

**LAND DEGRADATION IN THE NORTHERN PROVINCE:  
PHYSICAL MANIFESTATIONS AND LOCAL  
PERCEPTIONS**

**BY**

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## **Declaration**

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously, in its entirety or in part, submitted it at any University for a degree

## **Abstract**

The study traces some of the causes and effects of land degradation in Mutale since it is an environmentally challenging issue associated with depletion of resources. The degradation conditions identified by the Provincial Department of Agriculture in the Northern Province support the aims of this study.

Based on information obtained from the physical survey of the area and through questionnaires and interviews with the local people, it is evident that the environmental conditions of Mutale district have worsened due to the influence of land usage. From the survey made, the physical conditions are shown to be in a state of decline and to impact negatively on the soil and vegetation.

The perceptions of the local community regarding physical change revealed that a variety of activities such as gathering fuel wood, fencing, stocking, and cultivating fields, influence each other and exacerbate the encroachment of degradation conditions. Stock worsens the conditions through uncontrolled grazing associated with lack of grazing camps, trampling, and overgrazing. Extension of fields, residential areas, and inescapable massive harvesting of bush for different purposes are seen as further causes of the worsening state of the environment.

In the past attempts were made to curb the environmental decline, but such conservation measures were not fruitful enough as they changed from time to time and land users were alienated from land on which they depended.

The present study recommends the implementation of LandCare, a programme that the Department of Agriculture has adopted in other parts of the country, as a possible solution to some of the environmental problems, and as a conservation measure.

## Opsomming

Die studie ondersoek sommige van die oorsake en gevolge van omgewingsdegradasie by Mutale, omdat dit 'n omgewings-uitdagende kwessie is wat met die uitputting van hulpbronne in verband staan. Die degradasietoestande wat deur die Provinsiale Landboudepartement in die Noordelike Provinsie geïdentifiseer is, bied ondersteuning aan die doelstellings van hierdie studie.

Vanuit die inligting wat deur middel van 'n empiriese ondersoek in die gebied en deur vraelyste en onderhoud met die plaaslike mense verkry is, is dit duidelik dat omgewingstoestande in die Mutale distrik vanweë die manier van grondgebruik verswak het. Vanuit die ondersoek wat gedoen is, word aangetoon dat fisiese toestande agteruitgaan en 'n negatiewe impak op die grond en plantegroei het.

Waarneming deur die plaaslike gemeenskap met betrekking tot fisiese verandering dui aan dat 'n verskeidenheid aktiwiteite, soos die versameling van brandhout, bou van heinings, aanhou van vee en bewerking van landerye mekaar affekteer en die toename van die degradasietoestande veroorsaak. Vee vererger verder die toestande deur onbeheerde weiding wat verband hou met die gebrek aan weidingskampe. Die onafwendbare en grootskaalse afkap van die bos vir 'n verskeidenheid doeleindes word beskou as verdere oorsake van die toestand waarin die omgewing verkeer.

Pogings is in die verlede aangewend om die agteruitgang van die omgewing te keer, maar die bewaringsmaatreëls het nie genoeg vrug afgewerp nie, daar hulle van tyd tot tyd gewysig is en die grondeienaars vervreemd geraak het van die grond waarvan hulle afhanklik was.

Hierdie ondersoek beveel aan dat "LandCare", 'n program wat deur die Departement van Landbou vir ander dele van die land goedgekeur is, as 'n moontlike oplossing vir sommige van die omgewingsprobleme en as bewaringsmaatreël toegepas word.

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# 1 FACING THE CHALLENGE IN THE NORTHERN PROVINCE

Land degradation is an environmental challenge that the Northern Province is facing. This section starts by looking at land degradation as a silent threat, and the need for its understanding is highlighted. To have a clear understanding, the study delimits its scope by looking at one of the districts, Mutale, and the aims and objectives to be achieved are stated. Methodology and techniques of data collection and analysis are discussed, which is followed by the research structure.

## 1.1 Land degradation: "The silent crawl"

Land degradation is a world-wide phenomenon recognised and accepted as a prime environmental problem. It has implications for economic development of a country and future human welfare (Barbier & Bishop 1995). It is seen as and is considered to be a silent threat to the available resources such as soil, water and vegetation and is associated with clearing of bushes and overgrazing (Heck 1994; Thomas & Middleton 1994). In essence, it is the depletion of resources under their natural conditions. The United Nations has identified this in various regions of the world, including Africa and Southern Africa, (UNEP 1992). The impacts of land degradation are so vast that they influence the social, economic, and environmental conditions. Land degradation is a problem that needs immediate and close attention although it seems far away and not to affect the conditions of our daily lives (Thomas & Middleton 1994; Stocking & Garland 1995). There is a need to identify the causes, evaluate possible solutions and control measures in our immediate environment. It is essential to educate people concerning land degradation as such (Heck 1994). However, conservation and land management has seen a revolution in new methods and models for land users based on the assumption of theories through the diffusion of innovation. These methods evolved from soil conservation to land husbandry, lead to the emergence of new approaches in conservation, and thus LandCare (Critchley, Reij & Wilcocks 1994; Campbell 1995a; Morgan 1995).

In essence, LandCare is the caring for and conservation of resources. In South Africa, the National Department of Agriculture (NDA) is using LandCare through the National

LandCare Programme (NLP). This is a programme and a strategy for resource conservation adopted from Australia and vested in the provincial departments (Von Maltitz, Versfeld, Matela, Sulaiman, Oettle, Koelle & Critchley 1998). This resulted in the two countries collaborating and the signing of a memorandum on LandCare (Agricultural News 1999d).

The implementation of LandCare as a conservation measure to curb the silent threat of land degradation could provide a solution in South Africa and its provinces, like the Northern Province (NP). The extent of the problem of land degradation could be reduced. Ultimately, there is a need to combat environmental changes and address land usage. This can be a community responsibility; but will need prior empowerment and the power of enforcement in decision-making (Fuggle 1992). Thus, the purpose of this study is to enlighten people about degradation conditions in a section of the Northern Province.

## **1.2 Understanding land degradation**

The understanding of land degradation as a problem is shown by the involvement of international organisations. The global perspective and general causes are discussed next.

### **1.2.1 Land degradation as an international problem**

The decline of land resources due to human activities that place natural resources under severe stress attracted the attention of international organisations like the United Nations Environmental Programme (UNEP). The efforts of this devoted organisation have been on the study of desertification, which is the most dramatic and alarming form of land degradation (Harrison 1990). A first international assessment developed from the 1977 United Nations Conference on Desertification (UNCOD), and was followed by the Plan of Action to Combat Desertification (PACD). In 1991, the United Nations Conference on Environment and Development (UNCED) considered this (UNEP 1993).

Different authors perceived and defined land degradation differently. To get a better understanding of land degradation, the concepts of land and degradation first need an

individual focus. Land is a concept that embraces all the natural resources and life, as well as soil and water surfaces, land surface, and vegetation or crops that may be affected by processes acting on them (Conacher 1995). Bull, Daniel & Hopkinson (1984) identified variation in the quality and quantity of land depending on climate, soil, relief, and quality of land.

Mather (1986) and Marcus, Eales & Wildschut (1996) look at land as diverse and incompatible with various sectors and society. Due to its diversity, land can be used for a variety of purposes. In addition, land is a natural resource and a socio-economic asset to be exploited (Conacher 1995). Other interpretations of land embrace the physical environment, i.e. the atmosphere, soil, geology, fauna, and flora. Land is also taken as space within which humans live, or as a consumer good or commodity, as location and property (Davidson 1992). The Food and Agricultural Organisation (FAO), in Davidson (1992) defined land as an area of earth's surface embracing biosphere, atmosphere, soil and underlying geology, hydrology, plant, and animal population, with the influence of humans on land use. Land could be generalised as the centre of the ecosystem.

The decline in the value of soil, water, and vegetation in terms of their use appears as degradation. Conacher (1995); Mabogunje (1995) defined degradation as temporary or permanent deterioration in the density or structure of vegetation cover through various ways of interruption of energy flow in the food chain and disruption of habitat. Land degradation therefore is the declining of the productive potential of land in its major uses and value (Stocking & Garland 1995). Conacher (1995) further evaluated land degradation as the alteration of the natural environment, to the damage of vegetation, soil, water, landforms, and ecosystem. This results from human involvement and natural hazards like earthquakes, floods, drought and bush fires.

UNEP (1992; 1993) and Thomas & Middleton (1994) cited land degradation as human influence, and worsened by climatic conditions. Haworth (1996) identified land degradation as inherited from the previous generation. The causes differ with the extent of land use, of which some are evident while others are hidden (Barrow 1991). Critchley, Reij & Wilcocks (1994) identified land degradation as a continuous and uncontrolled

abated process. To confront this massive problem, LandCare (as discussed in section 4.2) as a new conservation strategy is urgently required.

### 1.2.2 Causes and processes of land degradation

Land degradation takes different forms and includes a variety of processes and changes. For a national understanding of the causes of land degradation, two theoretical perspectives, i.e. the global and the South African are focussed on.

#### 1.2.2.1 Global and theoretical perspectives

Little knowledge about the causes, processes, and direction of changes of land degradation exists. The cost of depletion and depreciation of natural capital is very difficult to calculate. Thus, the techniques of measuring the processes involved are frequently unreliable (Gray 1999). From some of the definitions, it is clear that human action and nature cause and aggravate land degradation. It is difficult to distinguish between naturally and human induced factors and processes. These occur at various levels and are related to the evidences of change in specific places (UNEP 1992; 1993; Critchley *et al.* 1994; Gray 1999; Penny 1999). De Graaff (1993) identified processes that are involved as physical, biological, and chemical, although chemical conditions fall beyond the scope of this study. The influencing factors included are climate, geology, vegetation, topography and soil (Leung & Marion 1996). These factors cannot be dealt with in isolation as they influence each other. The combination of these factors results in land degradation (Barrow 1991).

The global view on land degradation as put forward by UNEP (1993) and Conacher (1995) traced some causal factors such as urbanisation, unsustainable agricultural practices, and deforestation. The increasing animal populations, sophisticated farm implements, soil erosion, and chemical conditions pressurised this. Other authors such as Barrow (1991), Perkins & Thomas (1993), Thomas & Middleton (1994), Lal (1996a), Wickramasinghe (1997) and Darkoh (1998) indirectly support the global view, identifying similar causes of land degradation. Identified within the range of human activities that encourage environmental degradation, we have overgrazing, deforestation, poor

agricultural practices, poverty, and inappropriate land use practices. SADC (1996) identified poverty as a main cause and consequence of accelerating environmental degradation, as people take what they can from the natural environment to meet their needs.

The evident influencing factors of land degradation are physical and social, which are natural and humanly induced. Physical and human influences are associated with the misuse and mismanagement of resources such as land and/or soil, vegetation and water. Thus, the contributory factors to resource depletion can be said to be biophysical and anthropogenic factors (UNEP 1993; Hoffman, Todd, Ntshona & Turner 1999). Many relate degradation to reduction in productivity, decrease in the physical, chemical, and biological status of land and thus restricting its capacity to produce (Gray 1999; Penny 1999).

#### 1.2.2.2 South African perspectives of land degradation

The recognition of land degradation in South Africa is not new since the colonial government developed remedial programmes as early as the 1930s (White & Jickling 1995; Critchley *et al.* 1994). In South Africa, natural vegetation is increasingly degraded, and nobody seems able to stop the process. It is estimated that 87% of land in the Northern Province is in a critical condition of degradation (Versfeld & Nduli 1998).

In most of the rural areas of South Africa, there is no effective zoning of land use where large areas of agricultural land are lost to other uses every year. Land need is seen as one of the biggest problems (Nthakheni 1999). In South Africa, agriculture has a central role to play in building a strong economy and cannot afford conflicts due to controversial land allocation policies (National Department of Agriculture 1999).

A variety of measures and programmes designed to control land degradation yielded little or no success. Amongst these were rural development strategies that did not appreciate the skills, perceptions, knowledge, and aspirations of those they were to serve (Binns, Hill &

Nel 1997). Thus, new policies to solve rural development challenges are required in South Africa (Wickramasinghe, 1997). This needs holistic approaches that integrate relationships between people and their environment. LandCare can introduce a paradigm shift not only activated in principle, but in practice as well. Such a shift should be evident in a change from a top-down approach to a bottom-up strategy (Binns *et al.* 1997; Von Maltitz *et al.* 1998).

Focusing on the Northern Province and its districts, specifically Mutale district, areas used for crops have shown an increase for the past few years. The provincial and regional Departments of Agriculture, and the Department of Environmental Affairs and Tourism (DEAT) in the Northern Province, have identified the Mutale district as amongst the severely degraded areas within the province. According to the departmental heads at regional level in Thohoyandou, the area can be associated with misuse and mismanagement of resources such as land and vegetation. This embraces unplanned settlement, malpractice of agriculture, and unnecessary cutting of bush (Munzhedzi 1999 *pers. com.*, Tshabuse 1999 *pers. com.* & Tshakhani 1999 *pers. com.*).

The recent national survey suggested that almost 25% of the magisterial districts are badly degraded, Mutale district among them. These facts stimulated the interest to study in the area. Amongst the report findings (Hoffman *et al.* 1999) was stated that the selection of cultivation sites is inappropriate and there is rapid and long-lasting abandonment of land. These factors have a negative impact on grazing lands and the surrounding vegetation that faces decline (Hoffman *et al.* 1999). It is aggravated by clearing of bush in earlier times (White & Jickling 1995) and continues unabated for expansion of new agricultural land to support sustainable agriculture (Haworth 1996).

People in Mutale practice subsistence stock farming, with individuals keeping as much stock as they can, resulting in overstocking. Grazing for stock is in demand while grazing camps are unavailable. The removal of fencing materials, which results in lessening of control, overuse, and degradation threatened the sustainability of communal grazing lands, (Von Maltitz *et al.* 1998; Hoffman *et al.* 1999).

The Mutale area is semi-arid with limited summer rainfall. From the little rain received, the people produce little to feed themselves and their families. They also have to take care of water for their stock and themselves, which is amongst their basic needs. Due to high expectation of higher productivity, the unsuitable lands are targets for cultivation. Moreover, wood is the basic source of fuel for many. As such, vegetation in the surrounding area is highly targeted for the supply of fuel, for building materials, for selling, and for grazing of stock. It is reported that desertification conditions through vegetation decline and evidence of soil decline is a threat in the area, which support the findings made by UNEP (1993) and Thomas & Middleton (1994) in other areas.

### **1.3 Demarcation of study area**

The Northern province covers about 10.2% of South Africa (Statistics South Africa 1998). Administratively the Northern Province is divided into two District Councils, (Bushveld and the Northern District Council), 36 Regional Local Councils, 13 Transitional Local Councils, and 31 Magisterial Districts. Boundaries of some of these Magisterial Districts, like Mutale wherein the study is conducted, remained stable even before the new dispensation of South Africa in 1994 (Hoffman *et al.* 1999). Mutale district is located in the former homeland (Republic of Venda) in the Northern Province. Figure 1.1 below orientates the location of Mutale District in the Northern Province. Within this district, there are different territorial areas with chiefs like Manenzhe, Rammbuda, Thengwe, and Tshikundamalema in the remote rural areas (about 70 kilometres from Thohoyandou).

Figure 1.2 below shows the chain of authorities and different community structures involved in rural areas. The size of study area demarcated is 15156 hectares. Under these chiefs are different villages and headmen from among which four villages were selected for study, i.e. Shakadza, Muswodi, Mukovhawabale, and Tshivhongweni, as it was identified as amongst the degraded areas.

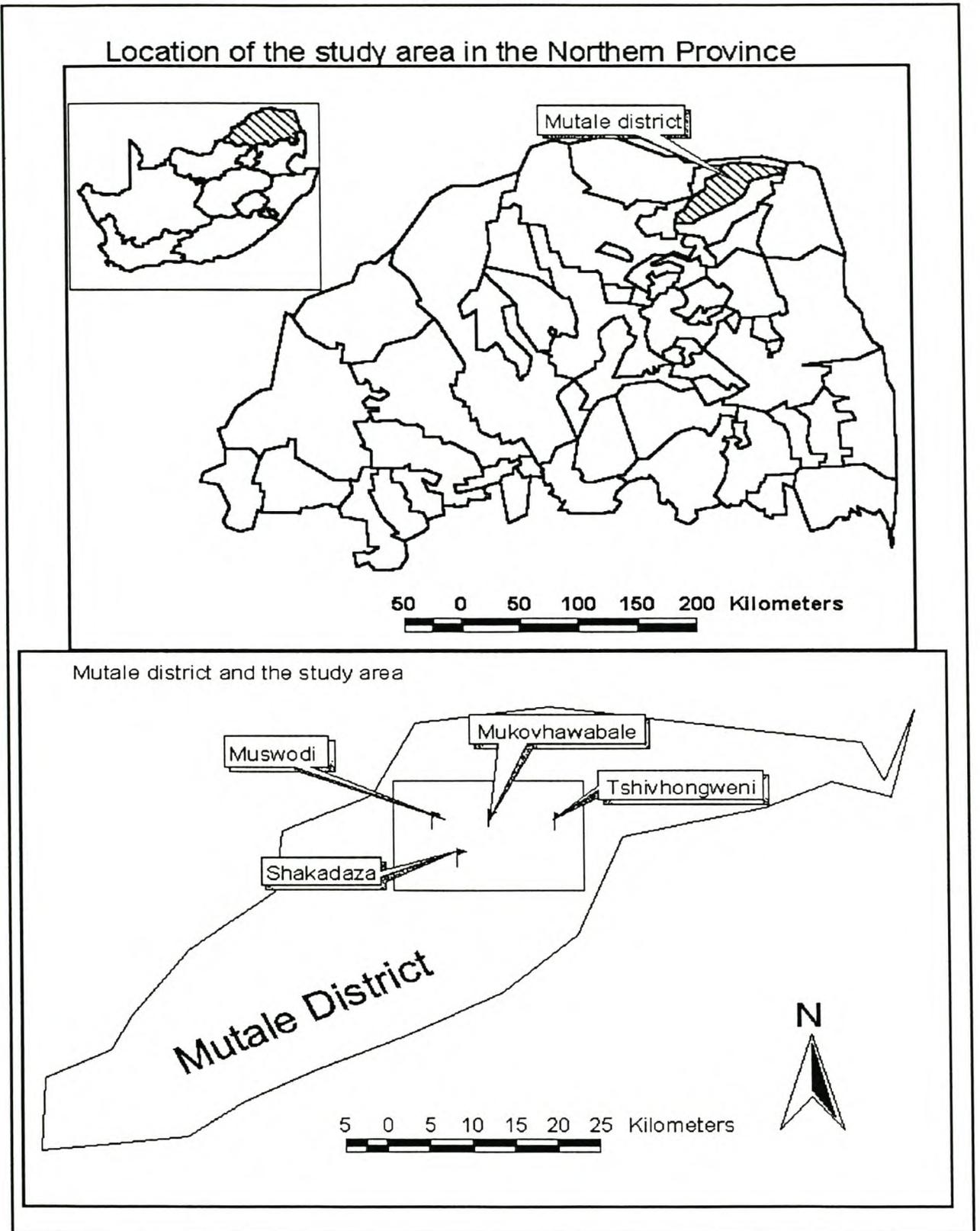


Figure 1.1: Location of Mutale and the study area in the Northern Province

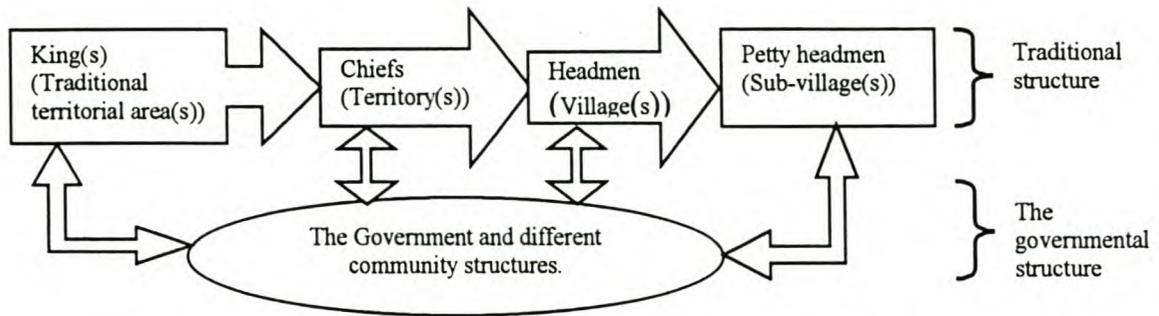


Figure 1.2: A hierarchy of authorities involved in rural areas like Mutale

These villages are under three different tribal authorities; thus, control within these tribal authorities may differ in some cases. Shakadza and Mukovhawabale are under the Thengwe tribal authority; Muswodi is under the Rambuda tribal authority; and Tshivhongweni is under the Tshikundamalema tribal authority.

#### 1.4 Study aims and objectives

The encroachment of degradation and depletion of resources such as water, vegetation, and soil can be examined from different angles. The awareness of the community about land degradation, their response to the immediate resources and land use in relation to type and pattern of agricultural practices, soil condition, vegetation cover, and other uses as well will be a focus. As the further foci of this study, the following questions will be addressed: What is the major influential impact of land use and use of the resources? How do the communities contribute to resource depletion?

Large numbers of projects related to land and resource conservation are in progress in South Africa at national, regional, and local level (Agricultural News 1999b). Thus, the reversal of land degradation may be possible, as Curtis & De Lacy (1995b) have shown. An attempt will be made to examine the potential of community-based initiative to reverse the existing degradation problem.

Against this background the main objectives of this study are to:

1. Evaluate the physical extent and causes of land degradation and to identify the effects on soil, vegetation, and water.
2. Assess the awareness of people towards land degradation and conservation methods to reverse land degradation.

### **1.5 Methodology and techniques**

There is no overall master design or standard set technique applied to find solutions to field problems, although methods to describe the overall research framework and technique refer to an actual manner of collecting data (Lounsbury & Aldrich 1986). Leedy (1997) speculates that data sometimes lie buried within the minds, attitudes, feelings, or reactions of people. The retrieval of such data as a raw material needs careful inspection. Thus, for the success of this study, various methods, which include quantitative and qualitative methods, are utilised.

### **1.6 Data sources**

Different data sources used in this study include population census, map and aerial photographs, and personal and group interviews. Field observations and a questionnaire survey supplemented this.

#### **1.6.1 Population census data**

Widely differing population numbers of Mutale were obtained from the 1996 census, acquired from Statistics South Africa, and Mutale Town Local Council (MTLC). However, this study used the national census of 1996 listed in Table 1.1 below.

The total population of the four villages was 4837 which constituted 14% of the total population of Mutale (68403). The latter was 12.1% of the total population (4 929368) of the Northern Province (Statistics South Africa 1998).

Table 1.1: Population numbers and average number of cattle in the four villages

Villages	Population according to 1996 Census					Sampled households	Mutale TLC population numbers		Average number of cattle
	Gender		Total		Number of households		No.	%	
	Males	Females	No.	%					
Mukovhawabale	377	477	854	18	147	14	906	19	375
Muswodi	884	1.009	1893	39	450	42	2482	49	710
Shakadza	750	928	1678	35	400	38	880	17	761
Tshivhongweni	188	224	412	8	82	8	776	15	342
<b>Total</b>	2199	2638	4837	100	1079	102	5044	100	2188

Although an official in the Population Unit of the Premier's Office in the Northern Province indicated that official population data is inaccurate and the census report released in 1998 shows an undercount (Burger 1999). The difference of 4%, however was judged to be acceptable for the purpose of this study.

### 1.6.2 Map and aerial photographs

A topographical map and aerial photos purchased from the Department of Land Affairs in Mowbray, Cape Town were utilised. A 1:50 000 topographical map (2230AD THENGWE) supplemented other methods to demarcate exact boundaries of the area, and identify a variety of physical and infrastructural features.

Aerial photographs at the scale of 1:50 000 for 1977 (Job 778, Strips 13, (photos 3599 and 3601), and 14, (photos 3566 and 3568)) and 1995 ( Job 982, Strip 4, photos 311, 313, and 315) were purchased.

The objective of using photos from different years was to have a clear visual idea of change and degradation processes over a 20-year period. These were to verify accuracy of change, map features and to avoid possible biases of the researcher.

### 1.6.3 Personal and group interviews

Perceptions of the local people on land degradation were extracted through interviews conducted formally and informally. These were held personally with the headmen of different villages, the departmental heads indicated below and through attending a LandCare workshop.

#### 1.6.3.1 Interview with the headmen

Interviews were conducted with the headmen of four villages together with their entourages. These lasted for about three-quarters of an hour each. The researcher introduced the purpose of and reason for interviews. In villages the headmen selected community members. Attendance after the usual community gatherings (khoroni) differed from the minimum of eight to the maximum of 20. This entails involvement of local people and invasion of their privacy although it developed trust and a close relationship between the researched and the researcher, as Robinson (1998) has stated. Amongst the themes investigated were the number of households (for sampling purposes) and whether land assessment preceded settlement allocation. Further, inquiry focussed on whether evidence of increase or decrease of settlement and vegetation had been detected and to obtain authorisation for study purposes in the area, although the Department of Agriculture had already given their permission. This was to avoid violation of cultural values by going into sacred and prohibited areas during observation and data collection.

#### 1.6.3.2 Interview with the Departmental heads

Three formal interviews, which each lasted for more than an hour, were conducted with the regional heads of the Departments of Agriculture and Environmental Affairs and Tourism in Thohoyandou, and of the sub-region of Mutale. Amongst the major themes of interview questions, was the role that each Department is playing in different communities. One focus was on the identification of mismanagement of resources such as land, water, and vegetation, while another was on awareness campaigns and environmental education. This embraced ways that the departments use to reach out to various communities; the way in which the departments interact with communities and

other departments and the role and aims of LandCare in essential projects within various communities. Constraints that the departments face in undertaking different tasks for different communities were also discussed.

#### 1.6.3.3 LandCare workshop participation

The researcher attended a LandCare workshop arranged by the Department of Agriculture. The origin of LandCare, policy shifts and project identification, and the delays in projects initiation were discussed. Other themes centred on policy guidelines and procedures that investigate initiatives and funding of LandCare projects. The focal point was on the institutional development and involved integration of LandCare and the commercial world.

#### 1.6.4 Field observations and measurements

Direct observations are major sources of information on spatial reality. It is essential for updating information and accuracy of knowledge through actual visual observation (Lounsbury & Aldrich 1986; Leedy 1997). This could be linked to participant observations, which involved local people (Robinson 1998). Field survey was done to substantiate details from the map and aerial photos. Some elderly local people from Mutale and government officials from the Department of Agriculture in the Mutale sub-region accompanied the researcher during the first visit to the study area to help with identification of actual boundaries recognised by the local people.

For easy access to the study region, the researcher was centrally based at Muswodi. Due to transport unavailability to and from other villages, walking was the best and easiest means of transport, and aided detail survey by the researcher. During observation, in some cases, willing local people often accompanied the researcher.

Observations were made of the natural condition of vegetation such as density and scarcity, and soil condition, i.e. erosion and accumulation of soil. Observations of cultivated fields focussed on the materials used for fencing, and on the extent of erosion, to determine if any conservation measures are applied. Abandoned lands were visited and conditions in and along the streams were inspected. The width and the depth of dongas in Mukovhawabale and Tshivhongweni were measured as representative examples of the state of degradation.

As listed in Table 1.2 essential social and economic infrastructure and services such as shops, schools, clinic, satellite police station, and post-office were recorded.

Table 1.2: Infrastructure and services within the four villages

Place	Boreholes		Dipping tanks	Earth dams	Shops & other services	Schools	Total number
	Wet	Dry					
Mukovhawabale	x	2	x	1	2	1	6
Muswodi	x	2	1	x	8	1	12
Shakadza	1	1	1	x	6	2	11
Tshivhongweni	x	1	x	1	1	1	4
<b>Total numbers</b>	1	6	2	2	17	5	33

Representative examples of observed features were photographed, some of which are displayed elsewhere in the text.

#### 1.6.5 Questionnaire survey

Efficient survey is an art and a science, because the questionnaire is used as an instrument for observing data beyond physical reach (Sheskin 1985; Leedy 1997). Allison, O'Sullivan, Owen, Rice, Rothwell & Saunders (1996) pointed out that a questionnaire might disrupt and arouse expectations amongst the respondents. In this study, this was countered by thorough explanation of the aims of the questionnaire.

The questionnaire used for this study (see examples in the Addendum) was in Tshivenda and English. The questionnaire was divided into Section A for personal details, section B for land use information, and section C for natural conditions. Tshivenda questionnaires only were used to obtain total and positive participation from the local people.

The survey unit decided upon for sampling was the household. The headman of each village supplied the total number of households in the four villages (1079) shown in Table 1.1. From this universe, approximately 10% of households were selected as a sample.

The houses in all the villages are located in a regular grid pattern, providing an excellent sampling frame. The first house in the first village was randomly selected, followed by every tenth house after that. The sequence of counting and selection continued from village to village and 102 questionnaires were completed. The selection of questionnaires in each village was proportional to the number of households. This method of systematic sampling ensures adherence to the principles of random sampling (Allison *et al.* 1996).

For the interview, the researcher requested any person acting as head of the household and explained the purpose of the questionnaire. Questionnaires were completed in the presence of and with the aid of the researcher instead of drop-off and collection at a latter stage. This was seen as an effective method since it allowed explanation of misunderstood questions. Where the respondent could not read or write the researcher had to complete the questionnaire on their behalf.

## **1.7 Data analysis**

Questionnaire responses were coded and were stored in an Excel spreadsheet for analysis. Cross-tabulation of different variables in the pivot table function assisted creation of tables utilised in the text to elaborate and emphasise the locals' perception of the different physical environmental conditions. An available map and aerial photographs were scrutinised for mapping features such as settlements, cultivated fields, and abandoned areas. Features from the aerial photograph, were transferred onto a map using a Planvariograph. Analogue maps were converted to digital format in the Arc/Info

Geographical Information System (GIS) package. Digitising of features such as contours, land use, paths, roads, and rivers was done as different layers for later overlaying and combination.

## 1.8 Research structure

The report is divided into four sections as shown in Figure 1.3 below. An overview of the study, statement of the problem, aims and objectives and methodology are presented in Section one. The second section focuses on the physical conditions of Mutale in the Northern Province.

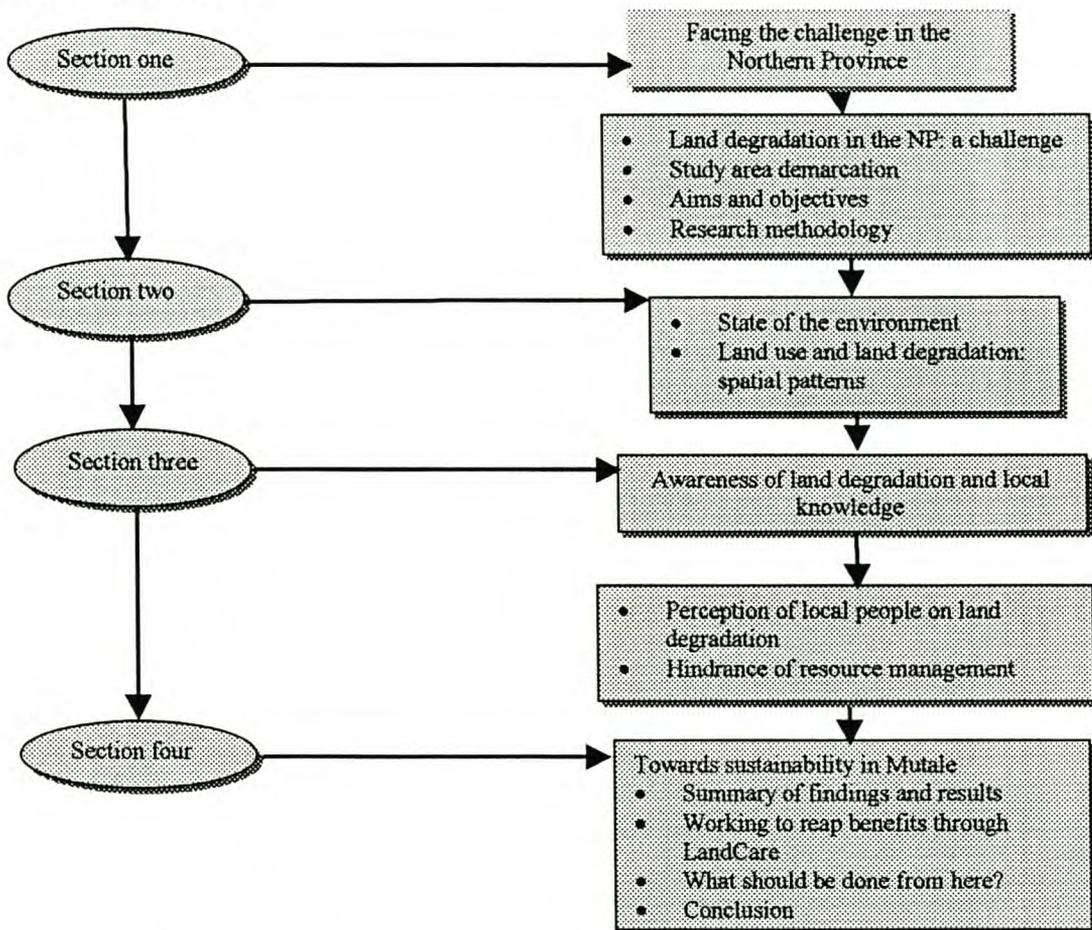


Figure 1.3: Research design and report framework

The third section looks at the awareness of people of the environmental conditions and their involvement in maintaining and improving it. The last section summarises results and looks at the sustainable ways in which degraded conditions can be improved through LandCare.

## 2 ENVIRONMENTAL CONDITIONS IN MUTALE

This section focuses on environmental characteristics and the spatial organisation of Mutale. It gives insight into the physical layout of the study area in South Africa and within the Northern Province in particular, followed by the discussion on physical conditions of Mutale. Emphasis is on observed features of land degradation and other environmental conditions. The land management practices, of land allocation and stock management, follow this. A discussion on land use analysis is given, focussing on land uses and the extent of land use change and its significance. Possible solutions to problems of land use change are discussed briefly.

### 2.1 Human organisation

The physical layout of Mutale district and its villages, (Mukovhawabale, Muswodi, Shakadza, and Tshivhongweni) in Figure 2.1 below also portrays territorial authorities.

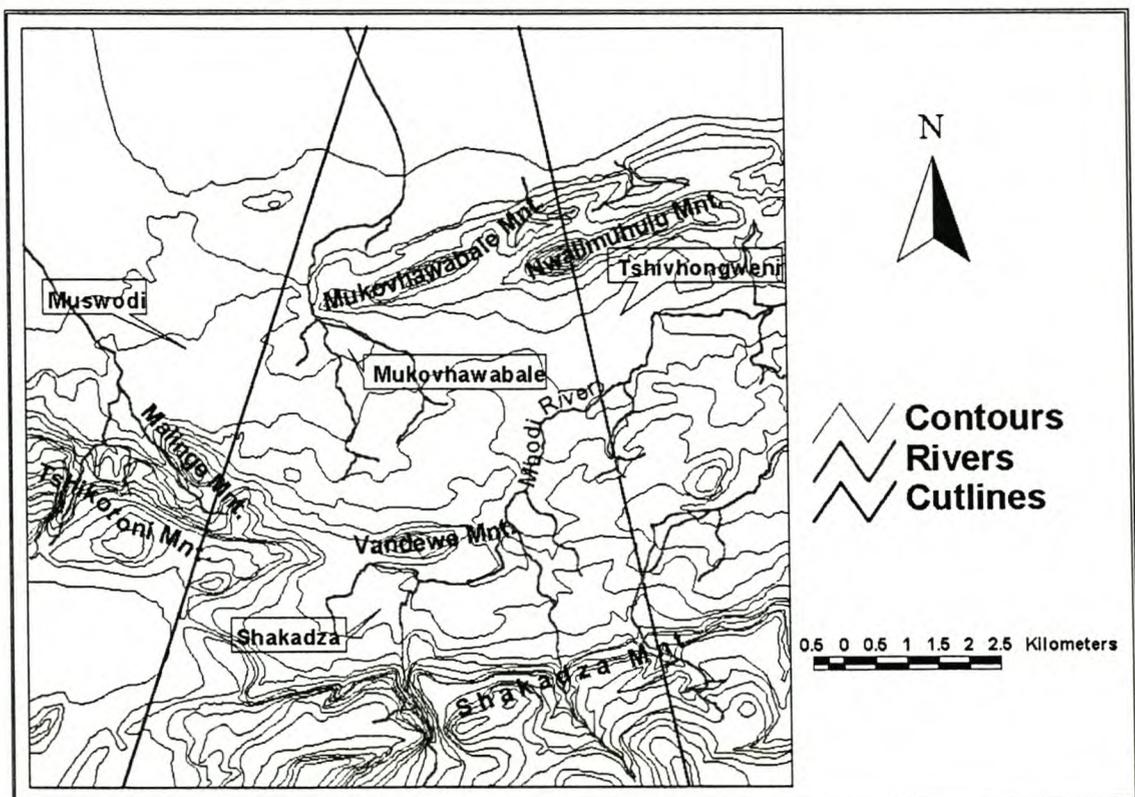


Figure 2.1: Physical layout of Mutale and the studied villages

The physical layout of the four villages in Mutale is characterised by cutlines (10m clear-cut of vegetation, with wire fencing and gates at intervals), rivers, roads, and the contours (interval of 20m) symbolising the hills and valleys. The map shows the Mbodi River (seasonal stream) surrounded by rugged hills reaching the highest point of 946m in Shakadza Mountain above the river plain (570m). Since there are no physical boundaries, the cutlines serve as territorial boundaries, as recognised by the locals. It separates the three territorial chiefs indicated in Figure 2.1, above, i.e. Tshikundmalema on the east, Rammbuda on the west and Thengwe in the centre. These lines control stock and prevent the spread of different stock diseases.

## **2.2 Physical environment**

Two of the 22 physiographic regions of South Africa recognised by Low & Rebelo (1996) are represented in Mutale: the Lowveld and the Soutpansberg. The study area is characterised by dry woodlands, thorn bush, and grassland, which constitute the low-lying areas of the Limpopo valley. This lies at altitudes between 300m and 900m above sea level (Low & Rebelo 1996).

The South African Weather Bureau (SAWB) supplied the weather data for the past 17 years for Tshiombo weather station (Station no. 19982). Climatologically Mutale falls in the Subtropical Lowveld, which is characterised by hot and dry conditions. The area receives a total annual rainfall of 825mm, mostly in summer. The plateau slopes play a role in the climatic conditions with regards to the cool dry winters (Agromet 1999). Climatic conditions and trends influence the use of land in Mutale. Daily temperature variations of between 15°C (low) and 42°C (high) occur. The annual average temperature is a moderate 22°C (Agromet 1999).

The vegetation of the Northern Province comprises two biomes, i.e. the grassland biome and the savannah biome. The savannah biome occupies 46% of South Africa with the largest area in the Northern Province. Economically, most of the savannah is suitable for grazing, making it remarkably important for an area like Mutale, as stock farming is practised. Mutale is characterised by sour lowveld bushveld, grassland, shrubveld, and

woodland. The most common bushveld trees and shrubs are mopane and a mixture of red bush-willow *combretum*, and *Acacia* with *adansonia digitata* and thick bush. These are found in areas of undulating landscape of 300-900m above sea level (Low & Rebelo 1996), making Mutale suitable for the growth of such plant species.

The dominant soil type is loose sandy loam to clayey soil, which determines the types of plant species and crops planted. The area is predominantly semi-arid and characterised by sandy soil that is less stable and quite susceptible to erosion (Morgan 1995; Mainguet & Da Silva 1998; Agromet 1999).

### **2.3 Evidence of land degradation**

The evidence of land degradation attributed to human action, is discussed in this section. The indirect influence of natural processes is also recognised.

#### **2.3.1 Human action and causes**

Land resources in arable and non-arable land face exploitation through development of commercial and subsistence farming. Erosion and further land degradation is liable to occur in non-arable land used for grazing (Bull *et al.* 1984; Marcus *et al.* 1996). Although the four villages are not practising any commercial farming, there is a practice of subsistence farming. This includes the cultivation of fields and communal stock farming producing a variety of products.

People's historical background and their personal interest determine the land use of an area. Thus the grazing type, especially the sour grass which animals prefer, increases the popularity of an area like Mutale for settlement and for raising stock such as cattle, goats, donkeys and sheep. Practices like the trimming of branches damages vegetation. The felling of big trees through the burning of the trunk, and digging out what is left, is a common practice. This destroys trees, since it clears and denies any chance for a plant to rejuvenate.

Mismanagement of grazing areas through overgrazing and cultivation of new fields promotes the demise of ground covering materials and is evidently the cause of soil decline. Regular use of trails and footpaths may increase the extent, degree, and rate of erosion. Much trampling occurs in such areas that are left exposed for grazing as shown in Figure 2.2, below.

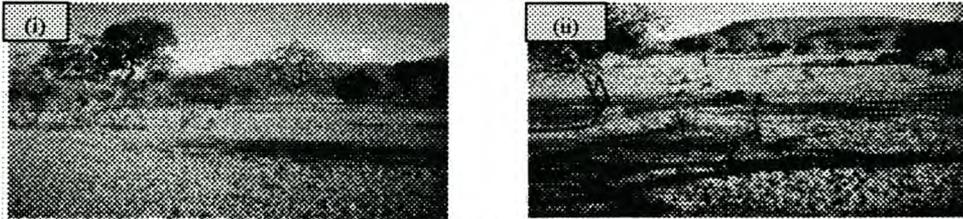


Figure 2.2: Stock trails in Mutale showing trampling on loose soil

The influence of cultivation of fields and overgrazing may become severe in time. Massive uncontrolled clearing of bush for different purposes is evident from stumps in Figure 2.3 (i) Muswodi and (ii) Mukovhawabale below. The clearing occurs initially through cutting down of the branches that are later utilised for fencing the fields.

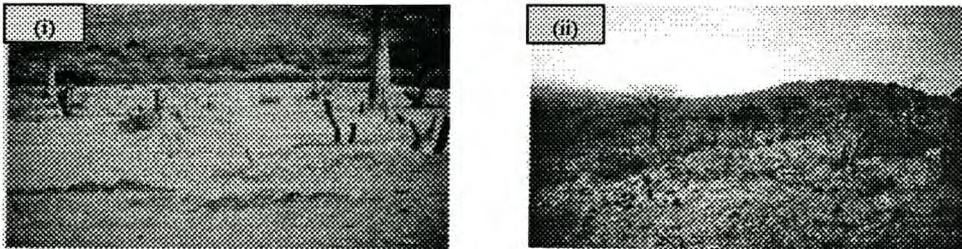


Figure 2.3: Trimmed and cleared bush

Settlement development plays a vital role as modifying land use. Concerning Mutale as a rural area, development takes place within the villages. Some infrastructure (roads and clear cutting for power lines) contributes to the decline of vegetation due to the disturbance of the environment from its natural state.

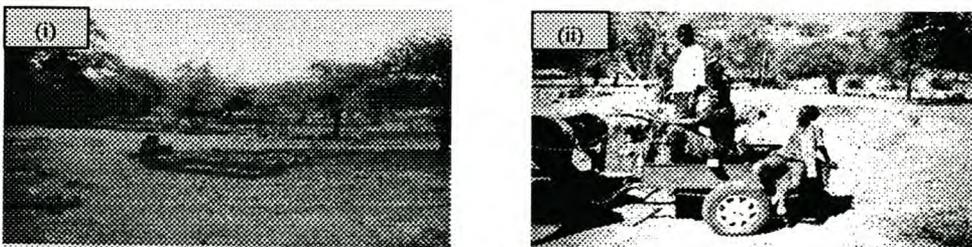


Figure 2.4: Digging soil for brick making and other purposes

Figure 2.4 above shows mud brick making for building construction and similar purposes. The quarrying of soil leaves the landscape modified and disturbed in a way that may be extremely difficult to restore. This also poses health hazards through dust and furthers the degradation of the environment. In some cases, it worsened the dongas, as it is easy to exploit the donga walls to get enough soil for building material. Another common practice is to surround houses and areas in between with muddy walls (maguvha\*) and a floor for decorative and functional purposes, for which large amounts of soil need to be dug up. Figure 2.4 (ii) shows boys from Muswodi carrying soil on a donkey cart. In the background is a hole where the soil is dug for building material in Mukovhawabale.

The quarried ditches may incur danger to the locals as stock and people may fall into such depressions, causing severe bodily harm, or even death. This shows how human activity may contribute to degradation. Conditions in Tshivhongweni and Mukovhawabale mirror other rural areas. Conditions are aggravated by strong winds that leave foundations of houses highly exposed, and some of the “maguvha” are totally covered with soil deposits.

### 2.3.2 Natural processes and causes

A variety of resources and activities occur in the rural environment. Conditions of the natural environment lead to competition in land use. Conflicts over resources result in environmental change and become evident through degradation (Bull *et al.* 1984; Conte 1999). The competition occurring in the four villages of Mutale is for grazing, settlement, cultivation, and wood for a variety of purposes.

Climate, i.e. temperature and rainfall, coupled with the crop type, slope type, soil type, and season determines subsistence production. Climate may interfere if rains stay away or/and if dry periods persist longer than expected. Heavy rains influence the occurrence of erosion and lead to the development of dongas as shown in Figure 2.5 (i) and (ii) below in

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\* Maguvha: Walls made of bricks or stones, use to separate rounded houses and serve as a platform in verandas and to prevent the inflow of water in the houses.

Tshivhongweni along the Mbodi River. Measurements of these visible dongas (due to erosion actions); were taken at Mukovhawabale and Tshivhogweni.

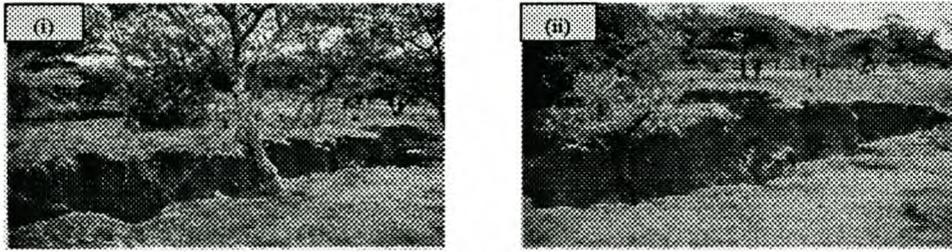


Figure 2.5: Dongas resulting from lack of ground covering materials and erosion

The widths range from 0.4m to 2.5m, and the depth from 0.2m to about 3.5m. With time and without taking control and establishing conservation measures, the conditions may deteriorate to a very bad state. Practices in Figure 2.3 and 2.4 exacerbate the ditches in Figure 2.5.

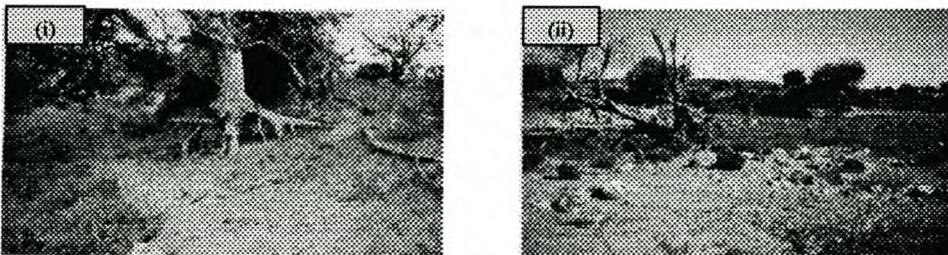


Figure 2.6: Extent of erosion through the exposure of roots

Other degradation evidence are clearly seen in the exposure of roots and uprooting of some trees in Shakadza, portrayed in Figure 2.6 above. Climate and human influence can aggravate the condition in Figure 2.6 (i) and soon similar results of uprooting as in Figure 2.6 (ii), occurs.

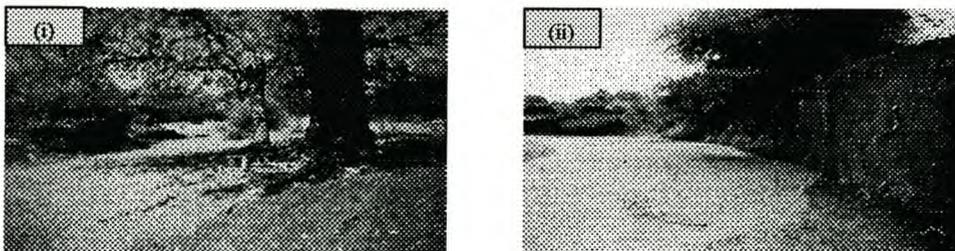


Figure 2.7: Erosion along the streams

Ultimately Figure 2.7 above shows the widening of the stream in Mukovhawabale (i), and Tshivhongweni (ii) and the accumulation of transported sediments.

## **2.4 Land management practices**

Roberts (1990) explains that there are some fundamental principles governing the use of land according to its potential and protecting it according to its hazards or shortcomings. UNEP (1993) noted broad changes in land use types with global increase in cultivated land to increase production. In this sub-section, the trend of land allocation in Mutale is discussed. Regions in Southern Africa with land use problems linked to land degradation due to limited resources have already been identified. There is conflict over land use because of the demand for land for cultivation, grazing, development, and settlement (SADC 1994), which amplify competition. In this section evidence is outlined regarding pastureland and stock management, and sources of drinking water for stock.

### **2.4.1 Trends in land allocation for cultivation**

Moor & Nieuwoudt (1996) reiterate that most of the land in South African black communities is legally held in the trust of the tribal authority for the benefit of the people, while the title is vested in the state. A similar situation exists in Mutale.

Production of crops for subsistence use is the regular seasonal duty of the people in Mutale. The headmen allocate residential plots and plots for cultivation to anyone whose background is made known before the headmen and their entourages. The increase in population is making it impossible to have enough plots for everyone. Though village authorities allocate land for a variety of purposes to other people, passing of land from parents to children is maintained. However, people tend to undermine and disobey the authority of the headmen and claim areas for themselves, which provokes conflicts. Gezon (1997) also identified similar conditions in Ankarana (Madagascar). To the concern of the headmen, this practice is exacerbated by the breakdown of customary beliefs (Clarke 1994, Mainguet & Da Silva 1998), land pressure and socio-economic changes. This

resulted in the people starting to cultivate unsuitable areas, such as along rivers and hilltops because of the misuse of the perceived rights under new government policy.

Different villages experience different conditions in the fields. The headman in Muswodi identified an increase in cultivated areas with the increase in settlement areas. This threatens the available resources, especially the vegetation, since more people mean more land for production and more land to settle on. Thus, some of the lands previously used for cultivation were converted into settlement areas due to the decline in the quality and quantity of products and the extent of degradation. The conversion of some areas from agriculture to settlement resulted after such areas became unproductive, due to the accumulation of wind blown soil.

Conditions in Mukovhawabale differ from that of Muswodi, as ditches that resulted from erosion cut through plots for cultivation. Wind threatened areas were used for cultivation and these became unproductive. This led to massive vegetation decrease and leaving the area exposed for long periods worsened this, which in turn lessened the areas for cultivation and grazing. Such unused land and areas presented more land for residential purposes.

Similarly, Shakadza claims not to have enough plots for cultivation as these have decreased with the increase in population, which resulted in the targeting of new areas for this purpose. On the other hand, lands previously used for cultivation are said to be far from the residential areas. The locals have to walk a minimum of 1.5km and a maximum of 8km a trip. Without appropriate care, especially during harsh and unfavourable climatic conditions, it may result in the abandonment of some fields. The population of Tshivhongweni is small, yet they consider plots for cultivation unsatisfactory and could convert part of their grazing areas for that purpose.

#### 2.4.2 Pasture land and stock management

According to Critchley *et al.* (1994) and Düvel & Afful (1996), conservation and improvement of grazing is possible through communal use and ownership, with land held as common free property. However, in Mutale there are no specific areas for grazing other

than the open grazing areas. With the use of the communal grazing system problems escalate between the local people. The stockowners feel reluctant to reduce stock numbers, as the quantity tends to be more important than the quality (Düvel & Afful, 1996; 1997). People from other villages and areas bring their stock, resulting in rapid decline of grazing. Some fences, as depicted cut-lines in Figure 2.1, are used to control the influx of stock and avoid the spread of diseases. Further purposes of such fences are to separate residential and cultivated areas from the open grazing areas. Unfortunately, the purposes that the fences had were not attained fully as they were destroyed. The removal of infrastructure, especially the fences (Hoffman *et al.* 1999) threatened the grazing lands.

Clarke (1994) and Gezon (1996) argue that fencing is not essential as it creates conflict through boundaries that curtail access rights to land. Fencing also prohibits walking through, which imply total alienation of people from the resources, and in this case may have contributed to their destruction, as they were not socially accepted. Instead, the writers stressed social fencing (community agreed access limitation) to be more effective as it involves the active support and participation of people living in the area. However, breaking down of customary beliefs, make it impossible for social fencing to be effective, which refutes the argument on social fencing as made by Clarke. It is clear that a great deal concerning environmental and social background has to be understood to enforce the use of fences.

Cattle have to be dipped bi-weekly for the control of pests and other diseases. This is when cattle and other stock are counted and where increase or decrease for individuals and for the total area, is recorded. The Veterinary Department from Sibasa supplied the cattle figures in Table 1.1 showing that for the past three years from 1997 to 1999, the total number of cattle in this study region were over 2000.

Stock in Tshivhongweni get their regular dipping at the nearby village of Muraluwe, while Shakadza has a dipping tank of its own. A dipping tank available in Muswodi caters for stock from Mukovhawabale. Due to dry conditions and for the safety of stock, they did not go for dipping for more than five months since a decrease in grazing make stock too weak for dipping. Besides, the survey was conducted when the dipping tank of Muswodi was full of sand that totally prevented dipping. This might also have discouraged the stockowners in Muswodi from taking their stock for regular counting; however, the

concerned villages started discussions to get rid of the sand, and initiate community involvement.

The accumulation of sand in the dipping tank of Muswodi serves as a good indicator of the state of soil degradation, as linked to other activities practised in the area. The blame for a problem of this nature is directed against the community who disregards their responsibility to care for the available resources. In turn, the community blames the Government for not maintaining the resources that they installed, although there is shared blame and responsibility.

### 2.4.3 Sources of drinking water for stock

Periodic rivers emerge from the higher lying areas of Vandewe Mountain in Shakadza and Nwalimuhulu Mountain in Tshivhongweni, accumulating water as they proceed towards the low-lying areas. Due to lack of sufficient water for stock, the government, together with the community at Mukovhawabale and that of Tshivhongweni, devised a way of harvesting rainwater from periodic rivers in the form of earth dams. This helps to conserve water during wet seasons for use in dry seasons and provides central drinking points for stock as demonstrated in Figure 2.8 (i) (ii) below.

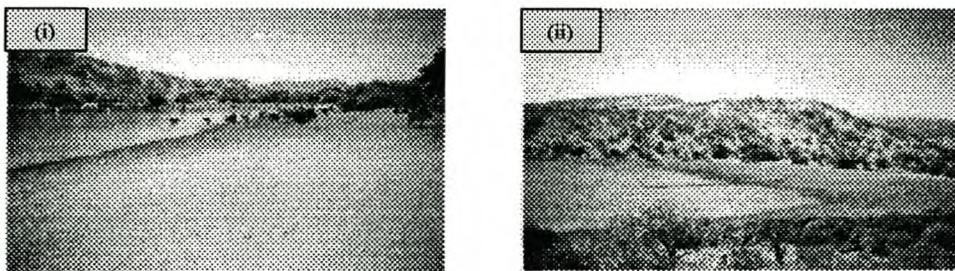


Figure 2.8: A drinking source for stock in Mukovhawabale

Thus, stock from Muswodi and other neighbouring villages assemble at these dams to quench their thirst, although they have to travel some distance. Due to large stock numbers, trampling is experienced, while grazeable vegetation shows a decline around these drinking sources. Perkins & Thomas (1993) also identified this phenomenon in Botswana.

Furthermore, the non-perennial Mbodi River flows from Shakadza to Tshivhongweni in the Northeast. A variety of agricultural activities intrudes upon the stream and interrupts its flow. These activities incorporate fields and gardens that need to get an adequate supply of water. Through this intervention this stream no longer supplies the people who live downstream. Due to the impact of these agricultural activities, the riverbanks widen, while the flow diminishes because of silt and sediment accumulation.

The pressure on the stream is also associated with and aggravated by the number of stock. Consequently, the Mukovhawabale dam suffered some negative effects after the gabions\* collapsed during the rainy season while sediments filling it are reducing its performance. This caused excessive erosion at a greater rate, downstream, affecting some of the fields through washing away the seeds and crops.

## **2.5 Land use analysis**

The patterns of land use in Mutale are analysed first in this section. That is followed by an analysis of land use in 1977 and 1995. The discussion of the extent of land use change is also supported by observations made in 1999 then follows.

### **2.5.1 Land use**

Land use impacts resources like water, through the modification of vegetation cover, increase in biomass and change in the rate of evaporation (Versfeld 1999). Evidently, sources of drinking water within the four villages in Mutale are ground water, which is engine drilled, pumped and stored in tanks. The use of ground water may lower the water table, which may modify the vegetation cover in the end. Some local people attributed the demise of some local plant species and the decline of vegetation to this factor.

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\* Gabions: retaining walls built of stones and supported by mesh wire preventing soil and other materials to pass through, but allowing water to pass (Morgan 1995).

Some of the locals in Mutale consider water supply (quality and quantity) amongst the greater problems, not only affecting the district alone, but the province as a whole. Some of the people in Shakadza are using water from the Mbodi River due to insufficient supply elsewhere. Gezon (1997) pointed out that the effective control of land is situational rather than predetermined. There is an excessive demand for land, while it is utilised for varieties of purposes resulting in resource depletion, and lowering of the yield. Mather (1986) and Mues, Peterson, Walshaw & Morris (1994) found that each land use impacts the environment and turns it from a stable state to one that is fragile and susceptible to change. Thus, a balance should exist between land use, technological advancement, and changes in individual and community attitudes (Cocks & Walker 1994).

Different communities have particular and often ineffective rules that relate to land use within their own areas. A number of inevitable factors that obscure and complicate the conditions are involved. Shifting political situations contributes to this. The headmen of Shakadza, Muswodi, and Mukovhawabale identified the growing population with the increase of residential areas as the main contributory factor. Unlike other villages, population in Tshivhongweni remains constant since the young generation is said to move away from their area of abode to better places.

### 2.5.2 Land use in 1977

In the past, settlements were sparsely distributed as some of the elderly locals testified. Figure 2.9, below, shows different land uses such as fields set aside for cultivation, communal grazing areas, and settlement in 1977. Although settlement areas were separated from productive lands, there was no consideration of proper planning for the development of these areas. People tended to settle wherever they liked for strategic reasons, such as proximity to other relatives, cultivated areas, and water sources, which led to resistance to relocation.

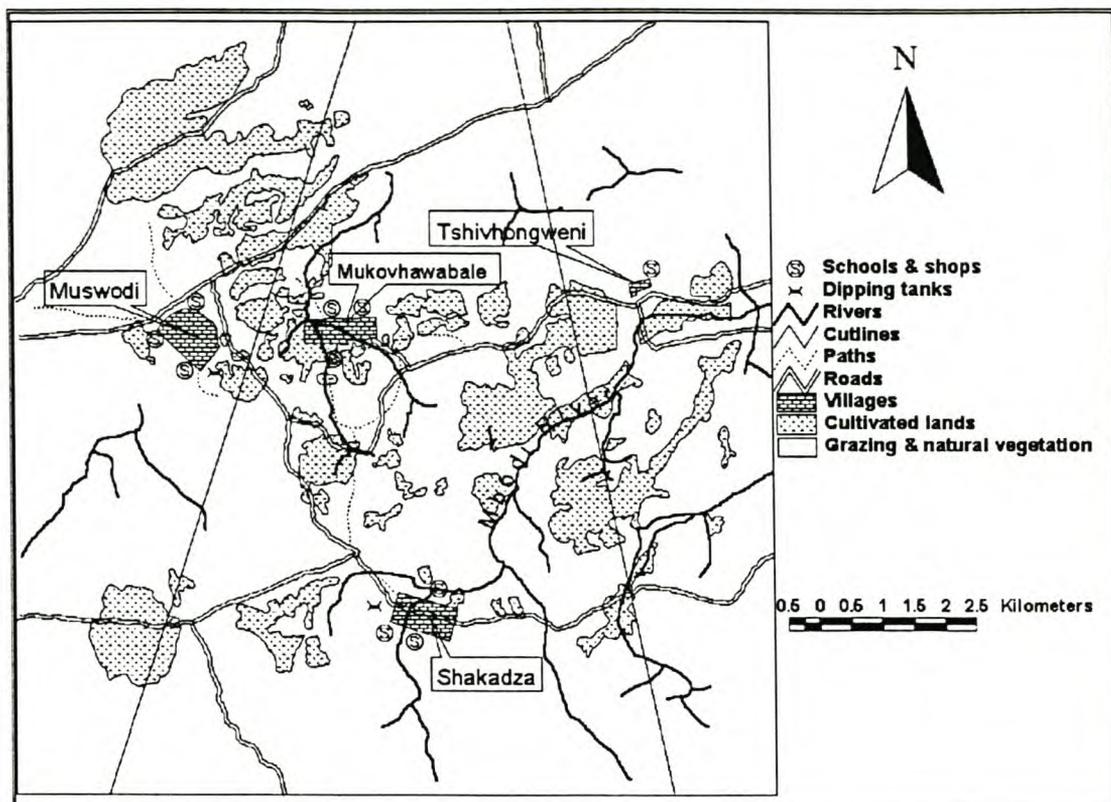


Figure 2.9: Land use in 1977

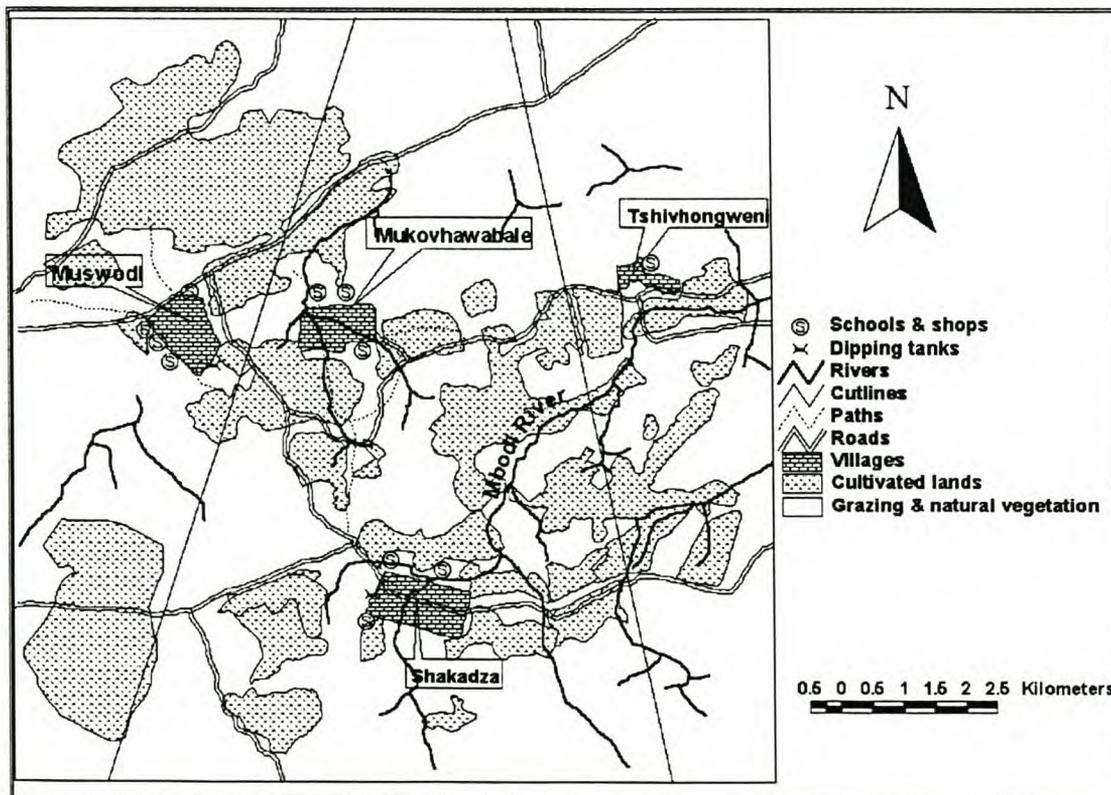


Figure 2.10: Land use in 1995

From the 1977 aerial photos, the cultivated lands were identifiable as units of plots with thick vegetation surrounding them, and fences that are highly visible. Less population at that time and therefore pressure on land resulted in smaller cultivated extent. The villages (227 hectares), cultivated lands (4066 hectares) and grazing space (12745 hectares) were identified and mapped.

### 2.5.3 Land use in 1995

Different types and mixes of land use affect each other and lead to land and environmental degradation. The many single smaller plots that were visible in aerial photo's of 1977 became fewer and merged into larger cultivated fields in the aerial photos of 1995 as new areas were added for cultivation. Land use in 1995 is shown in Figure 2.10 above. Vast change is noticeable in the increment of cultivated lands. Population increase and demand for more land explain this increment. Slight increases in settlement areas were evident. This supports the findings of Hoffman *et al.* (1999) in their report on the Northern Province that also notes an increase of areas used for crops, at the expense of forested lands. Lal (1996b) identified a similar situation in Nigeria where the conversion of unused lands to cultivation leads to increased erosion and sedimentation.

### 2.5.4 The extent of land use changes (1977-1995)

Land use change manifests in the increase of population, shown in increased settlement, and cultivated lands (Table 2.1). Nearly 2000 hectares of grazing lands were converted from 1977 to 1995. Cultivated lands increased from 14% of the study area in 1977 to 27% in 1995. This dramatic increase of cultivated land mostly took place in higher lying areas. Changes in the grazing lands directly implies decrease in natural vegetation, with more than 300 hectares irreversibly converted to settlement space. Settlement density is only 650m<sup>2</sup>/capita or 2910m<sup>2</sup> per household – much lower than normal urban densities. This signifies greater pressure on the available resources such as vegetation and water.

Table 2.1: Extent of land use changes from 1977-1995

		1977			Total	
1995	Areas in hectares	Villages	Cultivated lands	Grazing and other uses	Area covered	%
	Villages	219	6	89	314	2
	Cultivated lands	0	1778	2288	4066	27
	Grazing and other uses	8	400	10368	10776	71
	Area covered	227	2184	12745	15156	
Total	%	2	14	84		100%

Table 2.1 above summarises change of land use over time as manifested in the increase of population, increased settlement, and cultivated lands.

### 2.5.5 Land degradation and land use change

Figure 2.11 shows some areas (856 hectares) that were previously used for cultivation, grazing and for cutting wood, but are in a state of degradation and were abandoned by 1999. The proximity of degraded areas to settlement is also evident.

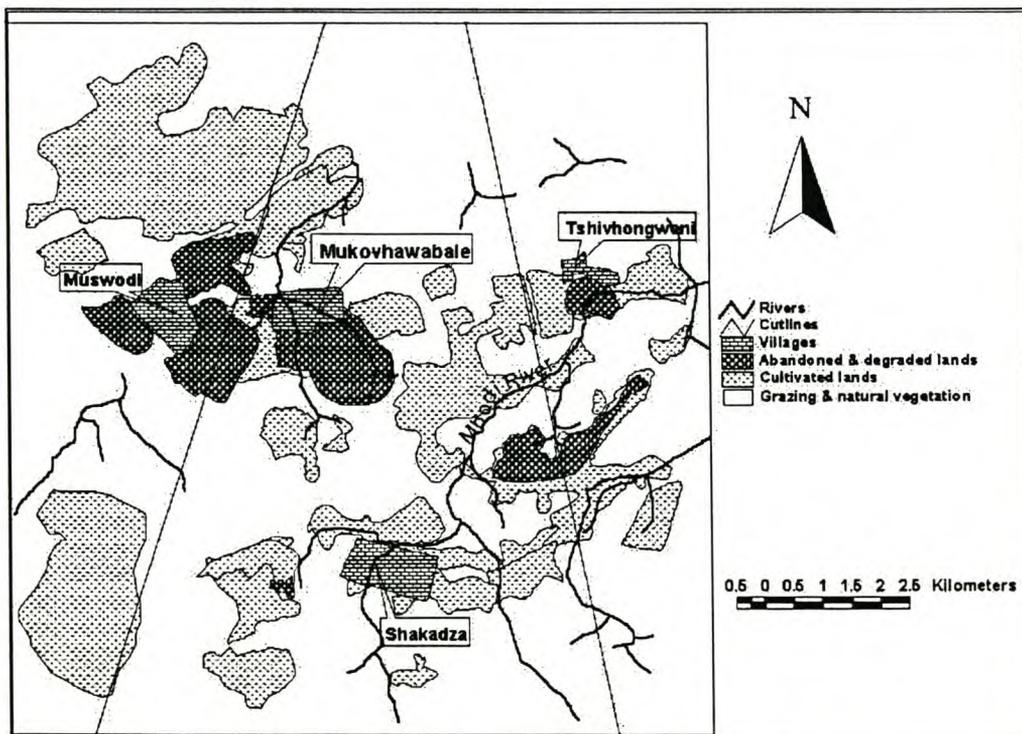


Figure 2.11: Observed abandoned and degraded area -1999

Evidently, some wells and boreholes dried up, increasing water pressure, and its scarcity. Some of the boreholes heads are visible where they were located. Due to the sediment deposits, only the tip of one of the boreholes at Mukovhawabale is visible. Soil filled a dipping tank of Muswodi, another example of the extent of soil degradation.

Although there are newly cultivated lands, the observed abandoned and degraded lands are shown in Figure 2.11. The locals mention a variety of factors such as unproductive land, erosion, fallow (leaving the land to recover for future use) and long-term drought that influence the abandoning of lands. The abandonment of some of these lands was because wind-blown soil started to accumulate as sand dunes, preventing proper cultivation.

With limited areas for cultivation, stock has the advantage of getting more areas for grazing. However, large numbers of stock are kept, depending on the will and wealth of individuals. Total stock density has revealed 6.9ha/LSU for the total area and 4.9ha/LSU for grazing areas alone.

Grazing stock and other activities may prolong or prevent rejuvenation of vegetation. Moreover, since there is no proper grazing areas, unused open areas and abandoned lands serve as alternative grazing grounds. Vegetation decrease, uncontrolled grazing and other uses as shown in Figure 2.12 (i) Tshivhongweni, (ii) Muswodi, and (iii) Shakadza below, may have a negative impact on the soil and exacerbate the environmental decline.

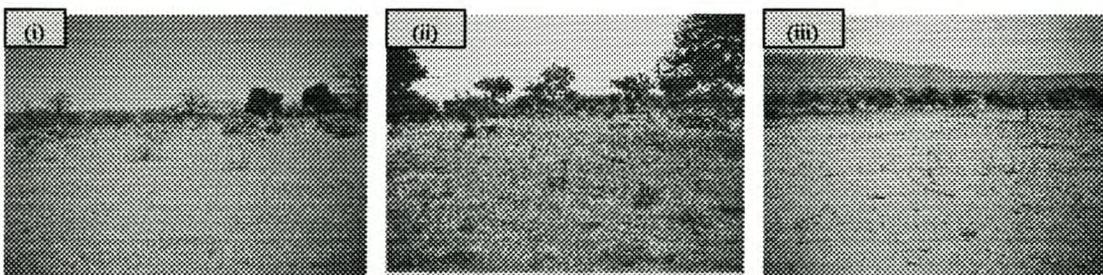


Figure 2.12: Grazing conditions in abandoned lands and in fields.

After harvests in the cultivated fields, stock graze on crop residues as in Figure 2.12 (iii) above, while some of their droppings contribute to improve soil nutrients and structure

(SADC 1996). Exposure of soil, severe trampling and loosening of the soil; and damaged fences may have a negative effect on the fields; leading to further degradation.

In some of the areas previously used for cultivation, degradation is visible where stock trampling and overgrazing interferes with the re-growth of ground covering materials. With not enough chance and time given for recovery, such areas remain highly exposed and become susceptible to agents of erosion such as wind and water, and further degradation.

Peoples' demand and need for fuel wood adds to the bareness of the soil. Areas for fuel wood collection are vast. Selection of specific trees for fuel meant conservation of other trees, although it implies the endangering of the selected plant species and the domination of others.

Due to the area being bare, the land looks wasted. Wind-blown soil is starting to accumulate visibly on the south-facing slope of Mukovhawabale Mountain. This reveals the extent of surface degradation, vegetation cover and soil erosion. Apart from the mountain indicating degradation, the settlement pattern and structure also serve as indicators. During the rainy season, streams that run across the residential area from the high lying areas of Shakadza (see location in Figure 2.1) cause much erosion damage in the village. Some people had to evacuate and resettle far away from the dangers of water; some evacuated the area for good and looked for better places. Some areas are gradually degraded due to erosion that results in soil and sand accumulation. Such areas are converted to settlement areas, while sand that accumulates is strategically utilised as a building material. Where erosion is taking place, areas are in a state of further decline and degradation as seen in Figure 2.5 and 2.7.

## **2.6 The significance of land use change**

Land use change is not an issue in Mutale district only, but it has been recognised and given wide attention in the global debate. In essence, land use changes may have negative or positive impacts. The positive impacts underlie economic development, which is recognised as a contributing factor to growing environmental problems through agriculture, industries, and urban functions (Beinat & Nijkamp 1998). Negative impacts

are visible in erosion, loss of habitat, decrease in the carrying capacity of land, and modification and loss of natural amenities. Nevertheless, land use change is inescapable and varies according to land utilisation (Davidson 1992; Henderson-Seller 1994). It is presumed that land is a commodity that is accessed through demand and supply in the market. Additionally, land use change is associated with greater need for natural resources. Thus, the magnitude of demand and amount of land becomes quantifiable and fixed. As such, availability and usage of land becomes static (Marcus *et al.* 1996), when it is socially determined through respect of sacred areas and graveyards.

Marcus *et al.* (1996) identified two types of land demand: for residential land for the increasing population, and for land for production to supplement food and income. Chisholm (1994) explained that production, demand for products, and change in the technology of agricultural production, shape the demand for and supply of land leading to development for potential use. Some of the effects of land use change are distinguishable, with evidence of deforestation as in Figure 2.3, extreme occurrence of erosion in Figures 2.5 and 2.6 and grazing conditions in Figure 2.12 above.

## 2.7 Solutions

The best use of land can be achieved with the right attitude and feeling for land. Thus, the willingness of people to accept land regulations is essential. According to the headmen consulted in Mutale, close co-operation of land users and administrators, together with the local leaders, as headmen and chiefs, is essential. In addition, communities should be involved in land use planning and land evaluation to determine the suitability of land use. Critchley (1998) pointed out that the necessity of administering land involves forbidding cultivation by land users on hillsides at certain gradients and along or close to riverbanks. Headmen and chiefs, whose powers and authority are still highly valued and respected in Mutale, vigorously supported this.

In summary: In Mutale, for various reasons, low-lying areas are in a more degraded state than the hilly landscape. Further land use encroachment on hills will cause further degraded conditions. The physiographic influence, coupled with climate, plays a vital role. Some of the evident degradation is inescapable since people have to earn a living. The escape route is through controlling the use of available resources, for example trimming

and cutting of bush, management of stock and cultivated lands. There is no total escape from development, which exerts pressure on different resources, but to reduce the environmental impact directly or indirectly, a new design for land use is vital, as suggested by Cocks & Walker (1994).

Delays in curbing the problem results in treating the land badly, by growing crops without replacing nutrients in the soil or by allowing erosion (Kaimowitz 1997). Land users have an influence on environmental conditions through development and other activities, as some of the evidence displayed would indicate.

The extent of physical degradation evident in Mutale has human and naturally aggravated causes. Land use plays a vital role in landscape deformation, where some of the causes and effects are inescapable. The next section highlights the views of the local people, and considers the situation from different perspectives. The views of the local people will assist in obtaining a better overview and understanding of the degradation of remote areas such as Mutale.

### **3 PERCEPTION OF ENVIRONMENTAL CONDITIONS**

A variety of factors influence how people consider and perceive degraded conditions. Their awareness differs and relates to how the individuals, Government, and other sectors may view such conditions. The views on physical evidence of land degradation as identified by Cocks and Walker (1994) concerning the attitudes and behaviour that people exhibit towards the environment is discussed. This may depend on the roles they play in the area of their abode and is highlighted with their views on land degradation and land uses. Different causes of environmental change were identified, and are discussed. Awareness of land conditions may also depend on the ownership of assets such as fields and stock (Klooster 1999). Involvement of locals in conservation is essential, and some driving forces to encourage their involvement are necessary. Looking at some of the control measures used and the willingness of the people to participate in controlling the condition, show that the effectiveness of environmental awareness campaigns is not an isolated occurrence. Some of the constraints faced in the process of developing some of these areas sum up the section.

#### **3.1 Views on physical evidence of land degradation**

Community members in Mutale identified some of the environmental threats that lead to degradation. The physical evidence of degradation discussed in this section depends on the recognition and acceptance of environmental change where general environmental degradation is considered. Responses emphasise the perception in relation to the degradation of immediate resources, especially vegetation and soil.

##### **3.1.1 General environmental degradation**

The majority (85%) of the total number of 102 respondents in Mutale notices physical environmental changes. Table 3.1 below tests whether the perception of physical environmental change could be related to gender, age category and duration of stay in the area.

Table 3.1: Association between gender, age, and duration of stay and awareness of physical change

(Column percentages) %	Physical change noticed		Row Total (Number)	Row Total as % of Grand Total
	Gender	Yes		
Males	38	40	39	38
Females	62	60	63	62
<b>Age category (years)</b>				
≤30	35	20	33	33
31-60	41	33	41	40
≥61	24	47	28	27
<b>Duration of stay (years)</b>				
0-20	37	20	35	34
21-40	43	47	44	43
41-60	9	20	11	11
≥61	11	13	12	12
<b>Column total (%)</b>	100	100		
<b>Column total (Number)</b>	87	15	102	
<b>% of Grand Total</b>	85	15		100

Note to Table 3.1-3.8: All crosstabulation cells list cell frequencies as percentage of column totals. Row and column frequency totals are also provided and expressed as percentages of the grand total.

The roles that different gender groups play in individual families or within a community differ and may influence the perception of change. Different activities with which these groups are involved give them a greater chance of noticing physical changes. Some of female activities include gathering of wood, and searching for proper types of soil for house decoration. Males take care of stock and look for some building materials, which gives them a chance to notice change in vegetation and availability of grazing. Their observations are related to the distance travelled in search of such materials. However, there is shared responsibility for some activities, as in the fields. However, the analyses in Table 3.1 confirm none of these expected associations.

Similar associations were investigated concerning the extent of change identified in Table 3.2 categorised as decline/deterioration, 'improving' and 'similar'. The determined changes might be either negative or positive. However, as in the former case, little association was detected. The possible exception is older males who seem to detect 'improved' environmental conditions more readily.

Table 3.2: Association between gender, age and duration of stay and the awareness of the extent of physical change

(Column percentages) %	Awareness of physical change			Row total (Number)	Row Total as (%) of Grand Total
	Decline	Improvement	Unchanged		
<b>Gender</b>					
Males	37	60	31	39	38
Females	63	40	69	63	62
<b>Age category (years)</b>					
≤30	33	30	31	33	32
31-60	45	20	31	41	40
≥61	22	50	38	28	28
<b>Duration of stay (years)</b>					
0-20	36	40	25	35	34
21-40	42	40	50	44	43
41-60	12	0	13	11	11
≥61	10	20	12	12	12
<b>Column total (%)</b>	100	100	100		
<b>Column total(Number)</b>	76	10	16	102	
<b>% of Grand Total</b>	75	10	15		100

Views on environmental improvements are probably affected by short-term extreme events, such as heavy rains after drought, rather than to gradual long-term degradation conditions. Such extreme events are easily remembered as dramatic change occurs, while it becomes difficult to identify the gradual processes acting on the environment. Historical knowledge passed from one generation to another generation may enhance knowledge about degradation and environmental changes. The media and the standard of education may improve knowledge, ideas related to environmental care, and awareness may have more influence than the actual changes that the individuals noticed over time.

Other local people consider improvement as strongly based on the socio-economic development and accessibility of some of the services that were not there before, whilst it occurs at the expense of the environmental conditions.

### 3.1.2 Perception on degradation of vegetation

According to Roberts (1990), Morgan (1995) and Grace (2000) plant cover plays an important role to prevent the impact of erosion, while misuse and mismanagement leads to

vegetation decline. Lal (1996a) and Gupta (1998) referred to several processes that destroy and change vegetation and such processes are also identifiable in Mutale. Curtis & De Lacy (1995a) showed that loss of trees represent degradation. Thin vegetation cover as seen from Figure 2.2 & 2.12 in the previous section, fails to protect the soil from erosion, since it is highly exposed as confirmed by Mainguet & Da Silva (1998). The after-effects of vegetation decrease are felt as winds sweep excessive soil away and leave roots and rocks exposed to further threats. Within the residential areas, some of the foundations around the houses are exposed.

Table 3.3, illustrates some of the views related to vegetation changes. The analysis tries to identify the expected association between some population characteristics and awareness of vegetation change.

Table 3.3: Association between age and duration of stay and awareness of physical change of vegetation

Column percentages (%)	Depletion		Increase		Row total (Number)	Row Total as % Grand Total
	Yes	No	Yes	No		
Age category (years)						
≤30	34	27	40	32	33	32
31-60	40	41	60	39	41	40
≥61	26	32	0	29	28	27
Duration of stay (years)						
0-20	39	18	0	36	35	34
21-40	39	59	60	42	44	43
41-60	9	18	40	9	11	11
≥61	14	5	0	12	12	12
Column total (%)	100	100	100	100		
Column total (Number)	80	22	5	97	102	
% of Grand Total	78	22	5	95		100

Similar to analyses in the previous sections, the expected associations did not materialise. Proportions in the variable categories remained highly similar to distributions in the total. The only exception was among the young adults with a diminished tendency to see depletion of vegetation possibly because of their short reference lifetime.

Some of the views about the increase and/or the decrease of vegetation relates to seasonal shedding of leaves. The change in vegetation in Mutale is evident (as shown in the

previous section) since, according to Barbier & Bishop (1995), the vegetation removal of today is just a continuation of past events traced from the earlier period (1930s) and before. Several other studies conducted in different places proved this. Mather (1986) and Klooster (1999) saw the rate of the present vegetation removal as somehow greater than before and preceding soil decline. Drastic decrease of vegetation (Morgan 1995; Lal 1996a; Gray 1999) follows continuous cultivation with the major decrease occurring during the first years of cultivation, increasing areas categorised as degraded.

### 3.1.3 Perception on degradation of soil

Different views on the occurrence of erosion are not only restricted to the local people, but are also applicable to scientists. Morgan (1995) indicated that causes of erosion are not easy to understand though they can be associated with land use. In contrast, Critchley (1998) argued that causes and effects of erosion are easy to understand, with the occurrence visible or hidden, humanly induced or physically generated. Lal (1996b) identified factors influencing soil change as the conversion of natural areas for agricultural purposes and other uses. Lal (1996a) and Gray (1999) identified removal of humus and topsoil due to exposure of soil during cultivation and early stages of growth as accelerating erosion and affecting production.

Amongst the identified causes of soil degradation in Mutale are cultivation of unsuitable lands, intensive use, and inappropriate soil and crop management practices. While Table 3.1 shows the differences of opinion on whether change had occurred, Table 3.4 below, shows different views on change in soil conditions. The opinions on the physical changes of soil relate to erosion by water and wind. The locals noticed that the negative effects involve accumulation of soil, and exposure of rocks and soil.

The vast majority (87%) recognises the existence of erosion, but only just over 10% are aware of soil accumulation. The table shows, moreover, that older people are slightly more likely not to recognise erosion.

Table 3.4: Relationship between age and duration of stay and awareness of physical changes of soil

Column percentages (%)	Erosion		Soil accumulation		Row total (Numbers)	Row Total as % of Grand total
	Yes	No	Yes	No		
Age category (years)						
≤30	32	31	31	33	33	33
31-60	42	31	46	39	41	40
≥61	26	38	23	28	28	27
Duration of stay (years)						
0-20	38	15	8	38	35	34
21-40	40	62	46	43	44	43
41-60	11	8	31	8	11	11
≥61	11	15	15	11	12	12
Column total (%)	100	100	100	100		
Column total (Number)	89	13	13	89	102	
% of Grand Total	87	13	13	87		100

Change in soil has a negative impact as it causes and influences change in vegetation. Roots become exposed and prone to uprooting due to the agents of erosion such as wind and water. The identified decline in soil condition may be due to lack of conserving methods or to expenses that make it difficult to adopt new methods. The change found in soil condition has a negative effect that is clearly shown by the loose soil and the exposure of rocks and roots that were previously covered. The soil said to be compacted before has become loose due to a variety of activities such as field cultivation; quarrying, footpath and trails as also portrayed in Figures 2.2, 2.4 and 2.12.

Although erosion as a natural process cannot be prevented, it can be reduced to an acceptable rate. Thus, identification of erosion problems and affordable conservation efforts are essential to sustain the available resources. To achieve this, people need help to develop appropriate strategies and greater understanding of processes involved in soil formation, which are slow and not determined easily (Barbier & Bishop 1995; Morgan 1995; Larson, Lindstorm & Schumacher 1997).

### 3.2 Views on land degradation and land use

In this section opinions on the extent of degradation in the cultivated areas is given. Degradation in grazing conditions is also considered. Different perspectives on change are similar to those on physical change noticed in vegetation and soil.

#### 3.2.1 Land degradation and cultivation

As pointed out by Van Dijk (1997) in Eastern Sudan and Gray (1999) in Burkina Faso, the best lands for production are already in use, this is also the case in the Mutale district. Thus, some expansion of cultivated lands takes place on unsuitable land and at the expense of forested lands. Land distribution for cultivation use tends to be inevitable (Marcus *et al.* 1996), although it becomes difficult to identify land use changes likely to be unchallenged on environmental grounds. People in Mutale depend on subsistence farming in which cropping of a variety of products is common. Predominant products are mixtures of maize, millet, sorghum and watermelons. These plants have in common that they survive in sandy soil and on little rain. Maize is cultivated in higher lying areas. Land users concentrate more on production than on conservation and therefore open new areas for cultivation when production from the existing lands declines (Barbier & Bishop 1995). New lands on mountaintops are targets, although taboos and government laws restrict such action. Some of the taboos and laws have become sterile due to weakening and dilution of power and people exploiting new land.

Table 3.5 below shows the relationship between views of those who possess cultivated fields and those who do not. As expected, non-owners could not identify changes with regard to products and change in climate. The majority of field owners however, notice change in the fields' production and climatic conditions.

Field owners in the economically active group far outnumber the older age group. This may indicate the responsibility that the active group has for production. Although abandoned lands are visible, there is a lack of land allocated for cultivation fields.

Table 3.5: Relationship between field ownership, age, and duration of stay and perception of change in cultivated areas

(Column percentages) %	Change in products		Climate influence.		Row Total (Numbers)	Row Total as % of Grand Total
	Yes	No	Yes	No		
<b>Ownership</b>						
Owners	100	86	100	78	92	90
Non owners	0	14	0	22	10	10
<b>Age category (years)</b>						
≤30	37	30	30	35	33	33
31-60	38	41	41	39	41	40
≥61	25	29	29	26	28	27
<b>Duration of stay (years)</b>						
0-20	37	33	36	32	35	34
21-40	38	46	39	48	44	43
41-60	9	11	9	13	11	11
≥61	16	10	16	7	12	12
<b>Column total (%)</b>	100	100	100	100		
<b>Column total (Numbers)</b>	32	70	56	46	102	
<b>% of Grand Total</b>	31	69	55	45		100

Over time, the locals experience production change in the fields, though there is no collected data on actual yields. The continuous use of land for the same products may exacerbate change because of diminishing soil fertility. The fluctuation of crop production is clear to the individuals, as it has an impact on the available food resources.

The locals associate general climatic variation, especially increase and decrease of rainfall, with production fluctuation. Too much and/or too little rain has a negative impact. Normal wet rainy seasons produce enough products while above normal rainfall causes erosion and the washing away of seeds and crops, and promote the donga formation, and limiting the area under cultivation. Drought worsens the situation. Fields may remain uncultivated for long periods, encouraging abandonment, and the rate of degradation.

The study conducted by Lal (1996a), shows that increasing cultivation time effects soil conditions negatively. Long abandoning of cultivated lands, makes them susceptible to

further erosion in which wind plays a major role. A similar situation was identified in Mutale. Land users leave land unploughed to let it recover, resulting in its degradation (Barbier & Bishop 1995)

### 3.2.2 Land degradation and grazing conditions

In subsistence economies, livestock serves different purposes for different individuals and families because it is a form of wealth and enriches their way of life. Cultural values may have some influence, while attitudes towards stock also change with time. Düvel & Afful (1996; 1997) and Perkins & Thomas (1993) listed stock as the core of economic activity among such communities.

Grazing condition is significant to stockowners while the number of stock and feeding habits may serve as determinants of degradation. Changes in grazing affect types of stock owned, since they graze differently. Grazing incorporates a vast area of the land used in Mutale since there is dependency on subsistence stock farming as well. However, grazing material declines as the surrounding vegetation has to supply in an enormous population demand, the main contenders being livestock and people.

Table 3.6 below; shows respondents' views on grazing conditions. Clearly, those most intimately involved with grazing (stockowners) recognise extensive disturbance in conditions, while non-stockowners do not. Older people show a slight tendency to deny the existence of such condition, while length of stay shows no association with opinion.

Views on what causes change in grazing include disturbances and availability of grazing (adequate or inadequate) depending on the type of stock owned. Disturbances in grazing include loss of fencing, overgrazing, massive harvest of vegetation for fuel wood, increase in cultivated fields and the increase of population and settlement.

The locals blame the government for not maintaining the infrastructure installed, especially fences limiting the influx of stock from other areas. The communities are turning a blind eye to the role that they can play in safeguarding properties in their vicinity and the reluctance to have their stock reduced. Thus, lack of control of the number of stock that individuals may have, may affect the degraded conditions.

Table 3.6: Relationship between stock ownership, age, and duration of stay and opinions on grazing conditions

(Column percentages) %	Grazing condition changed?		Row Total (Number)	Row Total as % of Grand Total
	Stock ownership?	Yes		
Yes	100	52	76	75
No	0	48	26	25
<b>Age category (years)</b>				
≤30	41	24	33	33
31-60	42	39	41	40
≥61	17	37	28	27
<b>Duration of stay (years)</b>				
0-20	31	37	35	34
21-40	44	43	44	43
41-60	15	7	11	11
≥61	10	13	12	12
<b>Column total %</b>	100	100		
<b>Column total (Number)</b>	48	54	102	
<b>% of Grand Total</b>	47	53		100

The extraction of wood for building and fencing materials, and agricultural expansion, lead to the reduction of grazing as Katere, Moyo & Myjakachi (1993) (in Zimbabwe) and Düvel & Afful (1996; 1997) also pointed out. Perkins & Thomas (1993) identified that drought can strike stock before there is actual degradation of land. Dry conditions lead to scarcity of food and water for stock and people which is associated with a variety of diseases that rapidly weaken the stock.

### 3.3 Causes of environmental change

The perception about the causes of environmental decline held by locals in Mutale should be mirrored against practices locally and elsewhere.

### 3.3.1 Perceptions in Mutale

Many factors that put pressure on habitats and scarce resources threaten the environment. This cannot be isolated from evidence related to human and physical causes in Mutale as shown in the previous section. According to SADC (1996) and Kaimowitz (1997), such evidence is related to poverty, population growth and the growing demand for scarce resources. However, Barbier & Bishop (1995) argue against the link of poverty and land degradation. Table 3.7, below, shows some of the locals' views on the causes of environmental change.

Table 3.7: Association between age and duration of stay and identified causes of environmental/physical changes

(Column percentages) %	Climatic influence		Cultivated lands		Population		Stock		Wood harvesting		Row total (Number)	Row total as % of Grand total
	High	None	More	None	High	None	More	None	High	None		
Age category (years)												
≤30	21	47	54	20	34	32	37	31	47	22	33	33
31-60	46	33	35	43	33	41	47	39	43	39	41	40
≥61	33	20	11	37	33	27	16	30	10	39	28	27
Duration of stay (years)												
0-20	31	38	44	29	34	34	52	30	42	29	35	34
21-40	44	42	46	42	33	44	32	46	48	40	44	43
41-60	11	11	5	14	22	10	0	13	5	15	11	11
≥61	14	9	5	15	11	12	16	11	5	16	12	12
Column total (%)	100	100	100	100	100	100	100	100	100	100		
Column total (Number)	57	45	37	65	19	83	9	93	40	62	102	
% of Grand Total	56	44	36	64	19	81	9	91	39	61		100

The table indicates that half the people directly blame climate-related phenomena i.e. drought associated with wind erosion, uneven and variable rainfall associated with water run-off, for change. The older respondents tend to blame climatic influence more than the young did. With the exception of young people, expansion of cultivated fields is seen less as a cause while population increases and growing stock numbers are virtually ignored as a cause. This latter view is perhaps the most astonishing and serious finding, since it lies at the heart of land demand and thus environmental impact in developing rural regions. The increase of population as amongst the contributing factors is linked to the inevitable Third

World trend of population growth. There is a slightly stronger tendency, again more readily supported by the young, to blame harvesting of wood for environmental damage.

The factors identified increase the threats to the available resources. This endangers the available plant species. For stockowners, the impact is in the fluctuation of grazing, while little rain affects crop-producers more readily. The depletion of vegetation, during drought, allows strong winds to sweep away soil and accumulate it in other areas as dunes.

### 3.3.2 Practices in Mutale

The conditions observed in Mutale can be related to other areas where similar studies were conducted. Human action everywhere plays a role through massive clearing of bush (Katere *et al.* 1993), the extension of fields, settlement, wood gathering, and feeding of stock, as also identified in Mutale. Adding to the identified factors is the (unplanned) population increases with resultant demand for more land (Barbier & Bishop 1995; Morgan 1995; Conte 1999). People often clear the land although they have no profitable and immediate use for it (Kaimowitz 1997; Roberts 1990), which increases erosion and reduces vegetation cover. One of the purposes of clearing new lands is for the extension of old fields or for new fields. Poor management where massive numbers of trees are cut and long exposure of cultivated land after harvest advances degradation.

Cutting and selling of wood for fuel (SADC 1996) is a common contributory factor of massive tree harvesting and deforestation. In areas like Mutale, the local authorities and taboos control cutting of certain trees, as traditional rules. This has links to sacred values understood differently by many people. Protection of some trees against cutting is to ensure harvesting for fruit and medicinal purposes, and to provide shade and social gathering space (Campbell, Grundy & Motose 1993; White & Jickling 1995; Agricultural News 1999c; Gray 1999).

In Mutale, the boundaries of compounds, fields, and shelters are fenced using a variety of materials. The materials include branches trimmed from trees, planting of hedges, and

wood in conjunction with wire. Some materials are mostly obtainable during the bush clearing for new fields. Since the stock feed in communal areas, individuals protect crops from devastation by the stock during the cultivation period.

Few households in Mutale use hedges as fencing as the indigenous way of agro-forestry conservation practised in Haiti (White & Jickling 1995). The use of branches is more common around the fields and gardens than around the homes, since the branches are easily destroyed after harvest when stock feed on crop residues. The cut branches require renewal after some time and as such are non-permanent fencing materials, which affect the surrounding vegetation negatively. Apparently fencing wire gradually replaces the use of branches, which reflect social and economic acceptance and advancement.

Building materials for stock shelters and for craft is from wood sources. Crop residues supplement grass for thatching the roofs and making storage sheds. Using crop residues as building materials implies a greater scarcity of food for stock in the fields which remain bare, and highly exposed to further threats of degradation. The role of the locals in resource conservation is vital and is discussed in the following sub-section.

### **3.4 Involvement of the local people in conservation**

South Africa is still lagging behind with community-based conservation practices. The notions of pay for work and food for work have negative impacts on communities (Oettle & Versfeld 1999; Makin-Taylor 1999, *pers. com.*), as it encourages them to require payment for everything they do. The dependency principle indoctrinated into such communities worsened this (Makin-Taylor 1999, *pers. com.*). People in Mutale believe that the physical conditions are reversible and, with the help of the government, will heal in time.

The motive of involvement in maintenance of the resources by the people of Mutale differs from individual to individual. Some show approval and are willing to be involved in conserving resources. Conte (1999) found that the purposes of protecting the resources vary and depend on how resources are used and are valued. In Mutale, some locals are

conserving resources for the benefit of stock, government, community and younger generations. Expectancy of involvement in conservation is highest amongst the active age group. Table 3.8 summarises the perceptions in Mutale on the importance of various strategies for conservation purposes.

It is encouraging that less than a quarter of respondents would rely on government aid, but again population control is seen as absolutely unnecessary, although its impact is evident on the available resources. In addition, a minority feel that tribal laws should be strictly enforced to remedy degradation clearly a move towards modernity. Age and duration of stay had no explanatory power in relation to these variations.

Table 3.8: Association between age and duration of stay on strategies for resource conservation

(Column percentages) %	Government help		Population control		Enforcing tribal laws		Row Total (Number)	Row Total as % of Grand Total
	Yes	No	Yes	No	Yes	No		
Age category (years)								
≤30	33	32	50	32	38	28	33	33
31-60	42	40	0	41	31	47	41	40
≥61	25	28	50	27	31	25	28	27
<b>Duration of stay years</b>								
0-20	50	29	0	35	38	32	35	34
21-40	38	45	50	43	43	43	44	43
41-60	4	13	0	11	7	13	11	11
≥61	8	13	50	11	12	12	12	12
<b>Column total (%)</b>	100	100	100	100	100	100		
<b>Column total (Number)</b>	24	78	2	100	42	60	102	
<b>% of Grand Total</b>	24	76	2	98	41	59		100

Some societies are moving away from the enforcement of tribal laws and other resource conservation methods. Some people are unconsciously using traditional resource conservation methods, like some communities in the Thohoyandou sub-region (Critchley & Netshikovhela 1998). Amongst these, exemplary communities of Thononda, Tshiheni, and Tshithuthuni need encouragement. They enforce prohibition on cutting certain trees, levy penalties against those who ignore the laws, as also recorded by Klooster (1999). Community control enables better management of resources to develop the rural communities.

Clarke (1994) has stated that the traditional conservation ethos, built up from the ethical considerations of people into culture, tradition and religion, is gradually being destroyed. Some of the customary beliefs are undermined due to land pressure; whilst the younger generations no longer uphold these beliefs due to educational advancement, as Conte (1999) also observed in Tanzania.

Expansion of cultivation should only be allowed on land that has been scientifically evaluated and demarcated for that purpose. This would prevent individuals from cutting down the bush to suit their own needs in the expectation of high productivity. Local people feel that grazing camps should be allocated to enhance rotational grazing and avoid overgrazing. Community involvement requires support from the government and other structures, as discussed below.

### **3.5 The effectiveness of environmental awareness campaigns**

The department of Agriculture and Environmental Affairs indicated concern for the local environment in the researched sub-region. The Department interacts with communities and other departments in different ways, which entails meetings to facilitate the proper running of the resources in the immediate environment. This entails the enforcement of laws and the education of the young, and training people to address environmental issues and to live in a sustainable way. In this regard, the media plays a vital role in conveying the message (Munzhedzi 1999, *pers. com.*).

Mismanagement of resources is a serious issue identified in different communities (Grace 2000). From the interviews conducted with the departmental authorities, the situation in Mutale is similar (Tshakhani 1999, *pers. com.*). Amongst some of the identified problems, is the unnecessary cutting of bush, ploughing along the rivers and on steep slopes, overstocking and unplanned settlement, the latter is common in urban areas. Since the identification of these issues, efforts have been made to reach out to all those communities through the media, with informative environmental programmes. The media used are the local radio stations, i.e. Phalaphala FM, Univen Community Radio, and the local newspaper (Mirror) all of which are claimed to be accessible. Munzhedzi (1999 *pers.*

*com.*) pointed out that “...*the newspaper coverage is situational as it covers occasional events*”. Since not all the community members can read or write, using newspapers is debatable. In the early mornings, the radio broadcasts a regular programme on environmental conservation (Munzhedzi 1999, *pers. com.*, Tshabuse 1999, *pers. com.* & Tshakhani 1999, *pers. com.*).

It is indicated that different fruitful awareness campaigns have been launched within the sub-region. These are government-driven and are in line with national environmental awareness days like National Arbor Day, and the No Fire campaign seasons. The Lwatshatsimu LandCare project and Fundudzi Forum point to the potential success of similar projects and campaigns. These awareness programmes have a high degree of youth involvement (Critchley & Netshikovhela 1998; Munzhedzi 1999, *pers. com.*, Tshabuse 1999, *pers. com.* & Tshakhani 1999, *pers. com.*).

In essence, traditional leaders are conservators, although their powers have been stripped and are replaced by the civic associations based on administering rather than taking care of the environment. The tribal authorities identify problems within their communities, who in turn alert the government since they cannot work in isolation. Thus, the enforcement of environmental awareness is through the traditional knowledge based on myths and beliefs which advocate the high value of natural resource conservation. Ultimately, these may raise more questions of interest related to whether the traditional myths and beliefs should still be valued, or if they achieved any success in the past.

Different community structures are involved in running environmental campaigns. These include the headmen, political structures, educational structures, local town councils, and Non-Governmental Organisations (NGOs). Within the educational structures, schools, the University of Venda, together with the Madzivhandila Agricultural College, are also involved in different community activities. However, some inevitable constraints that need consideration are encountered.

### 3.6 Constraints to combating degradation

The people in Mutale show interest in conserving their areas, although some constraints encountered from within the communities themselves and from the side of the government may hinder such development. People feel alienated from the resources, which makes it difficult to participate and have any feeling for caring for resources. Some people consider resources as belonging to the government, though they have the choice to make things right using the “*swim or sink principle*” (Makin-Taylor 1999, *pers. com.*). Poverty amongst the people at the grassroots level also increases lack of support.

Development comes from the people’s involvement, but selfishness may contribute to the delay in conserving the available resources such as vegetation, soil, and water. The non-payment principle resulted in civil disobedience with some of the community members destroying infrastructure such as wire for fencing, poles, and pipes. Civil disobedience was extended to disobeying the local authorities such as chiefs and headmen, being fuelled by the political shift, which created confusion amongst many regarding whom to follow (Makin-Taylor 1999, *pers. com.*). People in some cases need to adopt changes from which they will benefit. This influences their reluctance to participate in some of the activities (Barbier & Bishop 1995; White & Jickling 1995).

The Department of Agriculture and the Department of Environment and Tourism identified some of the problems that persist in the end. Amongst these are lack of financial support from the National Department of Agriculture, and delays in receiving requested infrastructure such as wires, poles, and pipes for water supply. Interdepartmental meetings are held, though some of the problems related to other departments such as the Department of Public Works escalate. During the construction and upgrading of some roads, sub-waterways are created in unsuitable areas, promoting erosion, which elsewhere shows lack of good communication, consideration of land assessment and land suitability (Davidson 1992).

With community willingness to participate in conservation, LandCare could be utilised in improving and maintaining sound environmental conditions. The integration of local knowledge in project development is essential. This requires determined people, as it is time-consuming to consult communities involved, for provision of transport and other facilities.

## 4 TOWARDS SUSTAINABILITY IN MUTALE

This final section summarises findings, advocates the implementation of LandCare as a solution and points out research options for the future.

### 4.1 Summary of results

This section summarises the results of findings regarding actual conditions recorded, as well as perceptions of local people on their environment.

#### 4.1.1 Observed environmental conditions

The nature of environmental conditions is found to be influenced by several identified causes threatening the environment into a state of degradation. The causes remain a challenge globally, at the national level (South Africa), at provincial level (Northern Province) and at a local level (the Mutale District).

- The **evidence of land degradation** shows the extent and how humans influence the processes that lead to **vegetation decline**. The clearing of bush, through trimming of branches and felling of big trees is associated with burning of the trunk and digging out whatever is left. Regular use of trails and footpaths, cultivation of fields and overgrazing influenced lead to **soil degradation** and donga formation. Settlement development plays a role in modifying the landscape. The exposure of roots through erosion and uprooting of some trees portray such evidence.
- **Land management practices** affect the environment and are evidence of land degradation. Land is held in the trust of the tribal authority who allocates plots for a variety of activities. The powers of these tribal leaders are disobeyed which incite conflicts. People start to use unsuitable land with no planned management. Large areas of unused lands were converted to **cultivated land**. This further promotes cutting down of trees on a massive scale. Mountaintops and rivers banks are preferred for new areas of cultivation and felling of trees. As production declines, such areas are abandoned for new natural environments and those areas closer to settlements are converted to residential areas. Degradation worsens due to **absence of grazing camps/areas**, which contributes to the decline in grazing through overgrazing and trampling. Accumulation of sand in a dipping tank indicates soil degradation and it is

physically visible. The streams widened resulting in silt and sediment accumulation affecting the flow of the stream.

- The extent of different **land uses and significance of land use change** were attributed to a variety of factors. The evidence revealed decrease of grazing lands with a sharp increase in the cultivated and settled areas. Soil accumulation and sedimentation also signify soil degradation related to land usage. The needs for consumption of natural resources influence land use change. Such environmental degradation is due to the demand for more land and resources.

#### 4.1.2 Local perceptions of environmental conditions

The perception and level of acceptance of environmental conditions differ among local people and can be useful in addressing degradation and change through policy and education. The salient findings from this study are:

- **General environmental degradation/change** noticed by the majority of respondents, but only older males tend to notice improvement in conditions. Otherwise demographic variables e.g. age, gender had no explanatory power.
- The majority are aware of **vegetation degradation** although young adults are less likely to notice change.
- The majority are aware of **soil degradation** through erosion but disregard detail such as sediment accumulation. Therefore people apparently do not understand causal relationships between natural processes and environmental effects.
- The link between land degradation and cultivation practices is recognised more readily by land/field owners. This group is more knowledgeable and also saw links between production and climate change.
- With regards to **land degradation and grazing condition**, a slight majority do not see change, while stockowners (knowledgeable) see change more readily.
- The locals recognise the role of climate as a **cause of environmental decline but firmly rejected overpopulation, cultivation practices, stockfarming and wood harvesting** as causes. The latter is slightly recognised by younger people.
- **Involvement of the local people in conservation** of the environment is highest amongst the economically active age group, and they expect less government aid.

- Official **awareness programmes** are transmitted efficiently enough to the community, but the means to pursue environmental actions are lacking.

## 4.2 LandCare as the solution

In the LandCare workshop held in Thohoyandou, Doy & Rowley (1999) pointed out that “*Every long journey started with a little step taken, so is the success of LandCare*”. The attitude and feeling of belonging to land as a crucial resource can prepare local people to look out for the occurrence of degradation in their vicinity. To rescue the environment from further degradation, close co-operation between the local people and various structures such as the Government and the NGOs is needed. A clear contextual understanding of LandCare is discussed below and implications for its application in practice are spelt out.

### 4.2.1 The conceptual understanding of LandCare

LandCare is a model and process that needs total participation of the community in planning towards the sustainable use and management of natural resources (Campbell 1995b; Curtis & De Lacy 1995a; Agricultural News 1999c). Lockie (1995) identified LandCare as a programme and an activity used for conservation that the Department of Agriculture in South Africa is adopting through the National LandCare Programme (NLP). It needs thinking about environmental problems in a systematic way that shows a close relationship between environmentalism and use of land. People in Mutale should have an understanding towards land management to reduce further decline as Larson *et al.* (1997); Klooster (1999) and Grace (2000) also stress.

Gezon (1997) and Wickramasignhe (1997) pointed out that management of resources and sustainable development cannot occur without the active support and participation of the resource users. LandCare is a strategy based on soil conservation to address land degradation problems (Heck 1994). The role of the local communities is to identify local environmental problems, suggest solutions and actions to such problems (Campbell 1994; Heck 1994; Curtis, Davidson & De Lacy 1997; Versfeld 1999). Since the people in Mutale have already identified some of the problems within their vicinity, they have to take a first

step. In the past, environmental consciousness and conservation of resources depended on people's attitudes activated through the respect of sacred places such as fountains, mountains, and specific trees. This was a foothold of LandCare as Nthakheni (1999) reports and should be maintained as a step towards restoring and conserving resources. LandCare is a forum for learning, since community participation works in close partnership with the government to enhance combined-shared knowledge and skills (Curtis & De Lacy 1995b; Haworth 1996). This could be essential in areas like Mutale, since there is a need to shift attitudes and to adopt new designs of conservation approaches and practices. The adopted management processes may represent a new paradigm for development strategies. The contribution of LandCare in Mutale is essential to improve the quality of life through empowering people with knowledge and understanding of sustainable use of available resources. The accessible media, environmental awareness campaigns and educational institutions could enforce conservation within the individuals. Although the influence of chiefs and headmen is limited, they also have an essential role to play at this grassroots level especially at "khoroni" where all the people gather and discuss problems within their communities, a progression to LandCare application.

#### 4.2.2 Application of LandCare

International conventions guide and support the LandCare objectives in the allocation of land for sustainable benefit. Thus, the purpose that LandCare has to serve within the communities is common to the Convention for Combating Desertification (CCD). However, LandCare is likely to be in the forefront of implementation of CCD programmes (Von Maltitz *et al.* 1998). LandCare is a major agent of change for agricultural production, environmental protection and social change (Vanclay 1994). However, in dealing with the environment, there is a need to redress social and economic issues, as they are inseparable.

In South Africa, as in other countries, sustainability focuses on the ability of the earth to support its inhabitants in their ever-increasing population numbers. This embraces growth and development, paralleled to the global action for environment and development, as adopted in the Earth Summit known as Agenda 21 (SADC 1996). A framework to facilitate the programme, which will involve the existing international, national, and regional policies, regulations, and programmes, is essential (Smith 1998). It is against this background that the Department of Agriculture developed a policy for conserving natural

resources, (National Department of Agriculture 1995), which complies with the Agricultural Resources Act, 1983, policies, programmes on land use, and the implementation of LandCare.

In South Africa, the environmental awareness programmes and responsibilities are vested in the relevant national and provincial departments. Figure 4.1 shows different structures involved in awareness and to the implementation of LandCare. Amongst these are the Department of Agriculture, in collaboration with the Departments of Education and Training (DET), Environmental Affairs and Tourism, Water Affairs and Forestry (DWAF), various NGOs and civil society. The potential that LandCare offers is essential in South Africa (Campbell 1995b), because in the past little success with land management was achieved through drought relief, poverty relief, and the Reconstruction and Development Programme (RDP).

LandCare is a process that needs total participation of local communities in planning, acting, observing and reflecting, although the government appears to have greater influence in decision-making (Curtis & De Lacy 1995a; Curtis *et al.* 1997; Agricultural News 1999c). It is also about what can be achieved if communities are directly involved with thinking about conservation of resources on which they depend and live (Campbell 1994; Lockie 1995).

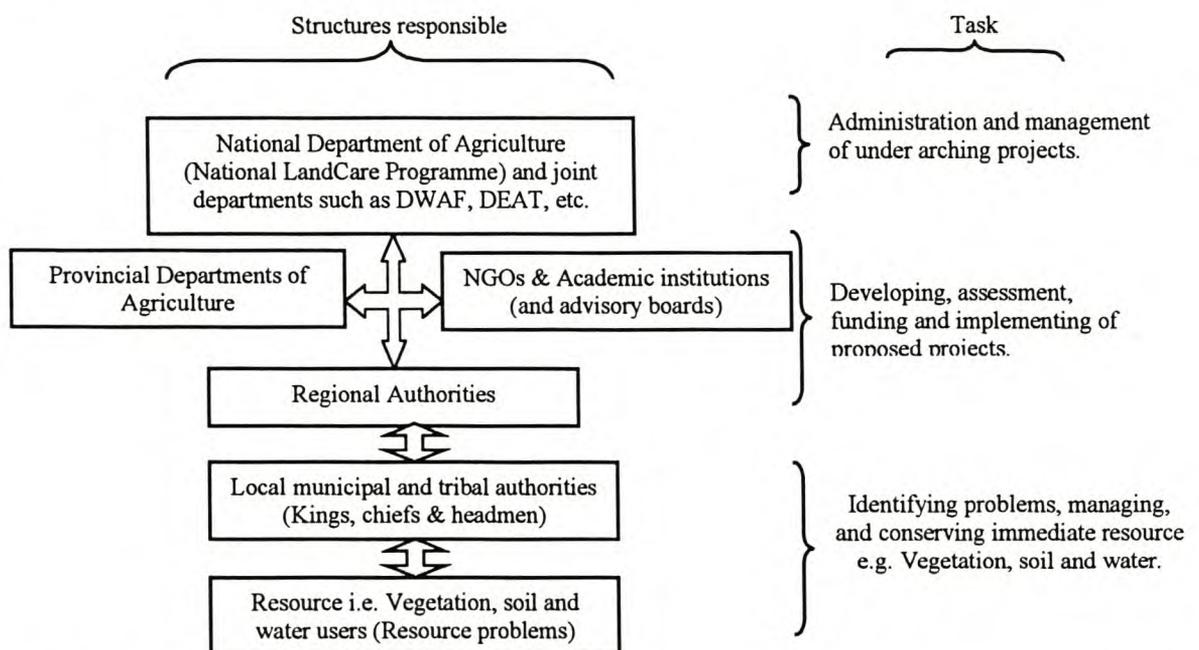


Figure 4.1: Structures involved in implementing LandCare programme

The success of LandCare is the responsibility of land users as they are the primary custodians of land (Curtis & De Lacy 1995b; Lockie 1995; Binns, *et al.* 1997; Agricultural News 1999b; Smith 1998). To achieve resource conservation and reduce degradation in Mutale, there is a need for investing in human capabilities, and giving local communities more opportunities to participate in and contribute to development planning and implementation. The launch of a variety of LandCare projects in South Africa was a turning point, which followed a string of successive events relating to land use practices. Amongst these projects are the Lwatshatsimu LandCare in the former Venda, and Okhombe LandCare in Kwazulu-Natal (Agricultural News 1999a; 1999b). The Lwatshatsimu LandCare project is the leading achievement in the province.

People live with the challenges of land degradation every day, and approaches to this problem should be made known at the grassroots level. Changes in the environmental condition of Mutale also indicated this and this necessitates an immediate application of LandCare. Communities should be given ownership of problems and control of solutions they may develop (Martin 1995). Moreover, the government and higher institutions of learning should introduce LandCare as an independent subject of study, since land users need education and encouragement to benefit conservation and production. This would instil the desire for good and fruitful conservation as Roberts (1990) and Campbell (1994) pointed out.

The approaches that the Department of Agriculture adopts in LandCare depend on the type of land problems faced within the provinces and they are related to funding (Dlamini 1999). From a distance, this may imply the dissecting of land problems, though UNEP (1993) indicated that land problems could not be separated from each other. Thus, the achievements of LandCare can be slim and it is through associating land problems that could delay this.

The process of change should encompass the traditional knowledge and practices that have been overlooked in the past (Critchley 1998). The use of biological rather than technical methods is essential. The biological methods are simple, cheap and are more easily maintained than extensive highly technical structures (Critchley 1998; Penny 1999). The

use of technical methods makes communities feel reluctant to participate in projects, although they show some interest, despite negative expectations.

### 4.3 Further recommendations

Implementation of sound conservation requires evaluation of alternative strategies used independently or jointly with others. Such evaluation should consider the attitudinal change of the local people concerning their relation to the environment. Regulatory controls regarding the application of environmental laws, procedures, and incentives need consideration. This may pave ways and prepare the ground for sound implementation of projects and programmes such as LandCare (Roberts 1990; Agricultural News 1999d), and be accelerated by involving the youth in development and in decision-making.

Environmental education and campaigns within different communities where competitions are necessary would enhance the facilitation and the promotion of environmental conservation. This would also help in raising funds. Although the media play a role in such activities, the Departments of Environmental Affairs and Tourism, Agriculture, and Education should run and schedule such campaigns with the assistance of the community.

The community and other structures (such as the political, religious, economic, and educational) could rescue the environment from further degradation, although other structures also play a role in making communities have different perspectives. Klooster (1999) and Makin-Taylor (1999 *pers. com.*) point to some resistance from communities that could be experienced in the process of rescuing the environment. Communities should have their own sets of rules related to their environment, and understanding of proper protection, running and management, which may include guarding against unauthorised bush clearance. This could yield more in development, since some land users are aware of their land issues, and are likely to adopt the best sustainable practices (Curtis & De Lacy 1995a).

Stock may be an economic asset of great quality and value to many, although negative outcomes are also identified. To avoid a negative impact, the setting aside of grazing camps could possibly control stock numbers within an area to a maximum carrying capacity and threshold. This would improve the quality of stock and grazing. It would also

provide and open doors for future extension in commercialisation, raising standards of living and sustainability. Strong security measures to safeguard the stock from theft and attack are also essential.

Projects that communities could strategically initiate with the assistance of the government could generate income for the society.

Although LandCare is people-directed and government-supported, South African communities should be mobilised to work and plan together to develop their areas to reduce alienation from their resources, and to avoid conflict. Concurrently, the government should ensure the management of resources for the benefit of the local community and the generations to come. The researcher supports Vanclay (1994), in stating that the government should not use LandCare as manipulator through transferring the responsibilities of land degradation to communities or a disguise for a top-down approach. However, should the government not be in the forefront, the projects would probably fail since the majority of the people are still living in poverty. Civil disobedience may also deter development.

Correct procedures to control available resources need to be followed. These embrace approval from the headmen, tribal authorities and civic associations. However, mismanagement is expected to persist and accompany these procedures, as in most bureaucratic systems. Such bureaucratic system could be essential in proper running of programmes. The people could co-operate with the government, which will give full support through advisers and funding, where suitable. This may improve and strengthen potential LandCare development. Thus, destruction of trees through burning has to be avoided and controlled through vigorous law enforcement.

Since it was noticed that the people in Mutale are willing to participate in conservation measures, issues such as the future population increases should be realised and addressed. Population growth has an impact on the available resources and land demand. The available land needs proper use and management. This requires environmental education amongst the people. Although improvement of remote rural areas is essential, it cannot come overnight. The supply of basic services such as electricity and water is crucial. Improvement of life through such services could lessen the dependence of people on wood

and improve health through alleviating some problems associated with fuel wood. However, vast generation of such power could implicate the quality of the atmosphere through air pollution at a later stage. To prevent such setbacks, natural energy generated from wind and solar power could be an alternative.

#### **4.4 Future research foci**

Further research should consider conditions prevailing in all seasons for broader understanding. This gap needs to be filled and might have affected the results of this study, since the observations were limited to the winter season. Broad analysis should also encompass the chemical influences on soil conditions (acidity and alkalinity) as this may impact on the degradation and physical nature of the soil. The use of a map and aerial photographs, surveys, interviews, and questionnaires helped to depict the core problems and lead to possible solutions, although some gaps remain for further inquiry.

The implementation and involvement of a community and support of the government need further investigation and research. With regards to degradation, the impact of stock farming must be investigated. The use of fuel wood inside homes and its effects on personal health and the degradation of the environment could also be researched. Investigating the extent of deforestation using satellite images is essential. This would assist in finding some suitable and possible areas for conservation, and alternative ways to curb further excessive harvesting of vegetation. Alternative tree species are to be identified to replenish the deforested areas. This will require a thorough investigation of the soil type and trees that would be suitable for planting.

#### **4.5 Conclusion**

Land degradation as identified, is a burning problem in the international arena and on local level, as in Mutale, where some of the causes are easy to deal with as they are evident. Precautionary measures and cure may be expensive to adopt and achieve since it implies funding and investing time. However, communities have a responsibility to make things right and to co-operate with a variety of structures to yield successful results.

The fulfilment of the aims set for this study revealed the extent of degradation within the province with regard to the available resources such as soil and vegetation. The causes and effects of land degradation in Mutale relate to population increase and are associated with climatic influences, and a number of other factors. Amongst these is the extensive harvesting of bush for various purposes, which influences and alters the environment.

Some of the purposes of harvesting the bush relate to the use of wood for building, fencing, fuel, and feeding stock. Digging up of soils to prepare materials for building and decorating houses influence degradation. Cultivated fields and grazing worsen the degradation, in relation to soil, vegetation and water. Extension of fields with the expectation of high productivity and stock trampling also contribute. Abandonment of unproductive fields affect degradation because of persistent dry periods and stock grazing in such areas.

People in Mutale are aware of the decline of the environment, although they do not know much about how to rescue the situation, since their conservation methods are limited. Thus, various awareness campaigns are essential to prepare and to fight against this silent threat. It is against this background that LandCare, as a measure towards the prevention of degradation, is likely to play a vital role if it can be utilised to sustain areas like Mutale, where community involvement should be encouraged vigorously.

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## Appendix A: English questionnaire

Research questionnaire to evaluate the perception of people on the environmental conditions in relation to land degradation. Information supplied here is for research purposes and would be confidentially handled. Mark a cross where appropriate.

### SECTION A: PERSONAL DETAILS

1. Sex

M	F
---	---

2. Age

3. Place \_\_\_\_\_

4. How long were you staying in this area? \_\_\_\_\_

### SECTION B: LAND USES

5. What are the types of land uses practiced in your area?

Cultivation of crops	settlement	Stock farming	Other (specify)
----------------------	------------	---------------	-----------------

6. What are the changes in the settlement area? \_\_\_\_\_

7. Do you own any type of cultivation field?

Yes	No
-----	----

*(If No go to question 10)*

8. Types of crop usually cultivated? \_\_\_\_\_

9. What are the changes in the cultivated area? \_\_\_\_\_

10. Do you own any stock?

Yes	No
-----	----

*(If no go to question 15)*

11. Type and number of stock you own?

Cattle		goats		donkey		Other(specify)
--------	--	-------	--	--------	--	----------------

12. How are they fed?

Open grazing	Pastoral grazing lands	Other(specify)
--------------	------------------------	----------------

13. Are there seasonal grazing lands set aside?

Yes	No
-----	----

14. What are the changes in the pastoral fields? \_\_\_\_\_  
\_\_\_\_\_
15. What type of fuel do you use for purposes as cooking? \_\_\_\_\_  
\_\_\_\_\_
16. What do you use for fencing your properties? \_\_\_\_\_  
\_\_\_\_\_
17. How and where do you get your supply? \_\_\_\_\_  
\_\_\_\_\_

### SECTION C: NATURAL CONDITIONS

18. Are there any changes noticed in the physical environment in your area?

Yes	No
-----	----

19. What are the physical changes in the area you stay that you notice in:

19.1 Vegetation


19.2 Soil erosion


20. Can you say the physical conditions are?

Deteriorating	Improving	Same	No observations	Other (specify)
---------------	-----------	------	-----------------	-----------------

21. What are the main causes of changes? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

22. Are the changes

unfavorable	favorable
-------------	-----------

*(If favorable, go to question 25)*

23. What should be done to improve the unfavorable/ worse condition of the environment

\_\_\_\_\_  
\_\_\_\_\_

24. What has been done to maintain the favorable conditions? \_\_\_\_\_  
\_\_\_\_\_

25. Who should be involved in bringing the condition to a satisfactory way?

\_\_\_\_\_  
\_\_\_\_\_

26. Do you find it possible to be involved in maintaining the environmental conditions?

Yes	No
-----	----

27. How could the environment in your area be conserved? \_\_\_\_\_

---

---

28. Who are you conserving it for? \_\_\_\_\_

---

29. Are there any traditional conservation methods used in your area?

Yes	No
-----	----

*(If No go to 31)*

30. What are these conservation methods? \_\_\_\_\_

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31. Comments


(Thank you for your cooperation)

## Appendix B: Questionnaire in Tshivenda

Research questionnaire ya u sedzulusa vhudipfi ha vathu kha nyimele ya mupo malugana na na u sudufhala hawo. Muvhigo une wa do nekedzwa afha u do shumiselwa risetshe fhedzi na u fulufhedzisa u kuvhatedzwa na u sa punda ha muvhigo une wa do newa. Ho teaho kha vha vhee tshifhambano.

### SECTION A. PERSONAL DETAILS/ZWA IWE MUNE

1. Mbeu  

M	F
---	---
2. Minwaha
3. Fhethu \_\_\_\_\_
4. Vha na tshifhinga tshingafhani vha tshi khou dzula fhano? \_\_\_\_\_

### SECTION B: KUSHUMISELE KWA SHANGO

5. Ndi ifhio nzulele ya kushumisele kwa mupo vhuponi ha havho?  

zwilinwa	vhudzulo	vhufuwi	Zwinwe-vho(kha vha tandavhudze)
----------	----------	---------	---------------------------------
6. Ndi dzifhio tshanduko dzine dza vha hone hune vha dzula hone? \_\_\_\_\_  
 \_\_\_\_\_
7. Vha na masimu/tsimu ane vha vha nayo?  

EE	HAI
----	-----

  
*(Arali I HAI kha vha pfukele kha 10)*
8. Lushaka lwa zwilinwa zwine vha anzela u zwala zwone? \_\_\_\_\_  
 \_\_\_\_\_
9. Tshanduko ine ya vha hone kha masimu avho ndi ifhio? \_\_\_\_\_  
 \_\_\_\_\_
10. Vha na zwifuwo/thakha?  

EE	HAI
----	-----

  
*(Arali I Hai kha vha pfukele kha 15)*
11. Lushaka na tshivhalo tsha thakha/zwifuwo.  

kholomo		Mbudzi		donngi		Zwinwe vho(kha vha dodombedze)
---------	--	--------	--	--------	--	--------------------------------
12. Zwi wana hani zwiliwa?  

U fula ho vuleaho	U fula ho gambelwaho	Zwinwe-vho(kha vha dodombedze)
-------------------	----------------------	--------------------------------

13. Huna hune zwifuwo/thakha zwa fula uya nga khalanwaha?

EE	HAI
----	-----

14. Tshanduko dzine ya vha hone fhethu ha u fula ndi dzifhio? \_\_\_\_\_

\_\_\_\_\_

15. Vha shumisa lushaka-de lwa zwivhaswa kha u shuma hayani? \_\_\_\_\_

\_\_\_\_\_

16. Vha shumisa mini kha u tsireledza kana u gambela thakha/ndaka yavho? \_\_\_\_\_

\_\_\_\_\_

17. Vha zwi wana ngafhi nahone hani? \_\_\_\_\_

\_\_\_\_\_

### SECTION C. NYIMELE YA MUPO.

18. Huna tshanduko ine ya vha hone kha mupo vhuponi ha havho?

Ee	Hai
----	-----

19. Tshanduko ine ya vha hone kha:

19.1 Madaka a mupo wa havho


19.2 Mavu kha kumbuludzee


20. Vha ngari nzulele ya mupo I?

Sudufhala/ ngwaluwa	Kwinifhadzea	A huna tshanduko	A huna vhusedzi	Zwinwe vho(kha vha dodmbedze)
------------------------	--------------	------------------	-----------------	----------------------------------

21. Ndi zwifhio zwiitisi zwa tshanduko dzine dza vha hone? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

22. Tshanduko dzine dza vha hone dzi a fusha kana u takadza?

EE	HAI
----	-----

(Arali I EE, kha vhaye kha mbudziso 25)

23. Ndi zwifhio zwine zwanga itiwa u khwinifhadza nzulele isa fushiho kana u takadza?

\_\_\_\_\_

\_\_\_\_\_

24. Ndi zwifhio zwe zwa itwa uri nzulele ivhe I fushaho? \_\_\_\_\_  
\_\_\_\_\_

25. Ndi vhafhio vhane vha tea u dzhenelela kha u kwinifhadza nyimele ya mupo? \_\_\_\_\_  
\_\_\_\_\_

26. Vha vhona zwi tshi konadzea u dzhenela kha u khwinifhadza nzulele ya mupo?

EE	HAI
----	-----

27. Ndi zwifhio zwine zwa nga tsireledza mupo wa vhuponi ha havho? \_\_\_\_\_  
\_\_\_\_\_

28. Vha vhona uri vha khou u tsireledzela vhafhio? \_\_\_\_\_  
\_\_\_\_\_

29. Hu na tsireledzo ya mupo ya mvelele/sialala ine vha I divha vhuponi ha havho?

EE	HAI
----	-----

*(Arali I HAI kha vha pfukele kha 31)*

30. Ndi dzifhio tsireledzo dza hone? \_\_\_\_\_  
\_\_\_\_\_

31. Zwinwe-vho zwine vha nga engedza


*(Dzindivhuho kha tshumisano yavho)*