Chapter 7

Land use: Review of current plans and identifying suitable areas land use expansion

Republic of Botswana

Table of contents

List of Figures

List of tables

Abbreviation

BLDC	Botswana Livestock Development Corporation
CHA	Control Hunting Area
DEA	Department of Environmental Affairs
FMD	Foot and Mouth Disease
GIS	Geographic Information System
LSU	Livestock Unit
MCA	Multi-Criteria Assessment
MFMP	Management Framework Management Plan
TGLP	Tribal Grazing Land Policy
WMA	Wildlife Management Areas

Report details

This chapter is part of volume 2 of the Makgadikgadi Framework Management Plan prepared for the Botswana government by the Department of Environmental Affairs in partnership with the Centre for Applied Research.

The following persons have authored this chapter: Dr. Chris Brooks and Dr. Glyn Maude, with inputs from Dr Graham McCulloch, Thoralf Meyer, Peter Ruthenberg and Dr Jaap Arntzen.

Citation:

Authors, 2010, Chapter title. In: Centre for Applied Research and Department of Environmental Affairs, 2010. Makgadikgadi Framework Management Plan. Volume 2, Technical reports, Gaborone.

1. Introduction

This component report addresses the need to integrate land use planning across the Management Framework Management Plan (MFMP) area, with an aim to integrate the conservation of biodiversity with the infrastructural and land use development required to improve livelihoods within the region. Our approach was to define the key livelihood strategies within the MFMP area and then delineate these activities in such a way that the required expansion of these activities across the region was both economically viable and ecologically sustainable. Sustainable development requires that core habitats and hydrological functions are not detrimentally affected, i.e. that key ecosystem services are maintained.

The integrated land use approach was therefore one of the last actions within the development of the MFMP. It was firstly essential to define the key livelihood strategies within the region, such as pastoral and arable farming and natural resource collection, while identifying potential for alternative livelihood strategies and economic development such as tourism. If these activities are planned and managed in a sensitive way and at an appropriate scale, they offer the prospect of securing the sustainable use of natural resources. Identifying these livelihood strategies and the aspirations of the communities within the MFMP area formed part of a bottom up process of community appraisal, with communities from across the region integrated into the process. All of the defined livelihood strategies and their subsequent activities require basic resources, some natural and some man made, as well as a policy framework in which to operate. The integrated land use planning exercise therefore built on the findings of the Ecology & Hydrology Component and the Policy Component.

This report was also informed by the land use plan review (see Appendix 1). The land use plan review detailed all of the physical developments and land use planning objectives defined for the area within the MFMP from all of the relevant land use plans since the 1980s, while also detailing all of the development constraints and conflicts categorised under physical issues, natural resource issues, social issues, livestock and arable farming issues and tourism issues. Issue specific mitigation recommendations were then also detailed.

It was also important to define the key ecosystem services provided by the Makgadikgadi wetlands and the key biodiversity hotspots in the region to ensure that these were effectively conserved. These were identified through a multi-criteria assessment, which is defined within the Ecology & Hydrology Component.

The integrated land use planning approach was then geared towards helping to achieve the stated vision for the region. This vision was defined as part of the Scenario Planning, which again was developed as part of a consultative appraisal through a series of stakeholder workshops. The preferred scenario was the wise use or sustainable development approach. The sustainable development approach requires that land use is optimised and that the areas most suitable for designated activities are defined. Our approach was to use a spatial multi-criteria evaluation that incorporated all of the data gathered through the rest of the MFMP development process. Our aim was to create land use suitability maps for the key livelihood activities within the MFMP area.

2. Approach-method and activities

2.1 Approach

To identify optimal land use recommendations for the MFMP area we need to identify and then evaluate regionally specific and relevant criteria in order to find the most suitable and optimal areas for the sustainable expansion and development of the main forms of land use within the within the MFMP area.
As a percentage of land use within MFMP area Tribal Land is most prominent (56%), as compared to State Land (44%); there is no freehold land (Table 1). The most prominent forms of land use are:

1. Land used for communal grazing, arable and residential development – primarily Tribal Land): 19 454km^2 (53.1%)
2. Land for wildlife conservation: WMAs, Sanctuaries and Protected Areas – primarily State land, apart from the Nata Bird Sanctuary): 16 366km^2 (44.7%)
3. Mining Lease Areas (Botash): 763km^2 (2.1%)
4. Botswana Livestock Development Corporation (BLDC) Ranches: 359 km^2 (1%)
5. Quarantine Camps: 134km^2 (0.4%)

The most prevalent land use is pastoral/arable and residential, this land being mostly under tribal/communal land-tenure, within which agriculture is the principal form of land use. Livestock production is widespread across the region, with arable development more spatially confined. Further land for pastoral development exists in the form of the Botswana Livestock Development Corporation (BLDC) ranches and quarantine camps. Around the periphery of the MFMP area, significant portions of land are allocated TGLP leasehold ranches in the review of the National Map (2009). There are some ranching developments within the MFMP area (area 4B in CT19); ranches are expected to be soon allocated north of CT14 (Figure 2).

Figure 1: The distinction between State and Tribal land within and around the MFMP area.

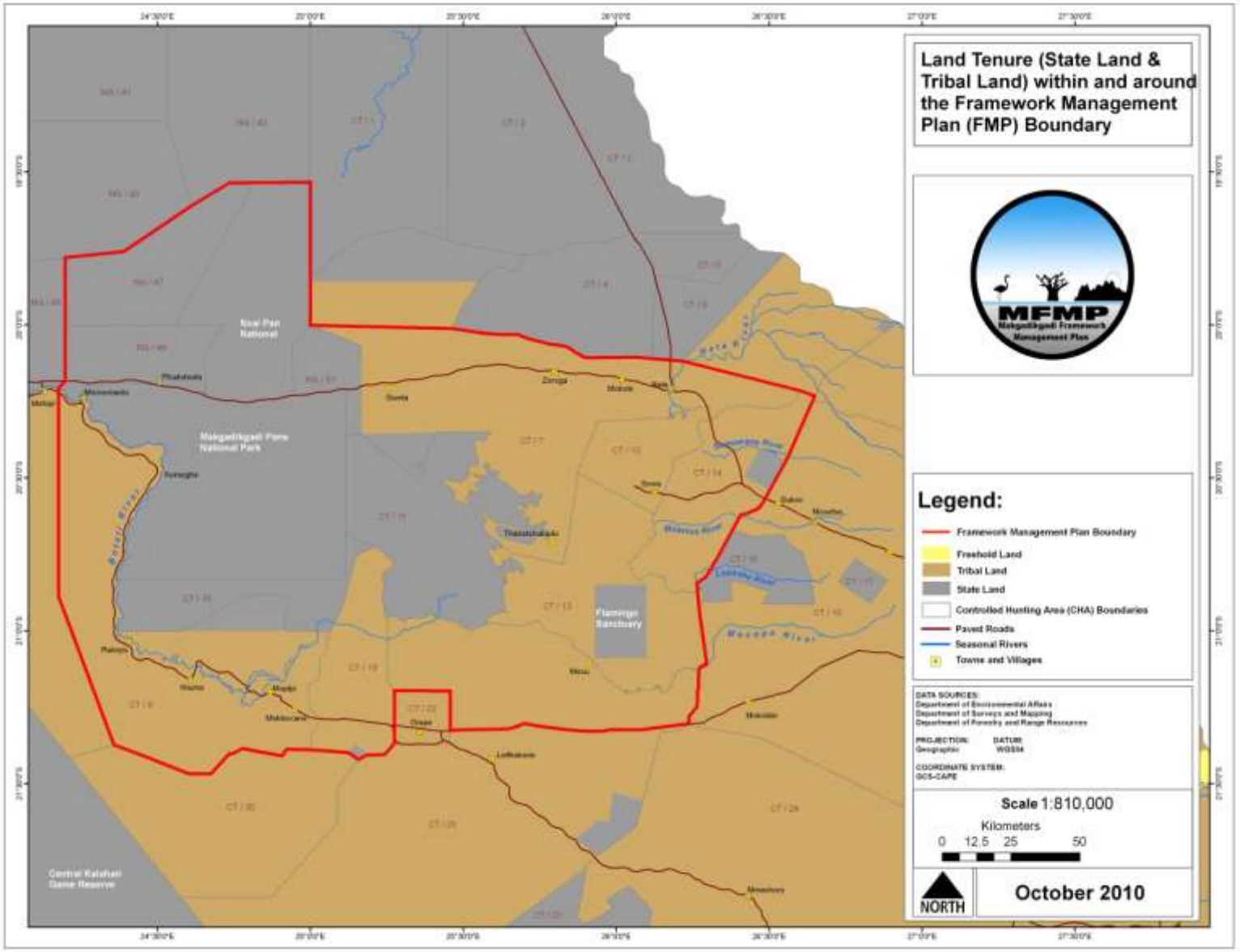


Figure 2: Current land use within the MFMP area

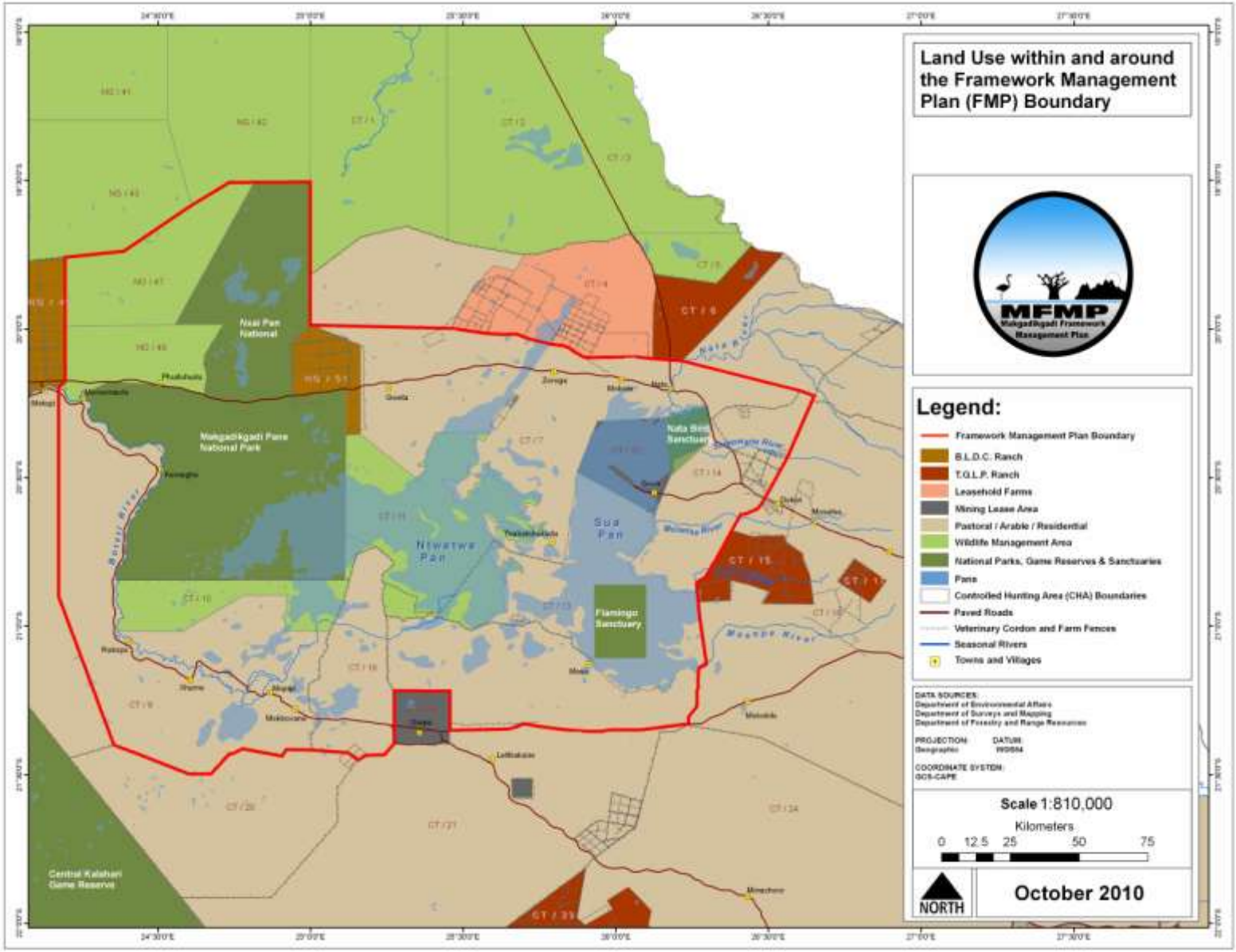


Table 1: Land use designation within the MFMP area

Number	District	Sub-District	Land Use	CHA Type	Land tenure	Area (km^2)	% inside project area	Area inside MFMP area
NG/47	Ngamiland	NA	Wildlife Management Area (Gazetted)	Commercial wildlife utilisation (leasehold)	State	1,689	100%	1,689
NG/48	Ngamiland	NA	National Park	Nxai Pan National Park	State	2,490	100%	2,490
NG/49	Ngamiland	NA	Wildlife Management Area (Gazetted)	Community wildlife utilisation (leasehold) WMA	State	1,128	100%	1,128
NG/51	Ngamiland	NA	BLDC Ranch (and WMA)	BLDC Ranch	State	565	100%	565
NG/52	Ngamiland	NA	National Park	Makgadikgadi Pans National Park	State	1,524	100%	1,524
CT/7	Central	Tutume	Pasture/Arable/ Residential	Communal area	Tribal	7,871	57.9%	5,225
CT/7	Central	Tutume	Wildlife Management Area (Gazetted)	Communal area	State	1,143	18.4%	211
CT/8	Central	Boteti	Pastoral/Arable/ Residential	Communal area	Tribal	9,095	59.6%	5,426
CT/8	Central	Boteti	Wildlife Management Area (Gazetted)	Communal area	State	304.5	100%	304.5
CT/9	Central	Boteti	National Park	Makgadikgadi Pans National Park	State	3,535	100%	3,535
CT/10	Central	Boteti	Wildlife Management Area (Un-gazetted)	Wildlife Management Area	State	1,151	100%	1,151
CT/11	Central	Boteti /Tutume	Wildlife Management Area(Un-gazetted)	Wildlife Management Area	State	2,984	100%	2,984
CT/12	Central	Tutume	SAB + Nata Sanctuary	Soda Ash Botswana + Nata Sanctuary	Tribal	966	100%	966
CT/13	Central	Tutume /Boteti	Pastoral/Arable/ Residential	Communal area	Tribal	2,954	100%	2,954
CT/14	Central	Tutume	Pastoral/Arable/ Residential	Communal area	Tribal	2,061	100%	2,061
CT/19	Central	Boteti	Pasture/Arable/ Residential	Communal area	Tribal	1,515	100%	1,515
CT/21	Central	Boteti /Tutume	Pastoral/Arable/ Residential	Communal area	Tribal	12,266	23.5%	2,882

Within the dominant first two of these land use forms, specific types of land use occur that often have competing claims for land with, in places, conflict between adjacent land use types. The third most dominant form of land use; Mining, may expand in the future, however integrating mining into any land use plan is difficult due to the unknown nature and distribution of mineral deposits. Prospecting licences for both diamonds and precious metals cover large portions of the MFMP area and the potential development of mining operations within any of these prospecting areas must be taken into consideration.

Land use conflicts can lead to the sub-optimal use of land and eventually land use degradation. The most predominant competing types of land use within most of these above defined land use forms in the Makgadikgadi include;

1. Pastoral farming (communal and ranch farming)
2. Arable farming (primarily rain-fed dryland farming)
3. Hospitality & Tourism (nature-based tourism, adventure tourism, cultural tourism, business hospitality)
4. Wildlife and birdlife conservation

One of the principal objectives of this component is to optimise land use within the MFMP area, so that livelihoods can be enhanced through sustainable development. Effective sustainable development should be based on the efficient and environmentally responsible use of the region's natural resources. Many of the criteria used to evaluate the suitability of each type of land use are therefore based around the natural resources present within the Makgadikgadi system.

Land use types not included within the above list include residential and urban development, and while an obviously important aspect of the socio-economic development of the Makgadikgadi region have not been evaluated within this component as they form a relatively small proportion of total land cover. Rather, to meet the objectives of the component, we have focused on the list of four competing principle land use types within the Makgadikgadi region.

1) Pastoral Farming

Pastoral farming occurs across the majority of all communal land within the MFMP area. Pastoral farming in the region is primarily based around the cattle post system, with cattle produced from small, family owned or run cattle posts scattered across the communal areas. Most have access to a borehole, either their own or through a syndicate from which the cattle movements are centered. There is extensive literature available on the potential long-term sustainability and viability of such communal grazing systems, with the main alternative being fenced ranches. Both of these approaches have positive and negative aspects and both are evident within the Makgadikgadi. The aim of evaluating land use for pastoral farming is to identify those key natural resources that are required to enhance the production of cattle, such as fertile soils and high carrying capacity with good access to potable water, while taking into consideration those factors that limit and reduce the viability of cattle production such as fragile soils prone to degradation and proximity to wildlife. Although cattle production is widespread across the region it is believed that there are areas currently under utilised by livestock production that are suited to the expansion of the cattle industry.

2) Arable Farming

Arable farming occurs in a patchy distribution across the MFMP area. The concentration of arable fields is closely related to the distribution and alignment of seasonal rivers in the system and the location of medium to large settlements. While many fields are aligned within riverbeds to maximise benefits from the more fertile soils and water provided by the seasonal rivers the majority of the fields are dryland fields, which are solely dependent upon rainwater. The aim of evaluating land use options for arable farming is to identify those areas of the MFMP area that are suitable for the expansion of farming, with key natural resources such as high soil fertility and good access to potable water used to help define those localities. Factors that constrain the development and arable fields include close proximity to areas of high cattle and wildlife density (with no drift or veterinary fences in between), and those areas far from current human settlements due to the highly labour intensive nature of arable farming. The spatial distribution of suitable, undeveloped arable areas is limited, but the evaluation hopes to identify those areas that could utilised with future human expansion.

3) Hospitality & Tourism

The Hospitality & Tourism industry is a diverse sector and can be wildlife based, culture based or facilitating the business environment, enabling potential hospitality and tourism development to occur across the region to a greater or lesser extent within each of these different forms. Further divisions of the market, such as high-quality / low volume tourism through to more basic guest houses and motels for passing traffic give even more spatial variability to the sector. The evaluation of the most suitable hospitality and tourism areas within the MFMP area is therefore complicated by the industriy's diversity. To successfully evaluate those areas most suited, the tourism sector needs

to be broken down and each sector assessed separately. However, for the purpose of this assessment we focused on those areas suitable for tourism outside of urban areas, i.e. those sectors of the tourism industry that are based around the natural and cultural resources of the region. Factors that enhance tourism in this sector include access to archaeological sites, wildlife, protected areas or wildlife management areas (WMAs) and good access to the site along dirt roads, but not necessarily the very close proximity of paved roads. Other limiting factors that constrain nature based tourism include the close proximity of settlements, boreholes and veterinary fences.

4) Wildlife & Birdlife Conservation

In semi-arid regions, such as the Makgadikgadi, wildlife require large amounts of space to move between areas of variable resource quality in different seasons. The majority of the wildlife and birdlife biomass of the Makgadikgadi region is migratory, both intra-migratory and inter-migratory. While space is an important factor in its own right, access to key resource use areas is vital for most species in the system. These key resource use hotspots have been defined for most of the wildlife and birdlife species in the system and the location of these will be taken into consideration within the evaluation of the wildlife resources evaluation. However, the general resources required by wildlife that enhance the viability of their population include; fertile soils, with high carrying capacity and good access to surface water. Factors that limit their populations include close proximity to human settlements, arable fields, boreholes (around which cattle are concentrated) and in most cases veterinary fences.

2.2 Method

2.2.1 Defining Appropriate Criteria

The criteria used to investigate the relative suitability of these four dominant forms of land use consist of a series of key factors and constraints that have been summarised briefly above. These factors have varying levels of influence in either enhancing the viability of that form of land use or limiting the viability of that form of land use. The set of criteria used to evaluate each type of land use within this assessment is not exhaustive, with only those judged to have significant impact used, while each criterion must have a spatial element so that their locational impacts can be mapped and evaluated appropriately. The spatial data gathered by the Department of Environmental Affairs (DEA) from each relevant government department for the MMP study was therefore essential in this respect.

The selection of criteria is based, as stated earlier, on key natural resources within the system that may enhance or limit the viability of that land use type. It is also important to consider other currently existing forms of land use that may conflict with and limit the potential of other forms of land use, or potentially enhance that land use type. Land use types such as tourism development and arable development may be enhanced by an improved road network and proximate human developments, while wildlife conservation may be constrained by such land forms. The relative suitability of land for each land use type must therefore be evaluated separately, with the weightings of each criterion adjusted to reflect the potential impact on that specific land use type.

Key natural resource criteria used in the assessment of all the four types of land use to be evaluated include;

1. High soil fertility (graded as very fertile, fertile & moderately fertile by Ministry of Agriculture)
2. High carrying capacity (those areas with a carrying capacity of less that 16 Ha per LSU)

3. Good ground water potential
4. Low fire risk
5. Distance to surface water

These criteria have been identified as the most significant natural resources regulating the viability of arable and pastoral farming within the system, while also being critical for most wildlife species.

The most significant land use developments that either enhance or limit the suitability of that land use type were defined to be;

1. Distance to paved roads
2. Distance to dirt roads
3. Distance to airstrips
4. Distance to boreholes
5. Distance to arable fields
6. Distance to cattle crushes
7. Distance to drift fences
8. Distance to veterinary cordon fences
9. Distance to existing small settlements (less than 1000)
10. Distance to existing medium sized settlements (1000-2500)
11. Distance to existing medium-to-large settlements (2500-10,000)
12. Distance to existing large settlements (greater than 10,000)
13. Distance to archaeological sites

The existing land use designation for that area was also defined to be of significant importance that would affect the viability of any proposed land use changes through the political and social support for those proposed changes. Land use designations included;

1. CHA designated land use type (WMA / PA / Pastoral, arable, residential)
2. Veterinary FMD zoning category (FMD Buffalo / FMD Vaccination / FMD Free)

Figures 3-8 show some of the key natural resources required by pastoral and arable development including; carrying capacity, ground water, suitable soil types, existing locations of arable fields and boreholes.

Figure 3: Carrying Capacity

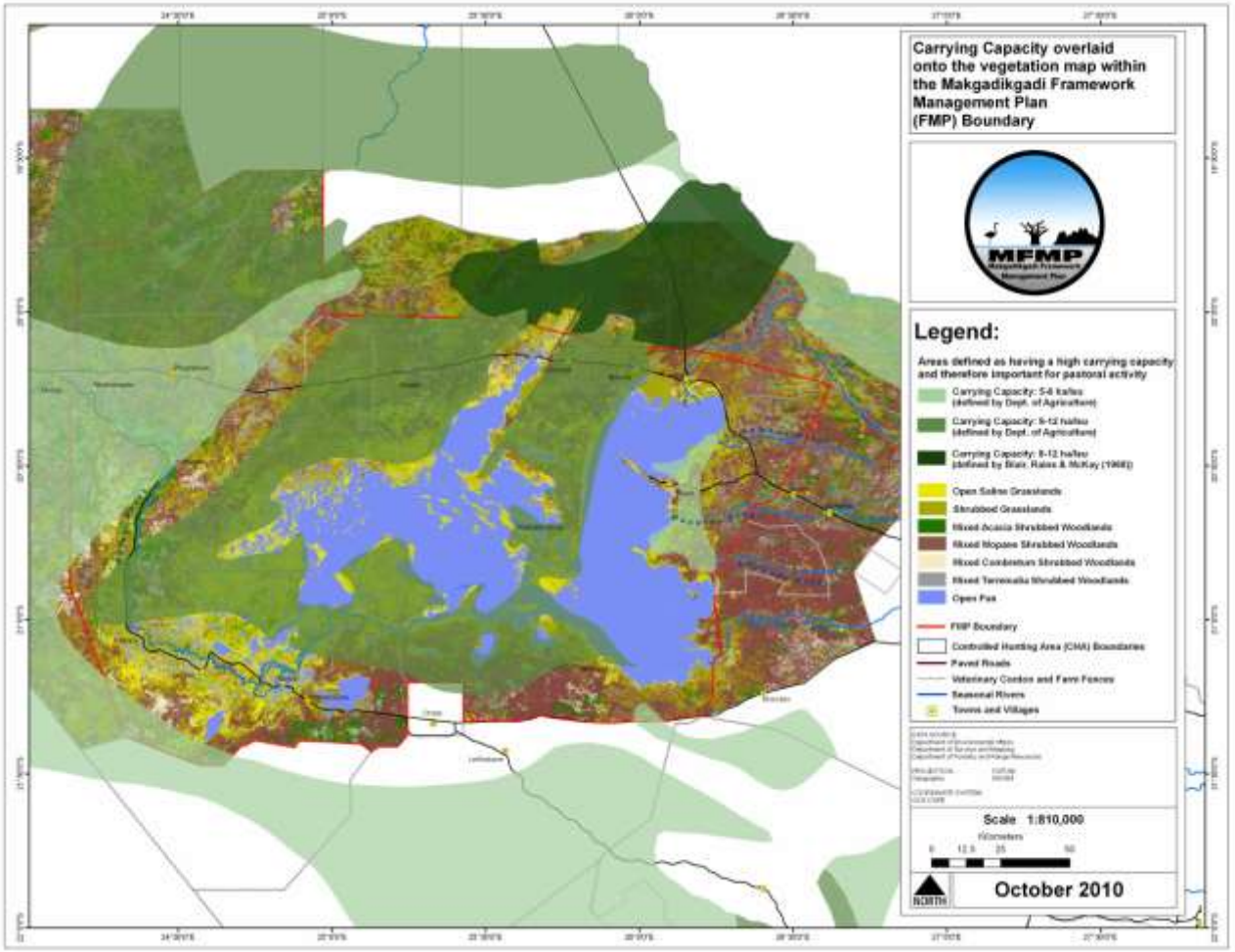


Figure 4: Ground water

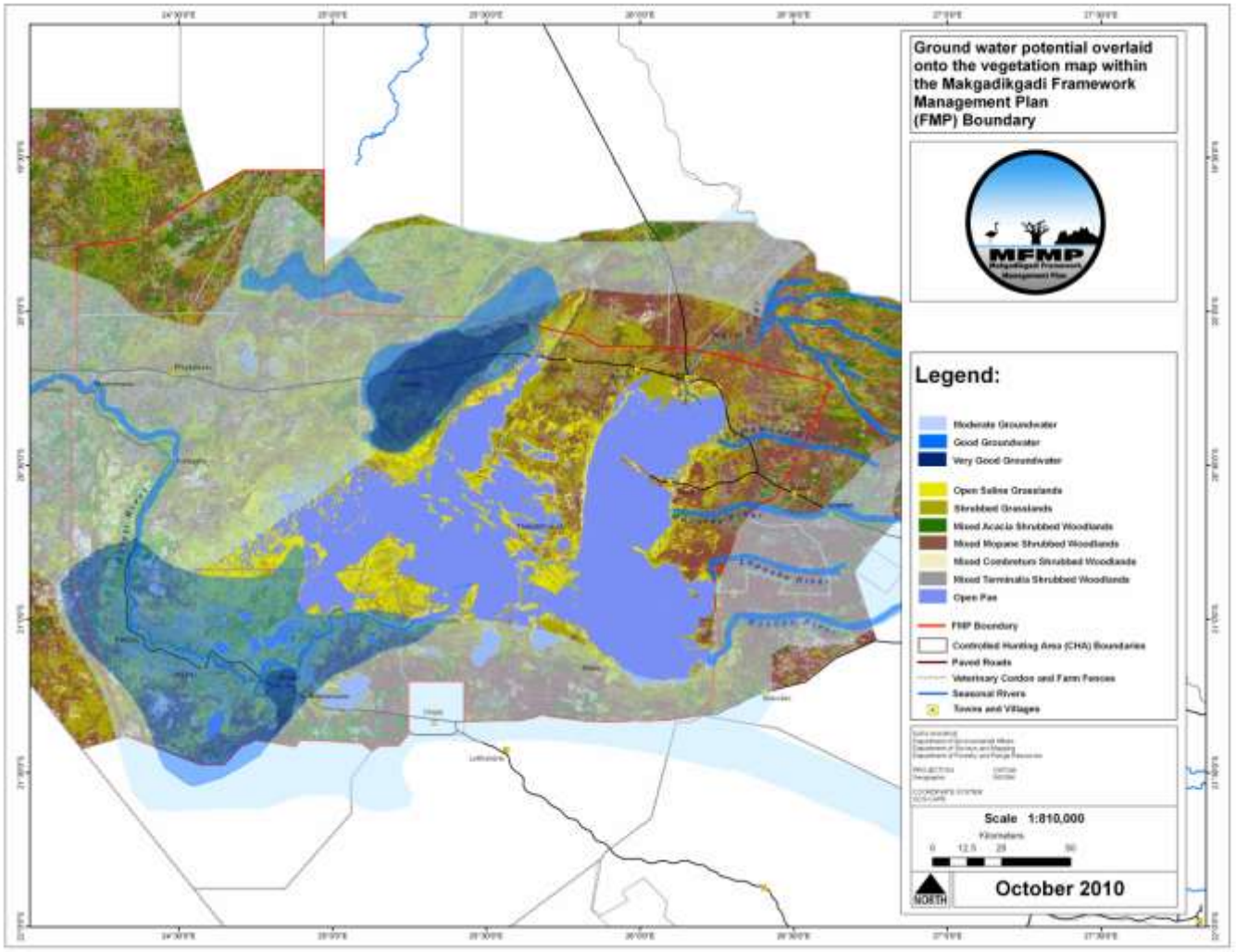


Figure 5: Soil type

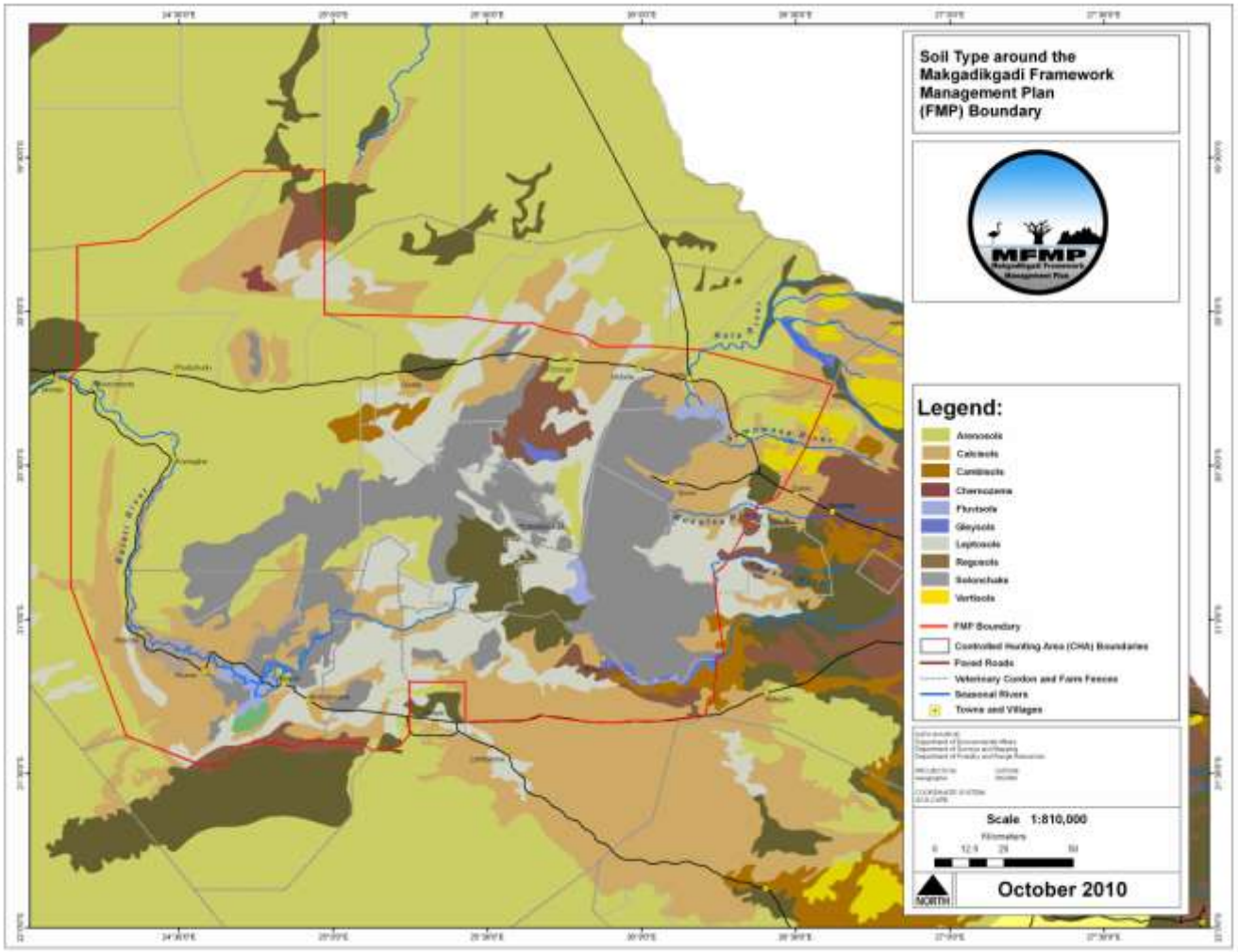


Figure 6: Land systems

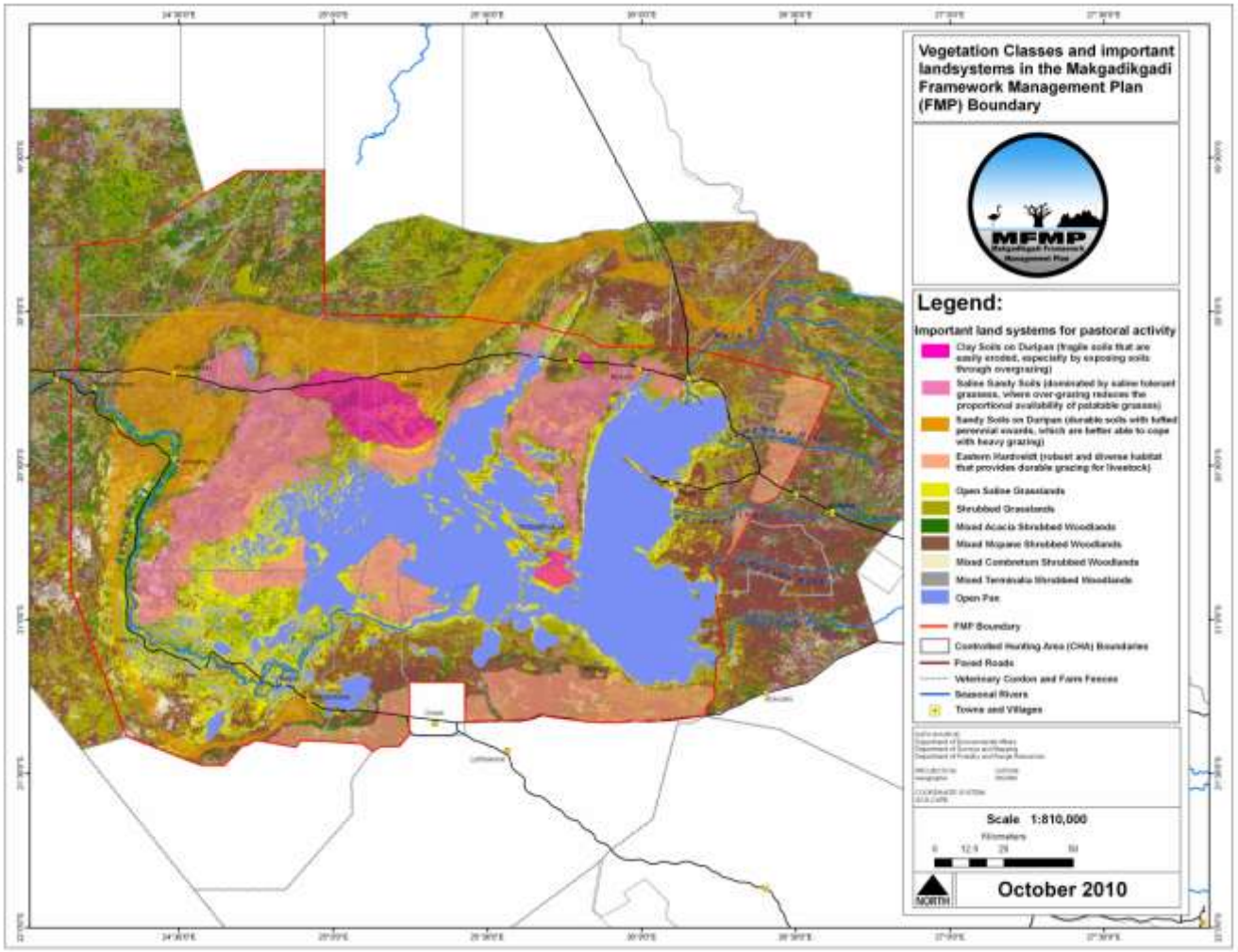


Figure 7: Existing arable fields

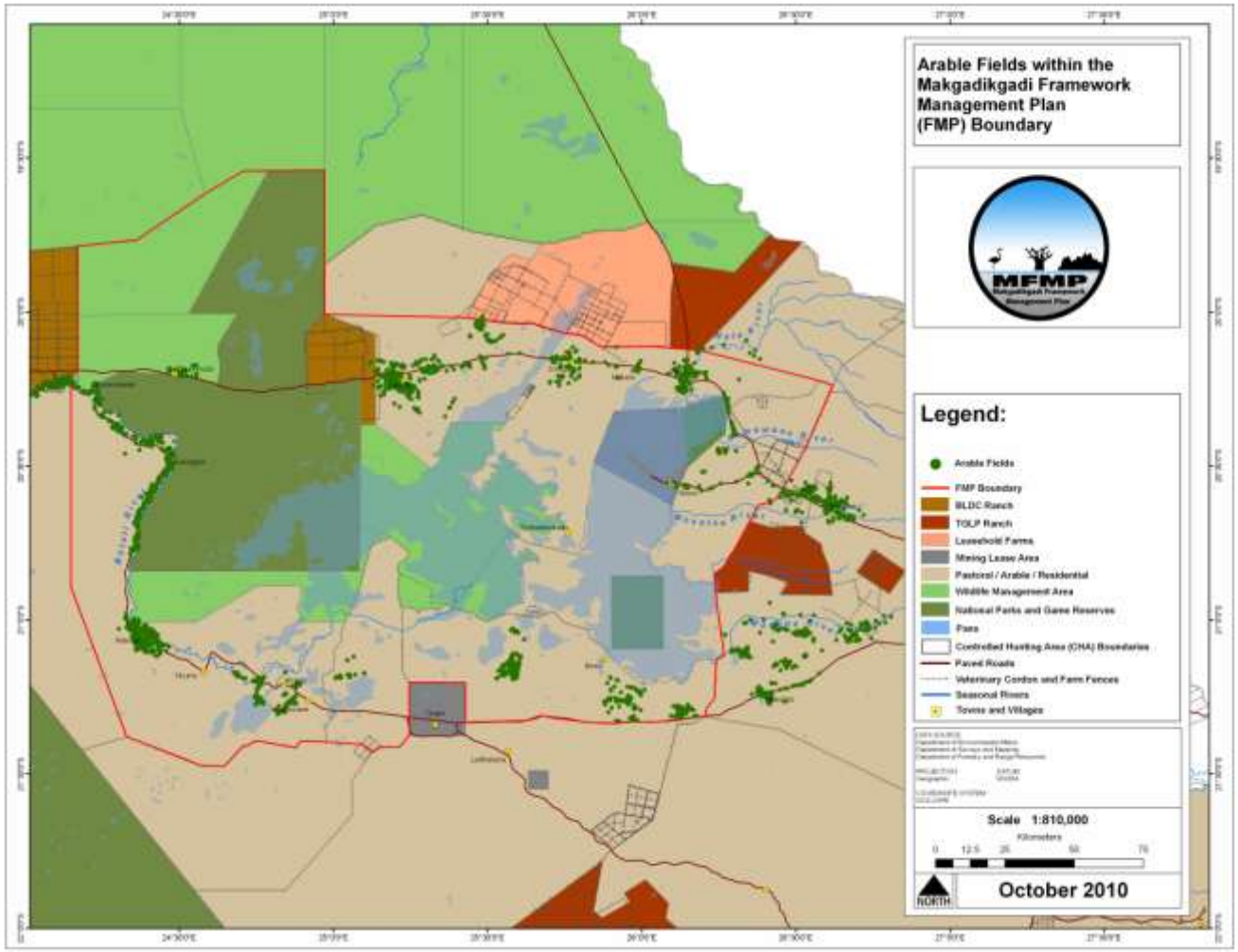
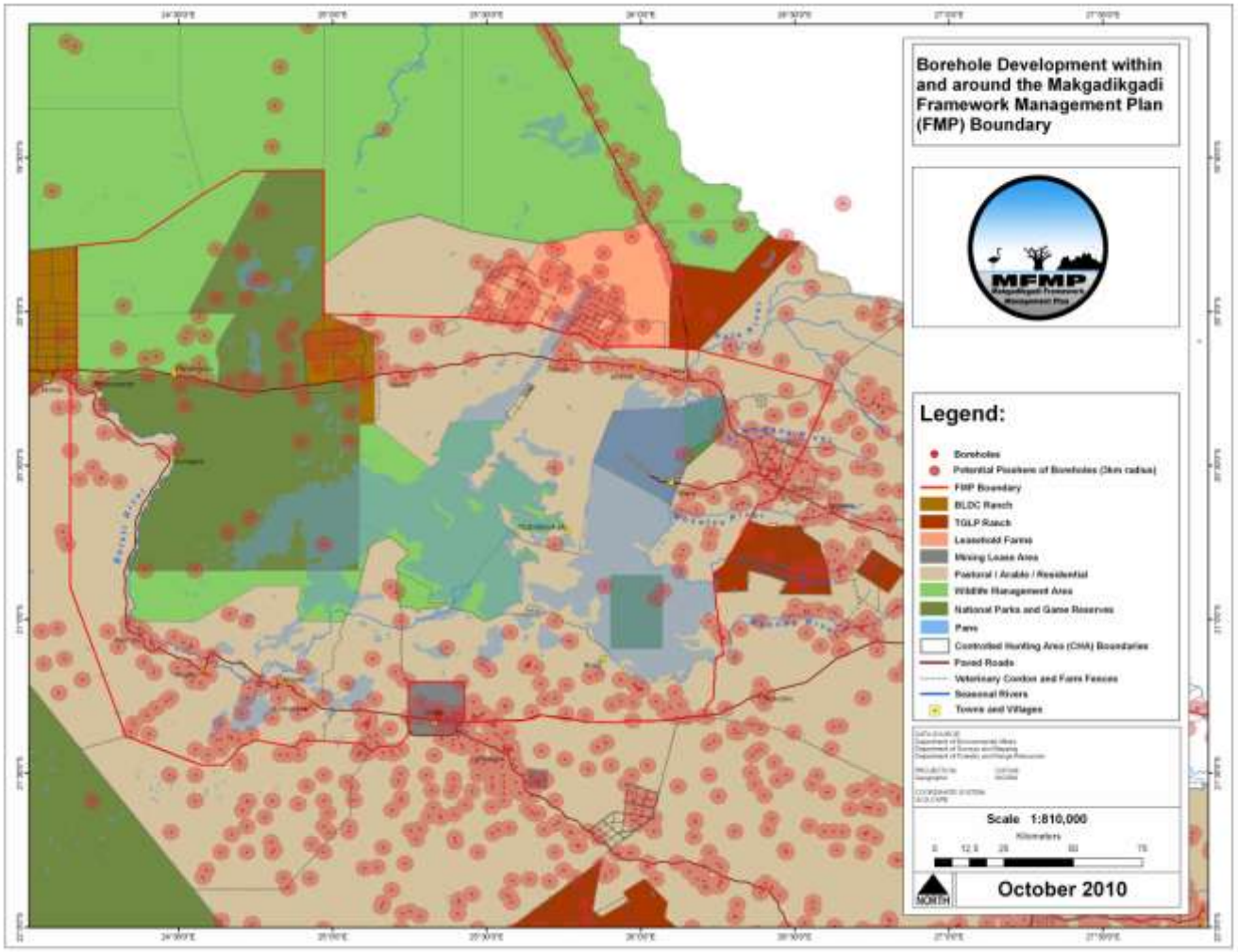


Figure 8: Existing boreholes



The selection of factors (those criteria that enhance the viability of a land use) and constraints (those criteria that limit the viability of any land use), where any criterion can be both a factor or a constraint depending upon which land use type is being evaluated are in Table 2.

Table 2: Selection of factors that enhance or limit the viability of a land use

Criteria	Pastoral farming Positive or Negative	Arable farming Positive or Negative	Tourism Positive or Negative	Wildlife Conservation Positive or Negative
Good soil fertility	+ve	+ve	N/A	+ve
High carrying Capacity	+ve	-ve	N/A	+ve
Good ground water potential	+ve	+ve	+ve	+ve
Distance to surface water	+ve	+ve	+ve	+ve
High fire risk	-ve	-ve	-ve	N/A
Distance to paved roads	-ve	+ve	-ve	-ve
Distance to dirt roads	+ve	+ve	+ve	-ve
Distance to airstrips	N/A	N/A	+ve	N/A
Distance to boreholes	+ve	+ve	-ve	-ve
Distance to arable fields	-ve	+ve	-ve	-ve
Distance to cattle crushes	+ve	N/A	N/A	N/A
Distance to drift fences	+ve	+ve	N/A	N/A
Distance to vet fences	N/A	N/A	-ve	-ve
Distance to existing small settlements (less than 1000)	+ve	+ve	-ve	-ve
Distance to existing medium sized settlements (1000-2500)	+ve	+ve	-ve	-ve
Distance to existing medium-to-large settlements (2500-10,000)	+ve	+ve	N/A	-ve
Distance to existing large settlements (greater than 10,000)	N/A	+ve	+ve	-ve
Distance to archaeological sites	N/A	N/A	+ve	N/A
CHA designation: Pastoral/arable	+ve	+ve	N/A	-ve
CHA designation: WMA	N/A	N/A	+ve	+ve
CHA designation: PA	N/A	N/A	+ve	+ve
CHA designation: BLDC / Quarantine	+ve	N/A	N/A	-ve
Veterinary zoning: FMD Buffalo	-ve	N/A	+ve	+ve
Veterinary zoning: FMD Vaccination	-ve	N/A	N/A	-ve
Veterinary zoning: FMD Free	+ve	N/A	N/A	-ve

2.2.2 Analytical Approach to Evaluating these Criteria

A Multi-Criteria Assessment (MCA) embedded within a Geographic Information System (GIS), called Idrisi32, is used to evaluate the various alternative land use types on the basis of the multiple and conflicting criteria for each specific land use objective. GIS is well suited to evaluating spatial problems with multiple criteria. IDRISI32 is a raster based GIS software system, which includes a specific Multi Criteria Evaluation module using a weighted linear combination. IDRISI32 works by

using expert opinion to identify relevant criteria, which are then subdivided into factors and constraints (Eastman, 1993).

2.2.3 Standardising the relative impact of each criteria

The spatial impact of each criterion through its relative enhancing or limiting influence on the suitability of each land use type must be standardised before evaluating each criteria with Idrisi32. The relative suitability for each distance criteria, for example, is assessed along a 0-255 suitability scale. The minimum and maximum impact distance is defined for each criteria, with the 0-255 suitability scale increasing or decreasing along a sigmoidal (s-shaped) curve. For example the relative benefits of distance to surface water for pastoral farming would have a minimum distance of 0km set within Idrisi32, with the maximum impact distance set at 6km, i.e., the mean daily walking distance of cattle away from water in the Makgadikgadi region (Brooks, 2005). The distances assigned for the relative impact of each criteria to the different land use types must be defined using expert advice and appraisal of the distances by each team member.

The Land use suitability standardisation scores on Table 3 define minimum and maximum distances (m) of land use suitability from each spatially defined criterion within the MFMP area.

Table 3: Land use suitability standardisation scores

	Pastoral farming		Arable farming		Tourism		Wildlife Conservation	
Criteria	Minimum Impact Distance	Maximum Impact Distance	Minimum Impact Distance	Maximum Impact Distance	Minimum Impact Distance	Maximum Impact Distance	Minimum Impact Distance	Maximum Impact Distance
Good soil fertility	0	6000	0	2000	N/A	N/A	0	12000
High carrying Capacity	0	6000	0	2000	N/A	N/A	0	12000
Good ground water potential	0	6000	0	500	0	500	0	12000
Distance to surface water	0	6000	0	500	0	500	0	12000
High fire risk	0	10000	0	10000	0	10000	N/A	N/A
Distance to paved roads	0	3000	0	1000	1000	40000	0	2000
Distance to dirt roads	0	5000	0	500	0	500	0	500
Distance to airstrips	N/A	N/A	N/A	N/A	3000	8000	N/A	N/A
Distance to boreholes	0	6000	0	500	0	6000	0	3500
Distance to arable fields	0	3000	0	500	0	3000	0	300
Distance to cattle crushes	0	10000	N/A	N/A	N/A	N/A	N/A	N/A
Distance to drift fences	0	6000	0	6000	N/A	N/A	N/A	N/A
Distance to vet fences	0	6000	N/A	N/A	0	2000	0	3500
Distance to existing small settlements (less than 1000)	500	5000	500	5000	0	3000	0	2000

	Pastoral farming		Arable farming		Tourism		Wildlife Conservation	
Distance to existing medium sized settlements (1000-2500)	750	5000	750	5000	0	4000	0	2000
Distance to existing medium-to-large settlements (2500-10,000)	750	5000	750	5000	5000	40000	0	3500
Distance to existing large settlements (greater than 10,000)	0	2500	1000	5000	5000	40000	0	5000
Distance to archaeological sites	N/A	N/A	N/A	N/A	500	8000	N/A	N/A
CHA designation: Pastoral/arable	-	-	-	-	N/A	N/A	-	-
CHA designation: WMA	N/A	N/A	N/A	N/A	-	-	-	-
CHA designation: PA	N/A	N/A	N/A	N/A	-	-	-	-
CHA designation: BLDC / Quarantine	-	-	N/A	N/A	N/A	N/A	-	-
Veterinary zoning: FMD Buffalo	-	-	N/A	N/A	-	-	-	-
Veterinary zoning: FMD Vaccination	-	-	N/A	N/A	N/A	N/A	-	-
Veterinary zoning: FMD Free	-	-	N/A	N/A	N/A	N/A	-	-

2.2.4 Scoring Criteria

Each of the above standardised criteria is scored according to their relative impact using a software based weighted-linear combination. Weighting scores must be defined using a collective approach amongst team members and outside experts. The technique used in Idrisi32 to weigh each criterion is that of a pair-wise comparison matrix known as an Analytical Hierarchy Process. Each criterion is weighed against the other using a 9-point continuous scale from 9 to 1/9, where a score of 9 is most important and 1/9 least important relative to that land use type. Expert opinion and team appraisal of scores is vital in defining the right relative scores for each criterion.

All of the criteria are aligned in a spreadsheet along both rows and columns, so that only half the spreadsheet is completed. The software package performs a weighting module to define the principle eigenvector (the most important criteria for that land use type), and also runs a consistency check to ensure that the weighted scores are appropriate for the evaluation.

Tables 4-7 show the scoring of criteria for the evaluation of suitable land for arable arming, pastoral farming, tourism and wildlife conservation respectively, where a 9 indicates that relative to the column variable, the row variable is significantly more important, while a 1/9 indicates that relative to the column variable the row is significantly less important.

Table 4: Scoring of criteria for the evaluation of suitable land for arable farming

	Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Good soil fertility	1																								
2	High carrying Capacity	1/3	1																							
3	Good ground water potential	1/3	5	1																						
4	Distance to surface water	1/3	7	5	1																					
5	High fire risk	1/9	5	1/9	1/9	1																				
6	Distance to paved roads	1/9	5	1/9	1/9	1/3	1																			
7	Distance to dirt roads	1/9	7	1/9	1/9	3	5	1																		
8	Distance to airstrips	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1																	
9	Distance to boreholes	1/9	7	1/5	1/7	5	5	5	1/9	1																
10	Distance to arable fields	1/5	9	5	1/5	9	9	9	1/9	9	1															
11	Distance to cattle crushes	1/9	7	1/9	1/9	5	3	3	1/9	1/5	1/9	1														
12	Distance to drift fences	1/7	7	1/5	1/7	5	5	5	1/9	1/3	1/7	5	1													
13	Distance to vet fences	1/7	3	1/7	1/7	3	3	3	1/9	1/5	1/9	3	1/5	1												
14	Distance to existing small settlements (less than 1000)	1/5	7	1/3	1/5	9	7	7	1/9	5	1/5	9	7	9	1											
15	Distance to existing medium sized settlements (1000-2500)	1/5	7	1/3	1/5	9	7	7	1/9	5	1/7	9	7	9	1/3	1										
16	Distance to existing medium-to-large settlements (2500-10,000)	1/9	3	1/7	1/9	7	3	3	1/9	1/3	1/9	3	1/3	3	1/5	1/5	1									
17	Distance to existing large settlements (greater than 10,000)	1/9	3	1/7	1/9	7	3	3	1/9	1/3	1/9	3	1/3	3	1/7	1/7	1	1								
18	Distance to archaeological sites	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1							
19	CHA designation: Pastoral/arable	1/3	7	5	1/3	7	7	7	1/9	5	1	5	7	7	5	5	7	7	9	1						
20	CHA designation: WMA	5	7	7	3	7	7	7	1/9	5	1	5	7	7	5	5	7	7	9	3	1					
21	CHA designation: PA	9	9	7	7	7	7	7	1/9	7	1	5	7	7	7	7	7	7	9	1	1	1				
22	CHA designation: BLDC / Quarantine	5	7	5	3	7	7	7	1/9	7	1	5	7	7	5	5	7	7	9	3	3	1/5	1			
23	Veterinary zoning: FMD Buffalo	7	7	7	5	7	7	7	1/9	7	1	5	7	7	7	7	7	7	9	1	1	1	5	1		
24	Veterinary zoning: FMD Vaccination	1	5	3	1	7	5	5	1/9	5	1	5	7	7	3	3	3	3	9	3	3	1/3	1	1	1	
25	Veterinary zoning: FMD Free	1	5	3	1	7	5	5	1/9	5	1	5	7	7	3	3	3	3	9	6	3	1/3	1	1	1	1

Note: 9 indicates that relative to the column variable, the row variable is significantly more important, while a 1/9 indicates that relative to the column variable the row is significantly less important

Table 5: Scoring of criteria for the evaluation of suitable land for Pastoral Farming

	Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Good soil fertility	1																								
2	High carrying Capacity	3	1																							
3	Good ground water potential	5	5	1																						
4	Distance to surface water	1/3	1/3	1/3	1																					
5	High fire risk	1/7	1/9	1/9	1/9	1																				
6	Distance to paved roads	1/7	1/9	1/9	1/9	3	1																			
7	Distance to dirt roads	1/9	1/9	1/9	1/9	3	1/3	1																		
8	Distance to airstrips	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1																	
9	Distance to boreholes	1/5	1/5	1/9	3	7	1/7	7	9	1																
10	Distance to arable fields	1/9	1/9	1/9	1/5	5	1/7	7	9	3	1															
11	Distance to cattle crushes	1/5	1/5	1/9	1/5	5	1/5	5	9	1/5	1/5	1														
12	Distance to drift fences	1/7	1/7	1/9	1/5	5	3	1/3	9	1/5	1/5	1/3	1													
13	Distance to vet fences	1/7	1/7	1/9	1/7	5	3	1/3	9	1/7	1/7	1/5	3	1												
14	Distance to existing small settlements (less than 1000)	1/5	1/5	1/7	1/5	5	1/3	1/3	9	1/5	1/5	1/3	1/3	3	1											
15	Distance to existing medium sized settlements (1000-2500)	1/5	1/5	1/7	1/5	5	1/3	1/3	9	1/5	1/5	1/3	1/3	1/3	1/5	1										
16	Distance to existing medium-to-large settlements (2500-10,000)	1/9	1/9	1/9	1/7	3	1/5	1/5	9	1/7	1/7	1/7	1/5	1/3	1/7	1/5	1									
17	Distance to existing large settlements (greater than 10,000)	1/9	1/9	1/9	1/9	3	1/7	1/7	9	1/9	1/9	1/9	1/9	1/3	1/9	1/7	1/9	1								
18	Distance to archaeological sites	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1/9	1							
19	CHA designation: Pastoral/arable	3	3	3	3	5	5	5	9	3	3	5	5	5	5	7	7	9	9	1						
20	CHA designation: WMA	3	3	3	3	5	5	5	9	3	3	5	5	5	5	7	7	9	9	1/5	1					
21	CHA designation: PA	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	1				
22	CHA designation: BLDC / Quarantine	3	3	3	3	5	5	5	9	3	3	5	5	5	5	7	7	9	9	1	5	1/9	1			
23	Veterinary zoning: FMD Buffalo	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	1/9	1/9	1		
24	Veterinary zoning: FMD Vaccination	3	3	3	3	5	5	5	9	3	3	5	5	5	5	7	7	9	9	1	3	1/9	1/5	1/9	1	
25	Veterinary zoning: FMD Free	3	3	3	3	5	5	5	9	3	3	5	5	5	5	7	7	9	9	5	7	1/9	1/7	1	9	1

Note: 9 indicates that relative to the column variable, the row variable is significantly more important, while a 1/9 indicates that relative to the column variable the row is significantly less important

Table 6: Scoring of criteria for the evaluation of suitable land for Tourism

Criteria		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Good soil fertility	1																								
2	High carrying Capacity	3	1																							
3	Good ground water potential	9	9	1																						
4	Distance to surface water	9	9	1	1																					
5	High fire risk	9	7	1/7	1/7	1																				
6	Distance to paved roads	7	7	1/9	1/9	5	1																			
7	Distance to dirt roads	7	5	1/9	1/9	3	5	1																		
8	Distance to airstrips	9	9	1/7	1/7	3	3	3	1																	
9	Distance to boreholes	7	7	1/5	1/5	3	3	3	1/3	1																
10	Distance to arable fields	3	3	1/7	1/7	5	3	5	1/3	1	1															
11	Distance to cattle crushes	1	1/3	1/9	1/9	3	7	1/3	1/7	1/3	1/3	1														
12	Distance to drift fences	1	1/5	1/9	1/9	1/3	7	1/3	1/5	1/3	3	3	1													
13	Distance to vet fences	7	7	1/7	1/7	5	5	7	5	7	7	7	5	1												
14	Distance to existing small settlements (less than 1000)	7	7	1/7	1/7	3	3	5	3	5	5	5	3	1/7	1											
15	Distance to existing medium sized settlements (1000-2500)	7	7	1/7	1/7	5	5	7	5	7	7	7	7	1/7	3	1										
16	Distance to existing medium-to-large settlements (2500-10,000)	9	9	1/3	1/3	7	7	9	7	9	9	9	9	1/5	7	5	1									
17	Distance to existing large settlements (greater than 10,000)	9	9	3	3	9	7	9	7	9	9	9	9	3	9	9	7	1								
18	Distance to archaeological sites	9	7	1/5	1/5	7	7	9	5	9	9	9	9	5	7	5	5	3	1							
19	CHA designation: Pastoral/arable	5	5	1/5	1/5	5	5	5	3	5	5	5	5	3	5	3	3	1	1/7	1						
20	CHA designation: WMA	9	9	1/3	1/3	9	9	9	7	9	9	9	9	5	7	5	5	3	1/3	5	1					
21	CHA designation: PA	9	9	1/3	1/3	9	9	9	7	9	9	9	9	7	7	7	5	3	1/3	7	5	1				
22	CHA designation: BLDC / Quarantine	3	3	1/3	1/3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1/7	1/5	1/9	1			
23	Veterinary zoning: FMD Buffalo	9	9	1/3	1/3	9	9	9	7	9	9	9	9	7	7	7	5	3	1/3	5	5	1	7	1		
24	Veterinary zoning: FMD Vaccination	3	3	1/5	1/5	3	3	3	3	3	3	3	3	3	3	3	3	3	1/7	1/5	1/5	1/9	1/5	1/5	1	
25	Veterinary zoning: FMD Free	7	5	1/3	1/3	7	5	7	5	5	5	7	5	3	5	5	3	1	1/5	1/7	1/3	1/7	1/3	1	5	1

Note: 9 indicates that relative to the column variable, the row variable is significantly more important, while a 1/9 indicates that relative to the column variable the row is significantly less important

Table 7: Scoring of criteria for the evaluation of suitable land for Wildlife Conservation

	Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Good soil fertility	1																								
2	High carrying Capacity	3	1																							
3	Good ground water potential	5	5	1																						
4	Distance to surface water	7	7	3	1																					
5	High fire risk	3	3	1/7	9	1																				
6	Distance to paved roads	7	7	1/5	7	5	1																			
7	Distance to dirt roads	3	3	1/9	9	1/3	1/5	1																		
8	Distance to airstrips	3	3	1/9	9	3	1/3	3	1																	
9	Distance to boreholes	3	3	1/5	7	3	3	5	3	1																
10	Distance to arable fields	7	7	3	1/3	7	7	7	7	5	1															
11	Distance to cattle crushes	5	5	1/7	3	3	3	5	1/3	1/5	1/7	1														
12	Distance to drift fences	5	5	1/3	1/5	3	3	5	1/5	1/3	1/7	3	1													
13	Distance to vet fences	7	7	1/3	1/3	5	5	7	5	5	1/3	9	7	1												
14	Distance to existing small settlements (less than 1000)	3	3	3	3	3	3	5	3	3	3	5	5	3	1											
15	Distance to existing medium sized settlements (1000-2500)	5	5	5	5	5	5	7	5	5	5	7	7	5	3	1										
16	Distance to existing medium-to-large settlements (2500-10,000)	7	7	7	7	7	7	9	7	7	7	9	9	7	5	3	1									
17	Distance to existing large settlements (greater than 10,000)	9	9	9	9	9	9	9	9	9	9	9	9	9	9	7	5	1								
18	Distance to archaeological sites	1/5	1/5	1/7	1/9	1/7	1/7	1/3	1/5	1/7	1/9	3	1/3	1/9	1/5	1/7	1/9	1/9	1							
19	CHA designation: Pastoral/arable	5	5	3	3	3	3	5	5	5	1/3	5	5	3	3	3	1/3	1/3	5	1						
20	CHA designation: WMA	7	7	5	5	7	5	7	7	7	3	7	7	5	5	5	3	3	7	5	1					
21	CHA designation: PA	9	9	7	7	9	7	9	9	9	7	9	9	7	7	7	5	5	9	7	5	1				
22	CHA designation: BLDC / Quarantine	3	3	1/3	1/3	3	3	3	3	3	1/3	3	3	3	1/3	1/3	1/5	1/7	3	1/3	1/5	1/9	1			
23	Veterinary zoning: FMD Buffalo	9	9	7	7	9	7	9	9	9	7	9	9	7	5	5	3	3	7	5	1	1	5	1		
24	Veterinary zoning: FMD Vaccination	5	5	1/3	1/3	3	1/3	5	3	3	1/3	5	5	1/5	3	3	1/3	1/3	5	1	1/5	1/9	1/3	1/7	1	
25	Veterinary zoning: FMD Free	9	9	1	1	7	5	9	7	7	1	9	9	1/3	3	3	1	1	7	3	1/5	1/7	7	1	5	1

Note: 9 indicates that relative to the column variable, the row variable is significantly more important, while a 1/9 indicates that relative to the column variable the row is significantly less important

2.2.5 Product of Multi-Criteria Evaluation

The product of this multi-criteria assessment or evaluation, is a set of suitability maps identifying those areas within the MFMP area most suited to that type of land use. The suitability maps identify those areas that should be prioritised for and those area not be considered for each respective land use type.

2.2.6 Suitability maps

Suitability maps were produced from the above defined methodology for pastoral development and arable development. These land use activities are expected to grow in the coming years along with predicted growth in population size within the Makgadikgadi. As such their planned development is crucial to ensure sustainable development within the MFMP area.

Wildlife conservation practices currently cover almost 45% of land cover within the MFMP area and any proposals to increase this amount should be based on the findings of the Ecology and Hydrology Report, which defined the biodiversity hotspots within the MFMP area. The maps showing these hotspots best define the land use suitability maps for wildlife conservation within the MFMP area and Idrisi based maps were not completed.

Tourism development is also expected to grow within the MFMP area, with tourism nodes for development and activity areas defined within the Tourism Report. Development will be driven by a combination of the private sector and through community based trusts and further consultancy is required to accurately define ideal sites for development.

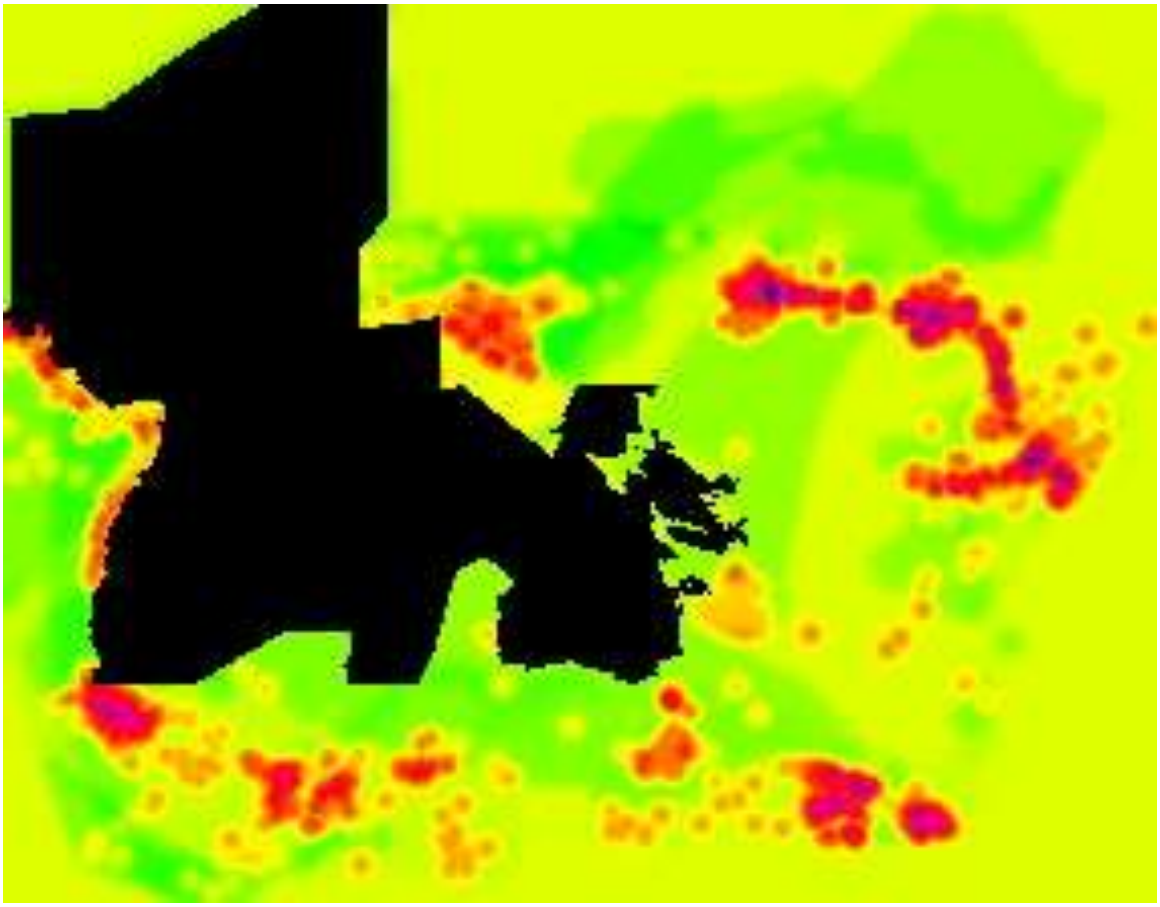
3. Findings

3.1 Pastoral Suitability maps

The multi-criteria evaluation undertaken to define the most optimal areas for pastoral development produced the following suitability map (Figure 9). The results from this map were then converted into a more easily interpreted map (Figure 10). The suitability zones were distinguished on their level of suitability, reflecting the relative suitability. After all the constraints within the landscape were taken into account, pastoral suitability was most influenced by carrying capacity, access to viable ground water and the fallibility of the underlying soil to degrade under heavy use.

Figure 9 shows the Land Use Suitability Map derived for pastoral activity within the MFMP are with the impact of existing arable field location prioritised as a constraints to stop livestock-arable conflict, followed by the constraints of fragile soils defined by the land systems and the constraints of borehole development which might promote over grazing with too high stock densities, then followed by the beneficial factors of carrying capacity, robust soil types, good ground water, surface water and then the constraints of settlements.

Figure 9: Idrisi Land Use Suitability Map derived for pastoral activity within the MFMP area



The Idrisi maps are colour coded to reflect the level of suitability within any area. The black areas are extracted out from the analysis and include all protected areas and WMAs that should not be

considered for pastoral development. Based on the proximity of the other various constraints, their spatial influence and the ranking of their constraint those areas least suitable for pastoral development are defined by dark colours, such as purple, which in Figure 9 identifies many of the arable fields, and especially those arable fields within areas of poor ground water suitability. Those areas most suitable for pastoral development include all the green areas, especially those in the darkest green. These can be found around Gweta, where the carrying capacity to the northeast and southwest is high, while ground water potential is very good. Areas with paler green reflect suitable but less ideal areas for pastoral development.

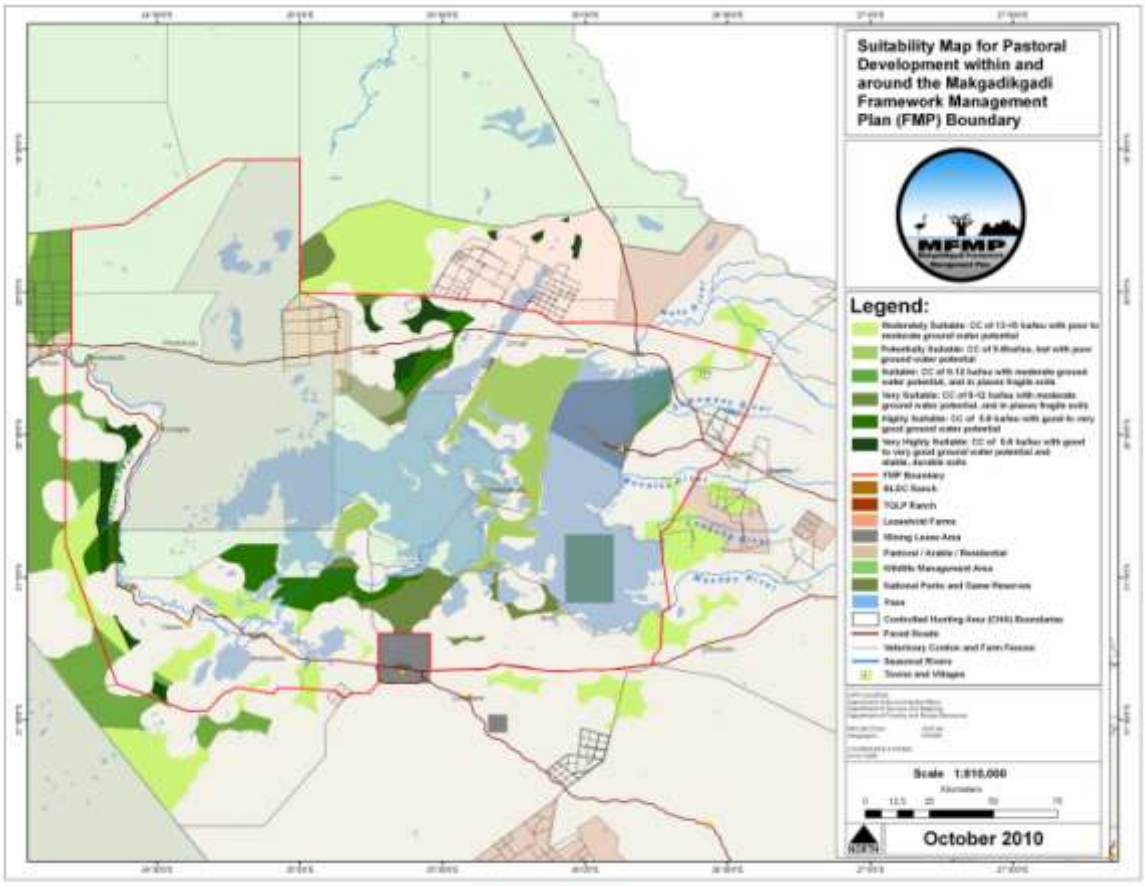
In the refined Figure 10, areas most suitable for pastoral development are more clearly defined and have been ranked into 6 designated zones. The best (very highly suitable) is found around Gweta as reflected in the Idrisi map, with the next most suitable area found to the west of the Boteti River. Here the suitability of the soil with sandy soils on duripan increases the relative suitability, so that the assessment is not just based on cattle productivity but on the sustainability of the development. Large areas available for cattle development lie far to the north of Gweta adjacent to the fenced ranches of CT4, with similarly large expansive areas of pastoral suitability to the west of the Boteti River, again adjacent to the fenced ranches of the Hainaveld ranches. While both these areas would be large enough for an expansion of the fenced component ranching policy, there are still undeveloped and poorly managed fenced ranches elsewhere in the region that could be allocated or have their management improved before more ranches are developed. Of the Nata ranches in CT4, only 60% were defined as being operated as effective fenced ranches, with 32% defined as not being properly fenced and to be operated more similar to a cattlepost, while 8% were not developed at all.

The total area defined as suitable for the sustainable expansion of pastoral activity within the MFMP area comes to 4,111 km^2 of land. Grazing requirements within the MFMP are defined as 23,823km^2, based on the minimum of 16 ha/LSU and the estimated numbers of cattle within the MFMP. Based on the accessible grazing to cattle around each of the boreholes within the region there is a shortage of 3,222km^2 of land for pastoral activity.

Improved land use management within the communal grazing grounds is required. Current cattle densities are unevenly distributed and improved land use planning of borehole development, fenced ranching and livestock densities must be undertaken if rangeland degradation is mitigated.

The defined pastoral land use suitability maps should be used to guide development within the MFMP area over the next 20 years. Whether it be improved communal rangeland management of new fenced component ranches, pastoral expansion should be targeted towards the defined areas. This will reduce arable-livestock and human-wildlife conflicts. Rangeland will also be better maintained for future generations.

Figure 10: Pastoral suitability within the MFMP



3.2 Arable development

Based on soil fertility and access to surface water as the principal factors that enhance arable development within the MFMP, the potential are for development is severely restricted. Figure 11 is the Idrisi map whilst Figure 12 is the refined Idrisi map. There is only 3,482km^2, of this approximately 1,479km^2 is already owned and ploughed for arable development, leaving approximately 2,000km^2 of potential land available for arable development. This land is all within 5km of existing settlements, so that people are able to tender the fields, but not necessarily located close to available surface water, as most farming within the MFMP is dryland, rain fed farming. Irrigation of crops is not undertaken, even using simple mechanical methods in close proximity to flowing rivers, rather a simple Molapo field uses seasonal inundation to assist productivity. It is clear that improved farming practices are required to help increase productivity within the MFMP, due to limited room for spatial expansion of arable development. There are several simple techniques employed by conservation agricultural practitioners as well as simple hand / foot powered irrigation systems.

The Idrisi evaluation highlights the importance of soils with improved fertility. The spatial limitation of these soils is the principal limiting factor for arable development within the region. These are restricted to areas of historic hydrological activity, depositing nutritious sediments, and along existing river systems. The important potential of irrigating fields increases the potential suitability of these river areas even more. Local knowledge has also been taken into consideration, as has the importance of accessing the fields to plough and harvest. Hence the improved importance of areas

close to existing fields and settlements. The Idrisi map does however show the limited potential even of these areas (Figure 11).

To ensure sustainable arable development into the future land use planners must start to integrate the allocation of fields into a more holistic land use planning approach. It is important to consider other aspects than just proximity to settlements. Issues of human wildlife conflict must be taken into consideration. The impact of elephants is increasing within the region. It has been shown in other regions how allocating and developing fields in clusters can help to reduce human-wildlife and arable-livestock conflicts. To develop fields in clusters they should be placed in optimal sites. The soil fertility should be optimal and if possible there should be access to surface water.

Currently, there is little legislation to control the development of unallocated fields. Many people just select a site and are then not penalised for doing so. Improved management and monitoring of field allocation is required if conflict is to be reduced and arable development within the region to be sustainable.

Figure 11: Arable suitability map as defined by the Idrisi evaluation

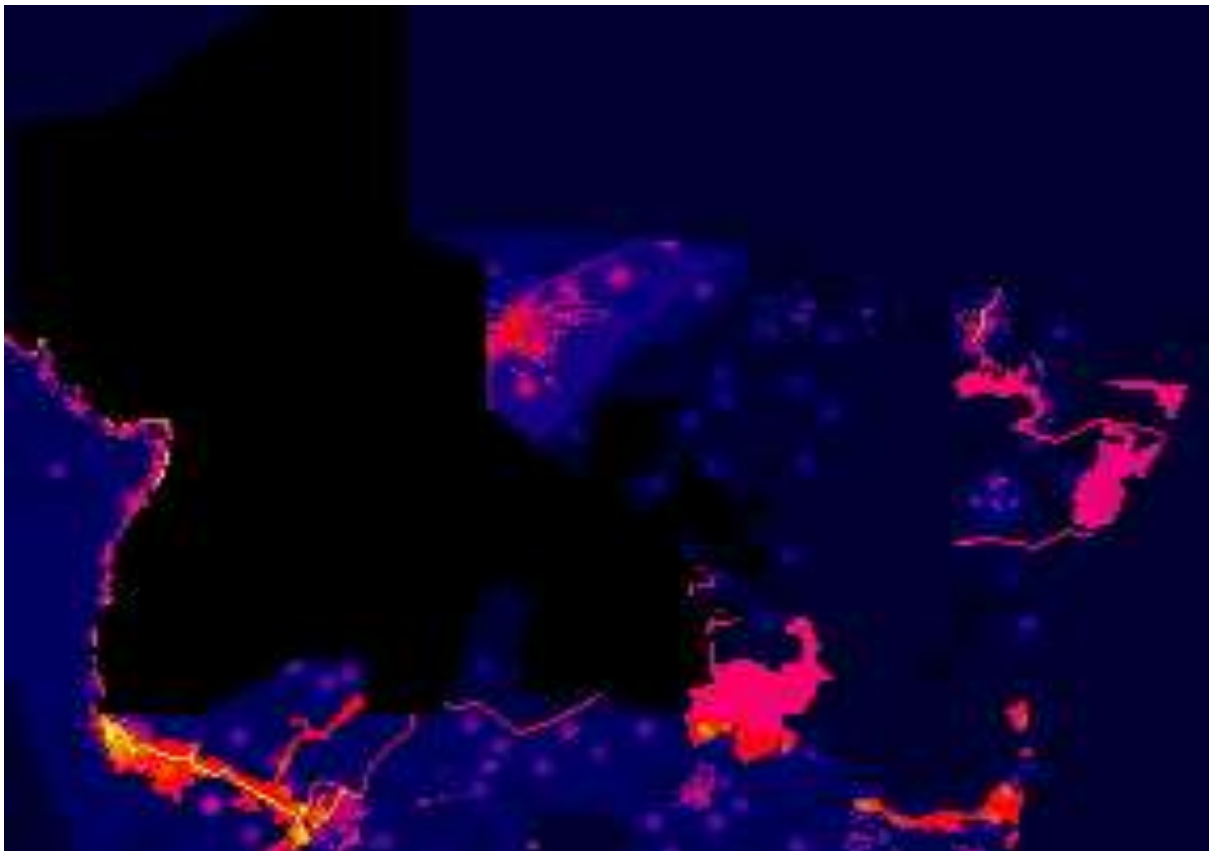
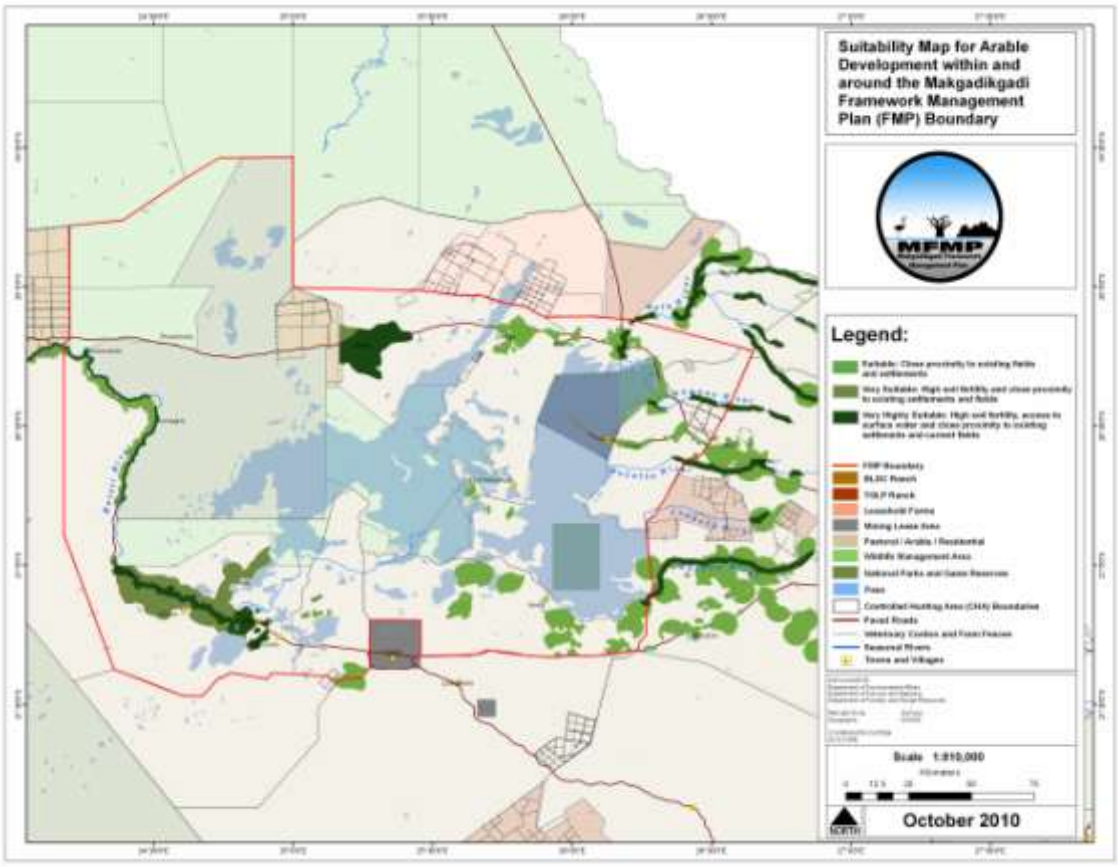


Figure 12 shows the areas suitable for arable development within the MFMP area prioritised according to potential suitability.

Figure 12: Refined map of areas suitable for arable development within the MFMP area



4. References

Brooks, C. 2005 Foraging Behaviour of Plains Zebra (Equus burchelli antiquorum), PhD. University of Bristol. UK

Eastman 1993. Idrisi: A grid based geographic analysis system. Version 4.1, Clark University Graduate School of Geography, Worchester, Massachusets, US

Land Flow Solutions, 2009. Review of the National Land Use Map. Department of Lands, Gaborone

Appendix 1: Existing Land use review

Introduction

This report provides a summary of existing land use plans for the Makgadikgadi region. It was felt critical to take cognisance of existing land use proposals and developments to ensure effective implementation of actions recommended within the Makgadikgadi Framework Management Plan. Land Use Plans have been developed specifically for the Makgadikgadi region since the late 1980s and have raised specific issues of environmental concern regarding natural resource use and resource use conflict, while also proposing issue specific mitigation plans to help reduce these conflicts. Proposals for land use developments within the Makgadikgadi region have also been made in regional and national land use plans, which have again identified conflicts and constraints specific to the Makgadikgadi wetland system.

The land use plan review detailed all of the physical developments and land use planning objectives defined for the area within the Makgadikgadi Framework Management Plan (MFMP) from all of the relevant land use plans since the 1980s, while also detailing all of the development constraints and conflicts categorised under physical issues, natural resource issues, social issues, livestock and arable farming issues and tourism issues. Issue specific mitigation recommendations were then also detailed.

Some of the most important proposed physical developments within the various land use plans include recent proposals for the development of a new dam on the Mosetse River, which may have significant impacts on the hydrology of Sua Pan, upgrading of unpaved-to-paved roads across the region with associated fences for some roads which may affect wildlife movement in the region, the electrification of some villages within the MFMP area, which will improve the livelihoods of people in the region. Other physical developments that have been identified within the review that are not included within any specific management plans but were felt to be of significant importance included the declaration of a new Flamingo Sanctuary in the southern part of CT13 in Sua Pan, as well as proposals by Botash to extend their mining lease area for further extraction of brine within the southern part of Sua Pan.

Key physical planning proposals for the MFMP area include developments to improve the fragmented administrative through new sub-district administrative centres at Nata and Rakops operating under devolved powers from the Central District Council. Land Use management will also be improved through the gazetting of the currently ungazetted WMAs of CT10 and CT11.

Key conflicts and constraints identified for the MFMP area also identify the WMAs of CT10 and CT11 as areas of concern, with limited day-to-day management at the district or local level, with subsequent disputed use of the areas. One of the most important natural resource constraints identified is for ground water resources, especially with planned increases in extraction and the poor management of extracted water is cause for concern with 46% of all developed water resources lost through various forms. Effective and integrated administration across the region is hampered by divided sectoral policies and administrative districts such as Central District and Ngamiland District with further splits along agricultural boundaries and veterinary boundaries amongst others including the education sector and the Police. The result is that the use and management of the region's natural resources are insufficiently coordinated with subsequent exploitation and mismanagement. Indiscriminate extraction and utilisation of resources relates to problems of overgrazing, deforestation, and the over exploitation of firewood resources, river sand, gravel and veldt products. The lack of holistic baseline data on the natural resources within the MFMP further increases the

potential damaging impacts of poor resource management. Areas identified as having significant problems from over exploitation include Rakops and Mopipi where rangeland degradation and desertification is a cause for concern.

Most of the land use plans for the area highlight the problems associated with human-wildlife conflict and the negative consequences for both people and wildlife. Wildlife numbers are declining, while fences erected to reduce the conflict have been associated with historic declines in wildlife numbers. The erection of the Makgadikgadi Pans National Park (MPNP) Fence, while reducing conflict has exposed wildlife to detrimental impacts of fire, while limiting access to riparian woodland and water access points. Major objectives outlined for the wildlife sector that would help mitigate human-wildlife conflict include; implementing chilli pepper strategies, monitoring fences more closely with improved management, while the village of Phuduhudu was recommended to be moved (or the resident livestock) to help reduce human-wildlife conflict within NG49. Some proposals were rejected such as the development of a fence in close proximity to Phuduhudu along the north-western boundary of the MPNP.

The use of natural resources within the MFMP area was defined as not creating optimal benefits for local communities, as such communities are not empowered with appropriate levels of ownership within the region. Many of the plans state the need for improved communal land use management with a need to define a concept between the extremes of open access communal grazing and fenced ranches in exclusive occupation. The MFMP region was stated to be, in the majority, unsuitable for cattle production, with the best grazing around Nata, to the west of the Nata Ranches, east of Sua Pan and south of Mosu, with major threats to grazing stability including overstocking throughout the area and the overlap between livestock and wildlife. Arable constraints identified within the various management plans include saline, sandy soils, extreme wind erosion, low and erratic rainfall and long distances to markets. More baseline information is required on natural resources, especially water resource quality, while a zoning strategy would help manage the extraction of resources. Improved livestock husbandry was also called for to help improve herding and kraaling practices, which would reduce human-wildlife conflict and improve rangeland management. Some proposals also called for more flexible mobile livestock management that can respond to the variable rainfalls in the region, while stating that there has been no evidence to suggest ranching practices are more productive than existing communal practices. To help improve land use and natural resource management further proposals were called for the development of Community Land Management Associations (CLMAs) – similar to current Trusts as an institution responsible for the sustainable use of natural resources for maximising agricultural / livestock production – the Association would be led by an elected board with devolved powers from Land Board with an agreement between each parties about rights and responsibilities with a lease similar to that used by CBOs as a basis of the agreement, which can be developed under the Tribal Land Act, or a new separate Act of Parliament. Livestock development could be expanded in currently under-utilised areas such as the fenced Odiakwe and Makalamabedi BLDC Ranches, which could also be converted to game ranches.

Constraints identified for tourism development in the region include statements suggesting that the 'high-cost; low-volume' tourism strategy within Botswana is too restrictive, limiting potential markets, with recommendations for the strategy to be relaxed in favour of a modified 'high volume-mixed price strategy', and shortage of serviced land with appropriate council services restricting potential development options. The diversification of the tourism industry within the Makgadikgadi was also requested to help improve the distribution of benefits. Recommendations to further improve the tourism sector included developing improved access roads, as well as site museums, site offices, staff accommodation, seating areas and ablutions at defined archaeological / historic and cultural sites, including Chapman's and Baines Baobabs & Nxazini. A new lodge could be built close to the entry gate to Nxai Pan to maximise economic returns for the community, while a

separate entrance gate fee might attract more visitors into the Makgadikgadi Pans and Nxai Pan National Park. Further lodge sites within the National Park would also improve tourism statistics and use of the region. However any tourism development must be associated with appropriate environmental impact assessments.

2. Land Use Plan Review

1 National Development Plan 10

1.1 Land Use Development Goals and Objectives

1.1.1 A Botswana Brand has been developed to promote Botswana on the world stage
1.1.2 Development of Mosetse Dam is to be completed within NDP10, with a capacity of 31.7 MCM and a yield of 7.9 MCM
1.1.3 Ground water resources were also to be investigated within the Boteti region
1.1.4 As water demands in the future will exceed supply, further water resources will be assessed including further dams / well fields and cross border resources
1.1.5 Gazetting ungazetted WMAs – including CT10 & CT11
1.1.6 Mining exploration is encouraged and will continue with potentially good prospects for further diamond, coal and base metal reserves
1.1.7 A feasibility study will be undertaken to assess the development of a new railway line from Mosetse to Kazungula
1.1.8 New fences to be developed include;
  1.1.8.1 Eastern Makgadikgadi
1.1.9 New airstrips / upgrades to be developed at;
  1.1.9.1 Nxai Pan
  1.1.9.2 Xhumaga
  1.1.9.3 Letlhakane
1.1.10 Improved road networks with upgrades of gravel to bitumen include;
  1.1.10.1 Mmatshumo-Mosu
  1.1.10.2 Moreomaoto to the F/town-Maun rd
  1.1.10.3 Xhumo-Kedia
  1.1.10.4 Mokoboxane-Kedia
  1.1.10.5 Rakops-Xere
  1.1.10.6 Letlhakane – Khwee
1.1.11 Settlement roads and associated developments, such as street lighting include;
  1.1.11.1 Letlhakane
  1.1.11.2 Nata
1.1.12 New Road fencing between
  1.1.12.1 Nata-Gweta
  1.1.12.2 Sowa Junction – Sowa Town
  1.1.12.3 Gweta-Makalamabedi
1.1.13 New Bridges for development include;
  1.1.13.1 Lepashe bridge
  1.1.13.2 Sepako river crossing
1.1.14 Development of new government buildings to include;
  1.1.14.1 New vehicle testing station at Letlhakane
  1.1.14.2 Rehabilitation of Tutume senior school
  1.1.14.3 New fire station at Tutume
  1.1.14.4 New council chambers at Tutume & Nata

1.1.14.5 New administrative centres at Rakops & Nata
1.1.14.6 New Service Centres at Motopi / Mosu & Gweta
1.1.14.7 Air quality monitoring station at Sowa
1.1.14.8 New sewerage system in Letlhakane

1.1.15 Electrification of villages at;

1.1.15.1 Kedia, Xhumaga, Toromoja, Mmadikola, Mea, Mokubilo, Xhumo, Xere, Khwee, Mosu, Zoroga, Mmanxotae, Sepako, Moreomaoto, Phuduhudu,

1.2 Land Use and Development Conflicts and Constraints

1.2.1 The 'high-cost; low-volume' tourism strategy within Botswana is too restrictive, limiting potential markets. The strategy should be relaxed in favour of a modified 'high volume-mixed price strategy'

1.2.2 An increase in speculative licences for mining prospecting, with little supervision and enforcement of legislation and enforcement / auditing of activities due to capacity constraints

1.2.3 Some factors that are restricting the development of the agricultural sector include;

1.2.3.1 Only 45% of farmers have access to roads
1.2.3.2 Only 17% of farmers have access to electricity
1.2.3.3 Only 22% of farmers have access to telecommunications
1.2.3.4 Only 64% of farmers have access to water
1.2.3.5 Only 39% of farmers have access to grain storage
1.2.3.6 Only 52% of farmers have access to markets
1.2.3.7 Only 54% of farmers have access to sanitation

1.2.4 The current status of the primary road network is at an unacceptable level

1.2.5 To improve water provision and conservation, a restructuring of water resources management is required. Water resources are currently under the responsibility of the Dept. of Water Affairs, Water Utilities Corporation, Dept. of Geological Surveys, Dept. of Local Government, Local Authorities and the Dept. of Waste Management – there are difficulties coordinating these institutions

1.2.6 The provision of water that meets BOS32;2000 standards is an increasing problem, especially due to high salinity, pollution at source, high operational and maintenance costs of desalination plants

1.2.7 Water requirements will grow with projected population growth increasing constraints on water resources

1.2.8 More focus must be placed on the conservation of current water resources with appropriate planning – it is more cost effective to conserve these resources than develop new ones

1.2.9 46% of developed water resources are lost through various forms per annum (57 MCM), of which 32MCM could be recovered through focused campaigns about water conservation

1.2.10 Constraints in the uptake and use of solar power technology within villages include;

1.2.10.1 High initial capital cost
1.2.10.2 Poor quality of available systems
1.2.10.3 Lack of after sales service

1.2.11 WMAs were not gazetted due to conflict for land with the agricultural sector, necessitating a review of the National Land Use Map

1.2.12 The process of making land available for different land uses is complicated by various factors;

1.2.12.1 Shortage of serviced land
1.2.12.2 Increase in cost of development

1.2.12.3 Encroachment of other uses into agricultural land
1.2.12.4 Illicit sale of land
1.2.12.5 Illegal land occupation
1.2.12.6 Unavailability of land

1.2.13 Some of the environmental constraints encountered during NDP9 include;
1.2.13.1 The implementation of waste management projects was not completed
1.2.13.2 Over-exploitation of forest and range resources
1.2.13.3 Increased bush fires
1.2.13.4 The growth of the elephant population causing increased spatial Human-Wildlife Conflict (HWC).

1.2.14 There has been an increase in the pollution of ground water resources

1.2.15 Only 40% of the population has access to adequate sanitation facilities with poor waste disposal areas

1.2.16 Insufficient information on national vegetation resources has contributed towards the lack of a clearly defined policy direction

1.3 Proposed Mitigation

1.3.1 The Tourism Policy will be reviewed to enable accelerated tourism growth and product diversification to more regions and to enable greater citizen / community participation

1.3.2 Regional and product diversification is central to tourism development strategies

1.3.3 Cultural and heritage tourism must be tapped into

1.3.4 Improved land use planning in areas such as Makgadikgadi and Kgalagadi will encourage greater financial investment

1.3.5 Tourism development plans and guidelines for all key tourism districts will be developed

1.3.6 Environmental scoping must be conducted where tourism land is allocated to ensure coverage of environmental sensitivities

1.3.7 Key strategies by BTO and DoT include
1.3.7.1 Encourage community based sustainable ecotourism
1.3.7.2 Promote the marketing of different products
1.3.7.3 Improved grading
1.3.7.4 Improved licensing

1.3.8 During NDP9 18 lodge sites were selected throughout PAs, it is envisaged that more sites will be availed

1.3.9 More focus on trying to educate farmers about managing agricultural resources such as soil, range and water

1.3.10 Use of waste water as irrigation for crops

1.3.11 Provisioning of fertilisers to farmers

1.3.12 Develop cluster fields with irrigation

1.3.13 Improved road maintenance will occur

1.3.14 Separate water resource management from water service delivery to improve water conservation and overall management (the ongoing water sector reform aims to address this shortfall).

1.3.15 More baseline information is required on water resource quality

1.3.16 To reduce reliance on fuelwood resources the following initiatives have been developed;
1.3.16.1 No more fuelwood to be used by any Government institutions (it was estimated that 57% of all schools were still reliant on fuelwood)
1.3.16.2 Incorporate fuelwood management into community-based management of resources

1.3.17 Improved enforcement of the Agricultural Resources Conservation Regulations (2006) is required

1.3.18 Improved use of solar power is required
1.3.19 The government will encourage private sector involvement in the servicing of land
1.3.20 Land Banks to reserve land for future use
1.3.21 Improved land use planning, with new settlement plans, district land use plans
1.3.22 Computerisation of all land tenure
1.3.23 During NDP9 the natural resource base has declined due to inadequate coordination, enforcement and management of natural resources
1.3.24 Mitigation for some environmental constraints include;
  1.3.24.1 New strategies for waste management, with public buy-in of services
  1.3.24.2 Conduct a forest and range resources inventory
  1.3.24.3 Improve wildlife management practices to confine wildlife to PAs and WMAs to reduce conflict
  1.3.24.4 Implementation of the CBNRM Policy to enhance conservation of resources through empowerment
1.3.25 The maintenance of firebreaks has been privatised to improve fire management
1.3.26 Improved understanding of the impacts of climate change is required
1.3.27 Increase in planting of indigenous trees is required
1.3.28 National Monuments and heritage sites must be developed to enable them to be fully appreciated and recognised
1.3.29 Improved access roads as well as site museums, site offices, staff accommodation, seating areas and ablutions are required at these sites. This includes Chapmans and Baines Baobabs & Nxazini, which have been earmarked for development.
1.3.30 A range of information technology systems are required to help improvement management such as;
  1.3.30.1 Integrated Pollution and Waste Management System
  1.3.30.2 Environmental Information System
  1.3.30.3 Management of Tourism Satellite Account
  1.3.30.4 Integrated Vegetation Information Management System
  1.3.30.5 Integrated Wildlife Management System
  1.3.30.6 Integrated Geographic Information System
  1.3.30.7 Integrated Meteorological System
1.3.31 There is a need for stakeholders to integrate activities of Multilateral Environmental Agreements into their strategies
1.3.32 National Forest and Rangeland Inventory will be developed
1.3.33 Development of management strategies for the control of alien invasive species
1.3.34 Review and Consolidation of the Forestry Act and the development of a fire management strategy
1.3.35 Develop and implement a Climate Change Policy
1.3.36 Develop and Implement the Dryland and Ecosystems Strategy
1.3.37 Develop and Implement the Wetlands Policy
1.3.38 Review and Consolidate the Waste Management, Pollution and Prevention Act
1.3.39 Monitor the implementation of the BSAP
1.3.40 Undertake economic evaluation of natural resources
1.3.41 Develop and Implement the Natural Resources Accounts
1.3.42 Develop and Implement Ecosystem (dry and wet) Management Guidelines and Procedures for Land Use Planning
1.3.43 Development of Multi-lateral Environmental Agreements Implementation Strategy

1.4 Other interesting facts for cross component integration

1.4.1 Beef exports have still not reached the EU Cotonou Agreement quota of 18,916 tonnes / annum, with on average 60% production, with livestock production affected by price / persistent FMD outbreaks and other trans-boundary diseases

1.4.2 Crop production is also down due to small farm size, inadequate water supply, recurring drought, poor drainage, poor soil and crop management and pests

1.4.3 Mining production since 2002

- Diamonds,'000s of Carats; 2002: 28,368 – 2007:33,636
- Ni/Cu, tonnes: 2002: 56,626 – 2007: 53,947
- Coal, tonnes; 2002: 954,081 – 2007: 828,164
- Soda Ash, tonnes; 2002: 283,197 – 2007: 279,625
- Salt; tonnes; 2002: 315,259 – 2007: 165,710
- Gold, kgs; 2002: 8 – 2007: 2,722

1.4.4 Copper production capacity at Duki = 300,000 tonnes per annum

1.4.5 Diamond production at Damtshaa = 500,000 Carats per annum

1.4.6 Botswana receives over 3,200 hrs of sunshine per year with an average isolation of 21MJ/m^2 – this is one of the highest in the world

2 Central District Development Plan, 2009

2.1 Land Use Development Goals and Objectives

2.1.1 New sub-district administrative centres planned for the FMP area at Nata and Rakops, as villages within Central District with a population of over 25,000. They will operate under devolved and delegated powers from the district council.

2.1.2 Potential new mines in the area include diamonds at Letlhakane (AK 06).

2.1.3 Primary hospital facilities are to be upgraded in the Boteti area (Rakops), with a new hospital to be built.

2.1.4 More government staff houses at Mosu, Xhumo, Rakops and Xhumaga are also to be built.

2.1.5 A new junior secondary school is to be built at Nata.

2.1.6 Improved DWNP facilities and infrastructure is to be built in Gweta, with a new operational base and a new station in Nata.

2.1.7 The rural electrification program will provide Photo-voltaic solar power to the following villages within the IMP / FMP area;

2.1.7.1 Kedia
2.1.7.2 Manxotae
2.1.7.3 Sepako

2.1.8 The following villages are to be connected to the national grid with electricity pylons being constructed;

2.1.8.1 Moreomaoto
2.1.8.2 Xhumaga

2.1.9 A central sewerage system is to be developed and installed for Letlhakane and Gweta

2.1.10 All villages with a population of more than 150 are to be supplied with council water

2.1.11 The following villages will be connected to the national phone network;

2.1.11.1 Lepashe
2.1.11.2 Kedia
2.1.11.3 Moreomaoto
2.1.11.4 Phuduhudu

2.1.11.5 Mmanxotae
2.1.11.6 Mmatshumo
2.1.11.7 Sepako
2.1.11.8 Mokubilo

2.2 Land Use and Development Conflicts and Constraints

2.2.1 There is a poor road network with a predominance of poor gravel roads
2.2.2 There is a mushrooming of illegal settlements
2.2.3 Development problems in the district include;
2.2.3.1 Shortage of serviced land, i.e. land with appropriate council services. This restricts potential development options, such as tourism or other SMMEs.
2.2.3.2 There is a slow response from Land Boards over allocation, slowing down development periods
2.2.3.3 Many of the Government departments are not aligned with district boundaries creating a problem of un-coordinated services, especially within the departments of Animal Health and Production / Crop Production / Primary and Secondary Education and the Police
2.2.3.4 There is indiscriminate extraction and utilisation of resources with problems of overgrazing, deforestation, over exploitation of firewood resources, river sand, gravel and veldt products
2.2.4 CT11 was identified as an area with significant land use degradation, with the main cause relating to cattlepost development within the WMA, with self-allocation of boreholes and water points due to a lack of control.
2.2.5 Both CT10 and CT11, as state land were highlighted as areas of concern, as there is no day-to-day management at district level, with subsequent illegal usage. Studies should be undertaken to look at the tribalisation of the land to augment shortage of land in other areas.
2.2.6 There is no district settlement strategy increasing problems of planning.
2.2.7 Land for future village development and expansion must be identified, with management plans developed to enable optimal land use.
2.2.8 Reliance upon depleting ground water resources is seen as a cause for concern, with the potential for increased extraction with an increasing population.
2.2.9 The population in the area is expected to increase by 15% over the last 10 years from 2001.
2.2.10 Areas within the district with significant evidence of desertification include the Rakops area, with projects such as the indigenous vegetation project in Mopipi expanded to tackle such problems.
2.2.11 A major concern throughout the district is the development of illegal burrow pits and the lack of rehabilitation of old and illegal new burrow pits, with sand and gravel extraction from river beds also a concern.
2.2.12 There is no central district waste management strategy, exacerbating problems of solid and liquid waste pollution.
2.2.13 There is no baseline data set for natural resources within the district, which is required to help monitor and asses the impacts from development and resource exploitation.
2.2.14 There are significant water shortage problems across the district, especially in the Boteti and Tutume sub-districts.
2.2.15 Water conflict is evident with many people refusing for boreholes to be developed on farmland
2.2.16 Water restrictions impede development in the area, including the development of tourism opportunities and other SMMEs

2.2.17 There are some concerns over the increasing development of communications antennae, especially as they serve as a distinct eye-sore across many parts of the MWS. Their development must be monitored and regulated through EIAs

2.3 Proposed Mitigation

2.3.1 To tackle environmental issues key policy implementation includes the National Policy on Agricultural Development and the Central District Integrated Management Plan.

2.3.2 Zones / areas for natural resource use and extraction must be demarcated with guidelines on amounts that can be extracted and licences for extraction

2.3.3 Major objectives outlined for the wildlife sector include;

- 2.3.3.1 Implementing chilli pepper mitigation strategies for elephants
- 2.3.3.2 Monitor fence problems around MWS
- 2.3.3.3 Reduce over-hunting due to the abuse of licences
- 2.3.3.4 Reduce the killing of problems animals by at least 10%
- 2.3.3.5 Promote wildlife awareness issues in all villages
- 2.3.3.6 Mobilise communities to become more involved in CBNRM ventures
- 2.3.3.7 Provide appropriate training for communities in financial management, business skills and ethics
- 2.3.3.8 Improved PAC practices
- 2.3.3.9 Improve the use of game farming as a land use strategy

2.3.4 One of the development goals of the plan is to implement the NADP, especially the fencing component, with an aim to promoting the sustainable use of resources, other goals and recommendations to improve the sustainable use of resources include.

- 2.3.4.1 Establish regulations and rules for the harvesting of natural resources such as mophane, firewood, sand and gravel
- 2.3.4.2 The sustainable use of firewood resources must be promoted as the over use of this resource is leading to significant deforestation and land degradation
- 2.3.4.3 Enforce penalties for over collection of resources
- 2.3.4.4 Develop guidelines on use of sewage effluent
- 2.3.4.5 Build appropriate incinerators
- 2.3.4.6 Protect underground water resources with regulation
- 2.3.4.7 Ensure all burrow pits are rehabilitated through effective audits
- 2.3.4.8 Introduce alternative waste disposal facilities, while applying the user pays principle

2.3.5 More work must be done to continue to teach farmers about appropriate use of chemicals and fertilisers to enhance crop production and reduce the impact of pests. Safe disposal of these chemicals and old containers must also occur

2.3.6 Several block ranches were demarcated for individuals and syndicates as a means of optimising land use and preventing land use degradation. More areas should be assessed by the ministry for the demarcation of ranches and the development of dams for irrigation and livestock watering.

2.3.7 Many boreholes are also saline with a need for desalination plants to be developed in villages across the region

2.4 Other interesting facts for cross component integration

2.4.1 Mining activities within the area include Orapa / Letlhakane & Damtshaa Diamond Mines, a quarry at Xhumo and a copper mine at Dukwi.

2.4.2 There is a prevalence of selling un-inspected meat due to a lack of slaughter houses within the area, although a new slaughterhouse has been planned for Gweta

3 Review of the National Land Use Map, 2009

3.1 Land Use Development Goals and Objectives

3.1.1 This project highlights the need to carefully examine alternative land-based livelihood options through research on alternative options and via community engagement.

3.1.2 To ensure sustainable and optimal land utilisation, it becomes necessary in some cases to propose a discontinuation of a particular land use with a view of achieving positive results such as reducing land use conflicts, realising optimal land utilisation and conservation of critical natural resources.

3.1.3 In zoning land for different land uses, it is important to identify and preserve land suitable for crop production.

3.1.4 The land use of NG49 should remain designated as a community managed consumptive wildlife area, as this will maximise potential for economic returns for the community.

3.2 Land Use and Development Conflicts and Constraints

3.2.1 A veterinary cordon / conflict fence has been mooted along the southern boundary of NG49, to run along the main tarmac road from Makalamabedi, past Phuduhudu to the south-western corner of Nxai Pan National Park

3.2.2 Tawana Land Board made the following comments in response to the Review of the National Land Use Map - We need more communal land around Phuduhudu and Mababe as these people are in serious need of land. (*Response from consultants = No possibilities for expansion were identified in this study*)

3.2.3 Wildlife conflict is evident around the boundaries of the CKGR

3.2.4 The current alignment of fences around the CKGR and the Makgadikgadi Pans NP restricts historic migratory movement

3.2.5 CT8 and CT21 are designated as pastoral arable. Water availability has enabled cattle production to expand up to the boundary of the CKGR. Cattle ranches have been designated within CT20, some of which are being utilised as mixed cattle – wildlife.

3.2.6 There is a need to improve the management of communal areas within Botswana with a need to define a concept between the extremes of open access communal grazing and fenced ranches in exclusive occupation

3.3 Proposed Mitigation

3.3.1 Fencing the southern boundary of NG49 would serve no economically justifiable purpose, and would cut off a critically important wildlife migration. The Phuduhudu community has alternative viable opportunities than reliance on subsistence-level livestock production to make economic returns from both consumptive and non-consumptive use of wildlife within this CHA. This fence would cut off the zebra migration, and would do little to separate wildlife from the Phuduhudu cattle population as extensive wildlife numbers occur to the north of the village. The proposal is considered to be economically and technically non-viable due the gazettement of the area as part of the internationally recognised Makgadikgadi Pans Ramsar Wetland. The cost of the fencing, plus the cost of constant maintenance and upkeep would negate the benefits of the fence to the owners of the very few livestock kept within NG49.

3.3.2 A new lodge could be built close to the entry gate to Nxai Pan to maximise economic returns for the community.

3.3.3 The Phuduhudu cattle herd should be relocated and the community given land to use within the Makalamabedi BLDC Ranches, or within the Fencing Component Ranches to the west of Makalamabedi and south of the Boteti River.

3.3.4 The area close to the CKGR boundary is not utilised by communities to a high extent at present and re-designating land as game ranches would have a limited negative effect. Game ranches would serve as a viable buffer to cattle as cattle populations increase in the future within this region and reduce the potential for human-wildlife conflict that is evident in other areas around the CKGR.

3.3.5 A land use policy to promote the development of game farms would help to serve as a wildlife / cattle buffer on the eastern side of the CKGR. All farms should be conservancies; amalgamations of several individually owned areas under one management. Each conservancy should be approximately 200km^2 in size of 4 farms, each of 50km^2.

3.3.6 Linking the two conservation zones of Makgadikgadi and CKGR would be of significant long-term benefit to wildlife populations within Botswana, providing genetic linkage and access to water and grazing to help survive prolonged droughts. The corridor would become an important wildlife area that could be used to maximise economic returns for local communities. Livestock grazing is restricted by access to water in the northern part of CT8 and designating this area for wildlife would not negatively affect overall cattle productivity for the region.

3.3.7 Develop Community Land Management Associations (CLMAs) – similar to current Trusts as an institution responsible for the sustainable use of natural resources for maximising agricultural / livestock production – the Association should be led by an elected board with devolved powers from Land Board with an agreement between each parties about rights and responsibilities with a lease similar to that used by CBOs used as a basis of the agreement, which can be developed under the Tribal Land Act, or a new separate Act of Parliament.

3.3.8 The most relevant Policy in Botswana at present is the Revised National Policy for Rural Development (2002), where the proposed CLMAs will try to uphold the objectives of the Policy;

- 3.3.8.1 promotion of communal livestock production
- 3.3.8.2 maintain the subsistence role of livestock in clearly designated communal areas
- 3.3.8.3 fencing of community managed zones around settlements
- 3.3.8.4 protect village (20km radius) exclusion zones from further commercial fencing
- 3.3.8.5 introduce improved management systems for communal land grazing and ranching
- 3.3.8.6 preserve livestock grazing by controlling overgrazing and degradation

3.4 Other interesting facts for cross component integration

3.4.1 Ministry of Agriculture is currently conducting a mapping exercise of land suitable for arable farming in Botswana.

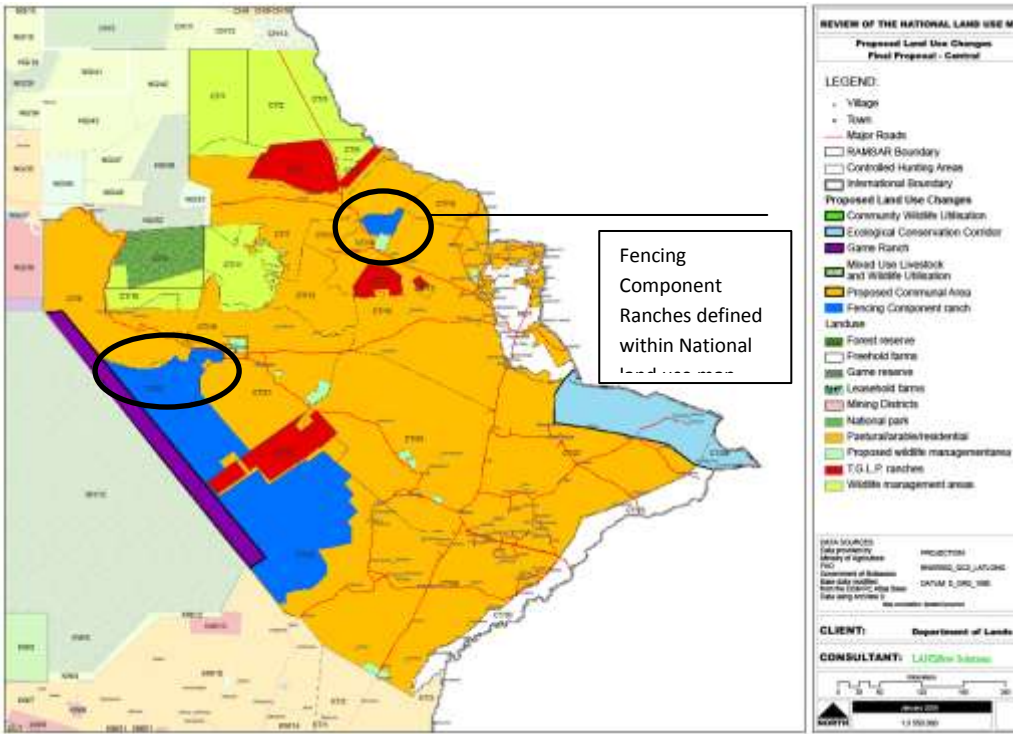
3.4.2 The conclusion from the Botswana Biodiversity Strategy 2004 document is that for successful and cost effective reduction and elimination of threats to biodiversity, inventories of threats and mitigation plans need to be brought down to the district level.

3.4.3 Some districts were identified by the *Feasibility Study for Bio-fuel Production in Botswana, Ministry of Minerals Energy and Water Affairs- 2007,* as having suitable agricultural land for the production of bio-diesel crops. The report identifies some 26m

hectares, in Central, Chobe, Ngamiland and Ghanzi Districts as being suitable for jatropha.

3.4.4 Available climate change projections indicate that on average, temperatures will rise by 1-3°C by around 2050 while future trends in rainfall will see a decrease of 10% to 25% in some parts of the country and an increase of approximately 10% in other areas. These changes in the physical environment are expected to have an effect on agricultural production, ecosystems, wildlife, tourism etc.

3.4.5 The Review of the National Land Use Map details 'Fencing Component Ranches' within the FMP boundary area



3.4.6 The Plan details old reports from the 1980s drafted to assess the problems of communal grazing (*Brown, C The Institutions Research Project Summary of National Resource Management Issues Applied Research Unit Ministry of Local Government and Lands 1983*) and (*Government of Botswana, The Management of Communal Grazing in Botswana, Ramatlabama Ranch Management Centre 1981*)

3.4.7 The reports detail the following benefits of lack of from some of the proposed forms of mitigation used to reduce conflict within communal lands;

3.4.7.1 Drift fence groups were quite effective and successful (60%) means of managing cattle (and small stock) movement.

3.4.7.2 Farmers committees were largely ineffective (80%) due to lack of purpose and top-down imposition.

3.4.7.3 Dam groups were half effective.

3.4.7.4 Borehole syndicates were unfair with large and small herders paying a flat fee contribution to costs.

3.4.7.5 Livestock management groups were half effective - the general purpose was for stock health management through removal of parasites.

3.4.7.6 Overall it was noted that cooperative efforts initiated from within the community were far more successful than those from outside. A perception of need, understanding of risks involved, ability to mobilise people,

expectation of good beneficial return in relation to costs, modest ambitions, ability to see and follow existing models were all noted as criteria present in success.

3.4.7.7 The continuing use and relevance of community-based decision-making through the kgotla, with involvement of chief and land overseer was seen as important for incorporation of local knowledge. This would gain community acceptance in a way difficult for a district land board to achieve through spaced and relatively short visits.

4 Ngamiland District Integrated Land Use Plan, 2009

4.1 Land Use Development Goals and Objectives

4.1.1 Village development plans are required for all settlements within WMAs to help regulate expansion and mitigate potential conflict with wildlife / land & resource use conflict

4.1.2 Land Use management objectives of the integrated land use plan include;

4.1.2.1 Decentralise land resources management to the level of the community, and in the process, build capacities among community members and structures, as well as at the TLB and Sub Land Boards;

4.1.2.2 Maintain the ecosystem integrity of the study District

4.1.2.3 Conserve, preserve and prevent irreversible damage to the resource base of the District, and conserve and sustainably utilise agricultural land;

4.1.2.4 Recognise and accommodate relevant local resource management practices in the formulation of a land resources management plan for the District;

4.1.2.5 Sustainably utilise and conserve areas identified as having a high capability for tourism and recreational use;

4.1.2.6 Consider the livelihood strategies of communities in recommending guidelines for natural resources utilisation and the zoning of land;

4.1.2.7 Preserve the biodiversity of the District.

4.1.2.8 Ensure that multi sectoral uses and interests are addressed by adopting an integrated approach.

4.1.2.9 Ensure that cultural and archaeological sites are preserved. This will mean working concertedly with local communities to continuously locate and preserve places of historical and archaeological importance.

4.2 Land Use and Development Conflicts and Constraints

4.2.1 Poor coordination amongst government departments in the management of land and natural resources

4.2.2 Tourism benefits and activity are confined within the WMAs and PAs of the Ramsar site – diversification of the industry is required

4.2.3 Communities, while custodians of the natural resources within community leased areas are not empowered with ownership of the resources and therefore lack the will and desire for effective management

4.2.4 Wildlife conflict with people and livestock is prevalent throughout the district

4.2.5 There are very few places within the district suitable for crop production

4.2.6 A veterinary cordon / conflict fence has been mooted along the southern boundary of NG49, to run along the main tarmac road from Makalamabedi, past Phuduhudu to the south-western corner of Nxai Pan National Park

4.3 Proposed Mitigation

4.3.1 Improved multi-departmental collaboration is required to ensure sound environmental management objectives are upheld

4.3.2 Need to develop an improved marketing strategy to help diversify the tourism market out of the current confines of the Ramsar site to help with the economic development and conservation of areas such as Nxai Pan

4.3.3 Private land owners should be given land user rights over wildlife and game farmers should be encouraged to form large conservancies and work together to ensure success of the strategy

4.3.4 There is a need to improve cattle husbandry to help reduce conflict with wildlife with improved herding and kraal design. This must be combined with improved benefits to the communities from the use of wildlife

4.3.5 Fencing the southern boundary of NG49 would serve no economically justifiable purpose, and would cut off a critically important wildlife migration and would do little to separate wildlife from the Phuduhudu cattle population as extensive wildlife numbers occur to the north of the village. Effective means to sustainably address livestock farmers concerns of insufficient grazing land in communal areas requires an approach that goes beyond the spatial expansion of communal grazing areas.

4.3.6 Although proposals have been made during consultations to realign some boundaries of WMA's to expand communal areas, it has to be stated that conflict between competing land uses in the future cannot be resolved by continuously extending boundaries of one land use at the expense of the other. Prudent management of land use practices become fundamental to ensure sustainability of competing land uses.

4.3.7 Various approaches are possible, including the creation of sub-committees delegated to work in particular locations, and the development of community-based land management structures. These may have one of two primary objectives, for environmental protection, or for production, or a combination of both.

4.3.8 The Plan advises the implementation of the Agricultural White Paper no 1 (1991) that recommends the concept of communal land management under the following guidelines;

4.3.8.1 Preparation of detailed land use and management plans for the areas

4.3.8.2 Permanent agricultural extension teams will be attached to each group of communities

4.3.8.3 The community will be assisted where necessary with water development

4.3.8.4 The community will be assisted in fence development

4.3.8.5 Mobile artificial insemination teams will be dispatched to community fenced areas

4.3.8.6 Services and technical assistance in range management and rehabilitation through provision of seed and trees essential for prevention of soil erosion will be provided

4.3.8.7 Farming cooperatives will be encouraged to provide necessary inputs and marketing services.

5 Central District Integrated Land Use Plan, 2001

5.1 *Land Use Development Goals and Objectives*

5.1.1 Proposals for tribalisation of state lands in CT11 and the state lands north of Gweta

5.1.2 Upgrade Rakops-Makalamabedi road

5.1.3 Include BOT5 in the larger recreational complex of BOT10 and BOT6 by fencing east of the southern boundary of the NP and relocating existing cordon fence eastward.

5.1.4 TUT 1 is well suited to rainfed arable farming, including non-traditional crops, a change from the current communal grazing could be considered
5.1.5 Tutume – use of fencing to increase stocking rates
5.1.6 Potential to develop agro-forestry projects, especially in BOB6 and TUT11.
5.1.7 Conversion of fenced ranches (TUT 7) in Nata state lands to WMAs
5.1.8 Relocation of vet fence in TUT7 to south of the proposed TGLP ranches, to allow the community to benefit from the presence of wildlife (Zibanana Pan).
5.1.9 Increased development of joint management structure around Sua Pan to allow community to exploit the economic potential of tourism.

5.2 Land Use and Development Conflicts and Constraints

General

5.2.1 Conflict between grazing and wildlife along Boteti River
5.2.2 Conflict between stateland in CT10 north of Rakops and the desire for grazing rights. Lack of resolution has led to the creation of illegal boreholes and wells.
5.2.3 Conflict of land-use in CT5. There are proposal to triabalise the state land in CT5 to control illegal self-allocation, however the communities in the area have proposed that the veterinary cordon fence is moved to allow wildlife to access Zibanana Pan where they could develop community-based wildlife projects

Boteti

5.2.4 Multiple use putting pressure on the small area of better quality land in the district
5.2.5 Movement of people and cattle to near the boundaries of the NP, compounded by the area being state land and therefore ruling out any possible co-operative control between sub-land board and the community.
5.2.6 Loss of community access to veld products and communal grazing to fenced ranches
5.2.7 State land versus tribal land – tribal land allows communities more influence in management/land-use decisions and benefit from the area.

5.3 Proposed Mitigation

5.3.10 A fence to be built along the Boteti River to mitigate human-wildlife conflict.
5.3.11 Tribalisation of CT10 to allow more control by Land board.
5.3.12 Western portion of CT5 could be tribalised.
5.3.13 Fence in CT5 to be moved to maintain the quarantine camp in the middle of the area but allow the creation of a wildlife zone in the east.
5.3.14 Environmental impact studies and detailed agricultural land-use planning in co-operation with the community is required to identify highly suitable areas for arable development and pastoral development
5.3.15 Fencing of the NP boundary or/ creation of fenced ranches as a buffer to stop on-going development of more conflict along park boundaries with encroachment of people, or/ the development of community based tourism initiatives.
5.3.16 Convert all of CT10 into tribal status, enabling involvement of the community in management decision-making.

6 Proposed Land Use Plan for the Ngamiland Statelands, 1987

6.2 Land Use Development Goals and Objectives

6.2.1 Joining of Makgadikgadi Pans National Park (MPNP) and Nxai Pan National Park (NPNP)

6.3 Land Use and Development Conflicts and Constraints

6.3.1 There is a low probability of locating good ground water resources

6.3.2 Low potential carrying capacities in the region

6.3.3 Extensive seasonal movement of wildlife (zebra / wildebeest / elephant) causing conflict with people

6.3.4 Limited tourism base

6.3.5 The location of Phuduhudu exacerbates conflict in the region

6.3.6 Cattle movement into the Makgadikgadi Pans National Park (MPNP) from the Boteti River, leading to a change in plant community and bush encroachment, with evidence of over grazing in the Phuduhudu area. The combined effects have reduced carrying capacity in the region

6.3.7 Overgrazing by cattle and zebra close to the Boteti River forces zebra to graze up to 40km from the riverbed, with an estimated 7000 zebra carcasses found in the first 6 months of the year between Xhumaga and Phuduhudu

6.3.8 Buffalo herd of 60+ causing crop damage along the Boteti River

6.3.9 Large numbers of cattle moving east from stateland into the MPNP

6.3.10 The population of Phuduhudu is growing, with increasing cattle numbers and subsequent conflict and over-grazing (in 1987 there were 274 people with 627 cattle, while early district records state that only 400 cattle were permitted in the region, while *mafisa* cattle must be removed).

6.3.11 There are illegal settlements of people moving into the CT11 area, which has been zoned for communal grazing, but with no permissible boreholes or cattle posts

6.4 Proposed Mitigation

6.4.1 Stocking rates in the region are too high. They must be decreased to between 10-25ha / LSU

6.4.2 The Phuduhudu community should not be resettled to solve conflict issues, but a settlement plan and grazing regulations are required, while no influx of people into the community should be permitted to reduce pop. Growth

6.4.3 Remove all mafisa cattle from Phuduhudu, while limiting cattle numbers at Phuduhudu to 400

6.4.4 The strip of CT11 that runs adjacent to the MPNP should be formed into a buffer zone to reduce conflict in the area

6.4.5 The Nxai Pan NP and MPNP should be joined

6.4.6 The currently fenced ranches of the Odiakwe and Makalamabedi BLDC could be converted to game ranches

6.5 Other interesting facts for cross component integration

6.5.1 Zebra population recorded to have declined by 65,000 in under 10 years, from 100,000 in 1979 (CWARAP, 1980) to 60,000 in 1982 (DWNP & Melton, 1982) and down to 34,000 in 1987 (DWNP, 1987)

6.5.2 Wildebeest population also declined over same period by 40,000 from 52,000 in 1979 (CWARAP, 1980) to 24,000 in 1982 (DWNP & Melton, 1982) and down to 12,000 in 1987 (DWNP, 1987)
6.5.3 Roan, which were recorded in the Makgadikgadi Pans are no longer found in the region
6.5.4 Eland found less than previously in the region
6.5.5 The BLDC ranch at Odiakwe (C.C. of 10ha/ LSU) has proved resilient to drought and high grazing intensity
6.5.6 The Makalamabedi BLDC ranch is not resilient to drought and over-grazing, with supplementary feed required for cattle
6.5.7 Experimental fenced ranch areas in the Motopi area are not self-sufficient. The area is not resilient to drought and grazing with supplementary feed required for cattle.
6.5.8 The best grazing in the region is in the bushman pits area, but fencing the region for cattle would be disastrous for wildlife

7 Proposed Land Use Plan for the Makgadikgadi Region, 1989

7.2 Land Use Development Goals and Objectives

7.2.1 Proposed land use objectives for the area are primarily forms of mitigation to reduce conflict and are detailed in the relevant section below.

7.3 Land Use and Development Conflicts and Constraints

7.3.1 The whole of the Makgadikgadi region has suffered from over-grazing for many years.
7.3.2 During dry cycles all available sward is removed in close proximity to water sources, causing grass species communities to be detrimentally affected and an increase in less palatable grasses and unpalatable forbs is common.
7.3.3 The majority of the area is unsuitable for cattle production, with the best grazing found around Nata, west of the Nata state ranches, east of Sua Pan and south of Mosu / Mmatshumo
7.3.4 Most serious threats to grazing stability are as follows;
- 7.3.4.1 Overstocking throughout the area
- 7.3.4.2 Livestock use of pioneer grasses
- 7.3.4.3 Overlap between wildlife and cattle in the WMAs

7.3.5 Unless something is done the carrying capacity of the region will continue to decline, while the area will continue to be susceptible to the impacts of drought.
7.3.6 Droughts in the 70s caused the population of cattle in the region to decline from 75,000 to 60,000
7.3.7 There is a significant problem of non-resident cattle owners in the region with up to 70% of cattle owners being non-resident.
7.3.8 Main conflicts for cattle farmers are as follows;
- 7.3.8.1 Wildlife kills livestock – 36%
- 7.3.8.2 Drought – 17%
- 7.3.8.3 Livestock diseases- 11%
- 7.3.8.4 Poor grazing – 8%
- 7.3.8.5 Water shortages – 14%

7.3.9 Main problems for arable farmers are as follows;
- 7.3.9.1 Weeds, pests & birds – 39%
- 7.3.9.2 Livestock destroys crops – 36%
- 7.3.9.3 Wildlife destroys crops – 23%
- 7.3.9.4 Shortage of labour – 19%

7.3.9.5 Lack of draft power – 19%

7.3.10 Region conflicts are as follows;

7.3.10.1 NATA

- Wildlife killing livestock
- Livestock destroying crops
- Wildlife destroying crops
- Arable encroachment into grazing areas
- Grazing competition between wildlife and livestock
- Expansion and development of settlements into grazing areas
- Development of fields in statelands near Sepako
- Cattle encroachment into statelands

7.3.10.2 GWETA

- Livestock destroying crops
- Wildlife destroying crops
- Statelands (CT11) excluding use for grazing
- Poor alignment of MPNP boundary

7.3.10.3 XHUMAGA

- Wildlife killing livestock
- Wildlife destroying crops

7.3.10.4 MMATSHUMO

- Livestock vs arable at Mmakgama

7.3.11 Critical areas identified within the region are as follows;

7.3.11.1 Pan fringes – over grazing

7.3.11.2 CT11 and CT10 – over grazing

7.3.11.3 Mosu escarpment – gully erosion

7.3.11.4 Thabatsakudu – over grazing

7.4 Proposed Mitigation

7.4.1 More effective fencing of arable fields from livestock and wildlife

7.4.2 More drift fences in Mmatshumo area

7.4.3 More clear demarcation of arable and pastoral areas with proper zoning of dry land areas

7.4.4 Improved social services for rural areas

7.4.5 Conserve the pan surface as a WMA, or some other form of protection as they are unsuited to WMA status in a commercial sense

7.5 Other interesting facts for cross component integration

7.5.1 Potential tourism sites include;

7.5.1.1 Kuku and little kubu

7.5.1.2 Tchaeitche

7.5.1.3 Gutsha pan

7.5.1.4 Greens baobab

7.5.1.5 Chapmans Baobab

7.5.1.6 Dunes covered with Hoodi plants near Thabatskudu

7.5.2 Carrying capacity of Nata rangelands is 12 ha / LSU

7.5.3 Black cotton soils of the region; has high crop production potential, but is rapidly denuded by cattle and faces water and wind erosion due to over grazing and trampling by cattle (C.C. of 20-30 ha / LSU)

7.5.4 Riparian woodland in East; suffers from extensive over grazing, with subsequent change in plant community with increased legumes (C.C. of 20 ha / LSU)

7.5.5 Riparian woodland west; is more resilient to trampling etc due to coarse sands, with high biomass (1800kg-4000kg ha) but has high bush encroachment problems (C.C. of 15-20 ha / LSU)
7.5.6 Salt pan grasses; very prone to wind erosion and has poor grazing conditions with low grass biomass (300kg/ha) – is unsuitable for year round cattle grazing and potential for complete loss of all grass cover in drought (C.C. of >30 ha / LSU)
7.5.7 Open shrubbed grasslands; high biomass (1500kg ha) and good grazing potential (C.C. of 15-25 ha / LSU)
7.5.8 Shallow soils with underlying calcrete, easily eroded and prone to wind erosion with medium grass production of 750kg ha (C.C. of 25 ha / LSU)
7.5.9 Open grassed *Acacia* shrublands; suffers dramatically from drought with high *A. erioloba* tree mortality, has variable grass cover 1500-150kg / ha, but in general is of good grazing potential (C.C. of 15 ha / LSU)
7.5.10 Open grassed *Terminalia sericea* shrublands; Tufted pioneer grasses with 700kg / ha of average grazing (C.C. of 25 ha / LSU)
7.5.11 Combretum woodlands; high grass biomass 1000kg / ha, but over-grazing has detrimentally changed plant community (C.C. of 15 ha / LSU)
7.5.12 Shrubbed woodlands to the south of the pans; Has tolerated long-term over-grazing well, but is prone to woody encroachment, with approx 1050kg / ha of grass biomass, but of predominantly low palatability (C.C. of 15 ha / LSU)
7.5.13 Mopane shrublands / woodlands on shallow calcrete soils; these areas, always have low grass biomass 700kg / ha and are quickly denuded in the dry season with poor grass spp composition. Due to accessible water in the calcrete soils over-grazing from high densities of cattle posts is common (C.C. of 25 ha / LSU)
7.5.14 Mopane / Kirkia woodlands around Mosu; high grass biomass 1100kg / ha, but has suffered from long-term over grazing and a change in plant species community (C.C. of 20 ha / LSU)
7.5.15 The escarpment; Soil is exposed in the dry season from over grazing causing extensive soil erosion from water run-off. Most grasses of low nutrition (C.C. of 30 ha / LSU)

8 Makgadikgadi Pans National Park and Nxai Pan National Park Management Plan, 2006

8.2 Land Use Development Goals and Objectives

8.2.1 Four east-west firebreaks are recommended to be developed within the park
8.2.2 Park to be provided with new fire fighting equipment
8.2.3 No early burning program to be implemented
8.2.4 Fencing of the eastern boundary of the MPNP, including some or all of CT11
8.2.5 Fence maintenance to be outsourced to private company
8.2.6 Fence to be built to OIE standards – the fence enables CT8 to become a FMD-Free zone and cattle are exportable from the area 2 years after the construction of the fence
8.2.7 New water holes to be developed along the length of the Boteti River
8.2.8 Provision of new water supplies for wildlife within NG49
8.2.9 PAC monitoring to be conducted along the lines of MOMS
8.2.10 Any livestock found in the park to be confiscated
8.2.11 Provision to be made for controlled and sustainable use of natural resources inside the park by local community members
8.2.12 Emphasis placed on protection and preservation of Baines Baobabs
8.2.13 MPNP to be zoned into low and medium density tourism areas and a wilderness area
8.2.14 150km of new tracks to be developed within the MPNP – all to be 4x4 only, but development can be with a bulldozer, with the following LACs limiting road density to;

8.2.14.1 1km of rd to every 2km2 in Medium Density Tourism Zone (MDTZ)
8.2.14.2 1km of rd to every 15km2 in LDTZ
8.2.14.3 1km of rd to every 15km2 in Wilderness Zone
8.2.14.4 1 vehicle per 5km of track, across the 470km

8.2.15 Provide areas for night drives
8.2.16 Two mobile campsites to be developed
8.2.17 No additional public campsites to be developed
8.2.18 Relocation of several entrance gates and the development of new ones at Phuduhudu / Gweta corner of MPNP (Makolowane II) and to the south of this near Jack's Camp (Xirexara) and re-siting Xhumaga entrance gate within the village
8.2.19 No new airstrips to be developed
8.2.20 New boreholes to be drilled to provide water supplies to new entrance gates etc
8.2.21 Move the weather station from close to the entrance into Nxai Pan
8.2.22 Dismantle the radio mast at Njuca
8.2.23 Improve the second, northern public campsite in Nxai Pan NP
8.2.24 Improve the main Nxai Pan Campsite and prevent localised flooding
8.2.25 Provide facilities to the wilderness campsites – enviro-loo, bucket showers at Njuca / sth of Njuca / Baines
8.2.26 Carrying Capacities for the area;
8.2.26.1 1 x 24 bed photographic lodge in Nxai Pan
8.2.26.2 One public campsite per park, each with 8 sites for up to 6 people and 2 vehicles
8.2.26.3 2x wilderness campsites in MPNP and 3 x sites in NPNP, each with 1 site for upto 12 people and 3 vehicles
8.2.26.4 Develop 1 Hatab site close to Hippo Pools
8.2.26.5 Locate picnic sites in the wilderness zone
8.2.27 Rehabilitate the old Mokolowane DWNP camp into an educational facility
8.2.28

8.3 Land Use and Development Conflicts and Constraints

8.3.1 Wildlife conflict around the periphery of the Park is the greatest concern and problem
8.3.2 The Boteti Fence has severed the connection between the MPNP and the areas around CKGR where there is recent evidence of a distinct wildebeest movement between the two areas.
8.3.3 The Boteti fence has created a physical edge and reduced the ecological resilience of the region, limiting movement of wildlife and making the area vulnerable to the impacts of fire, while limiting access to the riparian woodland and water points along the riverbed
8.3.4 The loops and sharp turns in the fence form traps for wildlife and simplify predation strategies.
8.3.5 The Boteti fence alignment does not follow the park boundary, excluding the riparian woodland from the NP.
8.3.6 Fires in the region are common – most start along the Maun-Nata Rd and spread into the park
8.3.7 There has been a significant decline of all wildlife within the park since records were first collected in the 1960s and 1970s – much of this is related to ecological variation / drying of the Boteti River and also some poaching and hunting
8.3.8 The elephant population has been increasing within the region
8.3.9 There are significant problems around the park boundary from problem animals and HWC

8.3.10 Invasive plants species, are not currently a problem, but could be with the following identified;

8.3.10.1 Agave, Castor oil plant, Mesquite, Pampas Grass, Prickly Pear, Queen of the night, Rubber hedge.

8.3.11 There are over 20 roadside burrow pits from the development of the Maun-Nata Road that must be rehabilitated

8.3.12 The area around Baines Baobabs has been degraded by lack of control

8.3.13 The park is one of the least frequented NPs in the country

8.4 Proposed Mitigation

8.4.1 Strategy to reduce HWC in the region includes the following points;

8.4.1.1 Develop more water in the park

8.4.1.2 Assist communities with developing predator proof kraals

8.4.1.3 Provide information to farmers to help reduce crop damage

8.4.1.4 Integrate PAC activities into general park management

8.4.1.5 Improve community liaison

8.4.2 The fence along the Boteti requires an increase in management interventions and responsibilities, with a focus on

8.4.2.1 Management of current and provision of additional water supplies

8.4.2.2 Protection of dry season grazing from fire through the development of firebreaks and the implementation of a fire management plan

8.4.3 The impact of the fence on wildlife must be monitored, with weekly patrols of the fence

8.4.4 The fence will be realigned if necessary to reduce mortality resulting from the fence, such as loops and sharp turns

8.4.5 The western fence must enclose part or all of CT11 to safeguard important foaling areas for the zebra migration

8.4.6 Community access gates must be established along the fence

8.4.7 All firebreaks to be kept clear of vegetation between April – November

8.4.8 Improve width of the cleared bush along the main rd to mitigate fires

8.4.9 Develop firebreaks along tourist roads within the park

8.4.10 Erect eye-catching notices along the length of the rd within the park to help prevent fires

8.4.11 LACs are provided to ensure there is no detrimental damage to vegetation around new artificial water points

8.4.12 The Boteti River's riparian woodland and other trees have been affected by elephants

8.4.13 There are several strategies to improve wildlife conflict problems;

8.4.13.1 Improve PAC coordination and response in the area

8.4.13.2 Capture and release problem predators

8.4.13.3 Improve fence maintenance

8.4.13.4 Educate farmers to improve animal husbandry

8.4.13.5 Improve reporting and feedback mechanisms

8.4.14 All weather tracks should be developed to the Baines Baobab site from the north and block the southern route, with measure to reduce impact to the site, with a car park site 200m from the trees

8.4.15 To improve tourism numbers in the Park, there should be a separate entrance gate fee to attract more visitors

8.5 Other interesting facts for cross component integration

8.5.1 Buffalo to be allowed to re-colonise the area now enclosed by the fence.

9 Nata Bird Sanctuary Management and Business Plan, 2008

9.2 Land Use Development Goals and Objectives

9.2.1 Development of two new lodges within the Nata Bird Sanctuary (NBS); a high-end market lodge placed close to the Nata River Estuary and Middle market lodge placed close to the Semowane River estuary

9.2.2 A new campsite to be developed in the mopane island and the current campsite closed down and developed as a staff headquarters

9.2.3 The eastern fence to be realigned to the original demarcated boundary of the Sanctuary and to include the Semowane River estuary and connect to the Sowa wildlife area

9.3 Land Use and Development Conflicts and Constraints

9.3.1 Community opposition to the movement of the fence

9.3.2 Dilapidated state of the current fence around the Sanctuary

9.3.3 Livestock intrusion into the Sanctuary

9.3.4 Low occupancy of the Sanctuary

9.3.5 Poor location of the existing campsite and poor state of upkeep of many of the facilities

9.3.6 Limited community benefits from the Sanctuary

9.4 Proposed Mitigation

9.4.1 Improved management

9.4.2 Tendering for a Joint Venture Partner to assist with the long-term future development of the Sanctuary

9.4.3 Proposal to include CT5 under the land use management of the Nata Conservation Trust to improve the tourism development opportunities of the area and for any potential JVP

9.4.4 Development of a new JVP structure to encourage greater community involvement and capacity building within the partnership

9.4.5 Restocking of the Sanctuary with more game

9.4.6 Appointment of a community liaison officer to ensure continued beneficial interaction between the partners

9.4.7 Appointment of a community conservation officer to undertake required ecological monitoring of the area.

10 Mopipi Community Land Use Management Plan, 2006

10.2 Land Use Development Goals and Objectives

10.2.1 The National Policy on Agricultural Development proposes the fencing of Boteti Area 4B

10.2.2 Proposed development in terms of land use zoning includes defining zones for;

10.2.2.1 Livestock grazing areas – cattle post areas and separate village grazing area

10.2.2.2 Arable zones; Molapo and dryland farming

10.2.2.3 Tourism hotspots

10.2.2.4 Veld gatherings areas

10.2.2.5 Potential game ranch in CT10

10.3 Land Use and Development Conflicts and Constraints

10.3.1 Environmental constraints in the area include;

10.3.1.1 Lack of grazing, with the best grazing around the Lake Xau area and north west of Mopipi

10.3.1.2 Veld fires

10.3.1.3 Stong winds
10.3.1.4 Clustered boreholes (mean distance between boreholes of only 2-4km = reduced resilience against land degradation
10.3.1.5 Open salt pans
10.3.1.6 Land degradation
10.3.1.7 Water shortage
10.3.1.8 Decline in tree numbers
10.3.1.9 Decline in quality of arable land
10.3.1.10 Bush encroachment – although not a major problem some species are increasingly evident

10.3.2 Resource use constraints in the area include;
10.3.2.1 Livestock movement between different cattle areas (village based and cattlepost based)
10.3.2.2 Livestock movements into arable areas with subsequent crop damage (with 70% of all farmers)
10.3.2.3 Cattlepost owners deny access to other community members to rangeland resources

10.3.3 Farming constraints include;
10.3.3.1 Saline and sandy soils are marginal for dryland farming
10.3.3.2 Wind erosion
10.3.3.3 Low and erratic rainfall
10.3.3.4 Located in veterinary buffer zone
10.3.3.5 Long distance to markets

10.3.4 Socio-economic constraints in the area include;
10.3.4.1 Labour shortage
10.3.4.2 Livestock theft

10.3.5 Policy constraints include;
10.3.5.1 Due to fragmented nature of laws and policies there is confusion about resource user rights and access
10.3.5.2 The Tribal Land Act; the Act is not clear on how to deal with the allocation of land and natural resources that is shared between neighbouring area
10.3.5.3 The Tribal Grazing Land Policy; After more than 25 years there is no empirical evidence the TGLP ranches are more productive than communal ranches, while ranching may not be the best strategy for semi-arid grasslands such as the Mopipi area, but requires other types of management, such as a more mobile livestock management that can respond to the variable rainfalls of the region
10.3.5.4 National Policy on Agricultural Development; The fencing component of NPAD is a continuation of the TGLP approach, that sees no future for communal areas management
10.3.5.5 Tourism Development Framework (2001); tourism development in the Makgadikgadi area is hampered by tribal land surrounding Gweta, stateland north and south of Gweta occupied by livestock farmers and the BLDC ranches west of Gweta

10.4 Proposed Mitigation

10.4.1 Tourism development
10.4.1.1 Rehabilitate the Mopipi Bays Club
10.4.1.2 Locate some wilderness campsites on pans such as Rysana Pan – link location with advice from Botswana Birdlife and National Museums

10.4.1.3 Develop a game farm, with emphasis on springbok production in the CT10 area
10.4.1.4 Develop nature walks and quad bike trails
10.4.1.5 Community to negotiate for a community use zone within the MPNP and to take tourists to the Orapa Game Farm
10.4.2 Livestock and range resources management
10.4.2.1 Develop a community based resource management system – identifying seasonal grazing areas, with collective herding with monitoring of the effectiveness of the scheme
10.4.2.2 Identify cattle holding pens – fenced areas that can be used to fatten cows before sale (possibly areas of CT10)
10.4.2.3 Undertake extensive clearing of bush encroached areas
10.4.3 Use and management of veld products
10.4.3.1 Monitor condition and levels of use of the key veld products such as fuelwood, mopane, Grewia berries using the event book system approach
10.4.3.2 Trust to acquire harvesting rights for key veld products and introduce charges for commercial use
10.4.4 Arable and fodder production
10.4.4.1 Ensure protection of Molapo areas and rationalise allocation of these, with re-allocation of under-utilised fields every year
10.4.4.2 Identify areas within the fenced areas close to Mokoboxane and in the Molapo fields that can be used for the production of improved fodder
10.4.4.3 Trial the use of new and different species
10.4.5 Land Use Degradation
10.4.5.1 Develop indigenous planting of shrubs and trees to prevent further degradation and wind erosion
10.4.6 Land use options

10.5 Other interesting facts for cross component integration

10.5.1 The Constitution of Botswana provides powers to the state to compulsory acquire land where it is deemed necessary for the conservation of soil and other natural resources

10.5.2 The Tourism Development Framework (2001) identifies the Makgadikgadi as one of 5 areas where tourism should be promoted with diverse alternative activities marketed and with community involvement. The framework states that for tourism to be successful there should be limited fencing as wildlife movement is essential for the viability of the system, with the corridors to the north of the Boteti a vital element, as are areas to the east of the MPNP, it provides Tourism options for the area including the development of Gweta & Rakops as secondary Tourism Nodes / establishing a wilderness trail from the CKGR up through the Makgadikgadi to Chobe and the development of 5 ecological corridors

References

Central District Land Use Planning Unit & Kalahari Conservation Society, Proposed Land Use Plan for the Makgadikgadi Region (1989),), Prepared for Department of Surveys and Lands, Gaborone, Botswana.

Centre for Applied Research, 2006. Mopipi Community Land Use Management Plan. Report to Mopipi Mokoboxane Conservation Trust. Botswana.

Central District Council, 2009. Central District Development Plan 7 2009-2016 (Draft). Botswana.

Department of Wildlife and National Parks, 2006. Makgadikgadi Pans National Park and Nxai Pan National Park Management Plan. Gaborone , Botswana.

Ecosystem Solutions for Africa, 2008. Nata Bird Sanctuary Business and Management Plan. Prepared for the Nata Conservation Trust, Maun, Botswana.

Government of Botswana, 2002. Revised National Policy for Rural Development. Government Printer, Gaborone.

Land Flow Solutions, 2001. Central District Integrated Land Use Plan. Plan prepared for Central District Council. Botswana.

Land Flow Solutions, 2009. Review of the National Land Use Map. Department of Lands, Gaborone

Ministry of Finance and Development Planning, 2010. National Development Plan 10. Government Printer, Gaborone, Botswana.

Ngamiland District Land Use Planning Unit & Kalahari Conservation Society, Proposed Land Use Plan for the Ngamiland State lands (1987), Prepared for Department of Surveys and Lands, Gaborone, Botswana.