COMMUNITY PERCEPTIONS OF RANGELAND DEGRADATION AND MANAGEMENT SYSTEMS IN LOOLOGANE AND SHADISHADI, KWENENG NORTH, BOTSWANA

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Title picture: Morula trees (*Sclerocarya caffra*) in Thotayamarula (photo taken by Geofrey Khwarae, December 2005)

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DECLARATION

I, ***Geofrey M. Khwarae***, do hereby declare that this thesis is a product of my own research work except where acknowledged, and that it has not been submitted for a degree award at any other University.

Geofrey M. Khwarae Ås, May 2006

DEDICATION

To my wife Letshe, my daughters Tapiwa & Tjedza, and my son Tumo, with love!

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ABSTRACT

Local land users often have different perceptions on the problems of rangeland degradation compared to researchers and government officials. Despite this, little research has so far been conducted into the environmental perceptions of the general public in Botswana. This study aimed at contributing to this important area of research by empirically exploring the communities' environmental perceptions regarding rangeland degradation and conservation strategies in Loologane and Shadishadi villages, Kweneng North, Botswana. The study administered questionnaires and collected primary data on communities' perception on (1) causes and (2) indicators of rangeland degradation; communities' awareness of (3) indigenous and (4) technical/modern rangeland management systems, (5) institutions and legislations in rangeland management and perception of their effectiveness. (6) Finally, the study considered what communities perceived as the most possible and workable solutions to halt rangeland degradation. The communities' perceptions were assessed with reference to grazing and biodiversity resources as these are the major products of rangelands. The study showed that communities have a clear perception of the problem of land degradation. The major findings of the study were: (1) the majority of the respondents perceived grazing to be degraded mainly as a result of poor rainfall, resource over-harvesting and overgrazing; (2) communities did not hold the view that there was depletion of non-grazing biological resources, especially veld products; (3) there was substantial awareness about indicators of rangeland degradation. (4) There was vast knowledge of indigenous management systems considered effective for rangeland management by the communities. (5) However, there was minimal awareness of technical methods to counter rangeland degradation; (6) institutional awareness was higher for local institutions than for Government and national institutions. (7) There was willingness to commit to participate in implementing the proposed rangeland management solutions. This study showed the need for rangeland professionals, researchers and planners to integrate the communities' perceptions and existing indigenous ecological knowledge to ensure success in rangeland management programmes.

Key words: Botswana; community; community perception; indigenous ecological knowledge; rangeland degradation; rangeland management.

1.0 INTRODUCTION

Local land users often have different perceptions on the problems of rangeland degradation compared to researchers and government officials (Dejene *et al.*, 1997). This has resulted in misunderstanding with experts in diagnosing and solving the problem. The issue has become a constraint to the successful implementation of rangeland management programmes (Mapinduzi *et al.,* 2003). Sustainable rangeland management systems should result from a combination of community based indigenous knowledge, communities' perceptions and past practical experience, and scientific knowledge to rehabilitate degraded rangelands and conserve biodiversity. A key factor for sustainable rangeland management is the ability to use indigenous institutions in order to conserve biodiversity and maintain full resource access rights (UNDP, 1997). Traditional management systems have an inherent interest in conserving rangelands and biodiversity because they are an important traditional economic base. It can therefore be argued that they have developed numerous methods that need institutional strengthening for continued sustainability.

It is important to understand the differences between perceptions of scientists and local communities in order to find out how these gaps can be bridged to bring about sustainable use of natural resources. In this thesis the term perception is used to mean 'awareness, concern and attitude' (Kikula, 1997), of local people or communities with regards to rangeland management problems. Experience shows that policies, programmes, and strategies aimed at halting degradation were hardly evaluated from the perspective of the local communities (Schechambo *et al.,* 1999). Rangeland management strategies have been approached from an *etic* point of view. This approach looks at rangeland management problems through the "eyes" of the scientists alone (Kikula, 1997). In this approach ecologists and planners determine what the problem is and suggest solutions. It is assumed, in this approach, that local people are not aware of the problem, hence they may require some form of awareness raising, by the scientists.

In the rangelands of Botswana degradation has been described and addressed in terms of the official's perceptions (Abel and Blaikie, 1989) without consideration of the perceptions of the local communities. This state of affairs has led to the breakdown or

loss of traditional management systems, resulting in ineffective community control and lack of participation in development policies by the local communities (Darkoh, 2000; Arntzen *et al.* 2004; Taylor, undated). In addition, the planned programmes and strategies misconstrued traditional land use (UNDP, 1997), and undermined the importance of mobility in rangeland management (Abel and Blaikie, 1989) by constructing fences to privatize communal rangelands (White, 1993) in the form of ranches.

By comparison community-based knowledge, specifically indigenous ecological knowledge, is based on human environmental perceptions and historical knowledge of resource use (Oba, 1994). Local communities have wide knowledge about the biodiversity in their rangelands and they have a way of interpreting the changes they see. Equipped with indigenous knowledge, local communities undertake activities to halt degradation based on what they perceive to be the causes and solutions of rangeland degradation. It is this knowledge that farmers use to regulate livestock grazing (Oba, 2001), and to know when and where to harvest other biological resources based on their perception about the resource status at any given time.

Local communities therefore had their traditional systems of rangeland management that can be used to explain their success in rangeland management before the introduction of technical and modern management systems. Traditionally, the rangelands and water points were locally controlled and managed, and livestock were herded and moved from one point to another depending on the conditions of the pasture (Peters, 1994; Mapinduzi, 2003). Seasonal migration in search for water and good pasture was a traditional management strategy for grazing resources (Motshubi, 2003b). Land allocation for different purposes was under the custodian of the village leadership and not the Land Board, and therefore outsiders were easily excluded in rangeland utilization and degradation was therefore reduced (Motshubi, 2003 a,b,c; Taylor, 2003).

Furthermore, many traditional societies had social taboos that guided their conduct towards the natural environment, including biodiversity conservation. Resource exploitation, especially veld product harvesting and tree cutting, was regulated by cultural beliefs, norms and taboos (Colding and Folke, 2001; Motshubi, 2003 a,b,c). Local communities applied social taboos to ban access to resources during certain periods of the year. Such taboos included, for example, the ban on the utilization of particular

species for specific time periods for individuals of a particular age, sex, or social status; ban on the use of certain methods and techniques for harvesting of biological resources, especially those methods that may damage or drastically reduce the stock of a given resource. Taboos associated with protection of habitats were applied when communities regulated both access to and use of resources from particular habitats in time and space. Community members were usually aware of such taboos in their societies and made efforts to abide by them because they perceived them as effective in biodiversity conservation. Social taboos therefore led to the conservation and management of biodiversity in many societies (Colding and Folke, 2001).

The breakdown of the traditional systems for rangeland management which ultimately led to the deterioration of the environment was a result of the imposed policies (Abel and Blaikie, 1989; Perkins, 1991; White, 1993; Taylor, 2003; Arntzen et al., 2004). The first legislation was the 1968 Tribal Land Act which ended the chief's powers of custody and allocation of land. This was followed by the 1972 Agricultural Resources Conservation Act (ARCA) that established the Agricultural Resources Board (ARB) and empowered the Board to issue conservation regulations and orders to manage the agricultural and biodiversity resources of Botswana. By the year 2000, the ARB had never issued any conservation orders or made any conservation regulations since its adoption (Briscoe, 2001, Botswana Daily News, July 28, 2000). Furthermore, the 1975 Tribal Grazing Land Policy (TGLP) and the 1991 National Policy on Agricultural Development (NPAD) failed to halt rangeland degradation, or improve rangeland management, but rather reduced the communal areas into degraded buffer zones around settlements (Briscoe, 2001; Arntzen *et al.*, 2004).

A brief presentation on the differences in perception between local communities and officials in terms of traditional management systems and policies, programmes and strategies is not enough of a contention of the debate. The differences are also noticeable even on the perceptions on causes of the problem. The major causes of rangeland degradation include climatic conditions causing drought and human factors leading to the overuse of biological resources (Dejene *et al.*, 1997). In Botswana the major proximate causes of land degradation and biodiversity loss include over-harvesting for fuel and construction needs, lack of ready livestock market, over-exploitation of other resources

for survival and the continued "top-down" approaches to development (UNDP, 1997). Overgrazing, resulting from overstocking, has led to severe land degradation, especially around settlements and natural and artificial water points (Abel and Blaikie, 1989; Perkins, 1991). This situation is exacerbated by the fact that rangelands are (mis)managed under open access regime. Local communities are not empowered to manage their rangelands and to apply traditional range management systems even where local knowledge exists (UNDP, 1997; Darkoh, 2000; Arntzen *et al.,* 2004; Taylor, undated).

A study by Chanda (1996) on human perceptions of environmental degradation in a part of Kalahari ecosystem, established that community members viewed drought as the major cause of natural resource degradation. Other identified causes included overstocking, commercial exploitation, poor livestock management, veld fires and overpopulation. Chanda (op.cit.) concluded that communities blamed degradation more to the physical causes, particularly drought, as opposed to the human causes and warned that this perception does not sufficiently support individual or community based rangeland intervention measures on a sustained basis.

The perceived indicators used to identify the problem of degradation also differ between scientists and communities. Although a number of frameworks have been used to identify and describe indicators for sustainable rangeland management, indicators have too frequently been identified, evaluated and selected by researchers (Reed and Dougill, 2002). The development of pre-defined, externally generated evaluation criteria for indicators does not acknowledge the communities' perceptions of the relevant criteria. The indicators are developed with little reference to land-user objectives, strengths or constraints, and they tend to encompass limited range of indicators (Reed, 2005). Meaningful participation by communities is essential to develop indicator-based management tools in order to facilitate sustainable rangeland management. Communities often have more meaningful interpretations of the rangeland indicators they use, although most of these indicators are found in the literature (Reed and Dougill, 2003). Pastoralist experience shows information from such surrogates is sufficiently accurate to support management decisions (ibid).

Recent research, however, has made efforts to combine expert knowledge with local knowledge through participatory process to develop indicators for rangeland

condition (Reed and Dougill, 2002; Stringer and Reed, 2004; Reed, 2005). This approach is intended to "integrate and harness knowledge from within and between scientific and local knowledge bases, so that communities are able to fully realize their capacity to monitor and respond to the challenges of degradation and change, and should allow scientists, local actors and their different understandings to interact to produce useful policy and more effective practice." (Stringer and Reed, 2004: 3).In their participatory selection process for indicators of rangeland condition in the Kalahari, Reed and Dougill (2002) found that communities relied heavily on vegetation and livestock indicators, and lightly on soil indicators. Interestingly most of the indicators as perceived by the pastoralists are not inconsistent with those used by ecologists.

Studies on perceptions of natural resources have become important as they shed more insights into areas of conflict between scientists and local communities, and how these differences in perception help or hinder efforts in environmental management. Differences in perception can also occur among people living in the same location, sharing the same resources. It is equally important to understand the basis for these differences and how they influence the use and management of natural resources.

However, previous research activities that influenced rangeland management policies and programmes lacked stakeholder analysis, particularly the integration of the communities' perception (awareness, concerns and attitude) of the problem, and what they (communities) thought could be done as a solution. Stakeholder analysis would improve information related to land degradation and land management by providing a general view of the problem as perceived by both the scientific and traditional experts.

This thesis examined the community perceptions and attitudes of rangeland degradation in Loologane and Shadishadi settlements, in Kweneng North, Botswana. The analyses focused on what the communities perceived as causes and indicators of rangeland degradation, followed by an assessment of the traditional management systems and institutions in rangeland management that the communities were aware of. The study assessed the level of awareness of modern or technical management systems, together with the formal institutions, including legislative instruments, involved in rangeland management. On the premises that management strategies are predicted by perceptions of causes and indicators of degradation, traditional and formal management institutions in

place, communities were given the opportunity to propose what they perceived as workable solutions to abate rangeland degradation. This was done with the aim of establishing sustainable natural resource management systems that combine traditional with formal management systems. The assessment was done with reference to grazing and biodiversity management as the two components constitute the useful biological resources in rangelands in Botswana.

1.1 Objectives of the study

The purposes of the study were to assess and analyze the communities' perceptions of rangeland degradation and understand their conservation strategies to reverse rangeland degradation. The study contributes to the information needed towards the development of effective management strategies of rangelands in Botswana.

1.1.1 Research Questions

The following questions were addressed:

1. Did the communities in the study area think that there was degradation of rangeland resources in terms of grazing, biodiversity and fuelwood?
2. What did the communities perceive as causes and indicators of rangeland degradation?
3. What were the indigenous management methods that were used to manage the rangelands, and how effective were they?
4. What were the technical (modern) management methods that were used to manage the rangelands, and how effective were they?
5. Were the communities' aware of existing institutions and legislations that dealt with rangeland management? How effective did they perceive them to be?
6. What did the communities consider to be the most possible and workable solutions to the problem of rangeland degradation?

2.0 THE STUDY AREA

This study was conducted in Kweneng North represented by Lephepe, Boatlaname, Shadishadi, Sojwe and Loologane (Figure 1) which is one of the three pilot sites (the others were Kgalagadi represented by the villages of Rappelspan, Vaalhoek, Bokspits and Struizendam and Boteti represented by Mopipi, Mokoboxane and Kedia villages) of the Global Environment Facility - Indigenous Vegetation Project (GEF-IVP) in Botswana. The Indigenous Vegetation Project (IVP) is a five-year project, being implemented in Botswana, Kenya and Mali. In Botswana, the project is implemented through the Ministry of Agriculture. IVP is a pilot project aimed at developing models for community-driven management and rehabilitation of degraded rangelands, for replication throughout the arid and semi-arid zones of Africa. The project is being implemented through six major components which are (i) establishment and strengthening of appropriate indigenous management systems; (ii) establishment of regional arid zone bio-database; (iii) rehabilitation of indigenous vegetation and degraded land; (iv) improved livestock production and marketing, and provision of alternative livelihoods; (v) technology transfer, training and regional comparative learning and (vi) targeted research (UNDP, 1997).

This study makes a contribution to the IVP's targeted research focusing on the component on establishment and strengthening of indigenous management systems with regard to rangeland management. The villages of Shadishadi and Loologane in Kweneng North were selected for implementation of the study where the principal concern was rangeland degradation. Headmen for arbitration administered both villages. The two villages have primary schools of modern house infrastructure. Shadishadi has a clinic and Loologane has a health post and gets its services from Sojwe, a neighbouring village within the IVP site. At a district level, the study sites are administered from Molepolole, which is about 160 km away. An Agricultural Demonstrator from Lephephe provides agricultural extension services to both study communities. The rest of the administrative and technical services are provided from Molepolole, which is the Kweneng District Headquarters.

2.1 Description of the study sites

2.1.1 Loologane village

Loologane is a new village that was established by the Government in 2003. The communities were relocated from the remote settlements of Makabanyane and Thotayamarula. The main reason for relocation of the settlement was for the Government to be able to provide more conveniently the community with basic social services such as education, water, health and other social welfare services. The 2001 national population census estimated the population of Makabanyane and Thotayamarula (now Loologane) at 448 people divided between 75 households. Subsistence farming, both arable and pastoral, is the primary form of livelihood for the community. However, due to the community's low economic income there is a high dependence on government welfare programmes such as monthly food rations for destitute residents and orphans, and pension for the elderly. Gathering and collection of various veld products (non-grazing products that communities obtain from the rangeland (Watson and Dlamini, 1999), such as fuel wood, food, medicines, craft materials, ornamental plants, etc) still play a significant role in local livelihoods (Motshubi, 2003). Residents of Loologane regard Thotayamarula[1] as their source of livelihood due to its rich bio-diversity.

Loologane village is situated in the sandveld part of Kweneng north (Figure 1). The climate of this study site can be classified as semi arid with a mean annual rainfall ranging from 450 to 500 mm (Field, 1978). The rain mostly falls in the summer months from October to April with high and poor variability throughout the season. The study site is characterized by sub-desert soils that developed from the dominant deep Kalahari sands. The vegetation is highly diverse and the tree woodland savanna is dominated by *Terminalia sericea, grewia* species (including g. *flava,* and *g. retenervis*) and several stands of morula trees (*Sclerocarya caffra*) (Motshubi, 2003).

[1] The name Thotayamarula means an island of morula (*Sclerocarya caffra*) trees.

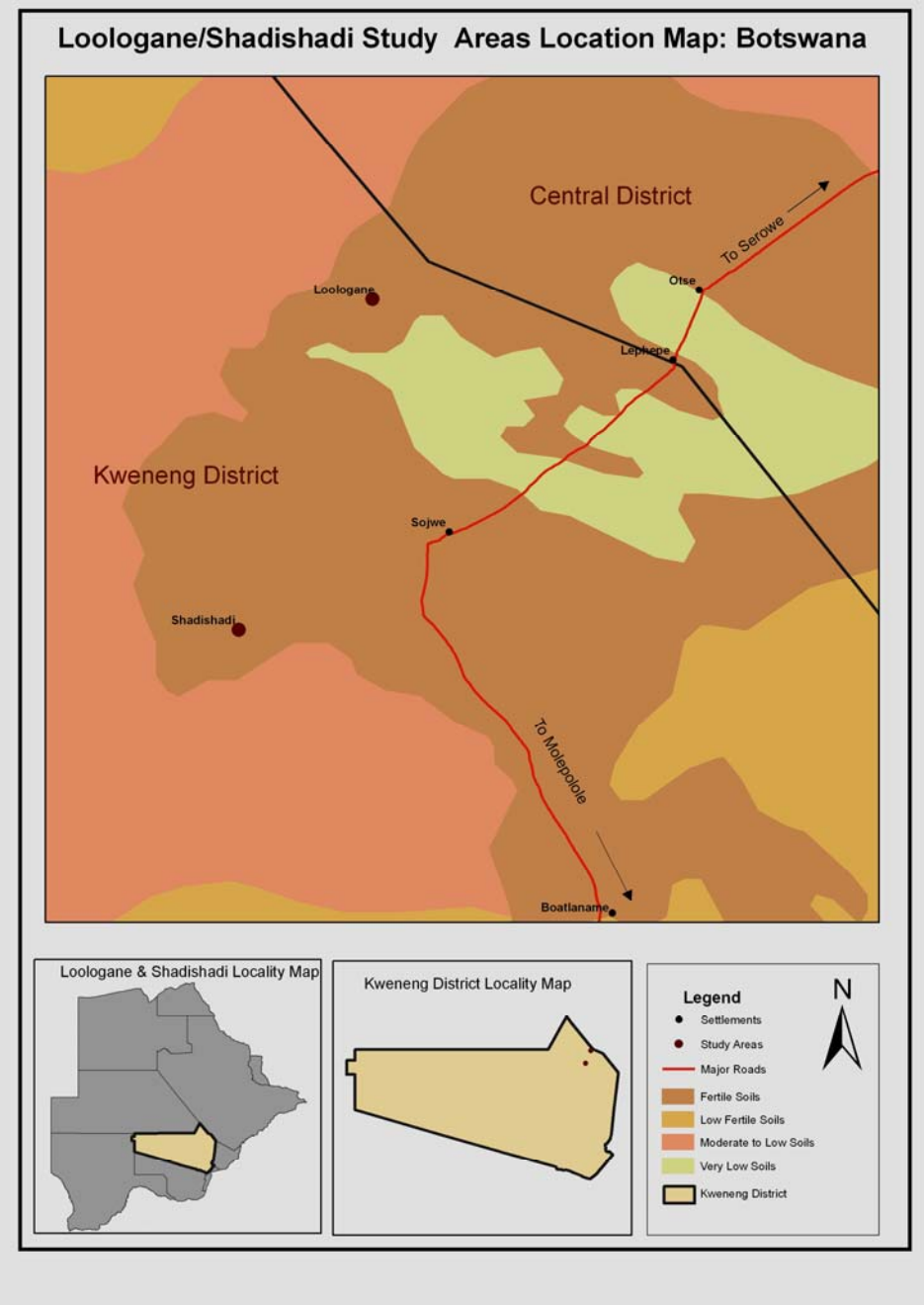

Figure 1: Kweneng North map showing the Study Areas

2.1.2 Shadishadi village

The second study site, Shadishadi village is situated about ten kilometers from the Molepolole – Serowe highway to the west of Sojwe village and the Shadishadi pan (Figure 1). The village lies on the transition zone between the hardveld and sandveld. The climate and rainfall patterns of Shadishadi are similar to that of Loologane. The

vegetation is dominated by *acacia* species including *Acacia mellifera* (mongana) and *Acacia tortilis* (mosu). The vegetation changes as one moves further to the west and south of the area. In these regions shrubby species, especially *Grewia flava* (moretlwa), *Grewia flavescens* (motsotsojane), *Terminalia sericea* (mogonono), and *Dichrostachys cinerea* (moselesele) become dominant. *Eragrostis pallens* (motsikiri) and *stipagrostis uniplumis* (tshikitsane) grass species are mainly found in the western sandveld part of the village towards Loologane and these are very important grazing resources (Motshubi, 2003).

The 2001 national population census estimated the population of Shadishadi at 1356 people living in 111 households. Similar to Loologane, subsistence farming is the primary form of livelihood for the community. There is also a high dependence on government welfare programmes, and evident gathering and collection of biological resources[2] to support peoples' livelihoods. There are limited employment opportunities available mainly through government assistance schemes such as drought relief. While some residents migrated to towns, few got casual jobs available as cattle herders in the nearby villages, boreholes and cattleposts.

For both study sites, the three major land use forms were human settlements, arable agriculture, and livestock grazing. Human settlements and arable agriculture were demarcated land uses, while livestock grazing was under open access regime. Livestock was kept both in and around the settlements, in the fields or at the cattle-posts. Small herds were kept and watered near the villages whereas the large-herd owning farmers managed livestock in cattle-posts and watered them at the boreholes. Most cattle-posts were situated in the western sandveld. The absentee farmers, resident outside the study area constructed and controlled the use of boreholes. Following the introduction of the Tribal Land Act of 1968, which took away the chief's powers to control land allocations and land use, the deterioration of the common property management regime, and the introduction of the open access management (or rather failure to manage) regime resulted in overstocking and overgrazing of the rangelands. Degradation has been reported as a common problem around Shadishadi village, the boreholes and other watering points

[2] Biological resources include genetic resources, organisms or parts thereof, populations or any other biotic component of ecosystems with actual or potential use or value for humanity (CBD, 1992)

(Motshubi, 2003) but the situation in the rangeland where water has not been developed are in fair to good conditions (BRIMP, 1997).

In the study areas there were drift-fences around the ploughing fields. In 1978 the Ministry of Agriculture introduced a programme called Agricultural Extension (AE 10) with the objective of increasing agricultural production and combating rural poverty (Sebele, 1996). Through the programme communities were encouraged to fence up their cropping fields to prevent crop damage by livestock. In some cases the drift fences were a success, while where they collapsed due to poor management, they have not been so effective. The impact of the recent revival and repairs of the drift fences on the rangelands have not been evaluated by the current study.

3.0 METHODOLOGY

In order to make rangeland degradation meaningful to the respondents, it was discussed with reference to the relevant livelihood systems of the study communities, namely, livestock production, and biological resources utilization (Chanda, 1996). Livestock production was discussed with particular reference to grazing. Biological resources were discussed as non-grazing products that communities obtained from the rangeland (Watson and Dlamini, 1999), such as fuel wood, food, medicines, craft materials, ornamental plants, etc. They are a product, and a major component, of biodiversity that should be used sustainably. The problems of the natural resource supply and quality relevant to the livelihood systems were used as surrogates of rangeland degradation. The problem of degradation was assessed from a social dimension because it was considered a social problem (Blaikie and Brookfield, 1987) that reduces the quality of the environment for a range of human functions, such as the supply of subsistence resources (Chanda, 1996).

3.1 Data collection

The study administered questionnaires to representative households from the two villages. The information that was gathered by the research included the household socio-economic characteristics, perceptions on rangeland resource degradation causes, indicators and proposed workable solutions; awareness of indigenous and modern or technical rangeland management methods and perceptions of their effectives; and, awareness on legislation and institutional capacity issues in relation to rangeland resource degradation and management. The questionnaires included both open-ended and close-ended questions. The open-ended questions gave the respondents an opportunity for self-expression to share their views, experiences and opinions.

An enumerator was employed to assist in data collection. He was trained for a day to be familiar with the questionnaire and understand the concepts, as well as ensuring proper completion of the data sheets. The first half of the training day was devoted to understanding, interpretation and translation of the concepts, while the last half of the day was devoted to pre-testing the questionnaire by both the researcher and the enumerator. Five respondents were randomly identified in Shadishadi study site and requested to

participate in the pre-testing exercise after which minor changes to some of the questions, were made. The questions were asked in Setswana.

The research was implemented in December 2005 and it took one and a half weeks to complete. Sixty households were interviewed in total and this comprised 25 households in Loologane and 35 households in Shadishadi. The number of households represented 30% of the target households in the study sites. The respondent households were identified randomly. With the use of the random sampling, the survey covered households of different characteristics such as female and male-headed, rich and poor, educated and non-educated, livestock owners and non-livestock owners.

Because the study coincided with the ploughing and planting season some randomly picked potential respondents engaged in ploughing postponed the interview dates to suit their availability. This was particularly the case in Shadishadi. The majority of the respondents in Loologane were available for the interviews without appointment, except a few who were either engaged in ploughing or in drought relief projects. The respondents were interviewed when they became available.

Additionally, the study reviewed government documentations, legislations and project reports in the study area. The information was compared with the findings of the current study in terms of how researchers and the government officials perceived the concept of degradation in terms of the causes, indicators and possible solutions.

3.2 Data analysis

All data on respondents' socio-economic characteristics, perception of degradation of pasture resources, fuel wood, and veld products availability, awareness of legislations and institutions on rangeland management were analyzed using the Statistical Package for Social Sciences (SPSS version 11.0). Frequencies were calculated using descriptive statistics for respondent demographics and socio-economic characteristics for all the farmers interviewed by site. Analysis for close-ended questions on the attitude of respondents towards diagnostic degradation of pasture and biodiversity resources; awareness of indigenous and introduced rangeland management systems; awareness of Policies (and Acts), projects/programmes, local institutions, and perception of their

effectiveness and success; the awareness of Government/NGO institutions dealing with rangeland management issues were presented in frequencies.

Open-ended questions were first categorized before being analyzed, also using frequencies. To create categories the patterns and themes within the open responses were first identified. Responses analyzed in this way included, perceived causes and indicators of rangeland resource degradation; known indigenous and introduced or technical methods for rangeland resources management; known policies, projects, and institutions; and, the proposed workable solutions to halting the degradation of rangelands. I also presented some of the views of the respondents as they were narrated during the interviews. All the presented narratives were translated into English as they were presented, and with very minimal editing to maintain the respondents' views of the issues.

Since few differences were found between the two study communities on their perceptions on degradation of grazing pasture and biodiversity resources and because the two communities used the same rangelands for similar activities, it was found necessary to pool the data, for Shadishadi and Loologane, and consider the results representative of the two communities. To determine whether the data could be representative of the respondents, chi-square tests were run on the responses given by the respondents on their perceptions on degradation status of grazing resources and biodiversity, and awareness of institutional arrangements in the management of rangeland resources. Responses were then compared between farmers from the two study communities. Preliminary analysis showed no significant differences ($p > 0.05$) between respondents in Shadishadi and Loologane.

4.0 RESULTS

4.1 Socio-economic and demographic characteristics

The two study communities had somewhat similar socio-economic characteristics ($p > 0.05$) except for the sex of the respondents (Table 1). There were more male respondents from Loologane and more female respondents from Shadishadi ($\chi^2 = 4.518$, $p = 0.032$). A higher proportion of the respondents were above the age of 41 years with a few of them having acquired only primary education. Most of the respondents below 40 years had received junior secondary education ($\chi^2 = 27$, $p < 0.001$).

Crop farming played a greater role in the respondent's livelihood as indicated by a high proportion of the respondents who stated it as the main and secondary livelihood activity (Table 1). Livestock also played a substantial role in many of the respondents' livelihoods. There is high dependence on the government as the provider of respondent's main livelihoods through provision of destitute and elderly food rations, and drought relief programmes. The majority of the interviewed households indicated that they relied on a monthly cash income of less than 500 Pula[3]. Forty percent of the respondents did not own cattle while 51% owned no small stock (goats and/or sheep). Of those who owned livestock the majority were small-scale farmers who owned between 1 and 10 animals ($\chi^2 = 25$, $p < 0.001$).

4.2 Communities' perception on rangeland[4] degradation

In comparing the responses between informants from both study sites, no significant differences ($p > 0.05$) were found except for 2 out of the 11 questions that were analyzed (Table 2). The results showed that almost all the respondents from Loologane were of the view that there was no biodiversity depletion (particularly that which provided veld products) while in Shadishadi the perception was variable ($\chi^2 = 10$, $p = 0.001$). A higher proportion of the respondents from Loologane were more aware of a Policy (or Act) dealing with biodiversity management than those from Shadishadi ($\chi^2 = 8$, $p < 0.05$).

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[3] 1 Pula = 0.19 USD or 1 USD = 5.37 Pula as at May 11th 2006

[4] This is communal land that provides grazing (and browsing) and other biological resources from utilization of biodiversity such as fuel wood, food, medicines, craft materials, ornamental plants, etc.

Table 1: Socio-economic or demographic characteristics of the study communities

Demographic information		Respondents Frequency		
		Shadishadi	Loologane	TOTAL
Sample size		35	25	60
a) Sex	Male	14	17	31
	Female	21	8	29
b) Marital status	Married	12	9	21
	Single	22	14	36
	Widowed	1	2	3
c) Age	15 - 20	1	1	2
	21 - 30	5	4	9
	31 - 40	9	7	16
	41 - 50	14	6	20
	51 - 60	2	2	4
	61 and above	4	5	9
d) Highest education acquired	None	8	13	21
	Primary	17	7	24
	Junior secondary	10	5	15
e) Main livelihood	Crop farming	16	10	26
	Livestock farming	5	1	6
	Small / piece jobs	2	2	4
	Food ration by government	2	2	4
	Drought relief programmes	6	8	14
	Full time job	4	2	6
f) Other livelihood activities	Crop farming	14	8	22
	Piece jobs	7	7	14
	Livestock raising	8	4	12
	Drought relief projects	4	5	9
	Pension money	2	1	3
g) Household income per month	Less than 500	30	23	53
	501 - 1000	2	2	4
	2001 - 2500	3		3
h) Number of cattle owned	None (0)	11	16	27
	1 - 10	15	7	22
	11 - 20	4		4
	21 and above	5	2	7
i) Number of small stock owned	None (0)	16	15	31
	1 - 10	11	5	16
	11 - 20	6	5	11
	21 and above	2		2

The rest of the tests showed that the respondents' response did not depend on which village the respondent came from (Table 2). In both study sites more respondents (1) thought that there was degradation of grazing and biodivesrity, (2) were aware of the local institutions and projects, (3) were not aware of the legislation (Policies or Acts) and the Government or Non-Governmental institutions involved with grazing and biodiversity management.

Table 2: Perception and awareness of rangeland resource degradation and institutions in the study sites

Perception and awareness	Study Sites				χ^2	P-value
	Shadishadi		Loologane			
	YES	NO	YES	NO		
Do you think there is degradation of pasture or grazing resources?	33	2	24	1	0.90	0.764
Would you say you face fuelwood shortage?	32	3	25	0	2.256	0.133
Would you say you face biodiversity depletion?	14	21	1	24	10.08	**0.001***
Are you aware of any Policy or Act dealing with grazing resources management?	12	23	9	16	0.019	0.891
Are you aware of any project dealing with grazing resources management?	20	15	17	8	0.727	0.394
Are you aware of any Government or NGO institution dealing with grazing issues in your village?	12	23	9	16	0.019	0.891
Are you aware of any local institution dealing with grazing in your village?	30	5	17	8	2.696	0.101
Are you aware of any Policy or Act dealing with biodiversity conservation?	9	26	16	9	8.795	**0.003***
Are you aware of any project dealing with biodiversity conservation?	30	5	24	1	1.714	0.190
Are you aware of any local institution dealing with biodiversity management in your village?	29	6	24	1	2.444	0.118
Are you aware of any Government or NGO institution dealing with biodiversity issues in your village?	8	27	5	20	0.070	0.791

* Shows significant difference

4.2.1 Perceived causes of range[5] or pasture degradation

All the respondents were interviewed to establish their perception of pasture degradation. The results indicated that almost all the respondents (95%) held the view that there was degradation of pasture caused mainly by low rainfall (91.2 %) and overstocking (87.7%). A notable number of the farmers (40.4%) cited over-utilization

[5] The terms "range" and "pasture" are used interchangeably, referring to both grazing and browsing.

and over-harvesting of biological resources such as felling of trees for construction materials, as causes of pasture degradation. Range fires and long periods of drought were reported by an equal proportion (15.8% each) as other forms of perturbations that reduce grazing resources.

4.2.2 Perceived causes of biodiversity depletion

Only 25% of the respondents said that there was depletion of biodiversity. The majority (75%) of the respondents did not hold the mainstream view that there was biodiversity loss in their villages. When asked what they perceived to be the causes of biodiversity depletion most of the respondents mentioned lack of rains (93.3%) as the major cause, followed by over-harvesting (66.6%) and overstocking (40%).

The respondents' assessment of the biodiversity further confirmed the perspective that the depletion of the biodiversity was limited (Table 3). Most of the respondents mentioned and assessed the biodiversity useful in their livelihoods. On top of the list was moretlwa (*Grewia flava*) mentioned by 88%, followed by morula (*Sclerocarya caffra),* motlopi *(Boscia albitrunca),* moretologa *(Ximenia Americana),* mogorogorwana *(Strychnos cocculoides),* mmilo *(Vangueria infausta),* motsotsojane *(Grewia retenervis),* morutwa *(Rothmannia capensis),* morama *(Tylosema esculentum)*, and sengaparile or grapple plant *(Harpagophytum procumbens).* The greater majority of the respondents who mentioned the useful biodiversity indicated high species richness and diversity within the communal area (Table 3).

Table 3: Biodiversity mentioned and perception of degradation status*

Scientific Name	Local Name	Response Frequency	Response Frequency (%)								
			Veld Products Availability			Past trend			Distance from village		
			Abundant	Moderate	Scarce	Increasing	Constant	Decreasing	Near	Far	Very Far
Grewia flava	Moretlwa	53	74	24.5	1.5	1.9	96.2	1.9	79.2	18.9	1.9
Sclerocarya caffra	Morula	43	83.7	16.3		2.3	95.4	2.3	70	28	2
Boscia albitrunca	Motlopi	38	89	11			100		92.1	7.9	
Ximenia Americana	Moretologa	34	65	29	6		94	6	38.2	55.9	5.9
Strychnos cocculoides	Mogorogorwana	33	54.5	36.4	9.1		90.9	9.1	42.4	45.5	12.1
Vangueria infausta	Mmilo	32	68.8	31.2			96.9	3.1	31.3	59.4	9.3
Grewia retenervis	Motsotsojane	27	70	30			96.3	3.7	51.9	44.4	3.7
Rothmannia capensis	Morutwa	15	47	53			100		60	33.3	6.7
Tylosema esculentum	Morama	14	71	21	8		85.7	14.3	50	21.4	28.6
Stipagrostis uniplumis & Eragrostis Pallens	Bojang jo bo rolelang (Thatching grass)	13	61.5	7.7	30.8		46	54	38.5	15.4	46.1
	Morogo (wild vegetables)	10	100				100		80	20	
Harpagophytum procumbens	Sengaparile (Grapple plant)	9	100				100		88.9	11.1	

* Assessment undertaken only by those respondents who mentioned the species

Two grass species tshikitsane *(Stipagrostis uniplumis)* and motshikiri *(Eragrostis pallens)* were mentioned as important for both grazing and thatching in the two study sites. During the research many huts were sighted with new thatch in both villages, especially in Loologane where the residents had just relocated (Figure 2). The majority of the respondents viewed the grass species as abundant while the minority viewed it as moderately available or scarce (Table 3). There was variation among the respondents' view of the past trends of the grass species as well as their view of the distance from the village. A higher proportion stated that thatching grass was available but decreasing in abundance and slowly getting to be found far from the villages.

Figure 2: A hut under construction using veld products – thatch grass, poles and mud (Photo taken during field work, December 14th 2005)

Fuel wood scarcity (comprising dead woody plants) was blamed mainly upon over-harvesting (84.2%). The problem was also externalized and perceived to be caused by government institutions (52.6%), commercialization (40.4%) and use of vehicular modes of transport (38.6%). Only 7% of the respondents cited population increase as another cause of fuel wood depletion.

> *"It is the government institutions like the schools, Prisons, hospitals and the army, which over-harvest the fuel wood with big trucks in our village.*

The government encourages the use of coal stoves instead of fuel wood but can't lead by example" (Respondent 10, 32 years, Land Board member).

4.3 Communities' perception on indicators of rangeland degradation

The most common feature mentioned as an indicator of grazing resource degradation was barren land. Poor emergence of seedlings after good rains and the drying up of existing vegetation in addition to causes by wind and bush encroachment were other indicators mentioned by the respondents (Table 4).

Table 4: Perceived indicators of pasture, biodiversity and fuelwood resource degradation

Resource	Indicators*	Response Frequency (%)
Pasture / Grazing	Barren land	51 (85)
	Poor seedling emergence even after good rains	40 (66.7)
	Drying up of vegetation	34 (56.7)
	Winds	14 (23.3)
	Bush encroachment	10 (16.7)
Biodiversity	Drying up of vegetation	9 (60)
	Visible used veld products in the village	3 (20)
	Too many livestock	3 (20)
Fuelwood	Increased distance to collection point	47(82.5)
	Increased time to collection point	26(45.6)
	Use of trees not traditionally for fuelwood	21(36.8)
	Use of vehicles	15(26.3)

* The respondents could give more than one indicator for each resource, and indicators were mentioned only by those who said that there was degradation of the resource
NB: The numbers in brackets show the percentages

Specific to the mentioned biodiversity, the few respondents who perceived it to be in decline mentioned the drying up of vegetation as the major indicator of decline (Table 4). A small proportion stated that the utilized resources in the homesteads (such as poles and thatch grass) indicated the intensity of exploitation that resulted in depletion, and that

high livestock numbers in the rangelands were indicators of potential biodiversity depletion (Table 4). Resorting to the use of trees not traditionally used for firewood, and the need to use vehicles in order to compensate for long distances and time spent collecting firewood were identified as signs of fuel wood depletion.

> *"…..our fear is that if fuel wood gets totally depleted people will start cutting down those trees not traditionally used for fuel wood because they need to cook, eat and live now"* (Respondent 10, 32 years, Land Board member).

The informants emphasized the need to identify indicators of fuel wood scarcity, in addition to indicators of other biological resources. The major reason put forward was that the shortage of the dead woody plants could lead to excessive exploitation of other tree species for energy supply.

4.4 Indigenous methods for rangeland resource management

Two major indigenous methods for the management of grazing or pasture resources were herding and controlled livestock movements. The greater majority of those respondents who mentioned these indigenous methods perceived them as very effective in the management of livestock grazing. Farmers stated that traditionally they also managed rangelands by keeping livestock only for subsistence and not commercial purposes, and by allocating cattleposts and watering points in a dispersed manner to avoid intensive grazing pastures around them. While all farmers perceived cattleposts and water-points dispersion as an effective indigenous management method, a high proportion perceived subsistence farming as effective and only a few said it was moderately effective (Table 5).

The indigenous methods mentioned by the respondents were not necessarily employed with the intention to manage biodiversity, but rather their actions resulted in less or no depletion of the biological resources. More than half of the respondents stated that traditionally people just harvested the amount required for subsistence and did not harvest biological resources for sale, and that during the harvesting process harvesters did not indulge in breaking or cutting down the trees or bushes from which they harvested

(Table 5). All these indigenous practices of biodiversity conservation were considered effective by almost all those who mentioned them.

Table 5: Indigenous methods for rangeland and biodiversity management

Indigenous management method*	Response frequency (%)	Perception on effectiveness (%)	
		Effective	Moderately effective
Pasture / grazing management			
Herding	52 (86.7)	49 (94.2)	3 (5.8)
Controlled livestock movement	44 (73.7)	40 (90.9)	4 (9.1)
Keeping enough livestock for subsistence	19 (31.7)	17 (89.5)	2 (10.5)
Dispersed cattleposts & water points	3 (5)	3 (100)	
Biodiversity management			
Just harvest amount required	35 (58.7)	33 (94.3)	2 (5.7)
No tree breaking or cutting when Harvesting	34 (56.7)	32 (94.1)	2 (5.9)
Control was with chiefs/headmen	19 (31.7)	19 (100)	
Taboo against cutting trees	17 (28.3)	17 (100)	

* The respondents could give more than one method. Perception on effectiveness was only assessed among those who mentioned the indigenous management method.
NB: The numbers in brackets show the percentages

Traditionally custodianship for management of biodiversity was bestowed upon chiefs and headmen who took control on behalf of the community. This was considered a very effective indigenous management method because traditionally there was high respect for chiefs and their assistants. Equally important were social taboos (or values, norms and beliefs) against cutting of certain tree species at certain times of the year.

> *"Cutting of the morula tree* (Sclerocarya caffra) *was not allowed during the rainy season because it was considered to be 'pregnant', and cutting it would lead to wind storms that would destroy crops in the fields. This taboo was used to protect the morula trees because we subsist from their fruits. People therefore did not cut these trees for fear of famine that could*

result from crop destruction by windstorms)" (Respondent 41, 60 years, VDC Vice chairperson).

This practice was considered very effective and it led to the increase in species richness and diversity of those tree species that were protected by this social taboo.

4.5 Technical (modern) methods for rangeland resource management

The research established that the majority of the respondents were not aware of the technical management methods that were introduced through the provision of extension services by either the government agents or the local NGOs. This was applicable to both grazing and biodiversity management. The higher majority of the respondents perceived the management methods for grazing resources as effective, while others considered them as moderately effective in managing the grazing resources (Table 6).

Table 6: Technical (modern) methods for management of grazing and biodiversity conservation

Resource	Technical Method*	Response Frequency (%)	Perception on effectiveness (%)	
			Effective	Moderately effective
Grazing				
	Drift-fence	13 (21.6)	11 (84.6)	2 (15.4)
	Rotational grazing	10 (16.7)	9 (90)	1 (10)
	Borehole syndicates	5 (8.3)	4 (80)	1 (20)
Biodiversity				
	Conservation education	14 (23.3)	9 (64.3)	5 (35.7)
	Drift-fencing	8(13.3)	8 (100)	

* The respondents could give more than one method. Perception on effectiveness was only assessed among those who mentioned the introduced management method.
NB: The numbers in brackets show the percentages

Only two methods for biodiversity management were stated as introduced in the study sites and known by very few of the respondents and they included conservation education and drift-fencing (Table 6).

> *"Conservation education is very important for instilling positive attitude towards biodiversity conservation especially among the youth. It should be provided even at schools"* (Respondent 9, 49 years, Shadishadi Conservation Committee Chairperson).

Drift-fencing was considered effective by all who mentioned it, but there was variation on the perception of the effectiveness of conservation education, with the majority viewing it as an effective rangeland management method (Table 6).

4.6 Legislation and institutions in rangeland resource management

4.6.1 Policies and/or Acts in rangeland resource management

Awareness of Policies and Acts that dealt with natural resources, especially the management of rangelands and biodiversity was found to be low among the interviewed farmers. Thirty-five percent of the respondents stated that they were aware while 65% majority were not aware of any legislation that was concerned with management of grazing resources. Forty-one percent were aware while the remaining 58% majority indicated that they were not aware of the existence of some legislation that guided the conservation of biodiversity.

The respondents who indicated that they were aware of the existence of some policies dealing with management of rangeland resources were further requested to name the legislation they knew and to provide their perception on the success or failure of the policies/acts. Of the 86% of the respondents who mentioned the Agricultural Resources Conservation Act (ARCA), 67% thought it was successful in range management while 72% perceived it as having been successful in biodiversity management. About 33% mentioned National Policy in Agricultural Development (NPAD) and perceived the policy as having been successful in addressing the problem of rangeland degradation.

It was noticed during the interviews that most of the respondents did not know much about ARCA and NPAD but rather had some vague ideas about some Policies and Acts concerned with management of natural resources. About 90% stated that they knew about an Act that dealt with stocking rates and carrying capacity issues while about 10% stated that they knew about an Act that managed veld fires in relation to rangeland management. Eighty percent of the respondents were aware of an existing Act that

regulated the harvesting of biological resources by issuing harvesting permits. This awareness brought ARCA[6] into the picture. All the respondents who were aware of the NPAD knew it as a policy that guided the demarcation of communal lands into private ranches.

4.6.2 Existing projects that dealt with rangeland resource management

The respondents' awareness of existing projects that dealt with management of natural resources was higher for those projects related to biodiversity management than for pasture resource management in the study sites. About 90% were aware of existing projects involved with biodiversity, and 61% were aware of projects concerned with pasture resource management.

All the respondents who indicated that they were aware of an existing project that dealt with the management of grazing resources and biodiversity mentioned the Indigenous Vegetation Project (IVP) and only 22% mentioned drift-fencing project. Seventy-three percent and 44.4% of the respondents who mentioned IVP stated that is had been moderately successful in its mandate to manage grazing resources and biodiversity. About 63% of the respondents who mentioned drift-fencing project viewed it as successful and 37% perceived it as only moderately successful.

> *"IVP has been successful in what the project is here for, they always organize workshops and meetings where they talk about management of natural resources. The project has even helped establishing the conservation committee and they are currently in the process of registering it to become a legal Community Trust"* (Respondent 42, 35 years, Loologane Conservation Committee Chairperson and VDC Secretary).

4.6.3 Institutions in rangeland resource management

The farmers' awareness of local institutions and their roles in management of grazing resources and biodiversity conservation are given in Table 7. The village

[6] ARCA contains regulations that prohibit the harvesting of the grapple plant (*Harpagophytum procumbens*) without the written permission from the Board.

Conservation Committee was stated by the majority of the respondents as the main local institution responsible for management of natural resources (Table 7). Members of the conservation committee mentioned instances that took place in exploiting natural resources in an unsustainable way, demanding the actions of the committee to guide the use of these resources (Figure 3).

> *"When we relocated to this settlement some community members started cutting trees recklessly to fence their residences, and we were concerned as a committee by the rate at which trees were being cut. We deliberately took responsibility to bring one culprit to task and questioned him why he did that when there was need to conserve this very important biodiversity. This person's yard is walled with poles"* (Respondent 44, 50 years, Conservation Committee member).

Figure 3: New home fenced with hundreds of poles (Photo taken during field work, December 14th 2005)

It was found out during the fieldwork that the Conservation Committee was proactive in its conservation education role especially in Loologane even before it was registered as a legal entity. Interestingly, the committee was also referred to as the Desertification Committee or the IVP Committee due to its activities and close association with IVP. The clarity to establish if these were separate committees was

sought with the IVP project manager and the chairpersons of the same committee for the two study communities and they confirmed that this was actually the same committee that the community preferred to call by different names.

Table 7: Local institutions and their role in pasture and biodiversity management

	Response Frequency (%)			
Resource	**Local institution***		**Awareness on role of the institution**	
Pasture / grazing	CC	47 (78.3)	Conservation education	47 (100)
	VDC	10 (16.7)	Policing the use of the NRs	10 (100)
	Others	7 (11.7)	Control grazing	3 (42.9)
			Advise on land use and allocation	4 (57.1)
Biodiversity	CC	53 (88.3)	Conservation education	53 (100)
	VDC	4 (6.7)	Conservation education	2 (50)
			Policing the use of the NRs	2 (50)

* The respondents could name more than one institution.
CC – Conservation Committee; VDC – Village Development Committee; Others – *bogosi* and land-overseer; NRs – Natural Resources
NB: The numbers in brackets show the percentages

The Village Development Committee was mentioned by few respondents who pointed out that the committee had an overall role of policing the use of all the natural resources (Table 7). The respondents indicated that the VDC, as the main local institution in each and every village in Botswana, had the responsibility to take care of the environment on behalf of the community members and this included taking to task intruders from other settlements who recklessly used the communities' environment. Other local institutions involved with the management of rangeland resources that the informants were aware of were chieftaincy or *bogosi*[7], and the land-overseers[8]. These institutions were said to be playing important roles by controlling grazing and advising the Land Board on land use and allocation issues in their villages so as to avoid possible land use conflicts among community members (Table 7).

[7] Village leadership consisting of the chief and his assistants, as well as other elderly opinion leaders
[8] Land-overseers are community representatives who advise community members and Land Board on whether the land that an applicant wants is suitable for the proposed use and on whether it has already been allocated or not.

> *"Land Board and land-overseers should work hand in hand with the headmen; since the introduction of land-overseers headmen who were the custodians of the land on behalf of their people have been by-passed in land use and allocation issues. Land-overseers do not show new applicants to the headmen and this situation ends up causing conflicts among villagers and has to be resolved by the headmen. We have to be involved in land allocation processes especially in the villages that we head"* (Respondent 37, 45 years, Loologane headman).

Another respondent added,

> "Bogosi *is a very important traditional institution, but as of today this institution has lost its credibility in land management to Land Board. No one, not even our headman, or even you, can say anything to people whose activities degrade the environment because they will tell you that the land belongs to the government and not you"* (Respondent 38, 72 years, Loologane village elder).

In determining the awareness of national institutions involved with management of grazing and biodiversity it was found out there was minimal awareness of Government or Non Governmental Organization (NGO) institutions. Only 11 respondents (18.3%) were aware of institutions concerned with grazing resources, while 13 (21.7%) were aware of an institution involved with biodiversity management.

Further enquiries were made with those respondents who stated that they were aware of some government and / or NGO institutions to establish the exact institutions they were aware of and what they perceived to be the role these institutions played in the management of rangeland resources. All the respondents mentioned United Nations Development Programme (UNDP) whose role they said was to support IVP in its mandate to mobilize communities to manage the natural resources in the communal areas. Others mentioned the Ministry of Agriculture which they said played an advisory

role in range management and controlled harvesting of the grapple plant (*Harpagophytum procumbens)*. A minor proportion recognized the Land Board's role on land allocation for purposes which would not negate the management of rangeland pastures. Thusano Lefatsheng was the only local NGO mentioned as involved in biodiversity management in the study villages. However, the respondents pointed out that the NGO was more involved in the utilization, as opposed to the management, of the biodiversity because this organization served as the sole market for the grapple plant by purchasing the harvested products from the community members.

4.7 Proposed solutions to address the problem of rangeland degradation

This section presents possible and workable solutions to the problem of rangeland resource degradation as perceived and proposed by the respondents. Presented also in this section are the stakeholders that the respondents thought were the right ones to initiate and implement the solutions, and the roles of the respondents themselves in implementing the proposed solution (Table 8).

Table 8: Proposed solutions to grazing and biodiversity depletion and the stakeholder responsibility

Proposed solution*	**Frequency**	**Response Frequency (%)**	
		Responsible initiator	
		Community	Government
Fencing of biodiversity-rich areas	44 (73.3)	41(93.2)	3 (6.8)
Conservation education	35 (58.3)	22 (62.8)	13 (37.2)
Community empowerment	29 (48.3)	15(51.7)	14 (48.3)
Enforcement of adherence to proper stocking rates	27 (45)	20 (74)	7 (26)
Controlled rotational grazing	20 (33)	17 (85)	3 (15)
Development of community ranches and syndicates	17(28)	10(59)	7 (41)
Enhancement of drift-fences	14 (23)	11 (79)	3 (21)
Plant trees for fuelwood and poles	7 (11.7)	7 (100)	

* The respondents could proposed more than one solution
NB: The numbers in brackets show the percentages

Of all the eight solutions proposed by the respondents only two were proposed by more than half of the respondents, two were mentioned by slightly below half while the remaining solutions were proposed by at most one third of the respondents (Table 8). The majority of the respondents proposed fencing of the areas rich with biodiversity as the main solution to biodiversity loss. Thotayamarula was particularly mentioned as one area that needed immediate fencing and protection because it had a diversity of biological resources that were considered important to communities of both Loologane and Shadishadi. Conservation education and community empowerment were appreciated among the respondents as other more important solutions to rangeland degradation and biodiversity depletion (Table 8).

Enforcement of adherence to proper stocking rates, controlled grazing, development of community ranches (and syndicates), and enhancement of drift-fences were proposed as workable solutions particularly in the management of grazing resources (Table 8). Planting of trees that provide veld products was proposed as a solution that would reduce exploitation of biodiversity resources in their natural habitat. This was mentioned by very few respondents.

The majority of the respondents who proposed the solutions to the problems of range degradation and biodiversity loss were of the view that the communities should take the responsibility to initiate the proposed solutions while a lower proportion thought that the government should start the solutions. For almost all the proposed solutions, the majority of the respondents indicated that they would be willing to participate in their implementation, and that they would mobilize fellow community members to participate in implementing the solutions.

5.0 DISCUSSION

5.1 Socio-economic and demographic characteristics

The high dependence of the study communities on mixed agriculture characterises the lack of a diversificity of opportunities in the villages of Loologane and Shadishadi. This situation compares well with the rest of Botswana where subsistence agriculture, both pastoral and arable, is the mainstay of the rural economy. However, given the erratic rainfall and recurrent droughts in Botswana and in particular with reference to these vulnerable communities, it is important to diversify into different livelihood activities. The collection and harvesting of biological resources constitute one set of such activities. However, these seasonal activities are not sufficient for the sustenance of the households. Thus, the provision of social welfare by government is intended to fill in the gaps by providing basic needs. These communities are vulnerable because dependence on government welfare programmes cultivates dependency syndrome. The social welfare programmes are unsustainable and this further increases the risk of vulnerability.

5.2 Communities' perception on causes of rangeland degradation

The communities had a clear perception of rangeland degradation which they attributed to both physical (insufficient rainfall and drought) and anthropogenic causes (overstocking, over-utilization of biological resources, range fires). The awareness of the degradation could be partly accounted for by the history of association that the people of Shadishadi and Loologane have in association with their rangelands. These communities moved to these areas in the beginning of the 20th century (Motshubi, 2003a,b,c). This means that they were able to recognize any environmental change that took place in their area and attributed it to some factors as causes.

The high perception of pasture degradation over biological resources depletion was indicative of high dependence on grazing resources rather than on gathering of biological resources. Similarly, overstocking has been identified in literature as the major anthropogenic cause of rangeland degradation while insufficient rainfall is the main natural cause of degradation (Abel and Blaikie, 1989; Perkins, 1991; Dejene *et al.*, 1997; Nangula and Oba, 2004).

This perceived rangeland degradation can be attributed to sensitization of the respondents on environmental issues by the ongoing IVP, and the past Kalahari-Namib project. These results are in consonance with those established by the IVP during the development of community action plans (Motshubi, 2003a,b,c). The Kalahari-Namib has held several conservation awareness workshops during its tenure and the communities still maintained the sensitization about rangeland degradation problem (Ministry of Agriculture, 1997).

The higher perception of abundance of biological diversity in the area was in Loologane as compared to Shadishadi. This observation was in contradiction with "over-utilization of biological resources" stated earlier as one of the causes of resource depletion. Because the study was undertaken during the rainy season when biological resources were abundant, this may have influenced the respondents' perception on availability of biological resources. In addition, Loologane is a relatively new settlement area and most accelerated rangeland degradation processes may not be serious. The respondents used Thotayamarula, as an example of an area with abundant biodiversity and biological resources. This is the same area that IVP was in the process of fencing, as a conservation measure, at the time of the study.

The shortage of fuel wood was blamed mainly upon over-harvesting by government institutions, commercialization and population increase. Fuel wood was a concern among the respondents because it was the major source of energy for the majority of the households. The findings of this study were, again, consistent with the findings of IVP (Motshubi, 2003a,b,c). Dejene *et al.* (1997) also found that communities in Tanzania hold the view that fuel wood was depleted by over harvesting and high demand in the market, leading to their commercialization and further overexploitation that created fuel wood scarcity.

5.3 Communities' perception on indicators of rangeland degradation

There was more frequent mention of physical indicators of rangeland degradation than of those associated with human activities in the study sites. These included barren land, poor emergence of seedlings even after good rains, the drying up of existing vegetation, bush encroachment, high livestock rates and the visible utilized resources in the homesteads (such as poles and thatch grass). Few areas of bare ground were cited

during the study and were not as bare as the communities perceived them to be. Because the study sites were characterized by diverse vegetation, dominated by woodland savanna, existence of barren land would be associated with mismanagement. Bush encroachment by different species has been observed in many parts of Botswana, both in land under agro-pastoral use (Arntzen and Veenendal, 1986) and in areas used solely for grazing (Skarpe, 1990). Bush encroachment, which was observed in the study area and entirely dominated by *Acacia mellifera*, confirms the findings in the literature as an indicator of degradation (Perkins, 1991; Darkoh, 2000).

Furthermore, poor emergence of seedlings even after rains, and the drying up of existing vegetation were also perceived as rangeland degradation indicators. These indicators could be attributed to the existing condition during the time the study was undertaken. Respondents showed the researcher areas that they thought had poor emergence of seedlings after rains but these were areas within the village where there was high movement of people and livestock. The situation improved, however, with increased distance from the settlement, consistent with the theory of the grazing gradient (Nangula and Oba, 2004).

Also during the study, it was observed that there were new huts and homesteads that were under construction and it was these that most respondents kept referring to as indicating the extent of biodiversity resource use and potential depletion if this went on unchecked. It is therefore important to take into consideration the conditions existing at the time of the study when these observations were made as this could also have influenced people's perception of the situation.

Indicators for fuel wood depletion included the use of trees not traditionally used for fuel wood, the use of vehicles, long distances traveled and increased time spent collecting fuel wood. The respondents were able to identify these indicators because they were directly involved in daily use of fuel wood as the main household energy source and therefore were aware of its availability or scarcity. In every community there are trees which are preferred for fuel wood and when these trees gets depleted in the village proximity households shift to the readily available un-preferred species for fuel wood. In the study areas these are small bushes of moretlwa (*Grewia flava*) and small twigs from standing trees. They respondents were able to know if fuel wood was becoming scarce

and if the distance they traveled and the time they took collecting fuel wood increased. If fuel wood was getting scarce then there was need to travel long distances to get the preferred fuel wood and this resulted in spending more time in this particular activity. This is done at the expense of other household activities which could be undertaken, for example, to diversify the households' livelihood activities. It was observed that the respondents had limited and strenuous options such as buying fuel wood, using cow-dung, paraffin or gas. Using these costly energy sources signaled to the respondents that fuel wood (which would normally be free) was being over-harvested.

The study areas have schools and hostels that accommodate students from remote areas and adjacent cattleposts and remote settlements and these schools used big trucks to harvest fuel wood to provide heat and cook for students. This further increased the scarcity of fuel wood, leading to increased time and distances by households that depended only on fuel wood for their energy supply.

The communities' perception of the indicators is also in line with the degradation indicators identified by rangeland practitioners in the study area (Ministry of Agriculture, 1997) and elsewhere in Botswana. All the indicators mentioned by the respondents are comparable with those mentioned by farmers in Kgalagadi South and Boteti districts (Reed and Dougill, 2002). Fuel wood indicators are consistent with those identified by Watson and Dlamini (1999), who, for instance, observed distance traveled to collect fuel wood increases as fuel wood scarcity increase.

5.4 Indigenous methods for rangeland resource management

The indigenous methods for rangeland management in Botswana are well documented (White, 1993; UNDP, 1997; Darkoh, 2000; Taylor, 2003; Makepe, 2006). Traditionally, many pastoralist societies practiced herding and controlled livestock movements as a way of managing their grazing areas. Although these methods are considered effective they have all been disrupted by the development process that led to the fencing of rangelands for different purposes. Traditionally herding was done to manage grazing and to guard against predation of livestock because livestock was a wealth indicator in the society. Herding is not practiced anymore and animals roam the rangelands on their own. Oba (2005) referred to this situation as "grazing management by cattle". The "herders" only watered animals at boreholes and left them to roam the

rangelands without even controlling their movement and directing them to areas with good pasture. Traditionally, livestock was herded by children but today they attend schools and are not available for herding.

Relating subsistence livestock production, dispersed cattle posts and water points, involvement of chiefs and social taboos to the management of rangeland by the respondents may be indicative of a long standing concern about rangeland degradation. As a method of rangeland management, subsistence livestock production characterized by low livestock numbers per household ensured that pressure on rangeland was minimal or reduced. Dispersed distribution of cattleposts and water points may have been employed as a means to have areas of inactivity in between. Such areas may have operated as 'reserve areas' for rangeland resources and therefore provided safety nets when resources around cattleposts and water points got depleted.

Chiefs played an important role in rangeland management by being the ultimate authorities on decisions governing access to, and use of range resources. Delegation of powers to headmen and overseers over the larger communal rangeland area ensured on-the-spot monitoring and proper use of the range. The chief also ensured that social taboos that protected biodiversity were respected; for example, chiefs could impose periodic restrictions on harvesting of biological resources and even temporarily proscribe entrance to habitats that needed recovery.

Although the above indigenous methods have been practiced since time immemorial, their continued existence is threatened by policy reforms that advocate for private ownership and management of range resources, e.g. the TGLP and NPAD. Furthermore, the de-legitimization of traditional custodianship of rangelands by the Tribal Land Act undermined the powers chiefs they had over their subjects. This resulted in the disintegration of traditional rangeland management methods.

5.5 Technical methods for rangeland resource management

Increased awareness of technical methods introduced to halt degradation was observed among respondents who had acquired education beyond primary school. This is consistent with the impact education had in empowering people with general knowledge, including knowledge on management of rangelands and biodiversity (Dejene *et al.*, 1997).

Awareness of conservation education, especially among members of the conservation committee was the reason as to why the closer one was to the committee the more aware they were. This could partly be because it was the responsibility of the conservation committee to educate the rest of the community members on conservation measures. The impact of implementation of IVP in the study area could also explain the positive awareness of conservation education. The elicited technical solutions were consistent with the objectives of previous projects that the government had promoted in the study area, like the drift-fence and the borehole syndicates. The drift-fences were being reintroduced in the areas to separate the grazing and arable lands. During the study, there was ongoing construction of drift-fences, this may have influenced respondents to state them as an example of introduced conservation measures.

Borehole syndicates promoted conservation through definition of membership such that sanctions could be imposed on those members who broke the rules. Thus, in the syndicates all members understood that they were accountable for their actions, unlike in an open access. The borehole syndicate is viewed favourably by Makepe (2006) who refers to this arrangement as a blend of private system with community based management system that is important for rangeland management. It was established during the study that most of the respondents who stated borehole syndicates were actual members of some syndicates, and they wanted this arrangement to go beyond 'just water', and to include grazing rights. One of the syndicate members indicated that since they established their syndicate they had been able to control livestock around their borehole and this had reduced the grazing pressure. The syndicate system could be construed as a re-incarnation at the micro scale of the traditional common property range management regime.

5.6 Legislation and institutions in rangeland resource management

Legislations and projects or programmes in rangeland management were implemented by institutions. The Agricultural Resources Conservation Act (ARCA) and the National Policy on Agricultural Development (NPAD) were the only two legislations that the respondents were aware of. Regardless of the insufficient knowledge that the communities had about the legislations it was found that they still maintained that the

legislations could be effective in rangeland management only if they were implemented and enforced.

The popularity of ARCA among respondents was accounted for by their association with the ARB, the government institution that issued the community members with permits to harvest available biological resources[9], particularly the grapple plant. As the government institution responsible for agricultural resource management, ARB used the same opportunity of issuing permits, and other participatory forums, to teach communities about veld fire management and stocking rates with the hope that this will translate into rangeland management. It was assumed that in this process ARB involves Thusano Lefatsheng, the local NGO that buys the harvested products from the communities. It was established during the study that Thusano Lefatsheng had just bought the grapple plant from Loologane. This could account for the awareness of this NGO among community members in this study area.

All the respondents who were aware of the NPAD knew it as a policy that facilitated the privatization of communal land, converting it into private ranches. NPAD has become a household word in many communities where fencing feasibility studies have been undertaken in an effort to demarcate communal rangelands into private ranches, the study sites being among the candidates. Some community members were worried that they were going to lose access to communal lands while others were eager to get exclusive grazing rights in case fencing was to be implemented. This situation triggered different interests in the utilization of the rangelands, leading to awareness about this policy. Awareness of NPAD was highly linked to awareness of the Ministry of Agriculture and the Land Board, which are the two major government institutions behind the implementation of this policy. These institutions were major stakeholders of IVP and were almost directly involved with the communities as far as land use planning and allocation were concerned. Relating to stakeholder participation, it was assumed that IVP linked both grassroots and high level institutions in rangeland management, leading to institutional awareness.

Institutional awareness was higher for local institutions than governmental and non governmental institutions. The local institutions involved in pasture and biodiversity

[9] Referred to as agricultural resources in the ARCA

resource management that were known to the respondents were the Conservation Committee, Village Development Committee (VDC), chieftaincy *(bogosi)* and land-overseer. The main possible explanation for high awareness of local institutions is that they are community based and are site specific. These were standing committees that in almost every community. While chieftaincy and land-overseer are traditional institutions, conservation and village development committees are just local but not necessarily traditional.

It was established that Conservation Committee, also known as Desertification or IVP Committee by some respondents, was among the most well known. This could be because of its immediate involvement in environmental management issues and its close association with IVP. In fact, it was observed that conservation committee was the conciliator between IVP and the community. At the time of the study IVP was in the process of helping legalizing the committee and establishing it into a Community Trust. Because every step in this process was participatory and therefore involving community members, this could partly have publicized the committee.

The VDC and the chieftaincy are major institutions that almost all members were expected to be familiar with. As much as they are known to be involved with all development activities in any village, their association with rangeland management was not immediate because of the existence of the conservation committee which was more interested, directly involved and active in rangeland management. The land-overseer institution also does not easily get associated with rangeland management but rather with land allocations because that their primary focus.

Involvement of local institutions in rangeland management is as crucial as it is for any other natural resource. Similar institutional awareness was established among the Okavango Delta wetland communities in both Botswana and Namibia during a socio-economic survey for the 'Every River Has Its People Project', a community based project on natural resources management (http://www.everyriver.net/BasinWide3.htm). This shows that most natural resource management initiatives and activities made efforts to involve all interested stakeholders, particularly the local based institutions in their implementation so as to win local support.

5.7 Proposed solutions to address the problem of rangeland degradation

The respondents proposed a wide range of solutions and strategies that could be put in place to halt the problem of rangeland degradation. This could be interpreted as an indication that communities were concerned with degradation of grazing and biological resources, and were therefore aware of possible strategies that could be implemented to curb the problem. While the proposed solutions consisted of a combination of modified methods that were previously mentioned as either indigenous or technical, it was observed that there were more technical than indigenous methods. But it is interesting to note that the solutions proposed by the communities were integrative and all-encompassing as far as stakeholder participation was concerned.

This situation implied that communities were accommodative of participation by other stakeholders, particularly range management experts, researchers, planners and policy implementers. It is also important to note that the suggested solutions included both means (processes, projects or strategies), aimed at achieving rangeland management, on one hand and legislative measures that could be achievable by enforcing relevant instruments on the other. Furthermore, most of the proposed solutions directly involved the communities and this could be seen as recognition of the need for the communities to initiate the management of resources they depended on, and reduced reliance on government.

There is reason to believe that some of the proposed rangeland management strategies were promoted by ongoing IVP and to a lesser extent, the relevant government extension services. The role played by these institutions in creating awareness on rangeland degradation and management strategies could not be ignored. It was established during the study that some solutions elicited included activities that communities, together with IVP were either already working on or in the process of facilitating their implementation. For example, fencing of biodiversity-rich areas was stated as the best management strategy by the respondents and there was high preference of Thotayamarula. This was the area that at the time of the study, IVP and the conservation committees from the two study villages were in the process of applying for a lease from the Land Board to be granted the right to protect and manage.

The important economic role that this biodiversity-rich area plays in livelihoods of the communities of both Loologane and Shadishadi, could also provide a justification for the need to fence the area. During the study we drove around the area and we observed that the area was so rich with biodiversity. The area was characterized by diversity of useful biological resources including morula (*Sclerocarya caffra),* moretlwa (*Grewia flava*), motlopi *(Boscia albitrunca),* moretologa *(Ximenia Americana),* mogorogorwana *(Strychnos cocculoides),* mmilo *(Vangueria infausta),* motsotsojane *(Grewia retenervis),* morutwa *(Rothmannia capensis),* morama *(Tylosema esculentum)*, sengaparile *(Harpagophytum procumbens),* to name just a few. At some point during the study, two 25m x 25m transects were hypothesized and, together with some members of the communities, we established that there was high species abundance and diversity for all these biological resources in each plot. The proposed area enclosure response would therefore be expected from these communities as a management strategy for Thotayamarula. In fact this solution had previously been proposed by both communities during the community action plan development process (Motshubi, 2003a,b,c).

By mentioning conservation education as an important tool in rangeland management, the communities appreciated the power of knowledge in rangeland management. This proposed solution cannot be overemphasized because communities appreciated that conservation education would enhance their indigenous knowledge and therefore help them realize their capacity to respond to the challenges of degradation. Conservation education is a major component of the IVP (UNDP, 1997). The project manager for the IVP indicated that the project had held several exchange visits between communities involved in IVP, the seminars and workshops aimed at awareness raising, and this they considered to be part of the necessary conservation education (Charles Motshubi, *pers. com.*, 2005) Furthermore, Chanda (1996) recommended conservation education as an important tool for sustainable community based interventions for natural resources management. The government also recognizes the role that public conservation education could play in rangeland management (GoB, 1990).

Caution should be made, however, to the fact that education in itself does not lead to rangeland management but rather empowers the recipients to make good decisions in undertaking activities that would not result in environmental degradation. Community

empowerment would therefore be an important factor in rangeland management. This has been hailed by advocates of CBNRM as a major component of a process that enables and empowers a community to achieve self-determined goals, with some measure of significant control over the processes and strategies to attain these goals. The communities' awareness of the need for empowerment should be applauded as this will impart skills and ability to manage resources without necessarily having to rely on external stakeholders. This solution response is coherent with the objectives and activities of IVP. It is the ultimate aim of IVP to empower the communities in Loologane and Shadishadi to rehabilitate degraded ecosystems and conserve biodiversity by developing sustainable natural resources management systems (UNDP, 1997). It was established during the study that the project had held several capacity building workshops for the communities. Additionally, it was established during the study that, the conservation committees were involved in the process of establishing a Community Trust, and this was viewed as a continuation of a community empowerment process. It is therefore not by chance that the respondents mentioned continued community empowerment as a solution to rangeland degradation.

An empowered community, assisted by relevant stakeholders would be in a better position to even implement other proposed solutions such as the enforcement of adherence to proper stocking rates, controlled grazing and enhancement of the drift fences. Enforcement of adherence to proper stocking rates and controlled grazing are management methods that can directly result in reduced rangeland degradation since overstocking results in overgrazing and ultimately degradation. These solutions have higher potential to manage rangelands because they are backed up by the ARCA which empowers the ARB to issue a stock control order, conservation order or regulation order (GoB, 1972). An empowered community could work with the ARB to enforce this Act in an area where exclusive communal rights have been granted to a community. It is noted, however, that this is an Act that has never been implemented since its adoption and the solutions related to it might not be viable. Additionally, there is need to consider factors affecting stocking rates and grazing such as rainfall, drought and socioeconomic situations before fully enforcing ARCA. The misconception about the stocking rates/production relationship poses a threat for many Batswana who already have

insufficient animals for their needs (Abel and Blaikie, 1989). A similar situation could be expected where drift-fences are proposed as having potential to control grazing and curb rangeland degradation.

Enhancement of the existing drift-fences would assist in management of pasture and biodiversity resources in that fodder banks for the dry season are conserved within drift-fences. For a long, time drift-fences have been considered important for improving rangeland management (Sebele, 1996). As discussed in an earlier section, there was ongoing construction of drift-fences at the time the study was undertaken and this could have highly influenced the respondents' view of the importance of drift-fences. There is need, however to enhance these fences because once farmers have harvested their crops livestock could be released into the fields to graze on the crop residues and the grass within the drift-fences. This will give the communal grazing areas time to rest, and it is a useful method if it is implemented for rangeland management purposes, especially if the animals have to be moved between communal rangelands and arable lands before the areas are overgrazed. The drift-fence solution has been perceived by farmers in Malwelwe to be very important in rangeland management (Sebele, 1996). Abel and Blaikie (1989) are also of the view that drift fences have been the only successful communal grazing management scheme in Botswana.

Privatization of communal rangelands in the form of community ranches and/or borehole syndicates was advocated for by the communities. While this was viewed as a possible solution to curb degradation it should not be seen as a way of individualizing and granting exclusive rights over grazing resources *per se*, but rather, as a way of shifting from the current open access to communal management. This solution would grant exclusive rights to members of the community in the form of syndicates. Thus, the community would be divided into syndicates that would be allocated pieces of land for them to use and manage under defined membership. This solution communicated the perception that communities held, that their rangelands were accessed by anybody including those from outside their communities. Yet the communities had no powers to deny outsiders access to their rangelands. This response solution indicated that community members follow the Malthusian view that privatization (communal), and not open access, will reduce degradation. It is therefore tempting to believe that communities,

without exposure to science and theories of land management, were aware that privatization of resources can lead to proper management. Under the arrangement, the costs of overgrazing and resource over-utilization are not relegated to the entire community, but are born by those who own the property as shown by borehole syndicates (Section 5.5).

The last and least proposed solution to reduce biodiversity depletion was to plant trees that provide useful biological resources such as fuel wood and poles. This is an unpopular solution because tree planting would play insignificant role in rangeland management. The benefits from tree planting are realized after a long time. Trees are not planted in rangelands, but rather in homesteads. With the current rate of economic growth in Botswana there is shift from use of biological resources for fuel wood and construction to use of modern equipment and resources. In any case, most community members prefer to plant fast growing exotic trees and these do not necessarily provide fuel wood and construction poles, nor do they contribute to conservation of biodiversity.

There is reason to believe that the "tree-planting" attitude has been instilled by the government extension services on communities through the National Annual Tree Planting Day[10] activities. Every year when this day is celebrated the government issues households with a number of tree seedlings and encourage them to plant trees as a way to protect the environment. Tree planting is a good course of action that contributes more to carbon sequestration than rangeland management. Tree planting has been identified by IVP as a possible way of rehabilitating degraded lands, additional to reseeding and allowing regeneration by protecting, heavily degraded rangelands (UNDP, 1997). The activeness of IVP in the study sites could have influenced the respondents' thinking of tree planting. However, by the time of the study there were no mass tree-planting activities undertaken to rehabilitate degraded rangelands in the study sites.

Overall it was interesting to observe that the majority of the respondents who proposed the solutions to the problems of range degradation and biodiversity loss were of the view that the communities should take the responsibility to initiate the proposed solutions. For almost all the proposed solutions, the majority of the respondents indicated that they would be willing to participate in their implementation, and that they would

[10] The 25th day of November has been designated as the National Annual Tree Planting Day in Botswana.

mobilize fellow community members to participate in implementing the solutions. This is a positive move towards recognition of the fact that communities should manage the resources that they use. The respondents supported the fact that communities should not always be dependent on government even on activities that they can do on their own. Nevertheless, one might wonder why the communities have not been proactive in initializing and facilitating the implementation of the proposed solutions all along. But this situation indicates the need for a forum where the government should assess and evaluate its policies, projects, activities and strategies towards rangeland management together with the communities and try to integrate the communities into these solution strategies. A community that is empowered to manage the resources would help the government in its effort to reduce and halt degradation of rangelands. Christoffersen *et al.* (1998:177) caution that "communities do not ask the state to withdraw but to support their resource management initiatives through the provision of independent and mediation services and through the enforcement of locally drafted agreements". This could be achieved by decentralizing and devolving management authorities down to the communities through the community based approach. Community Based Natural Resources Management provides the best approach and opportunities for improved pasture and biodiversity conservation, community empowerment and rural development through sustainable use of grazing and non-grazing locally occurring biological resources.

6.0 CONCLUSION AND RECOMMENDATIONS

Rural communities of Loologane and Shadishadi, Kweneng North, Botswana, were aware and concerned with degradation of their rangelands. This thesis focused on the use of community perceptions to understand, analyze and evaluate communal rangelands of the aforementioned communities. As the communities used grazing and other non-grazing resources in rangelands, these were important factors for the individual households. The degradation of the resources often has a negative effect on the household.

The study showed that degradation of grazing resources was higher than that of non-grazing biological resources owing mainly to poor rainfall and overgrazing, and there was diverse awareness of factors perceived as indicators of rangeland degradation. Knowledge of rangeland management systems was higher for indigenous than technical methods. Additionally, institutional awareness was higher for local than for Government and national institutions. Furthermore, there was high willingness by communities to commit to participate in implementing the proposed rangeland management solutions.

Based on the findings of this research, it is recommended that rangeland management systems should integrate community perceptions and practices. Thus, the indigenous knowledge of the villagers, in conjunction with the technical and scientific knowledge should be used to develop methods of resource management where it is in the people's interest to manage pasture and biological resources. This should be so in every aspect including policies, programmes, projects, strategies and activities that aim at reducing rangeland degradation, or managing rangelands. While these could be broad national policies and programmes, they should at the same time allow for site-specific management systems. This is so because communities have their own way of perceiving land degradation and it is these perceptions that influence their actions towards rangeland management. They have adapted to the changing situations, and have accepted scientific knowledge and technical methods to manage rangelands.

Researchers, rangeland management experts and all relevant stakeholders should appreciate communities in their environment and work holistically with them instead of working for them. Communities should be seen as part of the solution and not only as part of the problem. Important stakeholders in rangeland management, particularly the

Government Departments should ensure that they reach the communities, it is imperative that extension officers are based in the areas so that they appreciate the situation first-hand instead of providing services as regular visitors.

It is important to also recommend to the communities that they should appreciate that they cannot manage natural resources on their own. They need other stakeholders with whom they can integrate their knowledge so that communities are able to realize their capacity to monitor and respond to challenges of degradation and change. This would result in the development of sound natural resource management systems that would improve the communities' livelihood and at the same time combat land degradation.

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APPENDIX 1: QUESTIONNAIRE FOR COMMUNITIES

Start with self introduction to the respondent

Village: Shadisahdi / Loologane **Date…….** **Start Time……Finish time……**

Name of respondent: ……

Sex of respondent: 1. Male 2. Female

Marital Status 1. Married 2. Single 3. Divorced 4. Widowed 5. Other (specify)

Age of respondent: ……

Highest education obtained: 1. None 2. Primary 3. Junior secondary 4. Senior secondary 5. Tertiary

Main Occupation: 1. Crop farming 2. Livestock raising 3. shop keeping 4. Carpentry 5. Other (specify)

Other livelihood activities: 1. 2. 3.

Household Income amount per month in Pula

1. Less than 500 **2. 501 – 1000** **3. 1001 – 1500** **4. 1501 – 2000**

5. 2001 – 2500 **6. 2501 – 3000** **7. More than 3000**

B) Livestock production, rangeland and degradation

1. Do you *own* livestock? 1. Yes 2. No (Go to 2)

Type of animal	**Number**	**Where do you keep your livestock? 1. cattlepost-moraka 2. lands-masimo 3. village-motse)**
Cattle		
Small stock (Goat and/or sheep)		
Donkey		
Horse		

2. Do you think there is degradation of **pasture** or **grazing**? 1. Yes 2. No (Go to 2.1)

What are the causes, indicators and coping strategies for pasture degradation?

Causes of grazing land degradation	**Indicators that rangeland is degraded**	**Coping strategies**

2.1 What are the indigenous and introduced/technical management systems that were/are used to manage the grazing areas, and how effective are they in management of grazing resources?

Indigenous Management Systems	**Effectiveness (1. Effective 2. Moderately effective 3. Ineffective)**
Introduced or Technical Management Systems	**Effectiveness**

2.2 Are you aware of any policy, addressing the problem of degradation of grazing resources in your area?

1. Yes 2. No (go to 2.3)

If yes which policies, and how successful are they in addressing the problem of grazing resources depletion?

Policy	**Success in addressing the rangeland degradation? (1. very successful, 2. successful 3. moderately successful 4. unsuccessful)**

2.3 Are you aware of any programme / project addressing the problem of grazing degradation in your area? 1. Yes 2. No (go to 2.4)

If yes, which project and how successful is it in addressing the problem of grazing degradation in your area?

Programme or project	**Success in addressing the rangeland degradation? (1. very successful, 2. successful 3. moderately successful 4. unsuccessful)**

2.4 Are you aware of any local institutions or committees that deal with rangeland management issues in your village? 1. Yes 2. No (go to 2.5)

If yes, name them, their functions, and how you are/were involved with them

Local institution / Committee	**Function/Role of the institution**	**Your Involvement**

2.5 Are you aware of any institutions (Government or NGO) in your village/district that deal with rangeland management issues? 1. Yes 2. No (go to 2.7)

2.6 If yes, name them and their function or role on rangeland management issues.

Institution	**Function/Role of the institution**

2.7 Have you ever had any training (workshop, seminar) in rangeland management issues?

1. Yes 2. No (Go to 2.9)

2.8 If yes, what was it about? Please specify.

_____

Do you think the training has helped you in managing rangeland resources better?

1. Yes 2. No (Go to 2.9)

If yes, in what ways?

_____

2.9 What in your opinion are the three most important workable solutions to rangeland degradation? Who do you think should initiate/facilitate them and what would be your role in these solutions?

Solution	**Facilitator:** ***1. Individual 2. Community 3. Government 4. NGO***	**Your role in implementing solutions**

C) Household energy, use of other natural resources and veld products and degradation

3. What are the primary sources of your household energy, for heating and cooking?

(in rank order, 1 to 5, 1 = most important and 5 least important)

Source	**Rank (1 to 5)**

3.1 If fuelwood mentioned, do you buy it or collect it yourself? 1. buy 2. collect

3.2 If you are buying have the prices you pay been: 1. increasing 2. decreasing 3. constant?

Please explain your answer

_____

3.3 If collecting, how has the time and distance you take to collect the fuelwood changed?

a) Time 1. increased 2. decreased 3. stayed the same

Please explain your answer

_____

b) Distance 1. increased 2. decreased 3. stayed the same

Please explain your answer

_____ _____

3.4 Would you say that you face fuelwood shortage? 1. Yes 2 No (Go to 4)

3.5 If yes, what are the causes, indicators, and coping strategies for fuelwood shortage?

Causes of fuelwood shortage	**Indicators of fuelwood shortage**	**Coping strategies**

4. What other natural resources and/or veld products do you harvest from the rangeland land? And have they been increasing, decreasing or remaining the same?

Other natural resources or veld products	Availability (1. abundant, 2. moderate 3. scarce)	Trend (1. increasing 2. constant 3. decreasing)	Distance (1. Near 2. far 3. very far)

4.1 What in your opinion are the reasons for veld products scarcity and decreasing, and what are the indicators of depletion?

Resource	Reasons for scarcity and decreasing	Indicators of depletion

What in your opinion are the reasons for veld products abundance and increasing, and what are the indicators of depletion?

Resource	Reasons for abundance	Indicators of abundance

4.2 What are the indigenous and introduced/technical management systems that were/are used to manage veld products, and how effective are they?

Indigenous Management Systems	Effectiveness (1. Effective 2. Moderately effective 3. Ineffective)
Technical Management Systems	**Effectiveness**

4.3 Are you aware of any policy that deals with natural resources / veld products management in your area?

1. Yes 2. No (go to 4.4)

If yes which policies, and how successful are they in addressing the problem of veld product depletion?

Policy	Success in addressing the veld product depletion? (1. very successful 2. successful 3. moderately successful 4. unsuccessful)

4.4 Are you aware of any programme / project that deal with natural resources / veld products management in your area? 1. Yes 2. No (go to 4.5)

If yes, which project and how successful is it in addressing the problem of veld product depletion?

Programme / project	**Success in addressing the veld product depletion? ((1. very successful, 2.successful 3. moderately successful 4. unsuccessful)**

4.5 Are you aware of any local institutions or committees that deal with veld product management in your village?

1. Yes 2. No (go to 4.7)

If yes, name them, their functions, and how you are/were involved with them

Local institution / Committee	**Function/Role of the institution**	**Your Involvement**

4.7 Are you aware of any institution (Government or NGO) in your village/district that deals with management in your village? i) Yes ii) No (go to 4.9)

If yes, name them and their function or role on veld product management issues.

Institution	**Function/Role of the institution**

4.9 Have you ever had any training (workshop, seminar) in veld product management issues?

i) Yes ii) No (Go to 4.11)

4.10 If yes, what was it about? Please specify.

_____

Do you think the training has helped you in managing veld products better?

1. Yes 2. No (Go to)

If yes, in what ways?

_____

4.11 What in your opinion are the three most important possible solutions to veld product depletion? Who do you think should initiate/facilitate them and what would be your role in these solutions?

Solution	**Facilitator:** ***1. Individual 2. Community 3. Government 4. NGO***	**Your role in implementing solutions**

Ke lebogetse nako ya gago!!!!! Thank you for your time!!!!! Ke lebogetse nako ya gago!!!!!