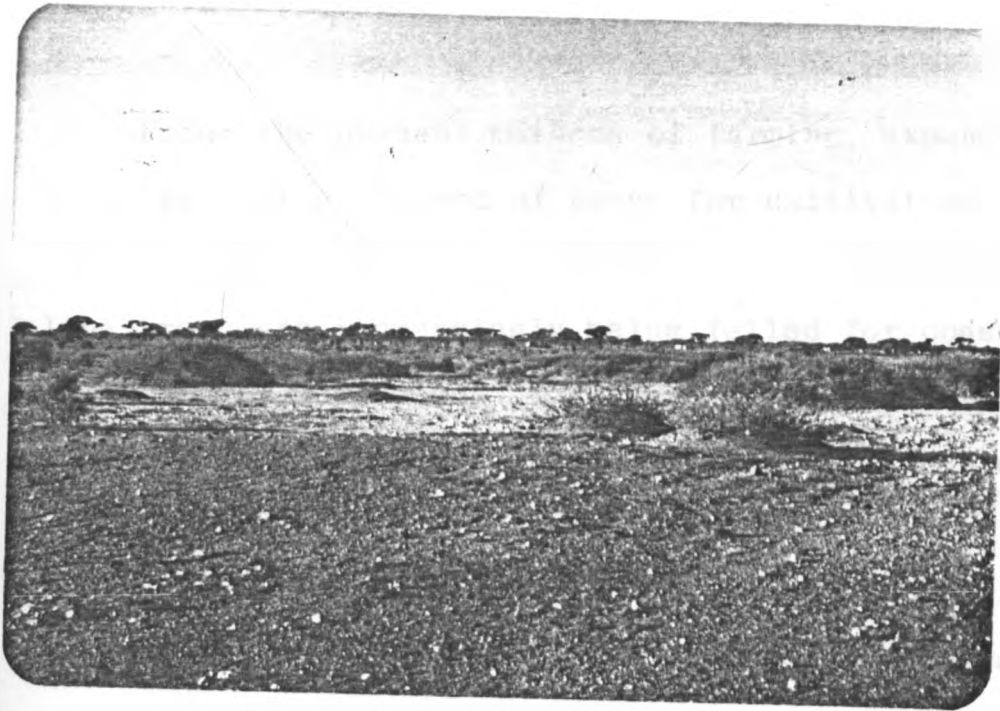


Plate No.2 : Bush Enchroachment

Overgrazed and over cultivated areas are invaded by dense and often thorny thickets. Thus, the presence of increasing amounts of bush has been noticed to coincide with heavy stocking rates. As a result of increasing preassure on land due to growth both in human population and livestock populations and therefore the growing demand for use of the vegetation cover, the balance of nature has been greatly upset, resulting in a serious problem of soil loss due to the absence



of vegetation cover.

Under the present methods of farming, expansive areas are being cleared of trees for cultivation and more areas, are being left barren. Furthermore, live trees are increasingly being felled for construction purposes and fuel wood. The areas immediately surrounding villages or larger settlements are the most affected.

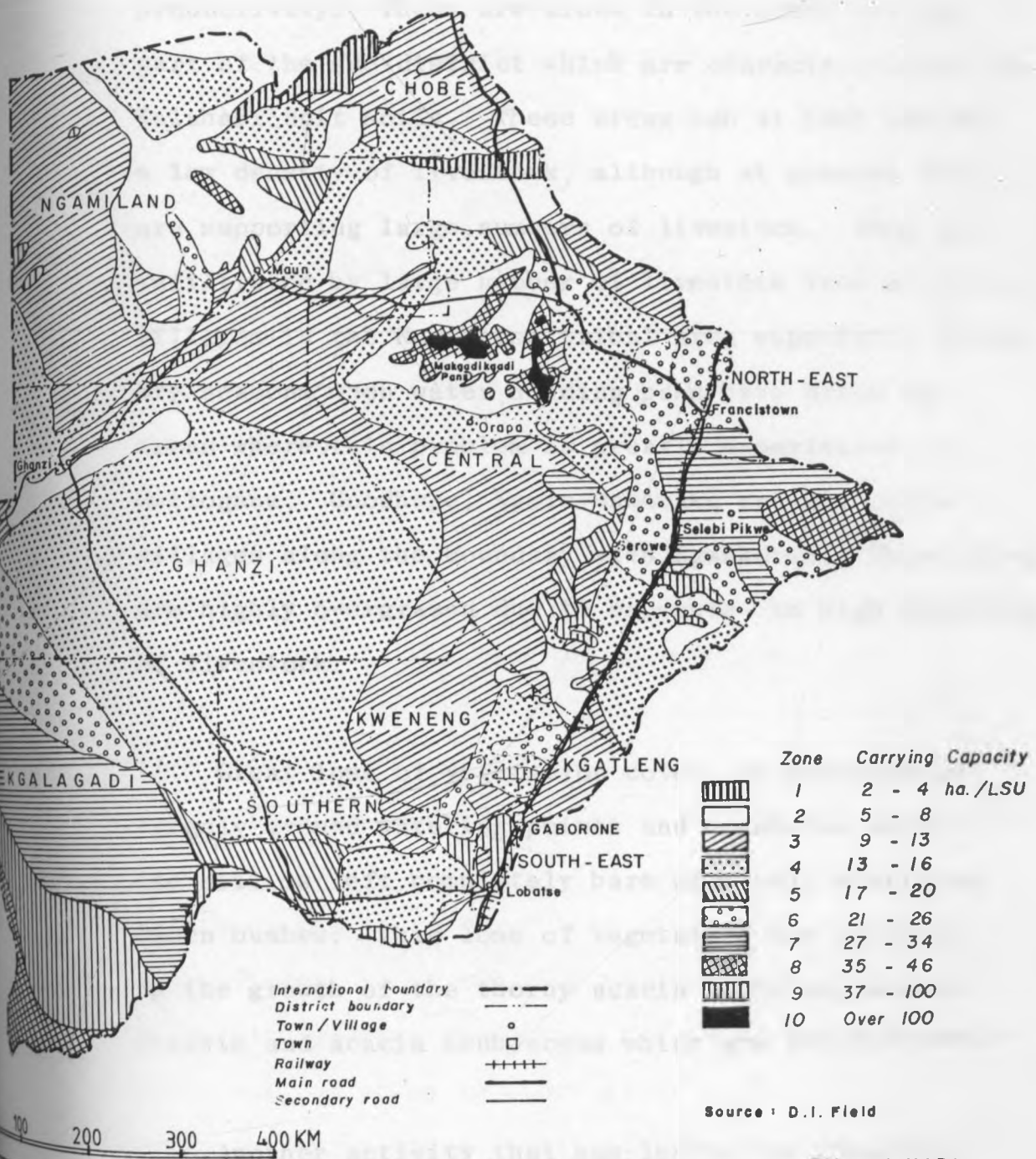
The grass layer on the other hand, is dominated by good and intermediate grass species that have a high potential carrying capacity - 5 - 5ha /LSU\* and 12ha/LSU based on rainfall (Field, 1978,<sup>(32)</sup> stap : 1981: p. 18).<sup>33</sup> Field, identifies the following types of grasses as being common in the area: panicum maximum, bigitania species, cenchrus ciliaris, eragrostic suberba, brachiaria nigropedata and urochloa species. These are grasses that are characteristic of the sweet veld and have a high level of desirability for consumption by livestock. (Map no. 1Q shows the potential carrying capacity of the country.

However, although the area is, relative to other parts of the country characterised by good and intermediate

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\* LSU = Livestock unit weighing 500 kg.

# Potential Carrying Capacity of Botswana's Rangelands



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MAP NO. 10

PAROLONG DEVELOPMENT STUDY

grass species, there are areas where low rainfall and poor soils have resulted in the growth of grasses of low productivity. These are areas in the south western part of the sub-district which are characterised by the Kalahari unit soils. These areas can at best sustain a low density of livestock, although at present they are supporting large numbers of livestock. They get infiltrated by large number of livestock from neighbouring villages in the Ngwaketse tribal area especially during dry seasons when water holding pans have dried up. Areas where this problem is greatly experienced are Metlogane, Goodhope, Kgoro Makatako and all other villages along the boundary with Ngwaketse. These areas are highly overgrazed due to exposure to high densities of livestock.

Great loss of vegetation cover, is experienced largely around watering points and boreholes where the soil is left completely bare with only scattered thorn bushes. This loss of vegetation has resulted in the growth of the thorny acacia tortilis, acacia fleckie and acacia erubescens which are not palatable

Another activity that has led to the clearing of large expanses of grass, is the use of grass for thatching purposes. The most affected grass species in this respect is the eragrostis pallens which is

taller than most other grass species and therefore easy to use. Central to the problem of grass cutting for thatching, is the manner in which these grasses are collected. They are often uprooted leaving no stubs for regeneration as well as holding soil together as a protection against erosion.

It can therefore be concluded that although this area relative to other parts of the country is dominated by grasses and tree species of good quality, its range productivity has however been greatly affected by the use of poor range management techniques. This together with the generally poor climatic conditions that often result in long drought spells, have resulted in most parts of the area being over grazed and heavily deforested especially in areas exposed to high livestock densities and over cultivation such as areas immediately around watering points and surrounding villages. Worth noting is the fact that due to the area's system of land use: that of consolidated system of settlement it is not easy to delineate areas of different landuses since they are intermingled together. Therefore, relative to other parts of the country where the three dimensional settlement system is being practiced, the whole area is virtually cleared of vegetation cover.

Demographic characteristics:

According to the 1981 population census, the villages in the Barolong area have a total number of 13,549 people and another 1,922 people are staying in related areas (cattle posts and lands). The majority of the villages are small. 25 of the villages have less than 500 people. 7 have a population of between 500 - 1000 people and 2 have a number exceeding 1000 people. The number of people that live in villages of different sizes is shown in the table below.

Table 3: Distribution of the population of settlements different sizes within the sub-district in 1981

Size of village	No. of people	Percentage of total population
0 - 499	5,501	36
500 - 999	5,374	36
1000 -	2,674	12
Lands and cattle posts	1,922	12

The table above, shows that most people stay in small villages. The number of people staying the lands and cattle posts is low. This, can be attributed to the dominance of arable agriculture in the area and people's settlement at close proximity to their lands.

The population can be categorised into age groups and sexes as indicated in the table below. A feature; that is common amongst most of the villages in the area, is that there is a predominance of children of the lower ages. Furthermore, the grouping into sexes, shows that the total number of females exceeds the total number of men in most age - groups.

Table 4 Population 1981 grouped according to ages and sexes. Barolong census district:

Age groups Years	Population		Male		Female		% Excess females over male:
	No.	%	No.	%	No.	%	
0-4	3199	20.7	1659	10.7	1540	10.0	-0.7
5-9	2721	17.6	1384	8.9	1337	8.6	-0.3
10-14	2253	14.6	1106	7.1	1147	7.4	0.3
15-19	1425	9.2	713	4.6	712	4.6	1
20-24	1063	6.9	400	2.6	663	4.3	0.7
25-29	791	5.1	317	2.1	474	3.1	1.0
30-34	627	4.1	277	1.8	350	2.3	1.5
35-39	576	3.7	238	1.5	338	2.2	1.7
40-44	504	3.3	219	1.4	285	1.8	1.4
45-49	434	2.8	188	1.2	246	1.6	1.4
50-54	408	2.6	191	1.2	217	1.4	1.2
55-59	447	2.9	201	1.3	246	1.6	1.3
60-64	276	1.8	130	0.8	146	0.9	0.1
65-69	219	1.4	96	0.6	123	0.8	0.2
70+	504	3.3	214	1.4	290	1.9	0.5
Not known	24	0.1	19	0.1	5	0.0	-0.1
	15471		7352 (45.7		8119	(52.5)	

Source: Compile from the 1981 Census Book.

The population of the sub-district has since the 1971 census, grown as follows.

Table 5 : Annual growth of the population in the Barolong Census district, 1971 - 1981

	Pop. 1971	Pop. 1981	Annual growth rate
Barolong Sub-district	10,973	15,471	3.6%
Land and cattle posts	1,563	1,922	2.2%

The population growth for the Barolong census area was slightly higher than the growth rate for the whole country between 1971 - 81 which was 3.4%. There is a considerably low rate of growth at the lands and cattle posts areas. According to the 1971 census, there were 30 villages with less than 500 people. 7 villages had a population between 500 - 1000 people and none had a number beyond 1000 people. The table below shows the number and percentage of people who were living in villages of different sizes by 1971.

Table 6 : Distribution of the population at settlements of different sizes within the sub-district in 1971

Size of Village	Number of people	% of total population
0 - 499	7435	50.3
500 - 999	4541	30.7
1000	-	18.9

A comparison with the 1981 figures, shows that the percentage of people living in small villages has decreased considerably and also the number of people has decreased. The number of small villages has decreased by five. The percentage of people staying in villages between 500 - 1000 people has slightly decreased, although the total number has increased. The biggest change, is that of the existence of villages with a population of over, 1000 people by 1981. By 1981, there were two such villages with 17.0 percent of the population. These are the villages of Pitsane and Ramatlabama. The lands and cattle posts population has decreased its percentage of the total population - from 18.9 in 1971 to 12% in 1981, having decreased by 6.9%.



Comparison of the above figures with the national figures, indicates a slight correspondence since the national figures, show an increase of small villages and a decrease of medium size villages. The growth of the bigger villages of over 1000 people and the decrease in the percentage of the population at the lands and cattle posts are also in correspondence with the national figures.

Migration:

According to the 1981 census, the rate of movement within the Barolong area is low; only 2 - 3 percent migration occurs due to the predominance of arable agriculture, which is practiced in permanently settled areas whereas in districts or areas where animal husbandry is predominant, movements are at the rate of 8 - 10 percent. This is due to the fact that people have to move from one place to the other - the village and the cattlepost.

Barolong sub-district also shows a positive net migration rate. 8% of people was moving into the area whilst only 7.1% was moving out. When compared with other areas like the Ngwaketse census area, which registered a net migration of rate of minus 1.2%,

Barolong area can be said to be experiencing an influx of new immigrants. This can be attributed to a number of factors such as the development in the arable agricultural sector which attract people both as labour and people aspiring to engage in commercial arable agriculture. Secondly, the villages of Goodhopes, Pitsane and Ramatlabama can be said to be having some population pull factors due to their development as administrative, (service - sector) Commercial and industrial centres respectively.

Estimated population growth:

The future growth rate of the sub-district depends on the natural growth and the migration. The natural growth depends on the rates of births and deaths. According to the Central Statistics Office assumptions the fertility rate is expected to declines at a more rapid rate (Goodhope - Pitsane Development Plan: Working Paper, 1984;).<sup>34</sup> The natural growth rate is expected to be 3.4% per year as an average.

The sub-district's in and out migration can be attributed to a number of factors. such as the following:

- development in the agricultural sector
- development in the mining sector in South Africa and in Botswana.

- the extent to which the villages of Goodhope and Pitsane can attract modern sector investment;
- the extent to which the Central Government and Council can provide funds for infrastructure and services and decentralise functions to the sub-district level especially Goodhope;
- conditions due to drought;
- other developments in the sub-district and in the communal first development area (C.F.D.A.). (Rolong Development Committee Meeting Minutes of January 1986.).<sup>35</sup>

From the above factors, three alternative growth rates can be assumed. This is due to a number of factors involved and the difficulties involved in their estimation since, they also depend on other factors that are external to the sub-district. The first alternative assumes a high growth rate of 3.9 percent. This alternative assumes that the designation and development of Goodhope and Pitsane into a sub-district and industrial centre respectively, coupled with the building of a health centre, post office and a new secondary school in the area, is likely to attract a considerable number of people (southern

District Development Plan (1986-1989).<sup>36</sup> Furthermore, the other settlements are also expected to attract a considerable amount of population from outside due to the improvement in the agricultural sector - (mainly arable production). However, this highly depends on whether the current drought conditions will end.

The second alternative on the other hand, assumes that the growth rate of the country will be the same as the national growth rate of 3.4 percent growth rate per year. This assumption, is based on the fact that the development of the administrative centre, industrial and service sectors may not be as fast as envisaged in the first alternative due to the fact that procurement of funds for the development of such activities may be very slow. For instance infrastructure for industrial development at Pitsane has upto date not yet been provided. And also, it is expected that the rate of migration into the sub-district mainly by miners coming back from south Africa (as a result of the current political function), will balance the rate of out-migration to urban centres within the country.

Lastly, alternative three, assumes that the total growth (2.6%) of the sub-district will be below the average for the country. This can be attributed to the fact that industrial development in Pitsane is quite

slow due to lack of infrastructure. The development of Goodhope is also very slow due to lack of funds. Above all, the development in the agricultural sector has for the past seven years (1980-1987) been very slow due to the unfavourable weather conditions of recurrent drought. There is also an increase in the pressure on land exerted by agricultural activities and the development of the human settlement. This, has resulted in shortage of land for both arable and livestock farming driving most of the people out of agriculture. This, results in some people resorting to out-migration to areas where they can get employment in the formal sector, such as in the mines within the country.

In this study, the medium growth rate alternative has been adopted. Reason being that whilst the general development of the area has remained high whilst the rate of deaths have relatively decreased.

In conclusion, it can be said the development of arable agriculture in the Barolong farms has greatly influenced the rate of population growth. For instance the years between 1960-1971 and 1971-1981, attracted a considerable number of people into the Barolong farms. This was due to the fact that, at those period

there was a tremendous growth in arable production and therefore, it was offering great prospects for economic development. Population distribution shows a characteristic of many people being settled in villages of over 1000 people are beginning to emerge. The development of the service sector and industries, is very slow resulting in stalled development of the area and high dependence on arable agriculture for employment and therefore the attraction of population from outside the sub-district.

Economic activities:

The economy of the area is directly dependent on agriculture. Two types of agricultural activities are practiced in the area. These are arable agriculture which is largely practised on highly mechanised commercial basis and also serves as an activity for the production of subsistence food stuffs. The Barolong also engage in livestock farming. However, their scale of involvement in this type of farming is very low when compared to the rest of the country. Livestock farming is mainly for subsistence and socio-cultural purposes.

The Barolong farms area is responsible for a large proportion of the country's arable output. For

instance, as early as 1974, it was said to have contributed 22 percent output to the country's total grain production. The involvement of the Barolong in high output arable farming - mainly commercial farming, can be attributed to a number of factors. Such as the areas' favourable ecological conditions in terms of rainfall and soil fertility relative to most other parts of the country. Secondly, its proximity to south African market providing favourable prices, training through employment on European farms and access to second hand tractors from the white farmers, have given the Barolong an advantage over the other agricultural communities in the country. As a result of the above mentioned factors, Barolong were able to take advantage of Government financial assistance and extension services from the mid 60's (Comaroff: 1977).<sup>(37)</sup> This success in arable agriculture, can also be attributed to Barolong's limited engagement in pastoral farming, which resulted in their achievement of capital growth through hard work in commercial arable farming - "arable oriented micro-economy" (Gulbransen, 1984).<sup>(38)</sup>

Comaroff (1977)<sup>(39)</sup> categorized the farming community into three major classes, namely: the elite farmers - a small proportion of well, consolidated commercial - highly mechanized farming units, typically

ploughing 100 hectares and more, and get access to more land through share cropping arrangements. In 1974, this group constituted 6 - 9 percent of the total farming population. The second group is that of the middle range farmers who plough 20 ha and above. They use small and usually second hand tractors which are substituted with drought power or alternatively hiring tractors from members of the upper class. In 1974, this class constituted 55 percent of the farming community. Thirdly, he identified a group of small holders who are engaged in subsistence farming and occasionally selling surplus. This group, plough less than 15 hectares and it constituted around 30% of the farming community. Finally, he identified a category of a restricted number of families who had no means for ploughing. This group constituted a small group of farm labourers who in most cases included members of the traditional class of servants.

There has been an apparent drop in production. This, is most evident amongst the middle range farmers (Camaroff 1977,<sup>(40)</sup> Gulbrandsen 1984).<sup>(41)</sup> This decline, has further been noted by Heisey (1983)<sup>(42)</sup> who attributed it to the following exogenous factors: the significant rise in the price of oil, implements and farm labour while crop prices remained almost



constant. The mechanisms through which the middle range farmers are being squeezed out of commercial production are explained in detail by Comaroff (1977,<sup>(43)</sup> and 1983)<sup>(44)</sup> and further elaborated on by Gulbrandsen (1984).<sup>(45)</sup>

The decline in agricultural production can further be attributed to climatic changes such as recurrent drought which has affected both land productivity and drought power. The years between 1979--1987 experienced severe drought conditions. The decline in productive capacity among the middle range farmers can therefore be attributed to a combination of inflation squeeze and unfavourable rainfall conditions coupled with the growing antagonism between the expanding 'land eaters' - the elite farmers and the rest of the agrarian community (Gulbrandsen, 1984: p. 76).<sup>(46)</sup>

According to Comaroff (1977:p. 17), Barolong was not always a high output producing area. This statement is supported by evidence from Schapera (1943)<sup>(47)</sup> and Wande (1949)<sup>(48)</sup> who indicated that until the late fifties most of the population comprised of subsistence farmers - a large proportion of which depended upon migrant labour to supplement family income. The subsistence income was largely

derived from mixed farming. no specialization was evident then. Large scale arable farming emerged in the mid - 60's. However, output could not exceed 20,000 bags of grain per annum until the mid seventies (1974) when gross output of grain approximated 350,000 bags (compound). Comaroff <sup>(49)</sup> goes further to say that this pattern of high outputs was marked by a near universal achievement leading to the overall transformation of the agricultural structure in the area.

The statement of universal achievement has received a lot of criticisms, amongst which can be singled out Heisey (1983) <sup>(50)</sup> who says that the rise of gross agricultural outputs in Barolong during the mid-seventies, was due to the emergence of a small number of very large scale farmers. As such the outputs of the area can not be taken as proof of aggregate or community wide success, but the success of the top group of farmers. And according to him, the peasantry has now more than anytime before, become dependent on extra - agricultural sources of income. Livestock ownership now correlate with the scale of cropping operations among the members of the lower strata (Heisey, 1984). <sup>51</sup> A process of polarisation has thus emerged through which both the middle and lower range farmers are slowly but surely being pushed out of commercial farming. This, has

resulted in contradictory relations between, the different classes. These contradictions have their origins from the external forces, which according to Comaroff led to a late colonial initiative to develop the local farming economy and the internal material and social forms, marked by the decentralization of households and a socio-cultural stress on individualism. This according to Comaroff, aided the entry of the community into productive arable agriculture and is now the mechanism through which the elimination of the middle and smallholder farmers is being effected.

There is on the other hand a relative lack of emphasis on pastoral activities. Thus, as indicated by the 1981 population census, the percentage of Barolong farmers who hold cattle is somewhat lower than the percentage of all Botswana. The percentage of livestock holders was given as 69 percent which as compared to the country's percentage of 86 percent, is relatively very low. Of the 69 percent own - between one and twenty cattle, 15 percent hold between twenty and thirty cattle while 7 percent own between 30 - 40 and the remaining 10 percent hold cattle of more than 40 heads. This constitutes only 4 percent of the total population of Barolong farms. Livestock is largely kept as an insurance against risk in arable agriculture.

Furthermore, it is kept as a socio-cultural activity. Ownership of livestock, just like the involvement in arable agriculture, is skewed. Large herds are held by a few farmers who at the same time belong to the group of large scale arable farmers. It is necessary to point out that livestock within the Barolong area is seen as a potential danger to arable farming due to the destruction of crops by livestock. This is due to the small land area of the community together with tight distribution of arable holdings which result in haphazard grazing for cattle.

It is necessary at this juncture to point out that safe for agrivultural practices, there is a very low level of diversification in economic activities within the area. These include small scale tailoring, capentry and many other petty activities that do not raise any considerable level of income. This phenomenon, result in limited income opportunities. Most especially for members of the lower strata who seek formal and informal employment outside the area. At the sametime, this lack of employment opportunities within the area, result in total reliance on employment in the agricultural sector and therefore underemployment of most people.

From this section, a number of things can be said about the Barolong farms area. First, it has a highly

mechanized commercial arable farming system which is characterized by a high level of specialization, individualism and isolationism which as shall be discussed later mitigate against communal activity. Secondly, arable production and therefore ownership of land for the purpose, is centred in the hands of a few large scale farmers. Thirdly, involvement in livestock farming is very minimal with larger herds of cattle also being owned by the same large scale arable farmers and therefore the existence of a highly polarized economy. Lastly, there is a very low level of diversification of economic activities resulting in greater reliance on employment in the agricultural sector as well as the migration of members of the lower strata out of Barolong area into other areas to seek employment opportunities.

#### Summary:

The purpose of this chapter has been to highlight some historical, physical, demographic, and economic aspects relevant to the analysis of land use practices and activities in Barolong area.

In this respect, the following major points were therefore identified with each of the aspects discussed. Barolong farms area was first a grazing area for the

Barolong who were then resident in Mafikeng. Its status as a grazing area continued until the late 19th century when it was sub-divided into 42 farms and some people started settling permanently at it. With this permanent settlement, there then arose the need to practise arable farming for subsistence farming which led to the area becoming a mixed farming. Until 1966, the area was ruled from Mafikeng as such there was no direct contact between the Barolong in the farms and their headquarters in Mafikeng. However, this system gradually changed leading first to the establishment of offices and an administrative system whose headquarters became Goodhope. At the same time as changes in the administrative system were being effected, came a change in emphasis with regard to the involvement in arable and livestock farming leading to the stress on arable farming for both subsistence and commercial purposes. The adoption of the mixed farming system, led to the problem of crop damage by livestock.

The area's climate is characterised by high solar, high temperatures, lack of moisture and high wind speed occurrences. This type of climatic conditions, pose severe constraints on man's activities be it those of arable, livestock or the human settlement due to their heavy reliance on water availability.

On a comparative basis, the soils of the area have a high arable agricultural potential although they are very sensitive to any form of misuse. These soils, if exposed through debushing and removal of grass cover easily get eroded by either run-off or wind, under normal circumstances, these soils could be best used for pastoral farming. Furthermore, the utilization of these types of soils whether for arable or pastoral farming purposes require high levels of management in order to retain their fertility and structure.

The natural vegetation of the area has greatly been modified due to natural and man-made conditions. Large exences of vegetation have been cleared for purposes of expanding on arable agricultural activities. At the sametime, poor methods of animal husbandry have resulted in the degeneration of the area's rangelands. Along side the distribution of vegetation by agricultural activities there have also been cutting and felling of trees for building and construction purposes as well as fuel for domestic use. The area has also suffered recurrent drought occurances leading to failure of trees to regenerate naturally.

Population growth has been greatly influenced by both natural and migration factors. Of importance is the extent to which arable agricultural development has influenced the rate of migration. The years 1960-71 and 1971-1981 saw a considerable number of people being attracted into the area. Along side the growth in population, there is a marked increase in the number of villages of 500-1000 people and there have also emerged some villages of over 1000 people. However, due to the slow development of both the industrial and service sector coupled with recurrent droughts which limit the development in the agricultural sector, the number of people migrating into the area is getting less.

Lastly, arable agriculture is the mainstay of the area's economy. The area has a highly mechanised system of commercial arable farming which is characterised by a high level of specialization, individualism and isolationism. Secondly, land ownership for arable farming purposes is concentrated in the hands of a few large scale farmers. Livestock farming on the other hand is very minimal with larger herds of cattle also being held by the same large scale arable farmers. Lastly, there is a very low level of diversification of economic activities resulting in the greater reliance on employment in the agricultural sector.



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## CHAPTER THREE

### LAND USE PRACTICES AND POLICIES

#### Introduction:

Efficient land use practices must satisfy, ecological, social and economic needs. Ecologically, the use of land must result in the greatest production on a sustained basis without depleting the natural resources and preferably improving them. Socially, land use must be equally beneficial to all members of the community or at least it should not favour any one group or individuals to the disadvantage of the rest of the community - and economically, the use of land should be such that the natural resources of an area produce the greatest financial returns without destroying those resources.

On the basis of the analysis in the preceding Chapters, and in the light of the general view presented above, land-use practices in the Barolong farms are going to be examined. An attempt will be made to specify processes which are presently leading to problems of land degradation and therefore the effects of mixed land use practices on fragile environments, and to point out conflicts that arise from these type of practices.

First, the system of land tenure that exist in the area shall be examined followed by an analysis

of the human settlement, arable agriculture, livestock farming and the supporting activities of water resources and wood utilization. The last section will discuss land use conflicts as identified in the discussion of the land use activities.

### Land Tenure Systems

As indicated in the historical background of Barolong farms, the area has undergone a series of changes both in its land use practices and activities and the administrative system. Although the area was held in trust for the tribe by the Chief, its internal administrative structure changed from that of a grazing area, to farms and into the present ward system under communal land administration. These three systems for purposes of this study, are discussed under two major categories of the traditional system - \* marking the period before 1970 , and the present system of Landboards which was introduced by the Tribal Land Act of 1968 - from 1970 to the present date - the modern system of tenure.

### The Traditional System of Tenure

Traditionally, land was communally owned and held intrust for the tribe by the chief. He was empowered to make decisions on matters concerning land, registration,

dispute settlement and land allocations and management. Within this system of land management, the chief also had the prerogative to decide on where each land use activity could be practiced. Specific areas selected for use for either residential, arable or livestock farming were allocated enbloc by the Chief to various ward heads. In principle, each ward had its own residential area, lands area and pasture. Ward heads were charged with the duty to manage and see to the general conservation of their respective areas. The chief as the overall land use manager, controlled both the activities and time within which they could be undertaken. In other words, unless the Chief had given a go ahead, no arable agricultural activities could be undertaken even if rains had already come. In the same manner, he controlled the use of grazing areas as well as wood and grass gathering for household use. Thus, under the traditional system of tenure, the overall conservation of the natural resources remained purely in the hands of the chief.

It was, within this general framework that the Barolong Boo Ratsidi were initially using the area presently under study as their pasture, whilst their residential or village area was in Mafikeng in South Africa. The use of Barolong area as a communal grazing area was partially ended by its sub-division into farms in 1895. This sub-division resulted in the

allocation of blocks of farms to individual tribesmen under leasehold terms. Thus the introduction of "individual tenure". However, the land remained in the hands of the tribe for purposes of allocation and administration (Camafoff, 1977).<sup>1</sup> Although the leaseholders were in theory holding the land in trust for the tribe, in practice they behaved as though they had full rights of ownership and as such they could decide on who to allocate and/or not to allocate land to. This was later to have a significant effect upon the social and economic structure of the farms. For instance, it is within this system of control that a considerable number of whites were able to occupy leasehold land on the farms for farming and commercial purposes (Trading).

The introduction of this system of tenure, resulted in partial alienation of the Barolong farms area from the tribal capital at Mafikeng. As a result of which, the area never became fully integrated into the Governmental structure of the Barolong 600 Ratshidi Chiefdom (Schapera : 1943).<sup>2</sup> It is was because of the realization of the emergence of this attitude, that an administration centre was established in Goodhope for effective management of the affairs of the area. This was soon followed by the invalidation of the certificates of occupation for individual tenure in 1957. The abolishment of this system was as a result



of the farm holders attitude towards the general use of such land, which they were now treating as their private individual property. Barolong farms area once more became a tribal communal area although the farms remained the basic administrative units.

1966 saw yet another major change in the tribal administration system of Barolong farms. The Barolong farms of Botswana and those in South Africa got separated soon after Botswana got its independence. The link between the Chiefdom in Mafikeng and the tribesmen in Botswana broke leading to the installation of the first chief for the Barolong farms who was the younger brother to the chief in Mafikeng and therefore, a new Barolong Chiefdom was founded in Botswana. The new chief - Chief Besele Montshiwa II was then installed in February 1970 (Comaroff, 1977:7)<sup>(3)</sup>. Soon after his installation, Besele introduced yet another change in the tribal administration system as a means towards strengthening his authority over the farms. He abandoned the traditional farm system and centralised power into five wards of Goodhope, Hebron, Nokatako, Pitsane and Papatlo. Headmen were then appointed for each ward and the former farm heads ceased to hold power.

Notable about this traditional system of tenure, is the fact that, although contact did to some extent exist between the headquarters in Mafikeng and the subjects in the Barolong farms, the chiefs control over the spatial organization of the Barolong area was very minimal and to some extent inexistent. The control of the productive resources for arable and grazing purposes, became very weak resulting on individual people locating where they wished and therefore, the emergence of the dispersed pattern of settlement. This pattern of settlement resulted in the breakdown of community spirit and hence individualism and heterogeneity became entrenched in the socio-cultural behaviour of the Barolong.

It was within this state of affairs that Chief Besele took over the administration of the area. However, his installation coincided with the inception of the Rolong Tribal Land Board in 1970 as constituted by the Tribal Land Act of 1968. This introduced a new system of Land administration where chiefs could no longer allocate or manage land. The Tribal Land Act transferred the administration of Land to the tribal Land Boards on which chiefs have become ex-officio members. The Land Board refers

directly to the Ministry of Local Government and Lands. It is authorized to enforce the land act, as well as to undertake overall land use planning. The next section, addresses the land tenure system under this new administrative system.

### Modern System of Tenure

The three fundamental categories of land in Barolong farms are freehold land (3%), state land (3.5%) and the tribal land (93.5%) (Map No.11 : Land Tenure). The system of tenure and administration that exist within these categories differs markedly. Freehold Land, is land that is held under interminable and exclusive ownership. State land on the other hand refers to any piece of land that is owned by the state for various purposes such as agricultural demonstration centres. In Barolong farms, two such pieces of land exist and these are the Bull camp and the Vet Camp.

Of central importance to this study is the Tribal Land which refers to communal ownership of rights. The allocation and management of the tribal land is done by the land board. Within this system of tenure, ownership of land is considered a birth right to all tribesmen and all citizens. However,



**LEGEND**

- INTERNATIONAL BOUNDARY
- SUB-DISTRICT
- RAILWAY LINE
- PRIMARY ROAD
- SECONDARY ROAD
- MINOR ROAD
- COMMUNAL LAND
- LEASEHOLD "
- STATE "
- FREEHOLD "
- 
- 



BY M. KAM

BAROLONG DEVELOPMENT STUDY : LAND TENURE

rights to use of this land are not exclusive nor perpetual. They terminate with a person's failure to utilise a piece of land for a period of not less than five years or in case of death. In practice, such land remains for use within the house-hold indefinitely. Though theoretically as per the provisions of the tribal land act, if a landowner dies and he has no immediate successors like a wife or minor children, such land reverts back to the tribe for fresh allocation. This means that a son or daughter who is a major has to go through the normal process of tendering an application through the Land Board if he so wishes to acquire a piece of land that formally belonged to his parents.

Within this system, of tenure grazing areas are used on communal basis and they cannot be fenced. However, ownership of boreholes within these areas gives exclusive water and grazing rights to the immediate surrounding areas covering a distance of 4 km. radius.

Communal land can be held under either customary or leasehold rights. Customary rights are granted to tribesmen or any other citizen who wishes to relinquish his tribal rights in the former tribal territory for residential purposes. However, in the case of

agricultural land, such rights do not have to be relinquished. This, therefore gives people the right to apply for land for any other purpose except for residency in other tribal areas. Leasehold rights on the other hand are for commercial purposes for either agricultural, commerce - industrial and any other form of business and for residential purposes in the case of non-citizens. In the agricultural sector, the most popular system of farming which is performed under leasehold is ranching under the tribal grazing land programme for which land can be leased for a period of 50 years. 3% of the Tribal Land in Barolong farms is under leasehold. Within these farms, both arable and livestock farming are practised.

The introduction of the Rolong tribal Land Board, has not to the present day managed to fill the management gap of environmental resources that was created by the traditional system. There is a growing problem of lack of control of grazing resources as a result of the absence of adequate range-management techniques. This has resulted in serious deterioration of the veld leading to the problem of soil erosion and encroachment of thorny bushes on degenerated areas. Furthermore, this system of tenure gives more advantage to the large scale farmers who are normally the borehole

owners; in that they can use both the grazing area around their boreholes and further extend to areas that are being used by the poorer members of the community. In the same manner ranch-owners normally move their livestock out of the ranches into communal areas so as to let the grass within their farms regenerate. This leads to communal grazing areas being seriously overgrazed due to this unfair practice. There is even no law that protects the rights of the community against large scale farmers on the use of the communal areas. It is therefore within this system of tenure that productive land use activities are being undertaken in Barolong farms area. In the following sections, we therefore address ourselves to land use activities in Barolong farms.

### The Human Settlement

#### Pattern of Settlement

The settlement pattern of the Barolong is traditionally of dispersed nature, with each homestead either surrounded by its fields or with fields not far away. The average distance from the fields is 2 km. Livestock grazing areas are also not far from homesteads. Villages are constituted by a group of homesteads that are in most cases separated by distances of upto 1 km. Concentrated or compact

villages similar to the traditional villages characteristic of other tribal areas within the country are very rare and there exist small scattered settlements of populations ranging between 500-1000 people (See Map No. 12).

Villages are a recent phenomenon introduced by the land management bodies. The 1977 plan for Barolong area recommended the concentration of population in the five main ward villages of Pitsane, Goodhope, Popatlo, Hebron and Mokatako for cheap provision of services. This attempt to concentrate people in villages has been met with limited success due to the fact that many Barolong farmers resist such movement for fear of loss of productivity (Comaroff, 1977:14)<sup>(4)</sup> The Barolong, tend to prefer to walk longer distances to social services than to their fields.

This pattern of settlement though favoured for its ability to promote increased agricultural production, requires very high levels of management by both farmers and the Government. First, the proximity of the villages to grazing areas lead to serious damage of property such as fences by livestock. Secondly the presence of livestock watering boreholes in major villages such as Goodhope and Metlojane result in large heads of livestock invading the areas most especially during dry seasons. Because of this,





**LEGEND**

- INTERNATIONAL BOUNDARY
- SUB-DISTRICT
- RAILWAY LINE
- PRIMARY ROAD
- SECONDARY "
- MINOR
- HUMAN SETTLEMENT
- ARABLE LANDS
- STATE LAND
- FREEHOLD //
- GRAZING AREAS & LAND
- FOR FRESH ALLOCATION

BAROLONG DEVELOPMENT STUDY : LAND USE MAP

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 M.A. PLANNING YEAR

MAP NO12

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the areas within and around these villages are over-grazed and suffer a serious problem of erosion - often covered with heavy clouds of dust. There have been efforts by the land board and the agricultural resources board to encourage the removal of livestock from these major villages. This has however been met with a lot of resistance for a number of reasons. First, is the question of availability of grazing areas and water and secondly, the problem of livestock management. If herds of cattle are moved from the villages where can they be taken and who can look after them. There is no more space for cattle posts within Barolong farms.

Another problem that is inherent in this system, is that of crop damage by livestock. Although I was unable to establish the amount of grain that farmers loose due to livestock distruction, the magnitude of this problem is shown by the ever increasing number of disputes between farmers. Records of the tribal administration offices show that a large number of people get engaged into disputes over crop damage and often large amount of money is demanded for payment for the distruction. What is evident about the system therefore, is that it does not only result in serious degradation of the environment but also in the breakdown of social

coherence leading to very low levels of community commitment and cooperation.

Other problems related to this system of settlement include people's distance to social services and infrastructural facilities. Although in theory people normally say that they do not mind travelling longer distances to facilities, in practice this is not the case. This problem is mainly felt with regard to water provision for domestic purposes and even for livestock watering. In some cases, people have to travel distances of 3 - 5 kilometres to the nearest water source. It is this very group of people who later on turn to the land board to apply for borehole allocations for domestic purpose. This becomes very tricky for the land board since it is not clear within the tribal land act as to what actually constitute domestic usage of water. Most especially in rural areas where the farmer may use the water not only for household needs but to water his livestock. Of course the water act does allow watering of domestic animals not exceeding 40 herd of cattle. A further problem arises with regard to the nature of relationships in rural areas where if one owns a facility, he cannot bar his neighbour from using it. The result is that a borehole that is meant to water only 40 herd of cattle may end up watering more than two hundred herd of

cattle as is the case with many of the boreholes in the area. This problem of water provision and borehole allocations is treated in detail in the section on water.

### Settlement Distribution and Hierachy

The sub-district has a high population density of 14.2 persons per km<sup>2</sup>. This density corresponds with the country's estimates for the most densely populated areas on the eastern side. This density, must be viewed relative to the environmental conditions of the area. This density further implies that the average amount of land per household is 4 km<sup>2</sup> (41 hectares)<sup>(5)</sup>. 1981 population census reveals the average household size as 5.8 persons. The study found that sizes of households are much bigger for Goodhope and Pitsane with an average of 8.8 persons. This can be attributed to the fact that 56% of the households interviewed on the average had 2 grand children born from unmarried mothers and forming part of the households.

The distribution of settlements is not even. Most larger settlements are found along the main road passing through Pitsane to South Africa. And also along the road leading to Phitshane Molopo

and the Mathethe Ramatlabama road. The most sparsely populated ward is Mokatako. This is due to the fact that large leasehold farms are located there and thus preventing further settlement of people. Another feature of the settlement distribution, is that as per the population census of 1981, 88% of the Barolong were living in villages whilst 12% were staying in related areas of Lands and Cattle posts.

Using the 1981 census, a 4 tier settlement hierarchy can be reduced for the area. At the upper level, are villages of 1000+ people. These are the villages of Pitsane and Ramatlabama. The second tier comprise of villages with 500 - 999 people. The third tier is that of small villages of 0 - 499 people whilst the last category is that of lands and cattleposts. Worthy of consideration are the villages of Pitsane and Goodhope. Although Goodhope has a population of less than 100 people, it is an important centre within the sub-district as its headquarters. Within the national context, Goodhope and Pitsane form the tertiary level of the settlement hierarchy. They form part of the Southern district's communal first development areas - and they are functional units that are presently being developed as productive areas. Within this strategy, Pitsane

is being developed as both an industrial and commercial centre for the area whilst Goodhope is the administrative centre.

Pitsane is the main marketing centre for the agricultural produce (grain). Pitsane forms a link with the other parts of the country. It links the sub-district to the railway system and the major road joining South Africa to Botswana. It hosts offices for the customs and exercise personnel, Botswana Marketing Board, a post office and the sub-district's only secondary school is located in this village. Goodhope on the other-hand, hosts the tribal headquarters, Tribal Land Board offices, a health centre, a post office, Council offices, District agricultural offices, district administration offices, etc. It has the highest population of Government employees.

It is at this point necessary to mention that although Mokatako ward is the most sparsely populated area in the sub-district, it experiences the highest rates of overgrazing. This is due to its expansive grazing areas that attract large numbers of livestock from other areas within the district and from the Ngwaketse side. This, coupled with the area's soils, low rainfall compared to the rest of the sub-

district and therefore very low potential carrying capacity of 9 - 12 hectares, has resulted in the areas environment being overly degenerated when compared to the rest of the sub-district.

### Housing

Housing in the Barolong farms area can be classified under two main categories the traditional and modern types of housing. The traditional types of houses, are built with either stones or mud and thatched with grass. The construction of modern types of houses is done with bricks, concrete blocks and roofed with either iron sheets, asbestos, tiles or grass. Because of the dry climatic conditions of the area, structures can stay for long periods without renovation and thus reducing the general cost of housing.

### Infrastructural and Community Facilities

#### Roads, Electricity and Telephones

The Barolong farms area is well served with roads. An International trunk road passes through Pitsane joining South Africa to Botswana on the Southern part of the country. There are two secondary roads that traverse the area from the north to the south and east to west. The former is the Pitsane-

Mabule Road while the latter is the Ramatlabama Mmathethe road. These roads are of grave standards. However due to low levels of maintenance; some parts of these roads especially Pitsane-Mabule road become impassable during rainy seasons, and also become agents of soil erosion in that they become small streams due to their construction standards which have not provided for drainage. This normally results in fields that boarder these roads being either washed off or flooded resulting in serious crop damage. This problem is experienced by people who own fields in the Malokakganyane area, Bethel, Goodhope down to Sedibeng farms.

Except for Ramatlabama boarder post and Pitsane, there are no electricity connections in the sub-district. Pitsane is served by generators. The area is however well served with telephones although they are of party line standards. Pitsane and Ramatlabama are exceptions to this in that they are connected to the direct line - automatic system.

#### Educational Facilities

The area is well served with educational facilities. There are 16 (sixteen) primary schools with each located in the major villages and serving the surrounding villages. On the average distance travelled by children to schools is less than five



kilometres. There is only one secondary school serving the area. This is located in Pitsané. It is a Missionary mixed school. When viewed relative to the population size of the area this one secondary school is very adequate.

#### Health Facilities

There is one health centre which is located at Goodhope. This health centre, serves as a referral facility for all the health services in the sub-district. Alongside this health centre, are two clinics one at Ramatlabama and one at Hebron. These clinics are run by nursing sisters with the support of general nurses, nurse aids and community health workers. All villages within the sub-district have health posts which are run by community health workers. These are visited fortnightly by a mobil clinic team from the health centre and the clinics.

#### Marketing Facilities

There is only one officially recognised outlet for grain. This is the Agricultural Marketing Board whose offices and silos are at Pitsane.

## Arable Agriculture

Barolong farms area, is characterised by relative lack of separation of the village, lands and cattle posts (Ntseane, 1983 :p.1)<sup>(6)</sup>. This pattern is apparent in the proximity of lands to the village, with the mean distance to the lands being 2.0 km. for the whole area. Arable agriculture in Barolong area is more emphasised than anywhere in the whole country (Heisey, 1980 )<sup>(7)</sup>. Comaroff (1977)<sup>(8)</sup> described arable agriculture in Barolong farms as being over-whelmingly successful. He attributed this success to the following factors : The relatively short distance to fields, the farmers capability to utilise government subsidies and their relative lack of fear of risk, hard labour and the use of mechanized inputs.

As already discussed under the section on land tenure, arable agriculture in Barolong farms is practised under two types of tenure viz-communal and leasehold. Farmers engage in dryland farming relying heavily on climatic conditions for the success in production. The success in arable agriculture not only requires farmers' high level of conscience but also the use of highly mechanised methods of farming. It is also highly dependent on the

environmental conditions of an area, such as climate, soils and vegetation cover for the protection of fields from wind etc. destruction, play a very big role in the productivity of an area. In this section, arable agriculture in Barolong farms is going to be discussed in relation to its environmental conditions.

### Agroclimate

As indicated in Chapter 2 Barolong farms is characterised by low, variable and erratic rainfall with very high temperature and strong winds all of which play a major role in arable agricultural production in semi-arid areas. The unreliable nature of rainfall together with high rates of evapo-transpiration are the greatest constraints to dry land farming which is the major method of farming in Barolong farms. Because of the high rate of evapo-transpiration, farmers have to plant only those crops that are heat resistant and cannot wither easily. Sorghum and maize, are therefore predominant types of crops grown in Barolong farms. Sorghum has been found to be more resistant than maize such that during years with below mean rainfall, farmers concentrate mainly on sorghum production. Data from the field shows that in the years 1986/87, 56 percent of the farmers had planted sorghum only while 27 percent had grown both sorghum and maize, 6 percent had planted

sorghum and beans and lastly 5 percent had planted sunflower with sorghum. What can be realised from the above information is that farmers involvement in arable agriculture although in most cases, is geared at the market, it is however dependent largely on climatic conditions. Farmers select those crops that have high resistance to dry conditions.

Rainfall variability in both time and space (spatial) also plays a major role in the selection of seeds and types of crops. Variability between sub-seasons is most critical in that it affects plant growth. As a result farmers have to select those types of seeds that have the shortest growing period and can stand sudden dry spell whilst at the same time being resistant to occasional night frost. Because of the variability of rainfall, farmers have to be prepared to plant at any time during the rainy season. This implies that farmers distance to the fields is very critical most especially due to the high rate of evaporation which result in quick moisture loss.

#### Land Capability and Arable Production

According to the land capability map for Barolong farms (1980) three agricultural zones can be

identified in the area. This categorization was based on the types of soils that are found in different areas. The following categories were then identified - cultivable soils, marginally cultivable and grazing non cultivable soils. This is very important in the farmers choice of fields. Thus 60% of the households interviewed indicated that they owned pieces of lands in different parts of the farms because of the difference in soil types which have different productive levels due to their structure and organic matter content. As such, farmers indicated that consolidation of fields such that each farmer would own a piece of field in one area, would reduce their production and therefore expose them to risks. Ownership of lands at different areas, also guards against variable rains which normally result in some areas experiencing high rainfall within a season while some areas may receive none at all.

49.7% of the area is used for arable farming. This extend even on the marginally uncultivable soils resulting in the extended exposure of such areas to high rates of soil erosion and nutrient loss. Presently, there is an increasing pressure to expand arable activities into grazing areas due to the attractiveness of arable agriculture in this area.

### Arable Production and Water

Presently the scale of engagement in irrigated farming is still very low in Barolong farms. Only 6% of the farmers were found to be engaged in irrigated farming. The average size of land used for this type of farming was a quarter of a hectare. Farmers were mainly engaged in vegetable and fruit tree farming. Vegetable growing was the most popular geared at serving the local areas and Lobatse.

Although this method of farming is still at a low level of practice, it however warrants special attention due to its significance in water distribution and demand. Its water demands are very high for instance at the national level, irrigation amounts to 35% of the total water use although it is practised in very few areas (Arntzen, 1986)<sup>(20)</sup>. Secondly, because of the reliance on ground water sources, this practice lays even greater demands on the already over-stretched borehole allocation space. Barolong farms is already congested with boreholes, therefore, the introduction of this new system of farming brings a problem since it is normally very hard to tell whether people will use boreholes purely for the use applied for. Experience has shown that people are very unreliable. For instance in the case of domestic boreholes, it has proved very difficult to stop people from watering

large herds of cattle. As for the effects of irrigation farming on the soils of this area, it is still too early to know how they react to exposure to high levels of saturation.

Household Participation in arable agriculture.

Peoples' involvement in arable agriculture is dependant on a number of factors such as climate, availability of land, drought power, inputs and implements. The survey revealed that 64 percent of the respondents were engaged in arable agriculture whilst 36 percent were not engaged in any form of farming at all. 42 percent of those engaged in arable agriculture were mainly subsistence farmers. They however, stated that in years of plenty, they normally produce excess grain which they then exchange for anything ranging from money to livestock. 22 percent engage in both commercial and subsistence farming. This category stated explicitly that although they have to satisfy subsistence needs, their main target is the market. Thus, the improvement of arable farming is of top priority for this group as the object of investment. It is within the improvement of arable farming that they perceive the development of the sub-district.

The success and involvement of people in arable agriculture is however dependent on the availability of land. In this study, it was revealed that 62 percent of the respondents owned fields ranging from 3 hectares to over 1000 hectares. And 38 percent had no lands at all. If they wanted to plough, they relied on sharecropping. Homestead's distance to lands ranged from about less than 100 metres to 25 km, and none of the respondents owned lands outside Barolong farms. When asked why they were not owning pieces of land outside Barolong farms, they gave the following reasons:-

- too far and difficult to manage.
- have enough land in Barolong farms which they are not even able to manage or plough effectively due to lack of capital for buying inputs.
- They have never had interest for applying for land outside their areas.

There was however a small percentage ( 2 %) which indicated that although they had continuously filed applications for land allocation in areas outside Barolong farms, especially Ngwaketse area, they have been refused allocation.



Since the people's arable farming involvement revolves around production for both subsistence and commercial engagement, their activities are centred around the production of staple foods and market oriented crops. The crops that are grown are sorghum, maize, beans, sunflower, cowpeas and melons. However, the engagement in the production of any one of these crops is dependent entirely on the climatic conditions. In years of drought, people's engagement in the production of maize, sunflower beans and others whose resistance is very low, declines. Sorghum is more resistant to drought conditions as such, it is more efficient during such periods. The amount of hectareage put under cultivation for each of the crops planted in 1986/87 planting and harvesting seasons, shows that although maize occupied larger space, its yield was much lower than that of sorghum. More people were engaged in sorghum production than in maize. The rest had planted beans and sunflower. What can be said about the reaction of the farmers is that they act more according to changes in climatic conditions than in market prices and demands. For though crops like sunflower and beans fetch much higher incomes from the market, farmers find it much difficult to engage in their production due to their sensitivity to dry conditions. Table No. 7 below shows hectareage, seeds and yields of each crop grown in 1986/87.

Table: 7            Hectareage, Seeds and Yields of  
                         crops grown

Crop	Hectarage	Seeds(Kg.)	Yield(Kg.)	Kg.Sold
Sorghum	718	1705	150900	96675
Maize	1032	1375	33375	18600
Beans	67	235	1500	500
Sunflower	5	150	3000	2625

Source:

The respondents indicated that from 1979 - 1987, they had experienced a decline in crop production. This was due to lack of rainfall and long spans of hot dry conditions resulting in the scotching of crops. They stated declines in quantities ranging from around 4 bags - 900 bages of grain depending on the amount of land cultivated, type of inputs and methods of cultivation used. The years 1981 to 1986/87, were the most critical. At any given time during these years around 60% of the farmers could not harvest any crop from some of their fields most especially with regard to maize, beans and sunflower. Beans and sunflower cultivation almost got faced out completely, and yet, by 1979, it was number three income generator after sorghum and maize. This is due to the fact that crops like sunflower, maize and beans are very sensitive to dry conditions.

Given erratic rainfall patterns, timely ploughing appears crucial for good results. In order to be able to take advantage of rains, farmers must have adequate drought-power. The Barolong have thus adopted highly mechanised methods of farming. For instance in 1986/87, 69 percent of the respondents indicated that they used tractors for ploughing while 31 percent indicated that they used drought power. Of the 31 percent, 5 percent used ox-drawn power, while 26 percent used donkey drawn power. 57 percent of those who used tractors indicated that such were hired for them by the government under the drought relief package and accelerated rain-fed arable production which were meant to encourage farmers to engage in arable farming even though it was proving to be a futile exercise due to drought conditions. This was meant to help reduce the problem of unemployment and poverty. 43 percent of the respondents used privately owned implements. Farmers who hired drought power indicated that their fields were often ploughed very late after rains; tractor or cattle owners started with their own fields and as such were always not able to take advantage of the earliest rains as such their produce was always very low or otherwise, they harvested nothing from their fields.

Although production had drastically decreased due to severe drought conditions, farmers still felt that there was still need to increase and encourage full participation of the people in the activity. For without involvement in arable farming, they did not see any way in which the area could achieve higher standards of economic development as well as social integrity.

#### Constraints to arable production

The prevailing climatic conditions of recurring droughts and the conditions of the environment favour arable farmers who can take risks at low costs and such are the large scale farmers and to some extent middle range farmers. This results in very low production of subsistence food-stuff since subsistence farmers can hardly afford to take the risk or if they do, they normally plough very late due to their reliance in most cases on hired implements and drought power.

Although the improvement of farming practices through the use of mechanised methods of farming and the use of high yield inputs such as high breed seeds and fertilizers has been realised to be helpful in the increase of output and productivity per hectare, it has however been realised that extra returns enjoyed by the farmers are relatively low

and yet the risks of crop loss are very high. 46% of the farmers indicated that they used fertilizers and now planted their fields which is an indication of the use of improved practices on individual fields. However, no farmer indicated that he engaged in soil conservation measures as a means towards the fertility of his fields. There was however an increasing number of people who were clearing more land for arable farming although they could hardly or could barely manage to effectively use the already cleared fields. This was due to the introduction of the destumping package under accelerated arable production programme. As a result more and more fields were being cleared of vegetation cover and yet they were not being put to any effective use.

There is also a problem of infestation with weeds and soil exhaustion which has led to a considerable number of fields being abandoned. A field trip around both the villages of Goodhope and Pitsane as well as travel along Pitsane-Mabule road, revealed that quite a large number of fields were infested with creeping grass, witchweeds, etc. This is an indication of soil exhaustion which result in reduced productivity of the land. The existence of these weeds on fields hampers ploughing and in most cases result in total abandonment of fields. Three abandoned fields were

identified along the Goodhope-Pitsane road and discussions with both agricultural demonstrators and the local people, revealed that efforts to clear these fields of the weeds had totally failed and that once a field is infested with weeds like the witchweeds, it becomes impossible to clear them; instead farmers are advised to look for new fields somewhere else.

The relationship of arable production with other land uses

Because of the growing need to expand on arable agricultural practices, there is an apparent problem of arable encroachment into grazing areas. For instance Land Board records show that by 1982 hardly any land was available for fresh allocation for arable agriculture and yet more and more fields were being allocated each year. This practice has led into a lot of complaints by people over the encroachment of arable farming into their grazing areas. Mention can be made of the Tsogare grazing group's appeal to the Minister of Local Government and Lands against the Land Board's decision to institute fresh allocations in their grazing area. The second appeal is that of Tshipane grazing group against the land board also over fresh allocations within their grazing area. Appendix No. 1 and No.4 give facts of these disputes.

Secondly because of the proximity of arable lands to grazing areas, farmers complaint of crop damage by livestock. This is aggravated by the fact that e very few farmers have so far managed to fence their fields due to lack of capital and as such unable to utilise arable land development programmes package on fencing because they cannot afford to raise the percentage of money that is required out of them. Only 16 percent of the farmers had fenced their fields.

Thirdly, it is a normal practice amongst farmers to use crop residues as fodder for livestock. Although this practice helps reduce the pressure on grazing areas for a short period and thus give them a chance to regenerate if possible, it does however result in the loosening of the soil structure on fields and therefore the exposure of soil to wind and runoff erosion. This further deprives the soil of nutrients that can be gained through the process of mulching which has an extended advantage of protecting fields against soil erosion.

Lastly, extensification of arable farming result in extensive clearing of the natural vegetation, as was the result in the years 1985/86, 1986/87 when many people cleared fields under the accelerated

rained agricultural programme under which the government was giving people P50-00 (5001/= Kshs.) for destumping one hectare of arable lands. This resulted in a large number of people clearing vast expanses of land although they could not even afford to plough them. This has resulted in the extended exposure of large tracks -of land to soil erosion. On the other hand wood clearing for arable production provides households with woodfuel although on a temporary basis.

#### Livestock Farming

The Barolong are arable agriculturalists whose engagement in pastoral farming is low relative to other parts of the country. Livestock is kept as an insurance against risks in arable agriculture for economic and social purposes. This livestock is grazed on communal grazing areas which as per the 1977 land use plan for Barolong farms constituted 33 percent of the total communal land. Although livestock farming is practised on a relatively lower scale than arable farming, it does however warrant attention due to its extensive nature and thus its demand for expansive amounts of land. It would however be misleading to think that since Barolong give relatively lower priority to livestock farming, there



keep small livestock. On the contrary, they keep large herds of livestock mainly in relation to the amount of land that is available to them.'

Presently, average livestock ownership in Barolong farms is 6.8 heads of cattle to every household and 5 smallstock. Livestock population ratios reveals an average ownership of 1.1 cattle to every person. This is low digure when compared to the country's average cattle ownership of 2.7 cattle to every person and 1 small stock. The actual distribution of this livestock is however skewed with only 10 percent of the population owning larger herds of over 100 cattle and 40 percent owning no livestock at all. In the following section, livestock distribution is going to be examined in relation to range resources of the area. In Chapter 2, it was revealed that Barolong farms falls under the sweet veld type of vegetation which results in its range being of a better quality when compared to most parts of the country (under natural conditions). However extensive modification of the physical environment of the area has taken place due to people's involvement in arable agriculture which occupies 49,7 percent of all land under communal use.

Stocking rates and Range Carrying Capacity

Barolong farms' rangeland resources can be classified into two types of the tree savanna. These are the eastern Kalahari sand veld which stretches from Mokatako in the south western part of the sub-district to Tswanyaneng on the north-western part and the southern hardveld. This corresponds to the areas potential carrying capacity which is 5 - 8 hectares/LSU in the southern hardveld and 9 - 12 hectares/LSU in the eastern Kalahari sandveld. It is important at this juncture to point out that an areas carrying capacity is dependent on its vegetation type and rainfall and grazing capacity varies considerably with grazing classes and amounts of rainfall. The grazing capacity becomes considerably reduced during periods of low rainfall. Thus whereas the carrying capacity of the larger part of Barolong farms is considerably high, its grazing capacity gets changes according to different seasons of the year and the amount of livestock that is being grazed at it.

Livestock statistics for Barolong farms show that in 1980 the area had very high stocking rates of 4.2/LSU in 1980. This rate dropped by almost 10 percent during the subsequent drought years such that by 1984 it had reached 6.6 h/LSU. The actual

carrying capacity had also dropped due to dry conditions resulting from the long spell of drought. By 1986, the stocking rates had gone even lower to 8.0 ha/LSU. This drop in livestock numbers has been as a result of drought which aggravated the problem of the already overgrazed areas and therefore lack of fodder for livestock. Large numbers of livestock died such that a considerable number of people lost all their livestock herds. The most affected people were the small stock owners who could not even afford to buy supplementary feeds. What is evident about the range condition of this area, is that it is very sensitive to dry conditions and since droughts are very regular, they greatly influence its carrying capacity by reducing it.

#### Household participation in the Livestock Sector

Livestock keeping in the Barolong farms area is seen mainly as an instrument of social power and insurance of saving against disasters that may take place in arable agriculture. There is however a small percentage of the people which regards livestock farming as a source of economic power. This represents 11 percent of the respondents who owned livestock herds ranging from 40 - 200 and above. It is the same group which also engage in large scale arable farming.

54 percent of the respondents owned livestock while 46 percent owned non. These figures compare well with the country's figures of 30 - 45% non-ownership of livestock by rural populations. The types of livestock owned are cattle, goats, sheep and donkeys. Donkeys are mainly used as drought power by the members of the society and they have been found to be more resistant to drought conditions. The table below shows the types and number of livestock owned by households and the average household livestock ownership.

Table: 8 Average Household Livestock Ownership

Type	Number	Average
Cattle	561	11.2
Goats	383	7.7
Sheep	337	6.7
Donkeys	25	0.5

Livestock is grazed in communal areas around the villages. 11 percent of the respondents indicated that they owned cattle posts in Ngwaketse tribal area in Matswatswe and Tsutsu. One cattle post was within Barolong farms at Tshipane-owned by the Chief, 48 percent indicated that the reason why they did not own cattle posts is because there is shortage of

land in Barolong area. 4 percent said that it is within tradition not to own cattle posts. While 38 percent did not find it necessary to own cattle posts since the number of livestock that they had was so small that ownership of cattle posts was not warranted.









### Range Utilization and Water

Water - especially ground water plays a major role in livestock development. Water development for livestock farming cannot be isolated from range utilization most especially in cattle farming since cattle consume large quantities of water as well as grass. According to Arntzen (1985)<sup>(10)</sup> ; cattle drink on the average 50 litres of water per day and consume 12 kg. dry weight of forage per livestock unit weighing between 450 - 500 kg. (N.D.P.6)<sup>(11)</sup>.

Presently, there are 63 livestock watering boreholes in the sub-district (Map No. 13). 10 of these boreholes are owned by syndicates, 2 by the southern district council and 5 by the Government. All government boreholes are located in the state land areas. The distribution of boreholes plays an important part with regard to the utilization of the grass. Presently, the amount of distance that is allowed between livestock watering boreholes is 8km.



LEGEND

-  INTERNATIONAL BOUNDARY
-  DISTRICT BOUNDARY
-  RAILWAY
-  TARRED ROAD
-  GRAVEL ROAD
-  TRACK
-  PAN
-  LIVESTOCK BOREHOLE

BY: M.KABI

BAROLONG DEVELOPMENT STUDY : LIVESTOCK BOREHOLE

DEPARTMENT OF URBAN AND  
 REGIONAL PLANNING  
 UNIVERSITY OF NAIROBI  
 M.A. PLANNING YEAR 2  
 1987/88

MAP  
 No. 13

with an area of 5030 hectares for every 400 - 500 livestock units. When the ideal area needed around each borehole is compared with the amount of grazing land that is presently available in Barolong farms as per 1977 Tribal Grazing land programme zoning exercise of 33,000 hectares, it is found that ideally the area must be having only 7 livestock watering boreholes and 2,800 - 3,500 livestock units. The present situation is that there are 16,462 livestock units being in excess of the potential grazing capacity by 12,962 livestock units and 56 more boreholes than the ideal number that has to be in the area.

If however, the number of boreholes is calculated against the total area of Barolong farms, taking into account the fact that livestock can alternate between grazing areas and lands areas depending on the seasons of the year and also that livestock graze in between arable fields, it is found that the area would adequately be served by 22 boreholes.

Although the area is well served with livestock watering points, it would however be misleading to say that peoples' needs are well served with regard to the watering of their livestock. In actual fact, the pattern of water use is related to the socio-economic status of the people such that

73% of the livestock watering points are privately owned. While 16% is owned by syndicates with less than 10 members and the rest by Government. What this means is that members of the lower strata suffer both in terms of grazing and water since the allocation of borehole to an individual automatically gives him exclusive user rights to the area immediately around the borehole. This is an area of 5030 hectares. It is therefore, members of this lower group who when they get to a slightly upper level and acquire capital apply for borehole rights which of course due to the present situation, they are not allocated. What happens in such situations, is that once rejected, people re-apply under different use - such as horticultural purposes or domestic (purely) purposes and once granted such rights, they simply water their livestock as well as those of relatives and friends in most cases under payment. Presently the control of the use of boreholes and the application of the stock limitations regulations are not being done. People are aware of the dangers caused by t both overstocking and drilling of too many boreholes on the quality of the range sand and yet nobody seems to be bothered by such occurances. If anything, nature is left to take care of itself. Such that instead of people reducing their livestock numbers by selling them, they keep them until their numbers get reduced or stabilised by natural disasters such as drought and diseases.



The relationship of livestock farming with other sectors

A positive and negative relationship exist between livestock farming and other social activities. First, a close relationship exists between arable agriculture and livestock keeping. The importance of livestock in communal areas, is indicated by its role as a source of food in the form of milk and meat and also as drought power and a source of manure for arable agriculture. It is also an attractive rural income generator due to its ability to adapt easily to the environmental conditions of the area. In years of drought, it serves as an insurance against risk in arable farming.

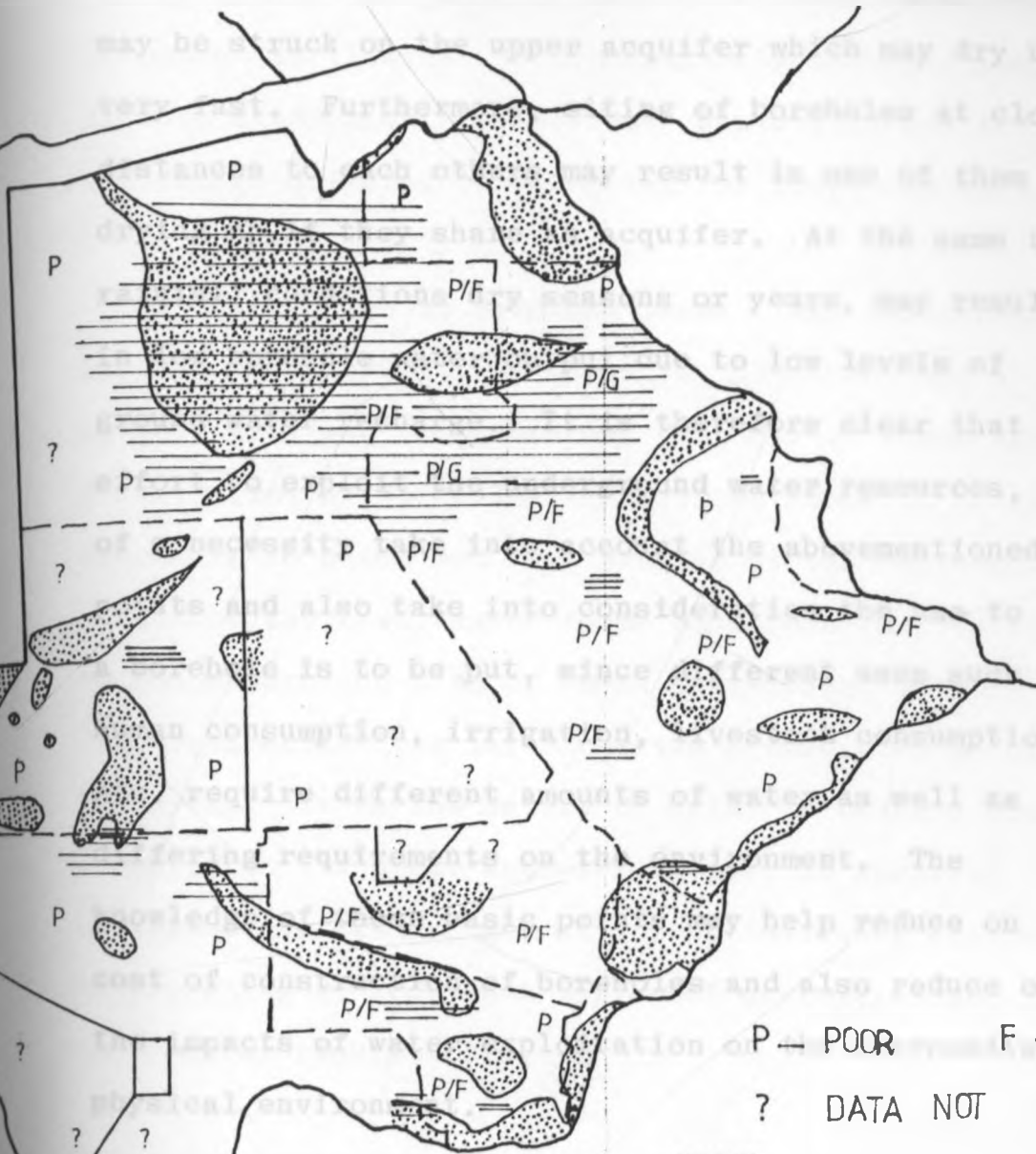
On the negative side, it aggravates the problem of land degradation through its ability to promote bush encroachment, soil erosion and desertification. Secondly due to the settlement pattern of the area, livestock has become a major threat to arable agricultural development since it constantly destroys crops. Not only is it a problem to arable farming but also to the human settlements. Large heads of cattle roam into villages and destroy properties especially fences. Despite its negative attributes, livestock still remains very useful and profitable in communal areas.



### Water Utilization

In order to put water related issues in perspective, the following issues have to be borne in mind : rainfall, the availability of surface and ground water. As has been discussed in Chapter 2, rainfall in the area is highly erratic and variable in both space and time. The annual rainfall of the area averages between 400 - 550 mm. during good years to below 250 mm in drought years. The availability and non-availability of rainfall, directly affects ground water recharge and surface water availability. Thus, surface water is available only during wet seasons. It collects in pans and dams. However, due to high temperatures, the water collected in these structures evaporates very quickly resulting in total reliance on ground water sources for domestic agricultural and other uses.

Map No. 14 on ground water resources, shows that the area's ground water potentials can be classified under three main categories of: poor, poor to fair and fair. This is as a result of the underlying rock of the sneisses of the basement complex which generally forms a better water bearing layer. However, chances of striking a good water aquifer, depends on the use of proper sitting techniques. In some areas, water can be struck at greater depth ranging from 40 - 250

# GROUNDWATER DEVELOPMENT PROSPECTS



P — POOR      F — FAIR  
 ? DATA NOT AVAILABLE  
 AREA GOOD OR FAIR  
 SALINE

0 100 200 KM

SOURCE, ADAPTED FROM ARNTZEN 1986

BAROLONG DEVELOPMENT STUDY

DEPARTMENT OF U.R.I.  
 AND REGIONAL PL.  
 U.O.N.  
 M.A. PLANNING YE  
 1987/88

metres below ground level. There are at the same time areas where two aquifers exist. In this case, water may be struck on the upper aquifer which may dry up very fast. Furthermore, siting of boreholes at close distances to each others may result in one of them drying up if they share an aquifer. At the same time, rainfall conditions dry seasons or years, may result in low borehole water output due to low levels of ground water recharge. It is therefore clear that any effort to exploit the underground water resources, must of e necessity take into account the abovementioned points and also take into consideration the use to which a borehole is to be put, since different uses such as human consumption, irrigation, livestock consumption, etc. require different amounts of water as well as differing requirements on the environment. The knowledge of these basic points may help reduce on the cost of construction of boreholes and also reduce on the impacts of water exploitation on the surrounding physical environment.

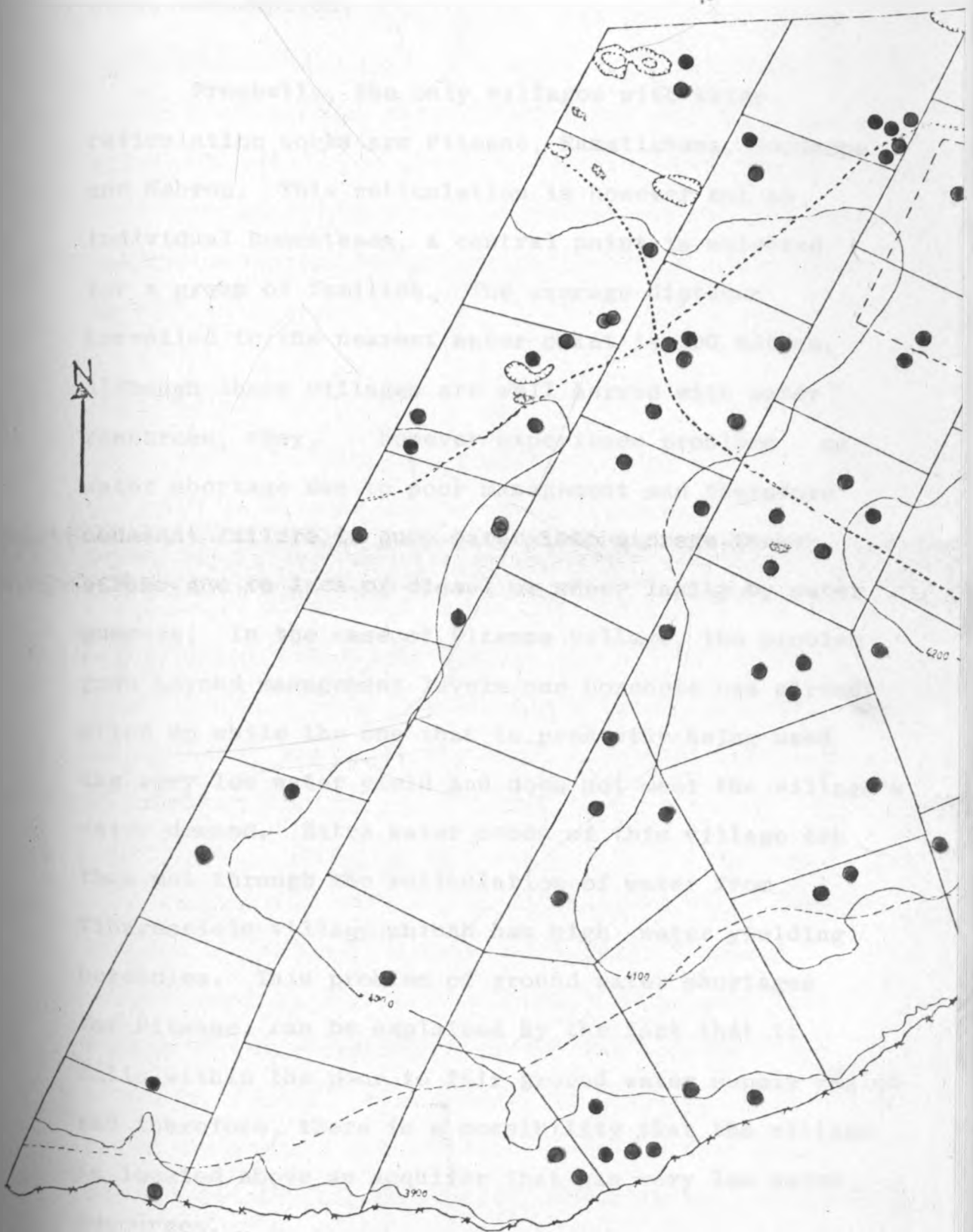
In general it is clear that water resources in Barolong farms cannot be considered large or easy to exploit. The exploitation of ground water resources is expensive and hence only the rich members of the society can afford to drill some boreholes on an

individual basis. It thus becomes an imperative on the government to provide water for human consumption in human settlements or alternatively organise people to form syndicates (collectives) especially for the collective drilling of boreholes for livestock watering.

Water uses in Barolong farms can be aggregated broadly into agriculture (both for livestock and arable agriculture) and for human use (Map No. 15 shows the distribution of boreholes in Barolong farms). It is necessary to point out that because of the semi-arid nature of the area, water forms a serious constraint to the nature and size of human activities. Hence different activities lay excessive pressure on water resources. It is the nature of water as being a central resource to all other activities, that it requires efficiency in its management in the following sections, we are going to look into different activities and their water requirements.

#### Water for human consumption

Village water supplies are operated and maintained at the Council level purely for human consumption. Demands for village water use are increasing due to increase in human populations and human activities. There is also an apparent increase of bigger villages of 500 - 1000+ people which lay



more demands on the government to provide water for human consumption.

Presently, the only villages with water reticulation works are Pitsane, Ramatlabama, Goodhope and Hebron. This reticulation is however not to individual homesteads, a central point is selected for a group of families. The average distance travelled to the nearest water point is 500 metres. Although these villages are well served with water resources, they, however experience problems of water shortage due to poor management and therefore constant failure to pump water into storage tanks either due to lack of diesel or sheer laxity by water pumpers. In the case of Pitsane village, the problem goes beyond management levels one borehole has already dried up while the one that is presently being used has very low water yield and does not meet the village's water demand. Extra water needs of this village are thus met through the reticulation of water from Tlhareselele village which has high water yielding boreholes. This problem of ground water shortages for Pitsane, can be explained by the fact that it falls within the poor to fair ground water supply region and therefore, there is a possibility that the village is located above an aquifer that has very low water resources.

Besides the Council boreholes, there are also some privately owned boreholes that cater for human or domestic use. There are eight such boreholes distributed through the sub-district, and these are privately owned. In total, there are 23 boreholes that are used for domestic purposes only in this case human consumption to the exclusion of all other uses of agriculture etc.

### Agriculture

Almost all the water delivery for agricultural purposes is catered for by the private sector. This water use is divided between two major uses and three major classes of users. The main uses are stock watering and small scale irrigation and the major users are the owners of leasehold farms, private owners of boreholes and syndicate owned boreholes (collective) on communal land.

Livestock watering is the largest water user and the requirements of livestock water increase proportional to livestock numbers. Because of its extensive nature livestock production require large expanses of land. As a result, in livestock production, water and grazing are closely related in that before a borehole site can be granted, investigation into the availability of land for pasture must be done. Thus,



the present 8 km. distance rule for boreholes is mainly based on grazing constraints. Presently, there are 63 livestock watering boreholes, 10 of these are operated on syndicate basis, 2 by the southern district council five by the Ministry of Agriculture, and 46 are owned by private individuals. This, means that water rights for livestock farming are largely in the hands of private owners.

It is necessary at this point, to mention that when using the eight kilometre rule, no more allocation space for livestock boreholes exist in Barolong farms. Map No. 15 shows the distribution of boreholes in Barolong area. The relaxation of the rule to 6 kilometres still amounts to the same problem. Further relaxation to around 4 kilometres, etc. result in a serious shortage of grazing. Although the sub-district is almost filled to capacity with livestock boreholes, there is however shortage of livestock water supply at the most localised levels. This is due to the fact that most boreholes are owned by individuals and therefore resulting in their use being limited in the hands of very few people. It is as a result of this that there is increasing pressure by people to drill private boreholes and yet there is no more space for livestock boreholes. The extent to which shortage of land for livestock boreholes

exist has to be viewed in relation to the extensive nature of arable agricultural development which is increasingly encroaching into grazing areas and thus-reducing the amount of land for pastoral farming. At the same time, this increase in livestock and arable farming competition has resulted in serious over-grazing which is almost generalised throughout the sub-district.

Water demands for arable agriculture are still at a very low scale. However, irrigation demands on water use are very high and as such warrant special attention even at this earliest stage. Presently the main problem with the allocation of boreholes for irrigation purposes, is the extent to which people have become tricky since they are now aware that they cannot be allocated boreholes for livestock or mixed uses. As such applications for horticultural boreholes have now increased. The problem that is likely to arise out of this situation is that people once allocated such boreholes, they will use them for all other purposes including livestock watering even for friends. This is what is presently happening with domestic boreholes. Once such a situation has taken place, it becomes very difficult for the Land Board, the Agricultural Resource Board and the water Apportionment

Board to impose restrictions on the borehole owners due to the weak structural formation of these institutions.

Conclusion:

What emerges out of the water utilization pattern of the sub-district is an overall problem of pressure on water resources which have extended effects of localised water shortages, overgrazing both at localised levels in the areas immediately surrounding boreholes and in a generalised level resulting from the increase in the number of boreholes which result in almost all parts of the area being exposed to livestock invasion. There are also some growing demands of water for human consumption and related activities.

Wood Utilization

Wood is used virtually by every household as a source of energy and for non-energy uses in the form of wood poles for construction of houses, cattle kraals and bush fences around arable fields. With the exception of the construction of housing and fencing for which wood can be bought from commercial enterprises, all other uses depend entirely on the use of the natural forests. Presently, there are two eucalyptus woodlots in

Barolong farms. These are located at Goodhope and cover 5 and 41 hectares respectively. Although these woodlots are over-mature, they are not being used; as such they are of no value to the community around.

The 1985 E.R.L.<sup>(12)</sup> study of resources utilization and requirements in the rural sector of Botswana, estimated the amount of standing crop of natural vegetation for Barolong farms at 2,1 million tonnes, total annual wood increment at 70,000 tonnes and an annual firewood increment of 19,000 tonnes on a surface area of 1,200 km.<sup>2</sup> (Environmental Resources Limited 1985)<sup>(13)</sup>. The total annual wood use on the other hand, has been estimated at 29,000 tonnes, 13,000 tonnes of which is used for domestic firewood. This implies that firewood accounts for almost half the total wood use.

The above cited figures show that there is surplus wood supply for the area. The surplus/demand ratio for the area is presently estimated at 3:1. Although these figures show a positive relationship between the supply and demand ratios for the area on a generalised farm, there is however a problem of shortage of wood - especially for domestic consumption. Thus this surplus values have to be looked at in

relation to people's preferences for particular firewood species and the distances at which these wood resources can be obtained. Thus, although the supply/demand ratios in the area look favourable they must the crucial problem of increasing local wood shortages especially in the vicinity of larger villages. There is also a problem of overlapping wood collection areas for some settlements which leads into the acceleration of wood resource depletion in such areas. This problem is more emphasised in the areas around the villages of Kgoro, Goodhope, Bethel, Malokaganyane, Pitsane, Rakhuna, Tlhareselele, Ramatlabama and Rakhuna. In fact, the problem is felt on a generalised scale since the average distances between villages in Barolong farms is 5 km. resulting in boundaries between villages being difficult to draw.

#### Wood use:

##### Firewood

Because wood is used in virtually every household and is dependent mainly on the use of the natural forests, fuelwood collection patterns deserve some elaboration. 65 percent of the households interviewed indicated that they gather fuelwood daily. While 35 percent indicated that they gather fuelwood once

a week. The average distance travelled from villages to fuel wood collection areas, is 7.5 kilometres and a range of 5 - 15 kilometres. This implies that there is a growing shortage of fuelwood at the localised levels. This growing scarcity of fuelwood in the areas around villages, adversely affects the lower income strata of the population which cannot afford to buy wood from the local woodsellors, and at the same time do not possess adequate means for gathering fuel wood from these distance places. This has resulted in peoples change of attitudes with regard eating habits. The study found that people have now started to consume less of the foodstuffs that require long cooking hours such as beans, maize, etc. and eat more of fast cooking foods such as sorghum porridge etc. which are comparatively of low nutritive value.

The increasing distances between the villages and wood collection areas can also be looked at in relation to peoples' preference for specific trees which have high calorie value, have good embers, do not smell badly when burned and can be harvested without too many problems (Kgathi, 1982;<sup>(14)</sup> Tietema, T., 1984<sup>(15)</sup>). However, where wood is scarce, twiggy shrubs are often collected for woodfuel mainly because of necessity. These preferences result in some species being endangered due to their value in

terms of use and such species, have almost been totally cleared in areas immediately around villages. A good example is that of acacia *geraffae/emoloba* locally called Mokala and Mogotlho respectively which are especially valued for fuelwood, fodder, building and fencing purposes. These trees are endangered what remains of them are scattered isolated trees amongst vast expanses of shrubs. Plate No. 2 shows acacia *giraffae* at the background with a broad canopy. These particular tree species, have good quality of protecting the soil against heavy down pour due to their spread and dense canopy such that if protected from overharvesting, they can help maintain the soil structure and fertility. At the same time, they form a good wind breaker which could help reduce on the effects of wind storms on the environment. Table No.9 shows the widely used and preferred tree species in the area.

There are some seasonal variations in fuelwood consumption. This can be indicated by high levels of fuel wood consumption in winter which have been estimated at 2.49kg./cap./day and 0.86 kg./cap./day for summer. During the cold winter weather from June to August, fires are used for warmth. (ERL, 1985)<sup>(16)</sup>. It was therefore revealed in this study that 96% of the households used fuelwood for space heating, cooking and lighting.

The major perceived problems in terms of energy supply are fuel shortage, physical work and distances involved in gathering firewood. This is so because areas immediately surrounding villages have been depleted of trees or bush. People have thus adopted a number of strategies as means towards resolving these problems. People now collect the less preferable species, purchase wood from wood seller, have reduced wood consumption, use commercial fuels of paraffin, candles and coal and have also turned to the use of cow dung.

12 percent of the households interviewed indicated that they owned cast iron stoves for both cooking and space heating. These families use coal for cooking purposes and alternatively buy fuelwood from wood sellers. 88 percent of the households cook over an open fire using three legged cast iron pots and normally cooking is done outdoors during the day.

21 percent of the families that use fuelwood buy it from wood sellers. The average price per tractor load is P.15.00 (Pula). Families buy loads ranging from head loads, wheel barrow loads to tractor and lorry loads. Prices for these range from P 2,50 - P30.00. 30 percent of households that buy fuelwood purchase it once a month; 10 percent buy it twice a month and 60 percent thrice a month.



Paraffin and gas are used as supplementary sources of fuel for cooking. Families indicated that paraffin is becoming easier to get and more efficient in terms of time and labour as against fuelwood which is becoming more scarce each passing year. 15 percent of the respondents indicated that fuel wood has become so scarce that they find it easier to steal fuel from the surrounding leasehold and freehold farms (of course risk being caught). Cow dung has also become a useful fuel for cooking purposes. The availability of cow dung, however, depends on the presence of fodder. Thus dung becomes plentiful during rainy seasons when there is enough feed for livestock.

#### Wood use for other human activities

Wood is also used for housing, fencing and kraal construction purposes. 72 percent of the respondents had their properties fenced whilst 28 percent had not fenced their properties. Materials used for fencing were barbed wire and natural hedge. Only 16 percent had fenced their fields. Wood poles, were used for roofing of houses by all the respondents. The construction of kraal was also done with the use of natural hedge. However, the majority of the respondents - 89 percent indicated that material for fencing had become so scarce that the use of natural hedge is the most tedious activity such that if they had capital, they would prefer to use commercial

such as barbed wire a or mash wire and poles,

### Wood use and Deforestation

Uncontrolled cutting of trees either as fuel wood, and or for construction purposes, has contributed to the clearing of vast expanses of the natural forest. In this case, the impact of wood use cannot be separated from the effects of human settlements and agriculture on deforestation. Large tracts of land have been cleared as arable land. This phenomenon became intensified from the 1960's upto the present day. The introduction of mechanised methods of farming contributed largely to this problem since it became a norm to expand an arable agricultural practices mainly for commercial purposes. Presently Barolong farms area is almost like a park land covered mainly by shrubs and thorny bushes.

The effects of tree cutting is soil erosion and currently most serious on hill slopes around Kgoro, Bethel and Malokaganyane, where a reduced vegetation cover causes increased run off and in turn gully forming on the lower sides of the hill. Furthermore, the combination of wood cutting and overgrazing has enhanced soil erosion and even desertification locally as in the villages of Tswanyaneng, Mokatako and

Metlogana that are now barren with very little amount of vegetation cover. The practice of destumping and clearing of arable land has also contributed considerably to the process of deforestation which of course subsequently leads to soil erosion especially in cases where clearing and destumping are not followed by regular arable practices.

Table No. 9

Widely used and preferred tree species in  
Barolong Farms :

Species Local Name	Especially valued for:			Species English name
	fuel	fodder	Building fencing	
Mogonono	*	*	*	Terminalia sericea
Mokala/Mogotlho *	*	*	*	A Giraffae/Emoloba
Mokgalo	*		*	Ziziphus Nucronata
Mongana *	*		*	Acacia Mellifera
Mooka *	*	*	*	Acacia Karroo
Moretlwa	*	*		Grewia flaua
Morobe	*	*		Ehretia rigida
Mosetlha	*	*	*	Peltophorum Africanum
Mosu	*	*	*	Acacia Tortilis
Motlhakula	*	*	*	Fuclea Undulata

Source: Adopted from the Sample villages of Goodhope and Pitsane.

\* Most popular woodfuel

\* Most frequently used.

### Summary

There are three main land tenure systems with which land use activities in Barolong farms are being practised. These are the freehold, state land and the tribal land tenure. Of importance to this study, is the tribal land tenure within which the communally based mixed farming activities are undertaken. Three land use activities were analysed together with two supporting activities and, problems related to each one of the activities were identified as follows:-

#### Land Tenure

Because of the distance from which the Barolong were initially ruled, there was no direct control by the chief which was essential in the traditional system of land allocation and management. This situation, led to the development of the Barolong into being individualistic capital oriented and lacking the communal coherence. The installation of a new (Permanent) chief for the Barolong farms area together with the introduction of the Rolong Land Board in 1970 as new administration institutions; could not manage to solve the land allocation and management gap as was left by the traditional system.

### The human settlement

As a result of the weak traditional institutional structure, the Barolong were able to locate wherever they wished within the territory. This resulted in a dispersed settlement pattern of characterised by mixed farming practices. Within this pattern of settlement, a number of problems exist : first, the human settlement gradually encroached into arable and grazing areas. Secondly, efforts of the land board to concentrate people into larger villages have failed and, people still continue to locate where they wish. Further more, this pattern of settlement lay constraints on the infrastructural provision, especially with regard to the provision of water which result in people pressurizing the Land Board to allocate them borehole sites and yet no more space exist for fresh borehole allocations - especially with regard to livestock watering boreholes.

### Arable Agriculture

There is an apparent decline in the productivity of the agricultural land due to excessive soil erosion (wind and runoff), leading to the abandonment of fields because of their loss of fertility and infestation with weeds that make farming impossible. The extensive nature of arable farming leads to the destumping of large tracts of land and aggravation of the process of deforestation. Farmers awareness with regard to

resource conservation is very low. They are only concerned with the maintenance of soil productivity within their fields through the application of fertilizers. Arable lands are increasingly encroaching into grazing areas.

### Livestock Farming

Livestock farming is secondary to arable farming, kept for both economic and social purposes. Livestock numbers are in excess of the carrying capacity of the area resulting in high stocking rates of 6.6 ha./LSU which is half of the required amount of land per livestock unit of 12 hectares. Overstocking of the area has resulted in serious problem of overgrazing and the general degradation of the range resources. The range degradation has led into bush encroachment soil erosion and localised desertification as in the areas around the villages of Tswanyaneng, Metlofane and Mokatako.

### Water Utilization

There is an increasing pressure on water resources due to the expansion in land use activities resulting from the increase in both human and livestock populations. This problem has become more intensified because of the difference in water demands and spatial distribution of the different land use activities.

### Wood Utilization

Wood is used for both energy and non-energy activities. Trees are increasingly being felled for fuel and construction purposes. The indiscriminate cutting of trees, has led to some tree species being endangered, these are acacia giraffae and erioloba trees which are valued for fuel, fodder and construction purposes.

The above sectoral problems can be grouped into two major environmental problems of land pressure and pressure on water resources, both of which have led to intensive generalised land degradation and therefore, the reduction of the areas productivity.

### Land Use Policies

#### Introduction

Since independence, development strategies and policies in Botswana have been aimed at the dual ends of social justice and the creation of a stable and self-sufficient economy based on increased productivity. This has been more emphasised in the agricultural sector due to its capacity to absorb large proportions of the population as direct or indirect labour, 70 - 75 percent (1981 population census), to provide basic food staff and to support industrial products. In

order to achieve the above ends, a further goal of output expansion was set, under which a number of programmes particularly aimed at the intensification and extensification of agriculture were introduced.

As a means towards the facilitation of the achievement of these development ends, a national policy and an institutional structure within which land use planning and management would be undertaken were created. A system of Tribal Land Boards structures was then instituted by the tribal land act of 1968 which removed the powers of land allocations and management from chiefs. These Land Boards were set up in 1970 and started operating fully by 1974.

In 1975, the government published the National Policy for Tribal Grazing Land (T.G.L.P.), which formed the basis for systematic land use planning at the national and district levels. The main objectives of this policy were to encourage the improvement of range resources to increase agricultural productivity (especially livestock) and to safe-guard the interests of non-cattle owners and small livestock owners.

Subsequent to the establishment of the Tribal Land Boards and the publication of the Tribal Grazing



Land Policy were policies, programmes and institutions that further emphasised the need to improve on agricultural production were launched. These were the Arable Lands Development Programme (ALDEP); Services Livestock Owners in the Communal areas (SLOCA), Agricultural Extension Small Projects, Rural Afforestation, etc. As more policies and programmes got introduced, there arose the need to establish a systematic method of integrating and co-ordinating the various development efforts. This need for integration of efforts led to the creation of the National Settlement Strategy (NPS) in 1980 and the Communal First Development Areas Policy of 1982 (C.F.D.A.).

Having thus given a brief outline of the institutional and land use policies' frame work in Botswana, this Chapter is going to address itself to government's responses to the problems of environmental degradation as outlined in the preceding chapters.

### The Human Settlement

The government policy on the human settlement before and immediately after independence and upto 1972 was centred around the formation of nucleated settlements, permanent settlement at centres of production, of lands and grazing areas, was regarded as highly undesirable by chiefs as it reduced their

authority (Silitshena; 1980). Thus people living in dispersed settlements of hamlets and homesteads became regarded as lacking strong local organization by comparison to villagers (Hitchcock; 1980)<sup>(17)</sup>. Social services' provision was only centred around the recognised major tribal villages during the colonial era. This type of set up was thought to be cheap in terms of administration since the colonial masters could easily control the people most especially for the purposes of recruiting labour and easy collection of hut tax. Schools, boreholes, health facilities, etc, became located only at the major villages limiting the peoples' movement from such.

It is apparent therefore, that the Barolong defied this system of land use control by settling permanently at the grazing areas. This act partially alleated them from the chief's control, thus their activities with regard to land use could not be closely monitored. Hence their adoption of a dispersed settlement system which was later followed by the introduction of mixed agricultural practices. Because of their adoption of this pattern of settlement, they could not be provided with services by the government. This led into individuals providing basic services like water for themselves. Educational needs were largely provided for through sending children back to

Mafikeng or to boarding schools within Botswana. Within this system of operation, the Barolong developed a culture of capital accumulation, through the extensification and intensification of arable farming, where the conservation of the environment was not given any thought. This state of affairs was to continue into the present day system.

Efforts of the present chief and the land-board to try and concentrate new applicants for residential plots into the five central ward villages have failed due to people's open refusal. This concentration was an attempt by the land board to apply section 13 of the tribal land act which gives it the right to control land use activities within its territory, by applying such measures as may be seen necessary for the conservation of an areas natural resources. Thus this concentration of the people was aimed at curbing further encroachment by the people into grazing or arable lands for residential purposes.

This effort by the land board failed due to two reasons. First, as soon as a person was refused allocation in these areas, he would suddenly reverse his application and say that he was simply re-affirming his traditional rights over the said piece of land, after all it had long been allocated

to him by the traditional land managers. Since the chief himself was still very new in the area, it became very difficult to ascertain the validity of such claims. It is not surprising therefore that upto the present day such claims still exist (I do not wish to delve into this issue since it is very complex as the Barolong themselves are - they have developed a culture of individualism which is so strong that they always look for a way in which they can out do any law or regulation that may seem to be not in their favour).

The second reason was as a result of the Government's change of direction of thought in 1972 after the 1971 population census had revealed that people's attitude towards settling permanently at areas of production had changed. As such a large percentage of the population had started settling permanently at areas of production. This phenomenon changed the Government policy with regard to the provision of social services to these areas. Areas of 500 even less people could now be supplied with services such as water, schools and health clinics. With this change in the Government's direction of thought, there was no way in which the land board could force people to settle in the selected villages. People could settle in these villages out of their own choice. However,

it was not long before the government realised that the exercise of providing social services to these settlements was costly and resulted in the duplication of efforts, the consequences of which were the under-utilization of most services especially schools. This led into the emergence of the National Settlement Strategy under which a hierarchical ordering of settlements into primary, secondary and tertiary centres was to be proposed for purposes of integrating the social services provision system. This led to the introduction of the communal first development areas strategy for the development of communal areas. This strategy involved the designation of defined geographical units below the district level where development efforts could be concentrated. Thus an area forming a corridor from Pitsane including Goodhope into Mathethe in Ngwaketse area was then designated a spatial planning unit under the communal first development strategy. Within this set up, Pitsane was designated the status of a rural industrial and commercial centre while Goodhope maintained the status of the district administration head-quarters.

The introduction of the above strategy brought yet another change in the settlement system of Barolong farms by introducing urban forms of settlement on both Pitsane and Goodhope. A lay out plan for Pitsane

was prepared in 1982 where the area south of the railway line was demarcated into three zones :- industrial area, commercial area and the residential areas. 200 residential areas were demarcated. The allocation of these plots started in 1984 and by the end of 1986, they had all been allocated. This led to the identification of an additional piece of land for the demarcation of more residential plots. The problem with this new and fast development, is that it is introducing into a grazing area for the villages of Bethel and Malokaganyane which are already having serious problems of shortage of pasture. And yet the development of allocated plots does not match the rate at which they are being allocated. There is therefore a need to closely monitor the activities under this strategy so that they should if possible result in the aggravation of the sub-district's problem of shortage of land and yet it was meant to lessen the burden on agricultural land by attracting people into the service sector.

It is clear from the above discussion that the present institutional framework although initially set up with an objective of resolving problems related to environmental resource management, it has however failed. And instead, it has led to even more

problems of encouraging further encroachment of the human settlement into the already scarce agricultural land resulting in the competition for land by the human settlement and agricultural activities.

### Arable Farming

Since independence, the expansion of output has been a major goal for arable agriculture and this remains the cornerstone of the present policy, for Botswana's food demands are still greater than her food production and the balance of requirements must be made up by increasing expensive imports. Rapid population growth and increasing export charges have further stimulated the drive for increased farm efficiency and output in the interest of import saving.

Government's intervention in arable agriculture for the insurance of improved production both at the subsistence and commercial levels has been through offering price incentives, subsidies and inducements to farmers to improve on the efficiency of their farms. Mention has to be made of the Arable Lands Development Programme (ALDEP) which was introduced as a counterpart to the Tribal Grazing Land Policy; aimed specifically at small farmers for purposes of reducing the levels of disparities between large scale and

small scale farmers. This programme offers various subsidy packages for the alleviation of the most pressing constraints to arable agriculture and the farm unit level. These are packages on drought power, fencing, farm implements and water tanks provision. This further includes the introduction of high breed seeds and the improvement of storage capacity. Because of the structure of the farming community in Barolong farms, these packages got utilised by a considerable number of farmers especially for the acquisition of drought power in the form of donkeys by the small scale farmers.

However, due to the recurrent drought conditions, the implementation of this programme got seriously affected. As a result, Government direction got centred mainly around strategies that were meant to be combating drought effects. This led to the introduction of the accelerated rainfall arable programme in 1985, which was aimed at providing additional incentives for dry land farming as a means towards assisting farmers during the drought period and the post-drought period as a recovery programme (NDP 6)<sup>(18)</sup>. This is a multi-component programme composed of six grants for:

- draft power- ploughing for farmers in an area of ten hectares
- destumping component
- seed procurement



- fertilizers
- fencing and
- water development components.

This programme led into the cultivation of extensive areas as well as the destumping of 1,222 hectares in 1985/86 planting season. In total, 27,541 hectares of land were utilised under this programme. This was distributed amongst 4,061 beneficiaries resulting in Barolong farms area being the highest utilizer of the programme and over-spending is provision by P 2145.00 (Pula).

The introduction of these policies resulted in the intensification of the involvement in the arable agricultural production without the consideration of environmental problems. All that they are concerned with is to increase food production and combat any form of disaster such as the distruction of crop by livestock and loss of soil fertility within fields, that may result in low crop output. The result has been the destumping or clearing of large tracts of land under arable agriculture which are soon abandoned due to lack of capital. This process does not only expose soil to excessive soil erosion but also leads into the clearing of areas that could otherwise serve as pasture for livestock and further lead into the

enchroachment of arable farming into grazing areas since no more land for fresh arable allocation exist in the areas designated for such. It is clear therefore that arable agricultural policies have up to-date failed to address themselves to the issue of environmental resources conservation. Instead, they assist in the degradation of the environment and yet increased production in arable farming, highly depends on the productivity of the physical environment.

#### Livestock Farming

The government's realization that there was need to conserve the country's range resources to promote greater equality of income in the livestock sector and to foster increases in the productivity and commercialization of the livestock sector led to the inception of the Tribal Grazing Land Policy (T.G.L.P.) in 1975. These objectives were to be met through the zoning of tribal grazing land into commercial, communal and wildlife management areas. Basic to this policy, was the emphasis on relieving of overstocked communal areas of access livestock through the encouragement of large scale farmers to move their livestock from communal grazing areas into commercial leasehold ranches. An important point with regard to the success of T.G.L.P. in communal areas is that communal grazing areas never got relieved of

excess livestock. Instead, this led to the intensification of degradation of the range resource in communal areas because no law or regulation existed for the prevention of leasehold farmers from moving their livestock between their ranches and communal areas which were now reduced in size due to the zoning exercises.

As a result of this failure by T.G.L.P. to meet its intended objectives of addressing the problems of grazing land pressure in communal areas, there became an emphasis towards the development and encouragement of small stock owners in communal areas (Sloca) and A.E.I.O finance Livestock development of small holders and groups in communal areas.

The development trend in Barolong farms has been such that due to the size of the sub-district, no T.G.L.P. ranches could be demarcated within it. As a result, the communal grazing area could only be relieved of large numbers of livestock through the movement of livestock into other districts where ranches existed. However, efforts by large livestock owners in Barolong farms to apply for the allocation of ranches in other tribal areas such as the Ngwaketse tribal area, have been futile. This means that the only alternative that is available for Barolong farms is for farmers to reduce their livestock holdings and

concentrate on fattening of a few livestock unit which if drought occurs, they can afford to feed on supplementary feeds,

Another problem that is emphasised in Barolong farms is that of the distribution of livestock watering boreholes which has resulted in serious degradation of the grazing resources. Thus, although livestock production programmes have fully addressed themselves to the problems of range development and management there have however been a problem with regard to the implementation of their recommendations due to the failure of institutional structures such as the Land Board, and the agricultural resources board to exercise their powers. The tribal Land Act empowers the land board to allocate boreholes and to declare boundaries between grazing and arable lands and to ensure that such grazing areas are gazetted so as to guard against arable encroachment into them. In the same manner, the agricultural resources conservation act empowers the agricultural resources board to impose stock limits if grazing conditions of an area justify such an action. However, these regulations have not been put into effect. This can be attributed to the fact that although each land board is represented in the agricultural resource board, no feed back is ever given to the land board as to how it should address itself to the problems of overstocking and

therefore overgrazing. An observation of the Rolong land board reveals a situation whereby members of the landboard although aware of the existing problems of land degradation are more concerned with the execution of more land allocations every three months without bothering about the application of the restrictive laws that are meant to help reduce the effects of overstocking on the range resources. If better management of the rangeland in Barolong farms is to be achieved, there is a need to conscientise the land board into the exercising of their legal restrictive powers.

#### Water Utilization

Water is one of Botswana's most scarce resources and boreholes are the most common method through which much of water is obtained. Without a borehole, open well or a small dam agriculture becomes impossible to practice so is the development of the human settlements. That water is a resource whose availability and non-availability directly affects all aspects of human life, can be illustrated by the occurrence of severe drought between 1982 - 1987, which resulted in a considerable number of boreholes in the Barolong's farms drying up (23 boreholes in all).

Water, settlement and production are highly interdependent within the context of Botswana. Thus, the main thrust of the government's policy on water supply is to provide reasonable access to a safe water supply to the whole population and to provide water supplies to facilitate the achievement of the Government's broad objectives of rural development and employment creation (N D P 6.)<sup>(19)</sup>. It is for these reasons, that borehole allocation as the main source of water, warrants special consideration.

The allocation of boreholes for different uses is done by the Land Board although the main responsibility for water lies with the Ministry of Mineral Resources. The land board allocates a borehole space while the water apportionment board is responsible for the granting of water rights. Because of the number of Ministries that are involved in water development, coordination and management of water resources is presently very difficult. Resulting in the haphazard allocation of boreholes which in turn result in serious pressure being laid on the ground water resources.

### Wood Utilization

Under the traditional system of tenure, chiefs were empowered to restrict the use of forest resources. It was within the power of a chief to prohibit further use of a specific tree species if he realised that it is in danger of being depleted. In the same manner, chiefs could prohibit the use of trees that were traditionally valued for sacred or medicinal purposes as well as warn people against using trees - the use of which would bring a curse to the tribe (Shapera, 1943)<sup>(20)</sup>. This was a very useful tool in the conservation of the forest resources resulting into people's awareness about the importance of safe-guarding against unnecessary felling of trees.

This system of control was however replaced by the introduction of new administrative institutions whose effectiveness with regard to forests conservation have not yet been felt. Presently, various laws with which forest resources can be presented exist. These include amongst others the Town and Country Planning Act and the Forestry Act which empowers the district conservation committees to declare some endangered and precious trees species protected forest reserves or where they no longer form compact forests, declare their cutting unlawful and therefore illegal.

Once such species have been identified the consent of the land boards can be sort for the declaration of areas on which such species are found as forest reserves.

Within the Barolong farms area, some members of the Rolong land board actually form the membership of the district conservation committee, no efforts have so far been made towards raising public awareness about the need to regulate the use of trees. As a result, some trees species such as acacia giraffae and erioloba are presently at the brink of extinction. There have however been some isolated efforts by the C.F.D.A. office (Communal First Development areas) to establish woodlots at selected villages through the assistance of the Botswana Forestry Association - a non-governmental organization - s one such woodlot has already been established at Tlhareselele village. Although there is an office of the forestry officer under the Ministry of Agriculture in the sub-district, the impact of this office with regard to tree conservation as well as the encouragement of people to engage in tree planting has not been felt thoroughout the area. If anything, the majority of the people do not know about the existence of such an office and yet it even a tree nursery.



It is therefore clear that more efforts have to be put into the creation of people's awareness about the importance of tree conservation and the engagement in tree planting activities especially within their own compounds for fuel purposes as well as wind breakers against the frequent wind storms as a means towards curbing soil erosion.

### Summary

With the exception of the livestock development sector policies which have for long put emphasis on the conservation of range resources, all other sectors have been gearing their programmes more at increased production without giving any consideration to the role of the environment in overall development. Where regulations exist for the encouragement of the management and control of the use of environmental resources, institutional structures that are responsible for their implementation have often failed to apply them. There is therefore, a need to encourage both Government Ministries and the institutions to develop management policies that are aimed at sustainable use of the environment so as to promote the conservation of the country's natural resources.

Competition for Land

As has been indicated in the above sections, there is an increasing pressure on land resulting from rapid growth in human populations and therefore the expansion of human activities. There is a low level of the application of the existing institutional arrangements and provisions such as the agricultural resource conservation act, Tribal Land act, the Water act, etc. leading to the uncontrolled over-exploitative use of resources. This low level of political will lays excessive demands on the existing land resources. Thus, pressure on land can result in either land degradation or competition for the land. It must however be noted that it does not necessarily follow that where competition for land exists, the process of land degradation also has to take place. There are on the other hand, cases where competition for land leads to land degradation.

Notwithstanding the above, two land use conflicts can be identified in Barolong farms. These are: conflict between arable and livestock farming and th human settlement and agricultural activities.

Competition between arable and livestock farming

The intensification of arable agricultural practices has led to an increase in the demand for land for the purpose. This has resulted in arable farming activities encroaching into grazing areas. This trend is not new; it had already commenced prior to the establishment of Land Boards (Culbrandsen; 1984)<sup>(12)</sup>. Thus in this study of the Barolong farms in 1973 - 74; Comaroff revealed that the encroachment of arable farming into grazing areas was a single most serious problem in the area and as such required immediate attention by both the government and the local communities (Comaroff : 1977)<sup>(22)</sup>. The second effect of arable encroachment on grazing areas, is the increasing damage of crop by livestock. This is made even more serious by the fact that local communities do not herd nor kraal their livestock. As a result, livestock roam freely both at night and during the day as such destroying quite considerable amounts of grain. This further results in inter-personal and inter-community conflicts. The settlement of which often result in payment of very huge sums of money.

Presently, arable farming occupies 49.7 percent of the communal land and the rate of encroachment into grazing areas is at 3.7 percent

per annum (Calculated from Rolong Land Board records). The over prioralization of arable farming over pastoral farming, has led to the reduction of grazing areas and yet the amount of livestock is increasing. Thus large herds of livestock get concentrated into relatively small grazing areas. This high concentration of livestock in small grazing areas coupled with recurrent drought conditons, have had an effect of degrading the veld resources. Furthermore, once a particular community realises that it has exhausted or reduced its grazing area, it normally drives its livestock into another community's grazing area. This process gives rise to some inter-community conflicts.

Although it is not possible at this stage to prove or disapprove the extent to which arable expansion has led into the cultivation of less suitable soils, the land capability map (Map.No. 6 ) indicates that arable activities have been extended into areas suited specifically for grazing purposes. A comparison of the 1982 air photos and a field survey that was carried out in 1987, shows that there has been considerable encroachment of fields into less cultivable areas.

This process has largely been encouraged by lack of institutional control. Thus although the government is aware of the importance of livestock in arable farming as well as for social and economic purposes, it was recommended by the Barolong sub-committee (23) in July 1981 that in view of the importance which the Barolong attach to arable farming, it has to superceed livestock farming. As such, arable fields be allocated in grazing areas (Hitchcock, R.K. 1981)<sup>(24)</sup>. This process together with the Land Board's failure to gazettee the existing grazing areas has led to the over prioritisation of arable practices over pastoral farming. The land has in principle, through its practices announced that there is no basic difference between grazing and arable areas. Thus as Gulbrandsen (1984 ; p 75)<sup>(25)</sup>, perceptively observes"

--"all areas are potentially available for the purposes of cultivation. Thus, in view of the fact that almost every piece of the Barolong territory is suitable for arable farming, the process of pastureland encroachment might be expected to continue until all grazing land is finished".

The community's reaction to this problem has been to fence individual fields and to erect perimeter fences for separating fields from grazing areas. Although this action partially managed to separate the two land uses, it has however encouraged the

process of overgrazing due to the concentration of livestock in small restricted areas.

The land board on the other hand, has responded by approaching the Ngwaketse land board to allow grazing of the Barolong's livestock in their area. This has of course been rejected by the Ngwaketse community. What is clear is the fact that such a transfer of livestock does not address the roots of the problem. What the land board has to be aware of is the fact that the present conflict between arable and livestock farming cannot be resolved by moving cattle. But rather it should be resolved within Barolong farms.

The solution to the above problems would therefore have to take into consideration the fact that although the area's economy largely depends on arable farming, livestock also plays a major role. The majority of the farmers still depend on livestock as a source of draft power and as an insurance against starvation during years of crop failure.

Competition between the human settlement and agricultural activities.

The increase in human populations together with the land board's failure to control the pattern of settlement, have resulted in people continuously being allocated residential plots in areas specifically set aside for agricultural purposes. Thus, the human settlement is increasingly encroaching into areas that could do well under agricultural use. This pattern of settlement has two fold effects. As the human settlement continuously advances into grazing or arable lands, livestock also roams in villages thereby causing very serious damage to property. Above all, villages are characterised by very careless surroundings, Such that even the cleaning day campaigns, fail to solve the problem.

The problem is further aggravated by the presence of livestock watering boreholes in some major villages. For instance, the villages of Good Hope and Metlojane are always invaded by large herds of cattle during dry seasons. This makes life within these villages very impossible for the large numbers of livestock result in areas within and immediately around these villages being seriously overgrazed and resulting in the villages being covered by dust storms.

Although this problem is still at a low level especially when viewed together with the arable/grazing conflicts, it does however warrant attention at the present stage. Since if left to continue will soon be very difficult to resolve it. Most especially because the community in this area has a tendency of building very expensive and permanent structure where if the need to relocate them arises, the government can spend a lot of money. It is therefore necessary for the land board to re-introduce the policy on concentration. This however, must apply only to people who are being allocated fresh residential plots. There would also be a need by the government to supply areas like Goodhope and Pitsane with electricity and other basic amenities so that they can attract people from the surrounding scattered settlement. It is obvious therefore, that although this pattern of settlement is valued for its ability to promote high agricultural production, it however requires very high levels of management.



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## CHAPTER FOUR

### IMPLICATIONS FOR FUTURE SETTLEMENT

The preceding analysis, has revealed that there are historical factors that influenced the area's pattern of settlement. First, Barolong farms was initially used as pasture land for the Barolong tribe which was resident in Mafikeng and other parts of South Africa. In 1895, the area became sub-divided into 42 farms which were allocated to tribesmen under certificate of ownership rights. The sub-division into farms, led to some members of the community settling permanently in the area. Thus, leading to the emergence of mixed farming practices for subsistence. History also reveals that an arbitrary pattern of settlement (dispersed) developed due to the lack of direct control of the chief who was at the headquarters in Mafikeng.

Some socio-cultural factors were also found to be playing a significant role in the development of the dispersed pattern of settlement. The Barolong community, has developed a strong culture of individualism based on highly capitalist mode of production. They value a pattern of settlement that supports their production system more than proximity

to social-services and compact settlements that provide for social coherence. Thus, they have emerged a heterogeneous community with each person providing for his needs without much bother about the community around him.

An analysis of the area's physical environment, revealed that the area's climate is semi-arid and is characterized by a low average rainfall of high variability and low reliability. Daily temperature range is high with a marked seasonal variation, winters are frost prone. These high temperatures and low humidity result in very high rates of potential evapotranspiration. At the same time, the sandy soils results in slow water filtration such that lots of moisture gets lost through evaporation. The areas soils are generally of sandy-loam type with very fine particles. These soils if exposed through debushing and overgrazing, get easily eroded by runoff or wind. Presently, the area experiences very heavy dust storms vegetation of the area can be broadly classified under the southern tree savanna. However, due to the expansion of the human settlement and the intensification and extensification of agricultural activities, the natural vegetation has been largely modified leading to the encroachment of a bushy vegetation.

It was found further that the area is experiencing very rapid population growth. This growth, is influenced by both natural and migration factors. The natural rate of growth is at the rate of 3.4 percent per annum. There is also a significant rate of in-migration. This, is influenced by the development in arable agriculture which has attracted a considerable number of people. The economy of the area on the other hand, can be said to be dependent mainly on agricultural production. Arable farming has emerged the mainstay of the area's economy. It is practiced on a highly mechanised commercial system. This has led to the areas recognition as the country's granary.

The study set out with two objectives of analysing the landuse activities in the Barolong farms area and identifying conflicts there of. Followed by the recommendation of solutions to the identified conflicts. Three land uses of: the human settlement, arable farming and pastoral farming were identified, we further identified two supporting activities of weed and water resources utilization.

The rapid population growth and therefore the increase in human activities, has resulted in the requirements for more space for human settlement. This,

has led to the encroachment of the human settlement into agricultural land. Secondly, the development of the arable sector has also resulted into more land being put under cultivation. The increased involvement in arable farming, has resulted into arable activities encroaching into grazing area's. This, has led to the reduction of the sizes of grazing areas. Along side the expansion of both the human settlement and arable activities, there has also been a marked expansion in the pastoral farming sector. The intensification of livestock farming has led to the increase in livestock populations.

This expansion of the human activities, has led to the problems of pressure on land and pressure on water resources. The result of these two problems, has been an increasing problem of land degradation resulting from overgrazing, defoliation and deforestation due to the cutting of trees for woodfuel and construction purposes and clearing of large expanses of land for arable cultivation. The effects of the above, has been the exposure of soil to erosion by runoff or wind. This, has led to some areas e.g. Metlojane, Cwanyaneng and Mokatako experiencing the emergence of desertification. In the same manner, the area's rangelands have seriously degenerated resulting in reduced carrying capacities.

Pressure on water resources, has also resulted from the expansion of the three land uses, Thus, the need for the expansion of the water sector has resulted on even more pressure being laid on the already over stretched land resources extending the problem of land degradation. Because of lack of surface water, ground water development has become very crucial to the development of the area. The area is presently over provided with boreholes for livestock watering. Resulting in generalised overgrazing. The people's culture of individualism coupled with the generally dispersed nature of the human settlement, has resulted in the management of water resources being the most difficult task for the land management bodies. This is more emphasized by people's refusal to own boreholes on syndicate basis resulting in the large number of boreholes being owned by individuals.

The combination of pressure on land and pressure on water resources, has resulted in the emergence of competition for land by the various activities leading to conflicts in land use. Two major conflicts were thus identified. These are: conflict between the human settlement and agricultural activities. The presence of these conflicts, has been aggravated by weak institutional structure - which have not to date



been able to apply the existing rules that gourd against the both the expansion of arable and livestock farming and the human settlement for purposes of reducing their imports on the environment. The effects of these conflicts have been threefold, first, arable intensification and extensification, has resulted in the encroachment of arable activities into grazing areas. This, has had an extended effect of reducing the sizes of grazing areas, which has also led to the problem of overgrazing due to the confinement of large herds of livestock on relatively small grazing areas. The second effect has been that of the significantly increasing crop damage by livestock. This, has resulted in increased deterioration of human relations emanating from increased inter-personal and inter-community conflicts. Furthermore, the expansion of arable activities has led to the cultivation of less suitable soils resulting in accelerated soil loss through runoff and wind erosion.

The human settlement has increasingly encroached into areas reserved for both arable and livestock farming. The expansion of the human settlement, has resulted in local depletion of wood and water resources. As in the case of Pitsane village where boreholes have dried up resulting in the areas development activities being stagnant. Because of the dispersed nature of

the human settlement, livestock have increasingly destroyed properties such as fences etc. The invasion of livestock into villages, has continuously resulted into the exposure of villages to heavy dust storms and very dirty surroundings. Furthermore, the dispersed type of settlement result into the human settlement encroaching into agricultural areas. The landboard's efforts to concentrate people in major villages - within which large spaces exist in between homesteads, have failed due to people's open refusal to be concentrated into fewer villages.

We realise therefore that the expansion of the human activities have had a twofold effect on the areas environment, first, there is an increasing problem of land degradation and secondly increasing conflicts for land use. The effects of these two occurrences, have been accelerated by the weak character of the institutional arrangement, failing to apply available rules that were designed for the proper management of the country's natural resources.

The study set out with a single assumption that was meant to explain the process of consolidated of settlement. It was assumed that the consolidation of arable lands, cattleposts and the human settlement can

result in high agricultural production only if efficient measures of combating environmental degradation are taken into consideration. Thus in order to test the success or failure of the consolidated pattern of settlement, the following questions based on Heathcote's model of testing the success of settlement in arid and semi-arid areas, questions were posed:

- has production been increased and has the increase been maintained through periods of environmental stress such as droughts?
- has the resource use system increased and maintained the human population - carrying capacity of the area.?
- has the quality of the environment been maintained or improved? and lastly,
- has the settlement been self-sufficient or it has required subsidies from elsewhere eg. national finance.<sup>(1)</sup>

The analysis, revealed that the occupation of the Barolong farms initially resulted in increase

in agricultural production. Not only were grain crops produced where none had been before, but they were produced in significant quantities and for a brief period yields per unit area also increased, this happened in the periods 1960 - 1975. The occurrences of drought in the years ranging from 1976-1979 - (Mild occurrence) and 1980 - 1987 greatly reduced yields. Farmers indicated reductions of quantities ranging from 3 - 100 bags and above (90 kg.) depending on the scale of engagement. This, led to a considerable number of farmers being bankrupt and being unable to pay off their loans. Disaster relief had to be organized for both large scale and small scale subsistence farmers. This relief, came in the form of a number of programmes such as the accelerated rainfed agricultural production and drought relief packages. Which were aimed at encouraging farmers to continue being involved in arable farming even though it was proving to be a very futile exercise.

The population statistics of the area, show that there has been an increase in the number of people resulting from both migration and birth rates. Whilst human populations have been increasing, the areas carry capacity has been decreasing due to excessive demands that have been laid on the existing

natural resources. Presently, the sub-district has a high population density of 14.2 persons per km.<sup>2</sup> and an average household size of 8.8 persons. These figures, must be viewed relative to the areas environmental conditions which lay great demands for large pieces of land for the sustenance of a household's requirements for a year. Thus, although the area has attracted a considerable amount of people, its ability to sustain their existence, has greatly been reduced.

Massive clearing of vegetation cover resulting from the expansion of arable production, overgrazing by livestock and deforestation by people for fuel and construction purposes, has resulted in extensive environmental deterioration. The effects of this, has been the continued lose of soil due to erosion and the lose of soil nutrients. Although this problem has been offset by the application of fertilizers on fields, its effects have continued since the use of fertilizers has al led to the emergence of even more distructive weeds which make arable farming very difficult. This, has resulted in a considerable number of fields being abandoned. People's engagement in the application of conservation measures, has only been geared at the maintenance of soil fertility within their fields to total neglect of the grazing areas and the rest of the

community land. Thus instead of improving on the quality of the areas environment, human activities have greatly encouraged the deterioration of the areas environment.

Lastly, the success of the settlement, has been shown by the rapid increase in the intensification of resource use, production per unit area and population increase. This has however been assisted by an exploitative means of production aimed at increased production (quantity) per unit area to the neglect of the application of some conservation measures by both the community and the government. The area is still a zone of high-risk farming and marginally successful settlement. Political decisions to maintain settlement in this area have carried high costs both to the environment and the national treasures. This is mainly due to the fact that part of the spectacular success of this settlement, has come from the willingness by the Government to subsidize it by providing disaster relief incentives during times of environmental stress.

We note therefore, that the development of this area has been marked by both evidence of magnificent achievements and catastrophic failures. While there is no doubt that significant successes have been achieved,

it is equally clear that much money and effort have been wasted, and that human activities have either led to the deterioration of the condition of both the land or merely accelerated population increase through the attraction of people from elsewhere.

Faced by this evidence of apparent failure to plan for improved resource management, the increasing human populations and the increasing evidence of the degradation of the pastoral and arable agricultural resources, there is therefore a need to develop a system of resource management that will encourage people and the government to apply conservatory methods of resource utilization.

Planning implications:

The above section has revealed that the trend of settlement in Barolong farms has been towards the consolidated pattern of settlement. This is indicated by the increase in population growth, the increasing involvement in the utilization of the area's natural resources and the increase in production per unit area.

If the above can be viewed as a universal pattern of development in Botswana, there is therefore a need to carefully review the present land use policies and

the institutional framework within which land use activities are being administered. The present policies, are still sectoral in outlook aiming at the resolution of individual pressing problems within individual ministries and even departments. In the same manner, the institutional arrangements, are piece meal and directed at the resolution of what seems to be an inherent problem within a particular institutional framework. There is a need to develop comprehensive land use policies that are aimed at the facilitation of improved resource use. Such must be multi-disciplinary in nature so as to be able to effectively deal with the inherent problems of consolidated settlement patterns.

It follows from the preceeding discussions that any attempt to resolve problems of consolidated settlements, must address itself to all potential causes of environmental degradation. The role of and livestock farming in both the local, regional and national development must be taken into account. Thus a balance has to be reached between the development of arable and livestock farming. There is need to review the present landboard's position on the prioritization of arable farming over livestock farming. It is necessary to realise that much as arable farming has proved to be very successful in the area, it must



not be overemphasized at the expenses of other land use activities. The analysis has shown that livestock farming plays a very important role in the economy of the area - first by acting as an insurance against risk in arable production especially during drought periods. Livestock also plays a very special social role and for most members of the community it also serves as draft power for arable agricultural production. It therefore follows that any attempt to resolve the present problems of environmental degradation must take into account the presence of this reciprocal relations between the different land uses. Thus whilst settlement at areas closest to fields has been recognised as one of the factors that lead to increased productivity, there is also need to control the development of the human settlement so as to counter the present trend of encroachment into both grazing and arable areas. It is about time the government makes people aware of the fact that whilst individual freedom has to be maintained, there is also need for people to adhere to some restrictive norms so as to save the environment from the inherent problem of degeneration.

Policy approach:

The resolution of the problems and land use conflicts in Barolong farms must first take into account the present pattern of settlement, socio-cultural the physical conditions, the present policy instruments, programmes and the present institutional arrangements. Thus it is the contention of this study, that the neglect of any of this conditions may instead of resolving the prevailing problems, result in the extension of the already difficult situation. The following problems are thus going to be dealt with: pressure on land leading to the prioritization of some activities at the expense of others and land degradation resulting from the over utilization of the existing resources and pressure on water resources.

From the previous analysis, we learned that pressure on land, may result in either competition for land or land degradation in the form of overgrazing, soil erosion and vegetation removal. We identified two land use conflicts in the study area. These are conflicts between arable and grazing activities and conflicts between the human settlement and agricultural activities. Although the Tribal Land Act of 1968 provides for the land board to zone different landuses and once such

have been zoned, that they be gazetted and no allocation of land for other types of activities either than the one for which the area is reserved for must be effected within it, this provision has not been used in Barolong farms. The present grazing areas for instance are part of the traditionally zoned areas. We therefore recommend that the existing grazing areas be gazetted so as to prevent further encroachment by arable farming. Once the grazing areas have been gazetted, it would therefore be necessary to guard against further degradation of the areas. It would be necessary to work towards the improvement of the carry capacity of the grazing areas by first, rehabilitating the degraded areas. This can be done through either reseeding and fertilizing of the grazing areas.<sup>(2)</sup>

An agreement would have to be reached with the concerned communities to avoid grazing their livestock in areas that are under the rehabilitation process. This, can be made possible by first conscientising people into realising the need to use the present pastures in the most sustainable manner. Experience and observation during the field work, revealed that people are very much aware of the effects of overgrazing on the range resources. However, they are not willing to practice any form of land conservation due to the fact that such grazing areas are communal and as far as they are concerned any improvement in these areas can only be

effected by the government. Thus, the creation of awareness amongst the people that the solution to the present problem of overgrazing lies squarely in their hands is very necessary.

Secondly, once grazing areas have been gazetted, livestock numbers must be adjusted to the carrying capacity of each grazing area. This can be done through the encouragement of the people to sell their livestock. These reductions, must also be done taking into consideration the seasonal fluctuation of range lands carrying capacities. Note has to be taken that this is a very sensitive area requiring very strong political will earlier attempts have shown that people resist the move. It is therefore necessary for the government to introduce incentive packages, (just like it has done with arable farming) that can encourage the people to reduce the number of their livestock. The percentage of the numbers that have to be reduced, must be based on the amount of livestock that each farmer owns. A stress must be placed on ownership of good quality livestock rather than many that are just as good as none. And lastly, people must be encouraged to employ more land productive management practices such as the production and use of fodder and reduction of total reliance on the natural veld. (3)

In order to guard against crop destruction by livestock, farmers must be encouraged to herd and kraal their livestock especially at night so as to prevent livestock from roaming idly as is the present situation. Secondly more farmers must be encouraged to fence their fields and where possible, new field allocations must be aligned with old ones so that fencing may be made cheap through farmer's sharing expences for part of the fence. On the other hand, people must be encouraged to grow bush hedges around their fields. (4) This can be done together with barbed wire fencing. The advantage of a bush fence is its ability to work as a wind breaker and it also has an extended advantage of holding soil together as such protecting it against erosion. Priority has to be given to the boarder villages of Metlojane, Cwanyaneng, Mokatako Goodhope and Kgoro (see Map no. 16). These are villages where the problem of land degradation is most serious. Once these programmes in these villages have taken off, efforts must be extended to the rest of the sub-district.

With regard to the conflict between the human settlement and agricultural activities, there is a need for the government to encourage the landboard to restrict further movement of people into agricultural










North Arrow

BAROLONG DEVELOPMENT STUDY



**LEGEND**

-  INTERNATIONAL BOUNDARY
-  SUB-DISTRICT "
-  RAILWAY LINE
-  PRIMARY ROAD
-  SECONDARY "
-  MINOR "
-  PRIORITY AREAS



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 M.A. PLANNING YEAR 11 1987/88

MAP  
 NQ 16

land. People must be encouraged to occupy the spaces that exist within villages. The necessary point is to make people aware that their continued encroachment into agricultural land, is reducing the amount of land available for the purpose.

We further recommend that public awareness on the crucial role that is played by water on resource management has to be raised. At the same time, there is a need to develop a framework within which the present fragmented administration of water can be dealt with. A central water management body has to be formed. The present situation is such that water resources are dealt with by several ministries and departments for instance domestic water supply for villages is supplied councils. Livestock and arable farming water supply is on the other hand handled by the Ministry of Agriculture. At the sametime, water rights are granted by the Mistry of Water and Mineral Resources whilst land is allocated by the Ministry of Local Government and Lands. This fragmentation of water administration, result in uncontrolled usage of water.

Lastly, we recommend that people be encouraged to engage in woodlot planting activities for both fuel and construction purposes. Where there is shortage of



of water, programmes like the one which is presently operating in Tlhareselele must be organised through the communal first development areas programme. The Ministry of Agriculture must take an active role in conscientising people on the need to plant trees both within their compounds and at their fields. There is also a need to protect the presently endangered natural tree species - Table No. 9 indicates the trees species that are presently facing depletion and yet they are very valuable for fodder, construction and fuel purposes.

These recommendations, are simple and basic to the present system of administration. All that is needed, is the government's willingness and capacity to control the present use of the natural resources. There is need to enforce the requirements of the 1968 Tribal Land Act, the Forestry Act, the Water Act and many others that have been designed specifically for the management of environmental resource use.

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## CHAPTER FIVE

### CONCLUSION

This study is set out to investigate the effects of the consolidation of grazing lands, arable lands and the human settlements on fragile ecosystems. To meet the requirements of the study, Barolong farms area, a mixed farming region in the southern district of Botswana, was chosen as the case study. The objectives guiding the study were:

- to review the existing land uses, and identify prevailing conflicts in land use in the Barolong farms and,
- to suggest possible policy measures for resolving the land use conflicts.

This basis of these objectives was the assumption that consolidation of grazing lands, arable lands and the human settlement can result in high agricultural production only if efficient measures of combating environmental degradation are taken into consideration. For this reason, the study covered such aspects as the historical background, the physical environment, demographic features, economic activities and land use activities and policies.

A look at the historical background revealed that traditionally the Barolong people used the area as pasture land while they resided in Mafikeng and other parts of South Africa. Towards the end of the 19th century, the area was sub-divided into farms, which led to the establishment permanent settlements by some members of the Barolong Community. The result was the adoption of mixed farming but at a subsistence level of production.

The other important thing that history revealed was the problem of administration, that came about because the area fell under Bechuanaland (Botswana pre-independence), yet it was ruled from Mafikeng - South Africa. This resulted in a weak control system between the tribal administration in Mafikeng and the subjects in Barolong farms. Soon after independence, a new Chief for the Barolong in Botswana was installed. The present day Barolong farms area is a fully recognised tribal territory within Botswana.

The physical environment is characterised by high daily temperatures, low and variable rainfall and high wind speed occurrences. This type of climate, poses severe constraints on human activities whether arable, livestock or the human settlement. On a

comparative basis, the soils of the area, loam soils, sandy soils with a very fine structure, have a high arable agricultural potential though they are very sensitive to any form of misuse. If exposed through debushing and removal of grass cover, the soils easily erode. Under normal circumstances, these soils could be best used for pastoral farming. Their use, whether for arable or pastoral purposes, require very high levels of management for the maintenance of fertility and structure retention. Likewise, the vegetation of the area-southern tree savanna - is very sensitive and susceptible to destruction and even complete depletion if exposed to uncontrolled utilization. The natural vegetation of the area has been greatly modified through cutting for fuel, and construction purposes, by clearing for arable farming purposes and overgrazing by livestock. At the same time, the rate of regeneration has been very low due to recurrent drought occurrences.

The area's population growth has been influenced by both natural and migration factors. The extent to which arable agricultural development has influenced the rate of migration is very important. The years 1970 and 1971-80 witnessed a considerable number of people being attracted into Barolong farms, and an increase in the number of villages of

500 - 1000 people and those of over 1000 people. However the slow development of both the industrial and service sector, and the effects of drought on arable agricultural result in a lower rate of in-migrations.

Arable agriculture is the mainstay of Barolong farms economy. Arable farming is practised on highly mechanized commercial basis: it is characterised by a high level of specialization, individualism and isolationism. This is more evident with regard the large scale farmers. There is a highly skewed ownership of both arable land and livestock. The largest amount of land is owned by the large scale farmers who also own the largest herds of cattle ranging from 40 to over 200 herds of cattle. Barolong's involvement in livestock farming is on a very low scale, kept primarily as an insurance against risk in arable farming and as draft power by the small scale farmers.

Three main land use activities noted are the human settlement, arable agriculture and livestock farming. Supporting these land use activities were the two activities of wood utilization and water utilization. The analysis of all these activities, revealed that two main land use problems exist in

Barolong farms these are: pressure on land and pressure on water resources. Pressure on land, is a result of rapid population growth and low productive capacity of the land. The institutional arrangements are also unable to cope with the present rate of growth due to their failure to apply necessary legal provisions for controlling the rate of development in the area. It has been noted that involvement in both arable and livestock farming has intensified as well as extensified. This, is further encouraged by government policies which are largely aimed at increasing agricultural production for purposes of reducing food imports. This intensification of human activities, has further led to high demands for water resulting in pressure being laid on water resources; mainly with regards to the acquisition of land for boreholes. The growth of the human settlement on the other hand, has resulted in greater demands for domestic water supply as well as wood for construction and fuel wood. The result has been the clearing of large tracks of land as a result of which Barolong farms now appears almost like a park land with scattered isolated trees.

Pressure on land, has further led to two problems of land degradation and conflicts in land use due to prioritisation of some activities over others by people

when they realise that there is shortage of land for the expansion of either one of their activities. Land degradation is indicated by the presence of high rates of soil erosion and bush encroachment both of which result from either overgrazing, poor methods of cultivation and removal of vegetation for either household use or agricultural purposes. Two land use conflicts were then identified. They are: conflict between arable and livestock farming and conflict between the human settlement and agricultural activities. The former has resulted in the reduction of grazing lands while the latter, result in the encroachment of the human settlement in both arable and grazing areas. This further has an effect of accelerating the rate of land degradation since large herds of livestock become confined to very small grazing areas.

Government and people's response to these problems has been very limited, carried out in piece meal. The Government efforts have been largely concentrated on the intensification and extensification of agricultural production to the almost total neglect of conservation of the resource on which agriculture is so much dependent. This is made more clearer by the government introduction of the drought relief and the accelerated rainfed programmes which promote further destumping of large tracts of land by providing people with destumping



premiums and yet most people cannot manage to even utilize the lands that they are presently owning.

In view of these problems, the study went on to suggest measures which can help to reduce the effects of consolidated settlement on Barolong's natural resources. The study based its recommendations on an understanding that the trend of settlement in Botswana is towards consolidation. This requires the government to address itself fully to the problem through the formulation of policies that can deal with land issues in an integrated manner. The study therefore went on to recommend that as a long term strategy, government should reorganize the institutional structures that deal with land matters and water.

A co-ordinated system of water administration must be devised so as to do away with the present situation where water affairs are dealt with by various ministries and departments. With regard to pressure on land, it has been recommended that a zoning exercise should be carried out and that once it has been effected, grazing areas be gazetted and arable allocations in grazing areas must be stopped. All the above must be complimented by the application of conservatory measures such as rehabilitation of the presently

overgrazed pastures, tree planting for fuelwood and construction purposes etc. Since the people attitude towards the conservation of natural resources is presently very low, it is necessary to create their awareness through some education media such as the use of the radio, Kgotta meetings (Kgotta - chiefs kraal) and many other public forums. The study thus realises the creation of public awareness for conservation of resources as the only way in which problems presently faced by Barolong farms can be resolved.

It has been indicated in the analysis that it was impossible for the researcher to acquire data on a number of issues which could have further strengthened the study. This data, is also necessary for overall planning purposes in the country. We therefore wish to suggest that further studies be carried out on the following: the magnitude and extend of soil erosion, the likely effects of irrigation on Barolong farms with regard to water consumption and soil salination \* and ~~clogging~~ and the extend of grain destruction by livestock.

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Appendix No. 1: Mr. A Vs Rolong Land Board 1985

This case involved Mr. A, Rolong Land Board and the Jshipane grazing group (syndicate). Mr. A applied for a piece of land in the Jshipane area, his application was rejected by the Rolong Land Board on the grounds that it was a grazing area. Mr. took an appeal, he was therefore granted the land by the Minister of Local Government and Lands. Jshipane grazing group raised an objection against the Minister's decision. They based their objection on the following grounds:-

- (a) They were allocated grazing rights in the area in dispute by the Rolong Land Board;
- (b) Among them were some who had applied for the arable land in the same area but their applications were turned down on the grounds that the area had been declared a grazing area.
- (c) They were surprised to learn that Mr. A had been granted arable land rights for 80 ha in the area this was not only contrary to the declaration of the area as a grazing area but also contrary to the Land Boards policy of allocating individuals arable land not exceeding 12 ha.

- (d) Available grazing land in the Barolong farm was very limited and 80 ha. granted to Mr. A would reduce their grazing area and result in livestock loss.
- (e) The area in dispute was too close to their borehole and it had been used by their predecessors and themselves as far back as 1972.
- (f) They understood that Mr. A had claimed the area he applied for as his by inheritance, but as far as they knew he had never had any land rights in that area. The area in dispute, a portion of Ishipane farm, was one of the 41 farms which had been consolidated into tribal land. The portion claimed by Mr. A was part of the farm allocated to Mr. Legwase (a South African) who had left the country and the land was resorted to the Land Board.

The decision to uphold Mr. A's appeal was based on the following grounds conveyed by the Land Board.

- (a) The applicant was applying for a portion of Ishipane farm (80 ha. only) not the whole area.
- (b) Land Board had failed to consult the people when it declared the area a grazing area and that was not in accordance with section 17(1) (2) of the tribal Land Act.

(c) Some Land Board members had an interest in the area which was not declared when dealing with Mr. A's application.

The Assistant Minister having carefully studied their grounds for objection in order to find out whether there was anything in their grounds of objection warranting a reconsideration of the decision has concluded that some clarification was necessary.

The portion of land granted to Mr. A was part and parcel of the farms consolidated into tribal land and he had no personal rights until the allocation was made by the Land Board. The reference to his claim meant that the land Board declined to allocate the land to him for no satisfactory reason hence he claimed that he should have been allocated the land.

The Barolong Tribal Land was a mixed farming area and no portion of it had been declared an exclusively grazing area in accordance with section 17 (1) (2) of the Tribal Land Act.

Mr. A applied for a piece of land measuring 80 ha. and upholding his appeal implicitly meant that he should be allocated the land he applied and appealed for. The Assistant Minister had concluded that besides these clarifications the grounds of objection do not warrant a reconsideration of the decision.

Appendix 2:

Average Rainfall

<u>Year</u>	<u>Average rainfall (mm)</u>
1973/74	522
1974/75	530
1975/76	455
1976/77	420
1977/78	361
1978/79	236
1979/80	366
1980/81	648
1981/82	439
1982/83	250
1983/84	265
1984/85	237
1985/86	236
1986/87	334

Appendix 3: Names of wards and names of farms falling under them

Good Hope

- 1 Mogwalale
- 2 Mogobewakhomo
- 3 Cwaanyaneng
- 4 Metlojane
- 5 Gamokoto
- 6 Kgoro pan
- 7 Kgoro
- 8 Good Hope
- 9 Madingwane
- 10 Sheepfarm
- 11 Malokaganyane

Pitsane

- 12 Methel
- 13 Mabete
- 14 Maiphitlwane
- 15 Morelelo
- 16 Rakhuna
- 17 Pitsane Patlokwe

Hebron

- 18 Tswagare
- 19 Maditlon
- 20 Logagane
- 21 Hebron
- 22 Mooiplaats

Hebron Contd.

- 23 Marojane
- 24 Piheiswane

Papatlo

- 25 Ngwatsau
- 26 Matasalalo
- 27 Borobadilepe
- 28 Makokwe
- 29 Papatlo
- 30 Ramatlabama

Makatako

- 31 Lokala
- 32 Matlaka
- 33 Motlhaba
- 34 Itlojatau
- 35 Mokatako
- 36 Sekokwane
- 37 Tshipane
- 38 Matetwe
- 39 Maletwe
- 40 Lotlhagane
- 41 Ditlharapa

Appendix No. 4 :

Cwaagare Grazina Group . Rolong Land Board

Facts:

The appealants - Cwaagare grazing group alleged that:

- (a) The disputed area had been reserved for their livestock grazing in 1976. As an agreement between Cwaanyaeng Community and their chief under the tribal grazing land policy.
- (b) In 1985 - some people from Metlojane applied for land for arable farming purpose within the area.
- (c) An objection to the applications was raised by the community and their chief.
- (d) However, the applicants were allocated fields despite the groups objection.
- (e) An appeal was then lodged with the Ministry of Local Government and Lands.

Holding:

The Minister dismissed the appeal on the grounds that the appellants had no rights to set aside communal land for their exclusive use without the authority of the land board. Furthermore, the area had not been gazetted as pasture; only after gazetment can an area be used excusively as grazin





C. Agriculture

1. Do you engage in

- a) Commercial farming -----
- b) Subsistence farming -----
- c) Both -----

2. What is the distance of your fields from your homestead?

- less than 100 m. -----
- 100 - 200 -----
- 200 - 300 -----
- 300 - 400 -----
- 400 + (please specify) -----

3. Do you have lands/fields outside Barolong farms?

- (i) Yes/No -----
- (ii) If yes where? -----
- (iii) If no why? (give reasons) -----
- 
- 

4(i)	Crops	Input	Total output	Cashcrop	Subsistence crop

4(ii) How much production from each stated cash crop did you get in the last year? (1986)

-----

4(iii) (a) Have you experienced any decline in production in production in the last ten years? Yes/No

-----

(b) If yes, would you state by how much?

-----

(c) Which was the most critical year?

-----

(d) And what were the reasons for the decline?

-----

-----

-----

(e) If the answer to (a) above is No, has your production been increasing or it has been similar all years?

-----

-----

(f) What are the reasons for the answer given in (e) above?

-----

-----

4(iv) How much of your production (1986) did you sell?

-----

4(v) What are the prevailing prices for each of the cash crops stated in 4(i) above?

-----

-----

-----

4(vi) Has there been any increase or decline in prices?

Increase -----

Decline -----

4(vii) By how much have the prices increased/declined?

-----

4(viii) Where do you sell your produce? -----

-----

-----

5. Methods of Cultivation.

(i) Ox-drawn -----

(ii) Donkey drawn -----

(iii) Tractor -----

(iv) Other -----

6.(i) Are the above

Hired -----

or Owned? -----

ii) If hired, what are prices per hectare? -----

7. Farming inputs used on the farm

(i) Seed -----

(ii) Fertilizers -----

(iii) Insecticides -----

8. Farming labour

(i) Family labour -----

(ii) Hired labour -----

a) permanent -----

b) seasonal -----

9. Livestock farming.

i) <u>Type</u>	<u>Grade</u>	<u>Number</u>
-----	-----	-----
-----	-----	-----
-----	-----	-----
-----	-----	-----

ii) Where do you graze your livestock? (state name of grazing area)  
-----

iii) (a) Do you own a cattle post? Yes/No -----  
-----

(b) If yes where? (name of area) -----

(c) If no why? -----  
-----  
-----

10. What problems related to agriculture do you face?

inadequate grazing land -----

shortage of arable land -----

lack of capital -----

other -----

11. What solutions would you propose for problems identified above?

-----

-----

-----

D. Income

(i) What are the sources of income

	<u>Head of household</u>	<u>Others</u>
Farming	-----	-----
Business (specify)	-----	-----
Wage employment (specify)	-----	-----
Others (specify)	-----	-----

(ii) Expenditure pattern per month (Pula) in order of importance.

<u>Item</u>	<u>Amount</u>
Item	-----
Food	-----
Fuel	-----
Transport	-----
Education	-----
Water	-----
Health	-----
Farming	-----
Others (specify)	-----

(iii) (a) What is your estimated total income per month (pula)

0 - 100	-----
101 - 200	-----
201 - 300	-----
301 - 400	-----
401 - 500	-----
500+	-----

(b) Do you make any savings/investments? -----

(c) Where do you invest your savings? -----

E. Land Use Pattern

1. (i) Land ownership

Bought -----

Inherited -----

Allocated by landboard -----

Allocated by Chiefs -----

Rented. -----

(ii)(a) If bought, what was the price? -----

(b) What is the current price? -----

(c) Other information -----

(iii) Amount of land owned ( $M^2$ ) (Hectares)

Homestead -----

Grazing -----

Arable farming -----

Other (specify - e.g Horticulture) -----

(iv) (a) Do you experience any problems with land acquisition? Yes/No

-----

(b) If yes, please state -----

-----

-----

(c) What solutions would you give for problems stated above? \*

-----

-----

2. Housing

(i) Type of house (eg. traditional roundawel) -----  
-----

(ii) Building used.

	Material used	Amount
Floor	Earth	-----
	Cement	-----
	Other (specify)	-----
Wall	Mud/soil	-----
	Bricks	-----
	Stone	-----
	Concrete blocks	-----
	Timber	-----
	Iron sheets	-----
	Other (specify)	-----
Roof	Grass thatched	-----
	Iron roofed	-----
	Tiled	-----
	Asbestos	-----
	Other (specify)	-----



3. Fencing:

(a) Are your properties fenced? Yes/No -----

(b) If yes, attend to the table below.

Material used	Homestead	Lands	Livestock/grazing area
Barbed wire Natural hedge (Specify species if possible)			

(c) Where do you get the materials from? -----

-----

(d) Do you experience any problems in obtaining them?

-----

-----

(e) How can the above problems be solved? -----

-----

-----

(f) If the answer to (a) above is no, what are the reasons for not fencing?

-----

-----

-----

-----

F. Water Resources

1. Sources of water supply.

(i) What is your source of water?

Borehole -----

Well -----

River -----

Tap -----

Roof catchment -----

Dam -----

Other specify -----

ii) If the source of water is a Borehole, is the borehole

a) privately owned -----

b) syndicate owned -----

c) council owned -----

d) Other (specify) -----

iii) What is the distance to the nearest water point?

-----

iv) Uses of water

Domestic -----

Livestock -----

Irrigation -----

Other (specify) -----

v.) Do you experience any problems of water supply?

Yes/No -----

vi) If yes, please state the problems. -----

-----

-----

G. Energy:

1. What is your source of Energy for:

	Cooking	Lighting
Electricity (a) Owner generated (b) other		
Gas		
Paraffin		
Fuel wood		
Other (specify		

2. Availability of fuel.

i) Is fuel wood easily available/obtainable?

Yes/No -----

ii) If yes please explain -----  
-----

iii) If no why? -----  
-----

iv) Do you (a) buy or (b) gather your fuel wood?

Buy -----

Gather -----

v) (a) If the answer is buy, what is the price per  
kg. or load? -----

(b) How many times a month do you buy it?  
-----  
-----

H. Land Conservation Measures

1. What are the types of land conservation measures undertaken on your pieces of land

(i) Paddocking of grazing area

(ii) Agro-forestry

(iii) Terracing

(iv) Cut-off drains

(v) Other (specify)

2.(i) Do you practice agro-forestry on your land?

-----

(ii) If yes state the tupes of trees grown? -----

-----

I. Marketing and Transport

1. How far is the nearest marketing centre?

2. (i) How do you transport your products to the market?

(a) Private car -----

(b) Public transport -----

(c) Donkey drawn cart -----

(d) Other (specify) -----

(ii) How much money do you spend on transportation of production? -----

3. (i) Do you face any transportation problem? Yes/No -----

(ii) If Yes, please state types of problems experienced

-----

-----

-----

J. Community Services

1. Schools

How far is the nearest-----

(i) Primary school -----

(ii) Secondary school-----

(iii) Other specify -----

2. Health

(i) How far is the nearest health facility?-----

(ii) Where do you go for your medical services?-----

(a) Private doctor

(b) Council clinic

(c) Health post

(d) Government hospital

(e) Missionary hospital

(f) Local medicine man.

3. Commercial services. Are the following facilities present

in your area? i) shops ----- (ii) Co-operatives

(iii) Butcheries ----- (iv) Other -----

11. Community Participation

1. (i) Are you a member of any community organization?

Yes/No -----

(a) If yes which one? -----

(b) If no why? -----

-----  
-----

2. (i) Are there any community development committees  
in your village? Yes/No -----

(ii) If yes, which ones? state -----  
-----  
-----

(iii) Do you participate in any of the committees stated  
above? Yes/No -----

(iv) (a) If yes, which one? -----  
-----

(b) What role do you play? -----

(v) If no why? -----  
-----  
-----

(vi) If the answer to 2(i) above is no, give reasons  
why there are no community development committees  
in your area?  
-----  
-----

(vii) Do you think it is possible to establish them?  
Yes/No -----

(viii) If Yes, how can they be established? -----  
-----

(ix) If no why is it not possible to establish them?  
-----  
-----

3. What are the functions of the committees stated in 2(ii) above?

Committee	Functions

4. What types of blems have been experienced on the running of these committees?

-----

-----

-----

5(i) Do the committees allow effective participation by individual members and members of the public? Yes/No -----

(ii) If no what improvements would you suggest to make them more effective means of community development?

-----

-----

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-----

6(i) Do you that more community effort should be used in resolving some of the development problems of the area? Yes/No -----

(ii) If yes in which sectors would you expect such efforts to work best?

Education -----

Health -----

Agriculture -----

Other (specify) -----

Thank you.