

Strategic Environmental Assessment For The Okavango Delta Ramsar Site

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The Permanent Okavango River Basin Water Commission

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STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE OKAVANGO DELTA RAMSAR SITE (ODRS)

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By
Ecosurv in Collaboration with SAIEA – October 2012



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EXECUTIVE SUMMARY

1. Introduction

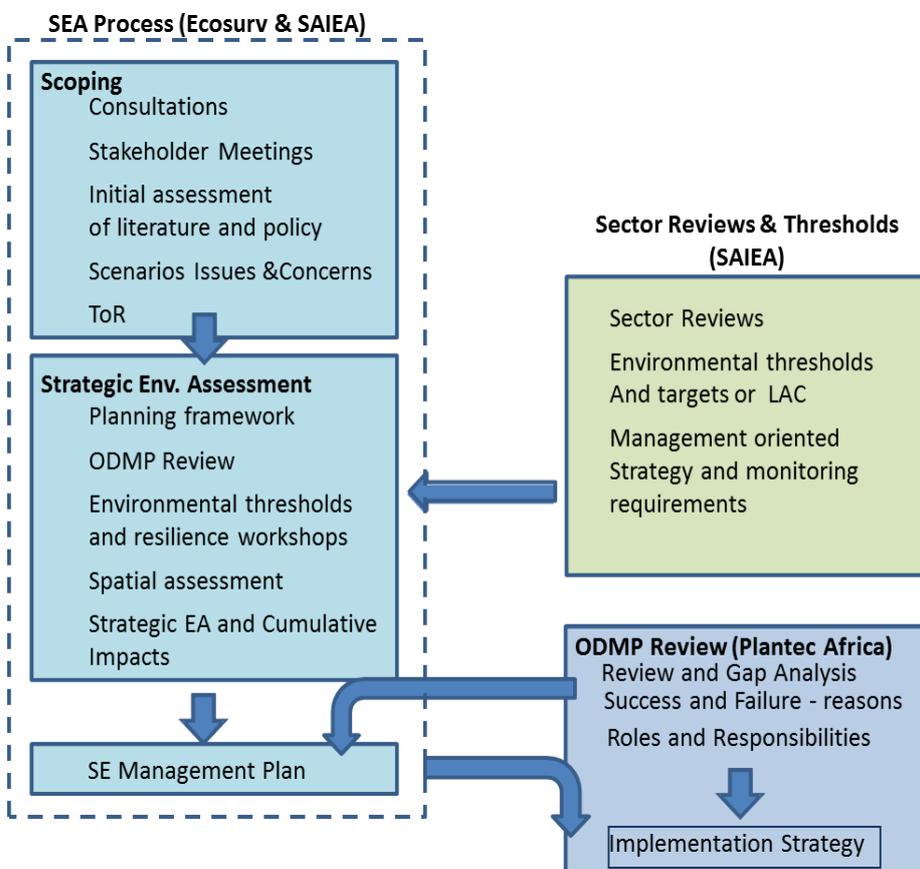
The Department of Environmental Affairs (DEA) (Maun) commissioned Ecosurv, in association with the Southern African Institute for Environmental Assessment (SAIEA) to carry out a Strategic Environmental Assessment (SEA) for the Okavango Delta Ramsar Site (ODRS). The work is part of the Southern Africa Regional Environmental Programme (SAREP) funded by USAID.

The ODRS is one of the largest Ramsar sites and covers 55,374 km² of NW District (Ngamiland).

a. Objectives and Scope of Work

The scope of work includes incorporating a review of the existing Okavango Delta Management Plan (ODMP) (DEA, 2008). The review was carried out by two separate companies: one review focussed on an analysis of sectors with the objective of identifying environmental thresholds (SAIEA), and the other review involved an assessment of the status of implementation of the existing ODMP (Plantec) (the relationship between the different activities is outlined below). One of the goals of the SEA is that it will make a positive contribution to the ODMP and the on-going management of the ODRS. Thus the SEA process complements the ODMP and should assist in its implementation.

This document comprises the SEA report and includes the SEA findings, recommendations and the Strategic Environmental Management Plan (SEMP).



Specific objectives are:

- To provide a robust institutional and legal framework within which policy- and decision-makers can systematically evaluate future development options to guide the sustainable management of the Ramsar site, so that the required monitoring and auditing feedback loops are effectively implemented.
- To move to a state of understanding based on existing baseline information. Using input from the sector reviews, the ODMP mid-term review and stakeholder inputs to develop and assess viable scenarios of sector based developments, with recommendations for sustainable development and guidance for solutions on critical cumulative impacts with a Strategic Environmental Management Plan to manage and mitigate these impacts.
- Outline Environmental Qualitative Objectives (EQOs), with a mechanism for refinement, based on the ability of the system to absorb development and provide ecosystem services on a sustainable basis that does not undermine the ecological integrity of the system.
- Define the role the authorities have in ensuring long-term sustainability of the Delta environment for the benefit of the country.

b. Approach to the Assessment

The approach included the following:

- Public consultations and workshops to identify concerns, issues and drivers. These focused on both administrators and user groups;
- Review of literature appropriate at the strategic level;
- Review of policy and planning appropriate at the strategic level;
- Spatial analysis of pressures and environmental sensitivity;
- Sector reviews (SAIEA);
- Thresholds analysis and identification of targets (SAIEA);
- Resilience analysis;
- ODMP review (Plantec);
- Impact assessment;
- SEA statement;
- Strategic Environmental Management Plan.

c. Legality

This strategic environmental assessment has been undertaken as required under the EIA Act of 2011. The appropriate authority (Department of Environmental Affairs) is required to review and approve the SEA which will then require the land authority for the Ramsar Site to ensure that the strategic management plan requirements are implemented.

The SEA would fall under the custodianship of the Tawana Land Board while monitoring and enforcement of the SEA would be the responsibility of DEA.

2. Summary of the process

A SEA is usually conducted for a policy, plan or programme, or where there is a risk of cumulative impacts occurring within a particular geographic area from the simultaneous development of one or many sectors.

This SEA contains an analysis of the driving forces and resulting pressures on the current and potential future state of the ODRS. After this analysis, the cumulative impacts of various development scenarios on the biophysical and socio-economic environments of the ODRS are assessed. These impacts are measured against sustainability thresholds to determine the degree of impact, and how close the system is to irreversible ‘tipping points’. The management actions required to mitigate the cumulative impacts identified are set out in the Strategic Environmental Management Plan (SEMP).

3. Key findings and strategic management actions

The overall findings of this assessment are that within a decade the Ramsar Site will cease to function as a fully functional wetland and will lose its wilderness qualities. Significant changes will have occurred at the regional, Delta and local scales that will have exceeded critical thresholds and changed the system into different and less desirable states.

a. Scenarios

The assessment presents two future scenarios

1. Business-as-usual which will result in the occurrence of the impacts described below, the system crossing critical thresholds and the failure of the nation to manage a national asset and wetland of international importance in a sustainable manner. The vision of the business-as-usual scenario is that the Okavango Delta will look after itself (if we leave the core area alone) and we will continue business as usual unless it is proven that it affects the Delta.
2. The high road: A vision that ensures that the objectives and requirements of the Ramsar site are considered prior to sector developments. This will afford the administrators and users of the Okavango Delta opportunity to refocus, thus maintaining the national and regional asset. This will require a significant shift in how the system is managed and a change from the one-shoe-fits-all approach to implementing sector policies and strategies selectively. We believe that this scenario is possible because of the high levels of awareness by all sectors of the importance of the Ramsar Site.

b. The Assessment

Most of the impacts described are masked due to the lag effect between driver implementation and the impact being felt. Often the system may appear to be moving away from a critical threshold during normal or wet years, but when a set of cumulative impacts combine or events come together in the “perfect storm” then the system will be pushed over a threshold and re-establish at another, and usually less desirable, state.

c. Key drivers and underlying causes

- International:
 - Climate change;
 - International conventions;
 - World economic situation;
- Basin:
 - Population increase;
 - Changes in land use and associated water requirements;
 - Poverty;
 - Regional governance structures;
- ODRS:
 - Population increase and poverty,
 - Settlement and land use;
 - Increase and change in tourism;
 - National policies and strategies;
 - National and local governance.

d. Key Impacts

- Upstream Basin: The Okavango Delta is maintained as a fully functional wetland and centre of biodiversity by the hydrological functioning of the upstream basin. Failure to understand the implications of upstream changes and the impact on delta functioning will create a situation where Botswana is unable to negotiate informed suitable targets and contribute to sustainable development of the upper basin. Key impacts are:
 - a. Reduction of the low flows due to abstraction mainly for irrigated arable agriculture. There are also impacts that are not as imminent but are significant, the two critical ones are a change in the hydrograph effecting the flood pulse (the key event driving ecological production in the delta) and, regulation of the river so that seasonal and periodic variability is reduced (reducing diversity and the ability of the system to absorb change). The Transboundary Diagnostic Assessment (TDA) predicted that the irrigation demand for water by 2020 will result in the Okavango River drying up for periods during years of low annual flow. The implications on the delta in terms of biodiversity loss and collapse of ecosystem services still need to be fully understood OKACOM (2011).
 - b. Decline in water quality resulting in changes in ecological processes.
 - c. Reduction in sediment (river bedload) entering the delta system thus increasing the rate of erosion in the Panhandle and change to ecosystem function.

- d. Policy and strategy conflicts particularly in applying national strategies to a unique system.
 - Within the ODRS and surrounding area: There is one overriding threshold that will be crossed within the near future, namely the collapse of the non-elephant wildlife populations due to the loss of key migration routes between the core and surrounding areas. There are multiple underlying causes as to why it will collapse, all of which need to be addressed to prevent the delta system from becoming isolated.
- e. Environmental findings within the ODRS:
 - Human wildlife conflict (HWC) and elephant management are related and critically important. The high elephant numbers and their movement into new areas together with the expansion of linear settlements are causing an increase in HWC. The urgent implementation of appropriate components of the Elephant Management Plan is considered to be essential.
 - There will be loss of ecosystem services and wetland functioning if upstream developments result in lower inflows, reduced flood pulse, change in sediment levels and decline in water quality.
 - High frequencies of fire are occurring in the northern ODRS. The fires are started from access routes along the border and northern Buffalo Fence amongst others. The implications of frequent fire damage on the teak woodlands of Ngamiland have not been quantified.
 - A decline in non-elephant wildlife numbers is occurring within the ODRS linked to a number of causes including loss of access to seasonal wildlife ranges and generally heightened levels of disturbance.
 - Increase in alien plant species establishing in the delta largely linked to tourism movement and supplies.
- f. Key findings relating to governance
 - The main findings are that there is little implementation of existing plans and a lack of monitoring and enforcement of those few that are being implemented. There is no adaptive management and very little effective CBNRM.
 - The problem is a result of a top down approach to governance, policy conflicts, a degree of inflexibility in how policy strategies are implemented, and an absence of feedback mechanisms.
 - Sector strategy implementation using a broad brush or national approach is creating a situation where sector developments are conflicting with the function of the ODRS, thus undermining its long term integrity and survival. Sectors pay lip service to supporting the ODRS aims but continue with (conflicting) developments unless these are specifically shown to have significant impacts.
 - CBNRM has been undermined through a number of state requirements, lack of support from NGOs and an absence of co-management.
 - There is need for a single and effective planning authority to manage settlement within the ODRS.

g. Key findings relating to research and monitoring

- The presence of the Okavango Research Institute (ORI) is important in the Ramsar Site. There is a need for ORI scientists to undertake research and monitoring into thresholds to support adaptive management.
- Effective monitoring is critical to understanding of system thresholds, identifying suitable targets and adaptive management.
- At present there is little understanding or information available on ecological functioning of the upstream (Angolan) environment, ecosystem resilience and buffering capacity of the mid-basin wetlands.

4. Conclusions and Recommendations

This SEA has found that the ecological integrity of the ODRS is under substantial threat and will, in the near future, cross a number of unacceptable thresholds. The SEA also found that there is a good sense of awareness at the district level concerning the ODRS and responsibilities. Many of the critical changes that are required are needed from players outside the ODRS such as upstream nations and sector ministries within Botswana. Flexibility in sector strategy implementation and improved feedback mechanisms are needed if district authorities are to be able to support the development of the ODRS in a consistent and sustainable manner. A significant improvement in land and settlement management is required; this can occur through changing the status of the ODRS and declaring it a planning area. Changes are also needed at the fine or specific location scale where on-the-ground activities are required.

The SEA has found that a paradigm shift in approach and attitude towards managing the ODRS is required and the momentum generated by the SEA process must be maintained if the Ramsar site is to remain a fully functional wetlands system.

The strategic environmental management plan (SEMP) included in this document outlines targets that will, if adhered to, keep the system from changing to less desirable states. The SEMP actions are divided into those that address the main issues and a further set that address less pressing, but contributing impacts.

This SEA and associated SEMP must be seen as the starting point to address the threats facing the ODRS. Much is required in terms of actions, changes and improvements in knowledge if realistic thresholds are to be identified and adhered to.

Recommendations

A Strategic Environmental Management Plan has been prepared that outlines the strategic targets and actions required initiating a process of change. The SEMP must become the overriding legal framework guiding future management decisions.

The implementation plan should be assisted through the following future activities:

- The SEMP needs to be work shopped with all implementing parties (public and private sectors) to ensure that the recommendations are realistic, practical. The implementing parties need to know what is expected of them so that they can plan and budget for the necessary management actions to be taken. A detailed work plan will be required to ensure a logistical flow of actions, based on an agreed set of priorities. Central to this activity would be the creation of a SEMP Steering

Committee, preferably within an existing management authority, to ensure that the action plan is being implemented within the defined timeframe.

- A Strategic Environmental Assessment at the Okavango River Basin level. This is critical if upstream developments are to be guided into a sustainable development direction.
- A facilitated workshop to integrate resilience thinking into the future management of the Delta. This needs to be undertaken at the ODRS level and a short introduction to resilience provided at the Sector Permanent Secretary level
- A facilitated scenario planning session held with key sector representatives at the district level together with a results presentation to senior central government personnel.
- Integrated land use planning based on the findings of the SEA and using the land-use conflict identification strategy (LUCIS), or similar, approach would assist in addressing land use conflicts.
- A facilitated scenario planning session held with key sector representatives at the district level together with a results presentation to senior central government personnel.

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ABBREVIATIONS AND ACRONYMS

AWP	Artificial water point for wildlife
BCWIS	Botswana Core Welfare Indicator Survey
BDF	Botswana Defence Force
BID	Background Information Document
BOCCIM	Botswana Council for Commerce, Industry and Manufacturing
BOGA	Botswana Guides Association
BPC	Botswana Power Corporation
BSAP	Biodiversity Strategy and Action Plan
BTO	Botswana Tourism Organisation
BWMA	Botswana Wildlife Management Association
BWPA	Botswana Wildlife Producers Association
CBNRM	Community Based Natural Resources Management
CBO	Community Based Organisation
CBPP	Contagious Bovine Pleura Pneumonia
CHA	Controlled Hunting Area
CITES	Convention on the International Trade in Endangered Species
CSR	Corporate Social Responsibility
DAHP	Department of Animal Health and Production
dBa	Unit in decibel for an A-weighted sound level (for quiet sounds)
DDC	District Development Committee
DDP	District Development Plan
DEA	Department of Environmental Affairs
DFRR	Department of Forestry and Range Resources
DGS	Department of Geological Services
DLUPU	District Land Use Planning Unit
DNMM	Department of National Museum and Monuments
DoL	Department of Lands
DoM	Department of Mining
DoT	Department of Tourism
DTRP	Department of Town and Regional Planning
DPSIR	Drivers – Pressures – State – Impact – Response model
DTRP	Department of Town and Regional Planning
DVS	Department of Veterinary Services
DWA	Department of Water Affairs
DWMPC	Department of Waste Management and Pollution Control
DWNP	Department of Wildlife and National Parks
EIA	Environmental Impact Assessment
EQO	Environmental Quality Objective
EPSMO	Environmental Protection and Sustainable Management of the Okavango River Basin Project
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
GoB	Government of Botswana
GMA	Game Management Area
GR	Game Reserve
HATAB	Hospitality and Tourism Association of Botswana
HWC	Human Wildlife Conflict
IBA	Important Bird Area
INR	Indigenous Natural Resources
ISPAAD	Integrated Support Programme for Arable Agricultural Development
KAZA	Kavango – Zambezi Transfrontier Conservation Area
KCS	Kalahari Conservation Society
LUCIS	Land Use Conflict Identification Strategy
NAMPAADD	National Master Plan for the Arable Agriculture and Dairy Development
MAR	Mean Annual Runoff
MEWT	Ministry of Environment, Wildlife and Tourism

NAP	National Action Plan
NCONGO	Ngamiland Council Of Non-Governmental Organisations
NCU	National Coordination Unit
NGO	Non-Governmental Organisation
NDP	National Development Plan
NP	National Park
NWDC	North West District Council
ODMP	Okavango Delta Management Plan
ODRS	Okavango Delta Ramsar Site
ODWC	Okavango Delta Wetlands Committee
OKACOM	Okavango River Basin Water Commission
ORB	Okavango River Basin
ORI	Okavango Research Institute
OWMC	Okavango Wetlands Management Committee
PL	Mineral Resource Prospecting Licence
PSC	Project Steering Committee
SAIEA	Southern African Institute for Environmental Assessment
SAREP	Southern Africa Regional Environmental Program
SEA	Strategic Environmental Assessment
SEMP	Strategic Environmental Management Plan
SoER	State of Environment Report
TDA	Transboundary Diagnostic Assessment
TGLP	Tribal Grazing Land Policy
ToR	Terms of Reference
tpa	Tons per annum
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USAID	United States Agency for International Development
VDC	Village Development Committee
WHS	World Heritage Site
WMA	Wildlife Management Area
WS	Workshop
WTTC	World Travel and Tourism Council
WUC	Water Utilities Corporation

INTRODUCTION

1.1 Background to the Study

In November 2011, the Department of Environmental Affairs (DEA) (Maun) commissioned Ecosurv, in association with the Southern African Institute for Environmental Assessment (SAIEA) to carry out a Strategic Environmental Assessment (SEA) for the Okavango Delta Ramsar Site (ODRS). The work is part of the Southern Africa Regional Environmental Programme (SAREP) which is funded by USAID.

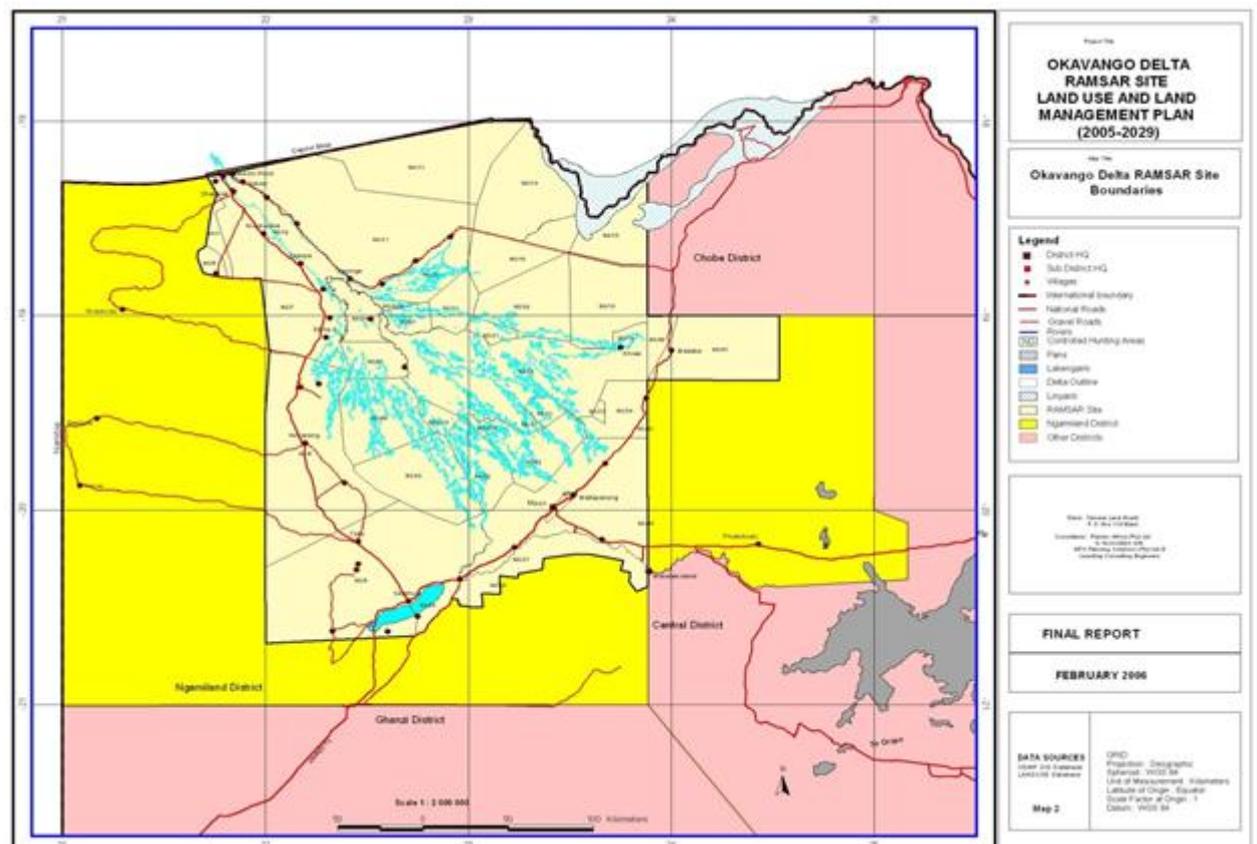


Figure 1: The Okavango Delta Ramsar Site (source: Plantec)

The scope of work includes incorporating a review of the existing Okavango Delta Management Plan (ODMP) (DEA, 2008). The review was carried out by two separate companies: one review focussed on an analysis of sectors with the objective of identifying environmental thresholds (SAIEA), and the other review involved an assessment of the status of implementation of the existing ODMP (Plantec) (Figure 2). The ODMP provided a point of departure for this SEA, and much of the information contained in the ODMP provides valuable input to this SEA process. One of the goals of the SEA is that it will make a positive contribution to the ODMP and the on-going management of the ODRS. Thus the SEA process complements the ODMP and should assist in its implementation.

This document comprises the SEA report and includes the SEA findings, recommendations and the Strategic Environmental Management Plan (SEMP).

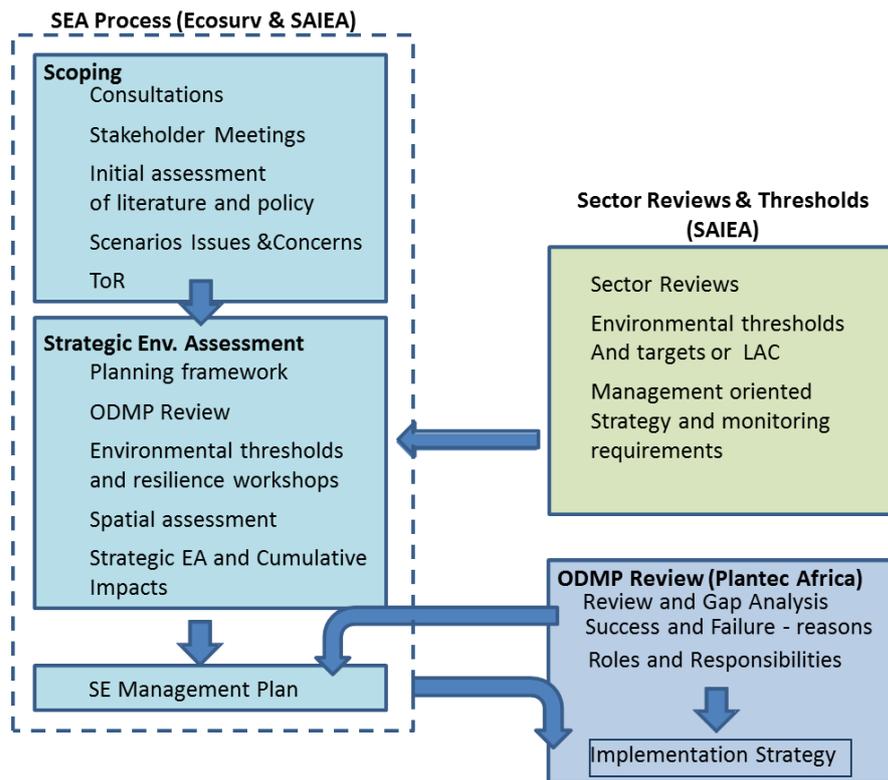


Figure 2: Integration of the review studies into the SEA

1.2 Study Objectives

The objectives of the SEA activities were to:

- Provide a robust institutional and legal framework within which policy- and decision-makers can systematically evaluate future development options to guide the sustainable management of the Ramsar site, so that the required monitoring and auditing feedback loops are effectively implemented.
- Move to a state of understanding based on existing baseline information. Using input from the sector reviews, the ODMP mid-term review and stakeholder inputs to develop and assess viable scenarios of sector based developments, with recommendations for sustainable development and guidance for solutions on critical cumulative impacts with a Strategic Environmental Management Plan to manage and mitigate these impacts.
- Outline Environmental Qualitative Objectives (EQOs), with a mechanism for refinement, based on the ability of the system to absorb development and provide ecosystem services on a sustainable basis that does not undermine the ecological integrity of the system. Define the role the authorities have in ensuring long-term sustainability of the Delta environment for the benefit of the country.

1.3 Summary of the SEA Process

A SEA is usually conducted for a policy, plan or programme, or where there is a risk of cumulative impacts occurring within a particular geographic area from the simultaneous development of one or many sectors (SAIEA, 2011). SEA can be defined as a range of “analytical and participatory approaches that aim to integrate environmental considerations ...and determine the inter-linkages with socio-economic considerations.” (OECD, 2006).

In the case of the ODRS, the area is experiencing rapid development of a diverse and possibly conflicting nature, where impacts may be additive, e.g. the overuse of water resources, conversion of natural habitat, pollution, etc. Thus the aim of the SEA is to provide a robust framework within which policy- and decision-makers can systematically evaluate future development options (Brownlie *et al*, 2009).

It is important to note that that SEA is not a substitute for an Environmental Impact Assessment (EIA), but it can create the overall framework and sustainability thresholds for individual projects within the ODRS.

The SEA scoping report was completed in February 2012 and it provided the following information:

- The results of the stakeholder engagement process, including the identification of:
 - Drivers of change within and outside the ODRS;
 - Opportunities and constraints for future sector development;
 - Key issues and pressures on the ODRS;
- Development of possible future development scenarios;
- The identification of data requirements for the SEA;
- Terms of Reference for the SEA report.

This document comprises the report of the strategic environmental assessment stage in which we analyse the driving forces and resulting pressures on the current and potential future state of the ODRS. Based on this analysis we assess the cumulative impacts of various development scenarios on the biophysical and socio-economic environments of the ODRS. These impacts are assessed against sustainability thresholds to determine the degree of impact, and how close the system is to irreversible ‘tipping points’. The management actions required to mitigate the strategic level impacts and cumulative impacts identified are set out in the Strategic Environmental Management Plan (SEMP). The latter will become the ‘robust framework’ referred to above, which should help direct decision-making and feed directly into the ODMP Management Action Plan. Linkages between the SEA and the SEMP and the main steps are outlined in Figure 3 below.

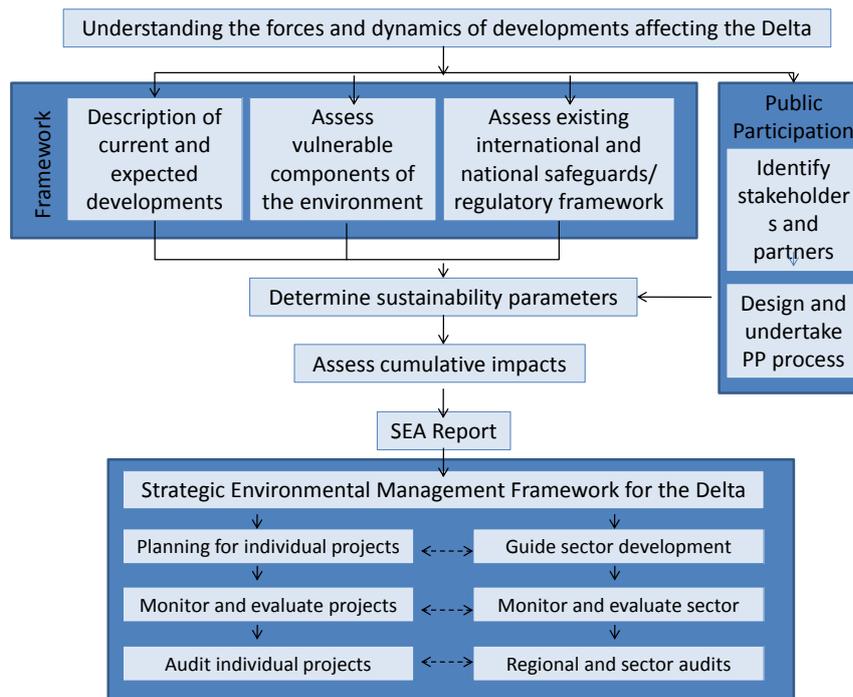


Figure 3: Key steps in the SEA process (after MME 2010)

1.4 Assumptions and Limitations

1.4.1 Assumptions

- Moderate term planning horizon (10 years) during which there will be no major changes to hydrology from either climate change or upstream developments. The moderate term horizon does not exclude identification of issues and actions that need to be taken now to prevent major future impacts beyond the ten year planning horizon.

1.4.2 Limitations

- The scope of work was limited to the Ramsar site, but many of the driving forces and pressures on the environment originate upstream in the catchment. Holistic management of the Ramsar site requires a basin-wide approach. Limiting this study to the Ramsar site does not allow for the integrated management of many of the key issues which could affect the ODRS in future.
- The sector reviews, threshold identification and review of the ODMP were undertaken by third parties and not the SEA team.
- The limited time available for integration of the findings of the various studies has hampered the delivery of the SEA.

2 APPROACH AND METHODOLOGY

2.1 Spatial and Temporal Boundaries

The SEA focuses on the Okavango Ramsar site (Figure 1) but takes cognisance of external pressures and linkages with emphasis on District and National linkages, as well as trans-boundary issues – particularly pertaining to potential developments in the upstream countries of Namibia and Angola. The resilience assessment helped identify linkages at the various scales.

The time period selected for the study was a ten year planning horizon.

2.2 Literature Review

An initial list of key documents was identified during the inception phase. The list has been supplemented by additional literature identified as critical by stakeholders. These documents are listed in Appendix 1.

2.3 Policy and Planning Review

The policy and planning review process focused primarily on the following:

- Objectives of the policy/plan;
- Lead sector responsible for the implementation of the policy/plan;
- Key policy objectives of primary and secondary importance to a sector;
- Key sector conflicts.

For each policy the main objectives were outlined and those objectives that were of critical importance to a sector (in the ODRS) were rated 1 while those which were of a secondary importance were rated 2. The review also indicated the specific sectors responsible for the implementation of the policy. The policy review was undertaken to highlight sector objectives that are in conflict and to identify critical issues that need to be addressed to assist in the conservation and management of the Okavango Delta.

2.4 Stakeholder Engagement Process

Stakeholder participation is at the heart of any development process. Integrating the various views, attitudes and opinions of different stakeholders is essential to improve information flow. Stakeholder involvement is crucial in the SEA development process, it was therefore essential for the scoping phase to follow a detailed stakeholder participation plan to ensure that interested and affected parties play an active role. A stakeholder analysis was undertaken and stakeholder representatives were invited to the workshops held in Maun on the 8th and 9th December. This was followed by a series of meetings with directors of different government departments on the 12-15 December 2011 and completed on the 11-12 January 2012. Minutes of the Workshops and the Meetings are provided in Appendix 1 of the Scoping Report.

Table 1 shows how stakeholder groups were engaged in the process and the activities carried out.

Table 1: Stakeholder Engagement Plan

ACTIVITY	STAKEHOLDER GROUP	APPROACH
Stakeholder Invitations	ODRS (Private, NGOs and Village Representatives) ODRS Key Government Departments	Phoned and wrote letters to individual representatives of organisations and departments to attend the workshops which were held on the 8 th and 9 th December 2011
Background Information Document (BID)	All Interested and Affected Parties	A BID was development, informing the stakeholders about the project and a comment sheet was attached for stakeholders to register their issues, concerns and aspirations for the ODRS. The BID was placed in to the Ecosurv website.
Newspaper Advertisement	All Interested and Affected Parties	A public notice written in both English and Setswana was placed in one of the local newspapers. The purpose of this documents was to inform stakeholders about the project and provide them with the opportunity to register their issues/concerns and aspirations for the area.
Stakeholder Workshops (Maun)	Representatives from the Users of the ODRS and key government Departments	Two workshops were held in Maun with representatives from two groups (ODRS users and the key government departments within the ODRS). Minutes of all the workshops are appended in to this document.
Key Persons Meetings (Gaborone)	Directors from all relevant government departments	Prior arrangements were made with all relevant departments to hold the meetings. Minutes of all the meetings are available in this report.
Workshops undertaken by the ODMP Review team (Plantec)	Stakeholders, Wetlands committee	One stakeholder meeting was held in Maun (7/06/2012) in which the review criteria were outlined and working groups assessed the implementation of the ODMP actions Community meetings were held in a number of villages around the delta.
Workshops undertaken by the Thresholds team (SAIEA) (5/07/2012)	Stakeholders, sector specialists, Wetlands committee	One stakeholder meeting was held in which the proposed thresholds were presented and discussed in plenary
Resilience Workshop (31/07-2/08/2012)	Stakeholders, specialists, Wetlands committee	Three workshops were undertaken (1) Stakeholders including the Wetlands Committee (2) Specialists workshop to outline resilience (3) Key decision makers and implementers

2.5 Mid-Term Review and Gap Analysis of the Okavango Delta Management Plan

Plantec Africa (together with GIS Plan and Fameventures) was contracted to undertake a mid-term review and gap analysis of the Okavango Delta Management Plan.

The ODMP review included consideration of a number of recent and critical planning documents, such as: the Ngamiland Integrated Land Use Plan (2009), the KAZA

Integrated Development Plan and the recommendations made within OKACOM's Trans-boundary Diagnostic Analysis (TDA) for the Okavango basin.

2.6 Ecological Thresholds and Sector Review

SAREP commissioned a consultancy to develop thresholds for use in the SEA of the ODRS. The work was undertaken by SAIEA. The consultancy was required to develop quantifiable thresholds in each of the six thematic areas as follows:

- Thresholds for ecological system integrity for:
 - Biodiversity, and
 - Hydrology
- Thresholds for development activities for:
 - Tourism
 - Arable Agriculture
 - Pastoral Agriculture, and
 - Mining.

The thresholds developed had to be:

- Quantifiable, with suggested Limits of Acceptable Change;
- Governed by the drivers of change and threats to the system as noted in the SEA scoping report;
- Reviewed at a thematic area workshop by relevant stakeholders; and,
- Ensure effective integration and cross examination of relevant constraints.

The thresholds team, made up of a number of sector specialists, undertook sector reviews and prepared thresholds in group working sessions. These thresholds were then discussed with the Wetlands Committee in a workshop and incorporated into the SEA process.

The results of the sector reviews and the thresholds (targets) were used to start the resilience process and are included in the SEMP.

2.7 Resilience Workshop

A three-day resilience workshop was attended by technical officers and scientists representing the Wetlands Committee of the ODRS, the Thresholds Team (SAIEA), the ODMP Review Team (Plantec) and the Client (DEA) (31st July – 2nd August 2012). Detailed results of the workshop are provided in Appendix 2. The workshop began the process of identifying:

1. The key attributes;
2. Appropriate scales;
3. Historic and existing drivers;

4. Controlling variables and;
5. Thresholds of the system.

It then explored the transitional states of the controlling variables, their underlying resilience and ways in which resilience could be increased. The results are preliminary and require far more work to increase our understanding of the thresholds and resilience of the system.

Thresholds were identified at different spatial scales and are affected by different components of the system (domains) (Figure 4). Thresholds can be linked, being dependent on another threshold, in either positive or negative ways. They can also be independent and thus easily managed.

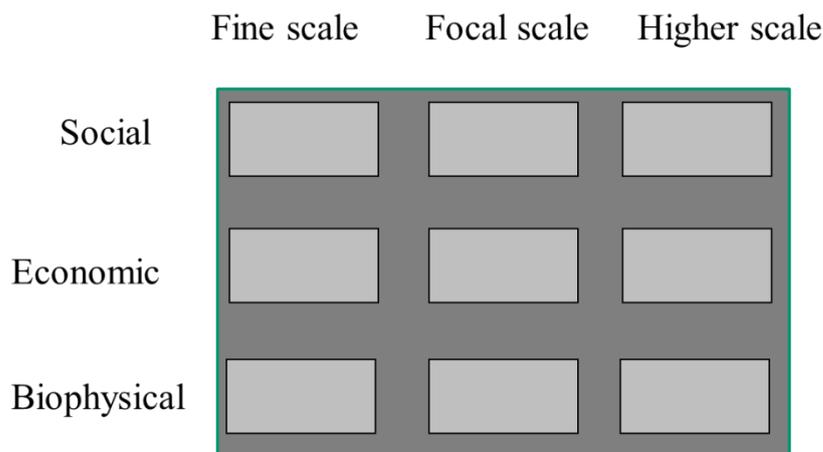


Figure 4: Thresholds across scales and domains (After B. Walker, 2012)

The approach undertaken by the SEA team was to integrate the pressures identified during the thresholds workshop and the scoping activities into the “scales and domains” matrix. Once complete, the environmental threshold relating to each core pressure was assessed and the resilience of the system examined. This examination takes the form of examining the relationship between the pressure and the environmental variable of concern to understand if the relationship is linear or not and thus identify the threshold point.

Once the relationship is understood and the potential threshold identified then the socio-economic management tools are explored to examine where the system can become more resilient.

Resilience analysis is a long process and further workshops are needed with the institutions implementing the SEMP to incorporate resilience thinking into management and planning.

2.7.1 Resilience Terminology and Approach

Technical officers and scientists who represented the Wetlands Committee of the ODRS, the Thresholds Team (SAIEA), the ODMP Review Team (Plantec) and the Client (DEA) attended the three-day resilience workshop. The first morning of the workshop was devoted to presentations and discussions of resilience and approaches to assessing resilience, adaptability and transformability of a system such as the Okavango Delta.

Several key ideas and concepts of resilience thinking were introduced in the presentations and these are briefly outlined in the following paragraphs.

1. Ecosystems, social systems and social-ecological systems (SES) are **self-organizing systems** and in SES the ecological and social domains are strongly interlinked. Changes in ecosystems, social systems and SESs are driven by two kinds of change: (i) external (environmental) and (ii) internal where systems go through internally generated cycles of change – known as adaptive cycles (Fig. 1).

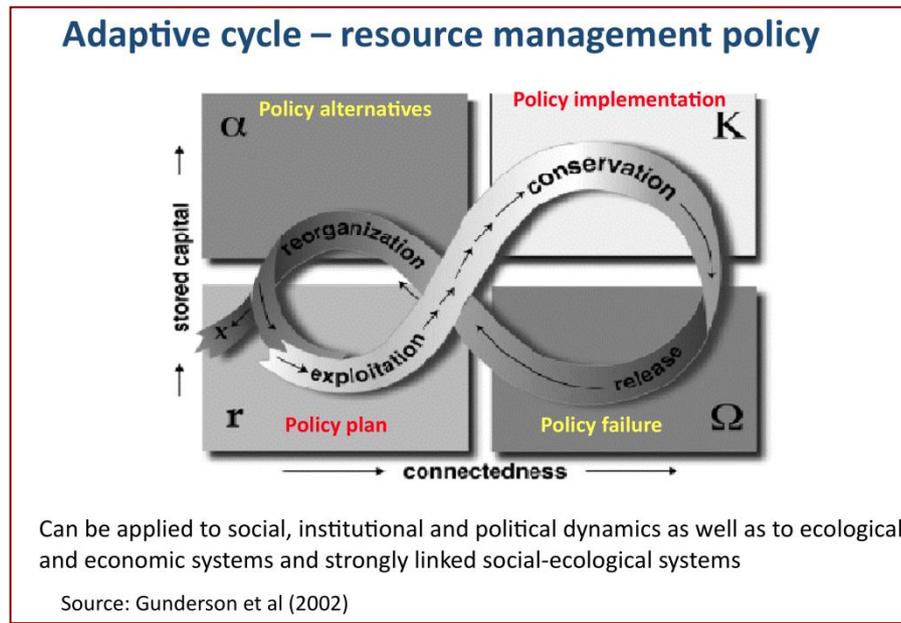


Figure 5: Diagrammatic representation of an adaptive cycle. The arrows within the loops indicate the rates of change with exploitation and conservation phases being slow and release and reorganisation being rapid.

2. Resilience is the “amount of change a system can undergo (its capacity to absorb disturbance) and remain within the same regime - essentially retaining the same function, structure and feedbacks.” (Walker and Salt 2006). The system is able to retain the same identity although reorganisation following a disturbance may not take it back to precisely the same state - change and adaptation are constantly present. Resilience is a conceptual framework for understanding how **persistence** and **transformation** coexist in SES and it involves three, intertwined concepts, namely, **Thresholds**, **Adaptability**, and **Transformation**.
3. There are **limits** to how much a system can be changed and still recover. Beyond those limits, or **thresholds**, it functions differently and changes to some other state, i.e. a transition between states occurs that may or may not be reversible. Thresholds occur in both ecological systems and social systems and when there is a change in feedbacks, when they occur across scales and result in cascading effects, and across scales and domains (ecological, economic, social) and can have cascading effects.
4. Adaptability (general resilience) is the capacity of the system to cope with shocks and surprises and the following attributes tend to confer adaptability and maintain system resilience:
 - a. High diversity and redundancy, and especially response diversity

- b. Being modular in structure and not over-connected
 - c. Detecting and responding quickly to change (having tight feedback loops)
 - d. Being ‘open’ (e.g. immigration and emigration, dispersal)
 - e. Reserves, both biophysical (e.g. seed banks) and social (e.g. memory and experience)
 - f. Trust, leadership and social networks (social capital)
 - g. Overlapping institutions and polycentric governance
5. There are four important points about resilience and adaptation:
- a. You cannot understand or effectively manage a system by focusing on one scale. Attention needs to be given to at least three scales the focal scale, the scale above and the scale below the focal scale. Increasing resilience at one scale, or pursuing efficiency (e.g. maximum sustained yield) at one scale can reduce resilience at other scales.
 - b. Making a system very resilient in one way, at one scale, can cause it to lose resilience in other ways, at other scales. There are trade-offs in applying resilience in practice
 - c. Resilience is NOT about changing or trying to keep a system constant by preventing disturbance, these actions reduce resilience. For example a forest or woodland from which fire is always excluded loses its resilience to fire. Most losses of resilience are unintended consequences of resource management narrowly focused on optimisation - single resource decisions with multiple resource consequences. (See Cumming (2010) an e.g. of livestock vs. wildlife in Botswana).
 - d. Resilience per se is neither ‘good’ nor ‘bad’. Undesirable states of systems can be highly resilient (e.g. dictatorships, saline landscapes, bush encroached rangelands).
6. **Transformability.** If a shift into a “bad” state has happened or is inevitable, or if the current state is no longer a desirable one, the only option is *transformation*. Transformability is the capacity to become a fundamentally different system when ecological, social and/or economic conditions make the existing system untenable.

Generally a **resilience analysis of a system** requires considerably more time than a two or three day workshop with the result that some steps in the analysis were not fully or adequately covered in the time available for this workshop. The main steps for a resilience analysis, as outlined in Brian Walker’s power point presentation, are as follows:

1. The main steps are:
 - a. **Define the system** - focal and related scales, and resilience of what to and to what?
 - System boundaries, scales; what is the region? The “focal” scale? Scales above and below?
 - Stakeholders, governance (formal, informal)

- Key assets, values, ecosystem services
 - Disturbances, shocks, trends and drivers. What are the “characteristic” disturbances, and their disturbance regimes (rainfall variation – floods, droughts, frosts)? What rare shocks have occurred in the past and may occur in the future (e.g. climatic, particular pests, civil unrest)? Or completely novel shocks such as new markets, emerging diseases? What have been the major trends and drivers in the system (e.g. climate change, demography, energy prices)? For trends, develop a timeline /historical profile (how did it get to be like it is now)?
- b. **Examine system dynamics** and assess resilience (i.e. resilience of specific components of the system or specified resilience and thresholds, general resilience [see paragraph 4 above], and transformation and transformability). This entails examining known thresholds, thresholds of potential concern, state and transition models, which transitions may be characterised by thresholds, what feedbacks are involved in the process, and short and long term spatial and temporal changes in the system.

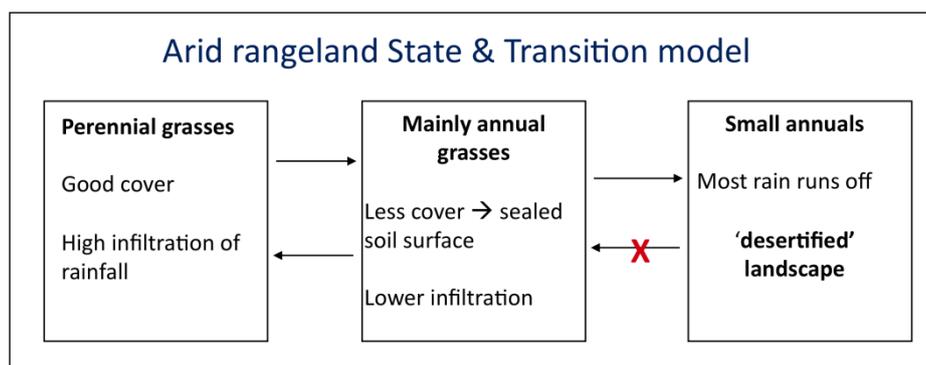


Figure 6: Example of a rangeland state and transition model showing reversible transitions and one (red X) that is unlikely to be reversible

For each of the identified valued system Goods and Services, what are the underlying **controlling variables** that determine them, and do any of them have threshold levels? This set of controlling variables determines the state of the system at any time, and its resilience (e.g. for crop production -- soil fertility / condition, rainfall, labour; or for biodiversity the proportion of native habitat, levels of fragmentation and connectivity).

For each S&T ‘model’ the following questions need to be explored: Could any of the transitions have threshold effects? What are the controlling (slow) variables that may have thresholds on them? What feedbacks are involved?

Interacting thresholds across scales (i.e. focal scale and upper and lower scales) and domains (ecological economic, social) also need to be explored. From what is known and from the State & Transition exercise can potential thresholds for each scale/domain be identified?

Determinants of transformability also need to be examined and include such factors as the preparedness to change, what the options are for change, and the capacity to change - with governance issues often being the major determinants. Achieving transformational change depends on the kind and strength of governance and those responsible for correcting inappropriate governance are often the root of the problem.

- c. **Examining options for interventions** involves considering the kinds and scales of interventions that may be possible (e.g. policy and governance, financial assistance, information and education), the sequencing of interventions, developing an adaptive management program and examining where transformational change may be called for. What form interventions may take will depend on where in the adaptive cycle the system is.
- d. **In summary.** How do you do a resilience assessment, and how do you apply it to planning and management. There is no 'recipe', no set procedure or sequence of actions. An alternative approach which develops scenarios of alternative futures (including maintaining the status quo) is outlined in Figure 7.

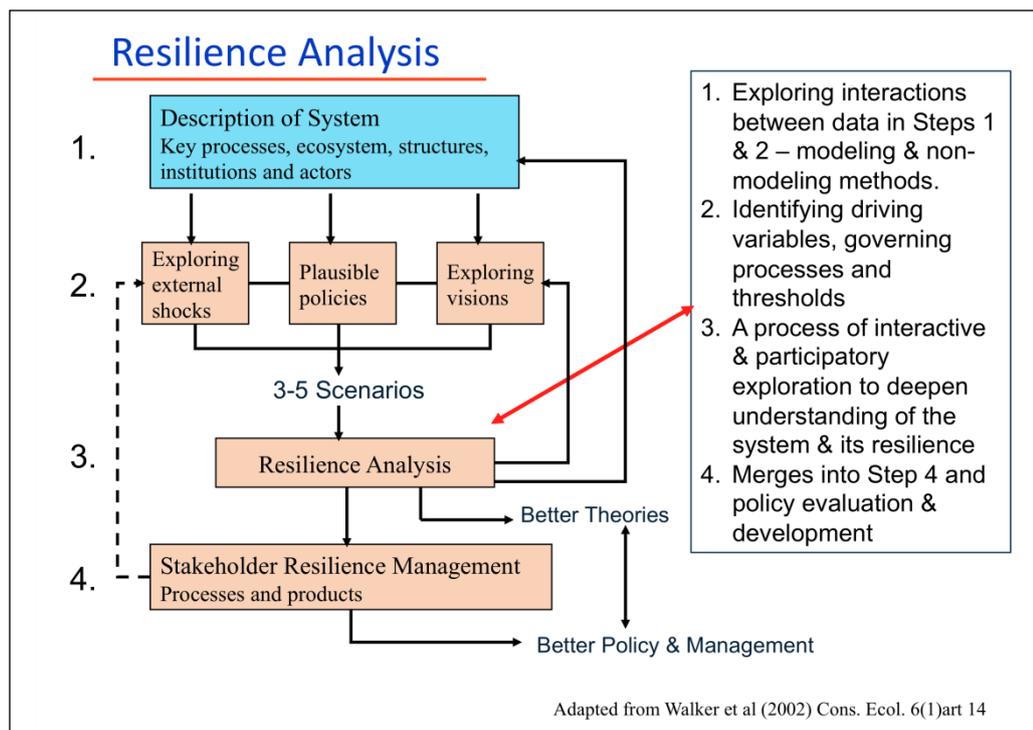


Figure 7: Schematic diagram of the processes involved in conducting a resilience analysis where plausible alternative futures (scenarios) are explored.

Following on from the presentations and discussions of resilience the workshop began the process of:

1. Identifying the key attributes
2. Defining appropriate scales (i.e. focal scale and upper and lower scales)

3. Examining existing and historic drivers

4. Exploring controlling variables and thresholds in system components

It then explored aspects of the resilience of the system and ways in which resilience might be increased. The results reported below are preliminary and require much more work in order to increase our understanding of the controlling variables, thresholds, and resilience of the system.

2.8 Spatial Analysis

The results of the stakeholder meetings and issues identified by the participants at workshops indicated that there are a number of potential developments that will increase pressure on the ODRS. From the stakeholder suggestions we identified a number of data sets that were used to prepare pressures and sensitivity maps. An overlay of the two (pressure x sensitivity) was used to spatially highlight the main areas of concern.

2.8.1 Data Sets that were Obtained and Used in the Spatial Assessment

The data sets, the manipulation of data (buffers and rankings) and comments are all contained in Table 2. To keep the assessment simple, we ranked all data on a scale of 0-4 with 0 being no threat or not environmentally sensitive, and 4 being an extreme threat or highly environmentally sensitive.

Running parallel to, but separate from, the SEA process was the development of raster data sets, based on the same data but structured to allow for easy manipulation of rankings and to support the land use planning and land-use conflict identification strategy (LUCIS).

Table 2: Spatial data used in the analysis

File Name	Source	Extent	Date	Comment	Buffer (m)	Ranking
Pressures						
Flight Noise	SEA	NG		Flight lines between Maun and camps	Yes	Buffer 5 km, Ranked 2 for up to 2 overlapping flight lines and 4 for 3 or more flight lines
Motorboat Noise	SEA	Delta		Main access channels	Yes	Buffer 1.5 km, ranked 1
Farming_Cattlecrush_NG	ODIS	NG		All recorded cattle crush sites	Yes	Buffer 5 km, ranked 3
Cattle_Dry_2003_7	DWNP aerial surveys	NG	2003_07	Average cattle biomass for 2003-2007	None	0=very low biomass; 1=low; 2=medium; 3=high
Cattle crushes	ODIS	NG			Yes	Buffer 5 km, ranked 3
FarmlandsFinal_UTM34	?	NG			Yes	Actual lands = 3, Buffer of 1km = 2
Settlement_Growth_Rates	CSO	ODRS	91_01_11	2011 data available only for major villages	None	0=little or negative growth; 1=slow; 2=normal; 3=fast; 4=very fast rates of growth
Settlement_buff	CSO	ODRS	91_01_11	2012 data available only for major villages	Yes	>50,000=10km; >5000=5km; >1000=4km; >500=3km; >1000=2km; <1000=1km
Tourism_camps_rank_buf	ODIS	ODRS		Does not include hotels and lodges in urban centres outside of the WMA	Yes	Camp ranked 3 and buffer of 0.5 km radius; Camp operational area ranked 1 with a buffer of 5 km radius
Vetfences_2012	Unknown and DVS	NG	2012	Southern fence from discussions. It may continue west	NA	NA
Veterinary control zones	DVS consultations	NG	2012		None	Export zone = 3; Proposed export = 2; Vaccination = 1 and cattle free = 0
Animal_graveyard_site	Unknown	NG			None	Ranked 10-1 high to low based on animal no and location
Transmission_line_potential	Discussions Energy Affairs	NG	2012	Link to Zizabona and Ghanzi	Yes	5km visual impact, ranked 3
Firebreaks_revised_August	DFRR	National	2010		Yes	2 km access impact ranked 2
Fire Frequency	ODIS	National	2002-2008	Frequency	Yes	Buffer 5 km, Ranks 1 = <4 in 7 years; 2 = 5 and 3 = 6 or 7
Mineral Prospecting Licences		National	2011		None	Areas with 1 or 2 PLs ranked 1; >2 PLs ranked 2
Geology_Million	BRIMP	National		Ghanzi Group	None	Ghanzi Formation ranked 3

Ranch_area_Ngamiland	Unknown & Consultations	NG	2012	Area proposed in Gcwihaba WMA	None	Rank existing = 3; Proposed = 2
Irrigation	SEA	NG	2012	From consultations	2km	Buffer 2 km along areas of Thamalakane and upper Boteti; Rank 3
Environmental Sensitivity						
Animal Movement Corridors	SEA	North Botswana	1995-2007	DWNP Wildlife census data wet and dry surveys	None	Zoned dry season ranked 3 and Wet season ranked 2
Flora_Generalised_Okavango_SeasonalIntermittentFlood_HighNativeBioDiv	ORI/SAREP	Delta		ORI	None	Seasonally flooded vegetation
wetdryranges	DWNP, Scott Wilson, EWB	NG		DWNP survey data (DWNP wet and dry season surveys; Scott Wilson 2000; Chase 2011)	None	Wet season range = 2 Dry season range = 3
Wildlife_Dry_2003_7	DWNP aerial surveys	NG	2003_07		None	0=very low biomass; 1=low; 2=medium; 3=high
Wildlife_Wet_1995_99	DWNP aerial surveys	NG	1995_99		None	0=very low biomass; 1=low; 2=medium; 3=high
Cbd_Biodiversity_2010	DEA, Birdlife, Ecosurv	National	2010	Combined, plant, bird and animal	NA	4 high, 1 low, 0 no known
ODRS Boundary	ODIS	NG	2010		None	Ranked 2
Worldheritagesite_Boundary	Unknown	WHS	2010	DNMM	None	Core = 3, buffer = 1
KAZA_Boundary	Ecosurv	Regional	2012	Approximate alignment	None	Ranked 3
WMA_Parks_Reserves	Unknown	National		DSM	None	Parks & Reserves = 3, WMA Gazetted = 2 Other WMAs = 1 Proposed IBAs = 1
Endrivers - Likely to dry out	ODRS	Delta		Major channels that are infrequently flooded	Yes	Buffer 2 km, Rivers ranked 2 and Lake Ngami 3
Maximum flood - wet cycle	Piotr/ORI	Delta	2011	Digitised from image	None	Ranked 2
Maximum flood - dry cycle	ODRS	Delta	1995-96		None	Ranked 3
Minimum flood - wet cycle	ODRS	Delta	2009-11		None	Ranked 3
Minimum flood - dry cycle	Piotr/ORI	Delta	1995	Estimated from image	None	Ranked 2

2.9 State-Drivers-Pressure-Impact-Response Model

In order to articulate the current status of the ODRS and the potential impact of future development scenarios, we have adopted the Drivers – Pressure - State – Impact - Response (DPSIR) model, which provides a useful framework for reporting the SEA findings. DPSIR models are often used in national state of environment reports (SoER), including Botswana’s SoER report of 2002. In the case of this SEA, we look beyond the impacts (pressures) of current land use and sector development to future development scenarios. We have also taken the assessment of impacts further to include the identification of cumulative effects and antagonistic impacts.

Thus this report is structured according to the DPSIR model (Figure 8):

Driving forces:	The underlying physical, biological, social, economic and governance activities which lead to environmental change, such as climate change, population pressure, upstream development, etc., (section 3).
Pressures:	The pressures on the environment resulting from the driving forces e.g. grazing pressure, changed flood regime, etc., are discussed in section 4.
State:	The current state of the environment as it has been fashioned by the drivers and pressures. The environment and recent trends in environmental quality are described in section 5.
Impacts:	The consequences of the pressures on the environment result in impacts, which may be cumulative, antagonistic (conflicting), direct and indirect. These are analysed in section 6.
Responses:	Section 7 describes the human responses to environmental change, including policies and management strategies to reduce environmental damage, maximise opportunities, minimise cumulative impacts and encourage sustainable development (adapted from DEAT (1999)).

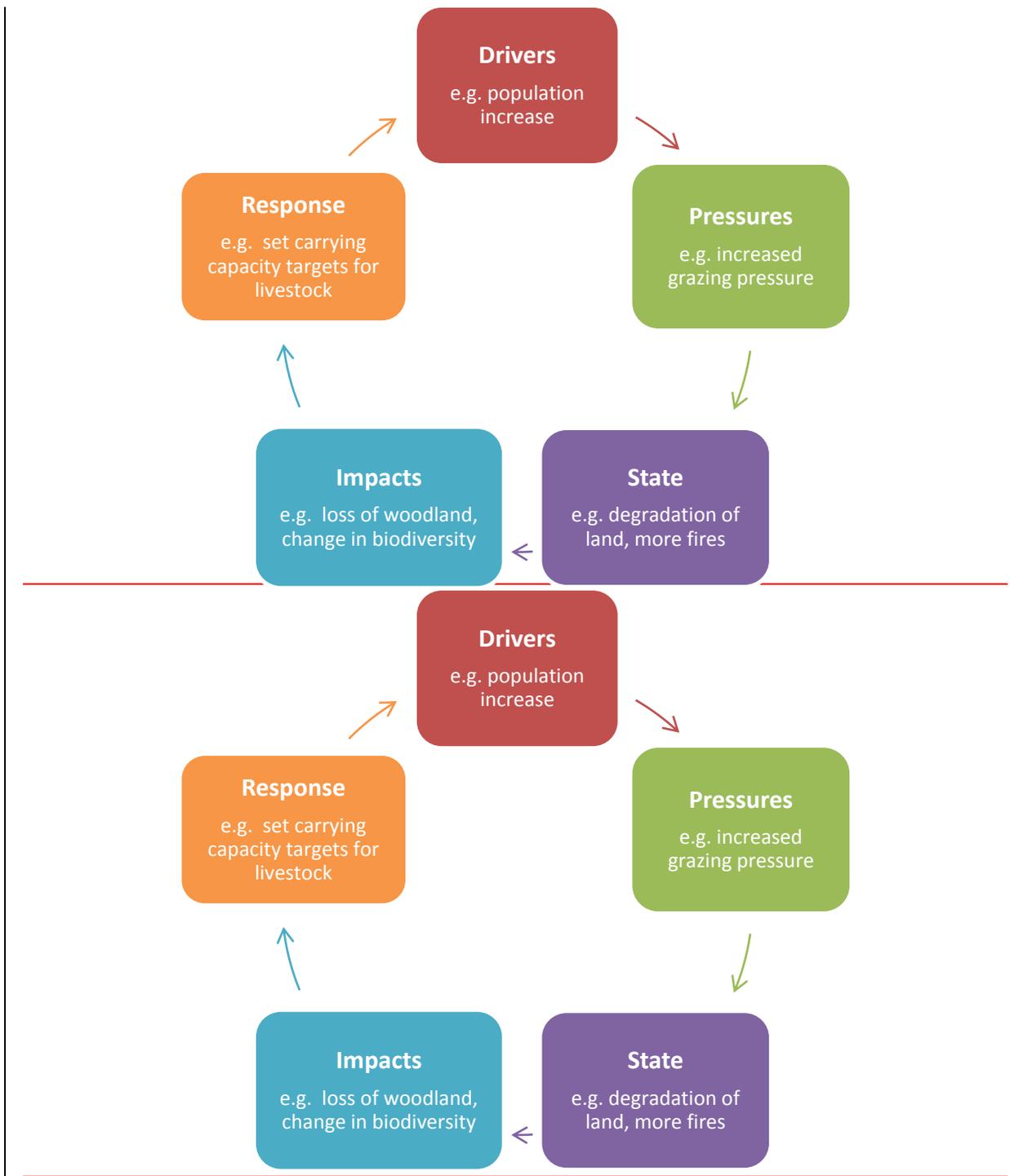


Figure 8: State – Drivers – Pressure – Impact – Response model

3 DRIVERS OF CHANGE (GLOBALLY, RIVER BASIN AND THE ODRS)

The Cubango-Okavango River basin remains one of the basins least affected by human impact on the African continent. In its present near-pristine state, the river provides significant ecosystem benefits and, if managed appropriately, can continue to do so. However, mounting socio-economic pressures on the basin in the riparian countries of Angola, Botswana and Namibia, could change its present character and there is therefore a critical need to establish sustainable management of its resources. The riparian countries recognize that economic and social development within the basin is essential and there is a need for it to be balanced against conservation of the natural environment and ecosystem services currently provided. This requires basin-wide understanding, agreement of the basin's problems and issues, and a blueprint for a development pathway guided by an adaptive management process (OKACOM, 2011).

Environmental change is caused by human activities and natural phenomena (driving forces) which combine with natural processes and put pressure on ecosystems. It is important to understand the driving forces and the pressures they exert, to be able to develop and implement policies, strategies and plans to encourage sustainable development within the opportunities and constraints (limitations) of the ODRS. Experience has shown that the costs of preventing environmental damage are far lower than the costs of rehabilitation or environmental repair. In the case of the ODRS, where there is a high level of environmental sensitivity within an extremely complex ecosystem, it would be almost impossible to rehabilitate or repair the system once damaged beyond the limits of acceptable change or thresholds. This is why it is so important to apply the principles of sustainability, including the precautionary principle, to the current and future management of the ODRS. In order to do this, it is critical to understand the ecosystem processes and functioning i.e. the drivers of the system.

This section describes the driving forces of environmental change and how they work together to put pressure on the ODRS.

During the stakeholder engagement process, drivers were identified at five levels: global, regional, national, basin and ODRS. Since regional and basin-wide drivers are very similar, these can be rolled into the category of 'basin'. Most of the national drivers related to governance of the ODRS and so these two categories have been amalgamated under the category 'ODRS'. The drivers at three levels (global, basin and ODRS) are described in more detail below.

3.1 Global driving forces

There are three main global drivers of change which affect the ODRS:

- Climate change;
- International conventions;
- Macro-economics.

3.1.1 Climate change

The effect of global climate change on temperatures and rainfall has been largely misinterpreted as modelling is still relatively coarse. The climate change specialist study commissioned as part of the Transboundary Diagnostic Assessment (TDA) (Wolski 2009) sought to clarify the implications of global climate change on the climate and hydrology of the Okavango Delta and the river catchment. The analysis of projected climate change effects predicts a rise in temperature and rainfall in the basin. Higher temperatures (2.3 – 3°C) will affect the south of the basin more strongly than the north, with increasing evaporation. There is a projected increase in rainfall of 0 – 20% across the basin, with the greatest effect in the north because of the north-south rainfall gradient. In general, the projected increase in rainfall will more than compensate for higher evaporation rates. This could result in an increase in runoff (total and monthly) with proportionately stronger peak flows (OKACOM, 2011).

3.1.1.1 Projected hydrological change

Three climate change scenarios were investigated as part of the TDA for the Okavango Delta: Dry, Moderate and Wetter than Present Day.

In the Dry Scenario, an increase in evaporation and transpiration may exceed the increase in local rainfall and inflow from the catchment, resulting in drier conditions; a decrease in frequency and duration of flooding throughout the delta; and a reduction of low flows in the rivers draining the system. However, in the Wetter Scenario, the rainfall would increase substantially, which would present an increase in duration and frequency of inundation throughout the delta, with an increase of high and low flows in the rivers draining the system. In both the Moderate and Wetter Scenarios, there would be an expansion of the areas that are subject to long or permanent inundation, while in areas subject to short inundation, there would be a relative reduction (OKACOM, 2011).

However, it is unlikely that any of these scenarios will affect the ODRS within the 10 year planning horizon, i.e. the system will continue to operate within known cyclical and seasonal fluctuations.

3.1.2 International conventions

International agreements and conventions can also be powerful forces driving national policy, behaviour patterns and how we manage our environment. Botswana is a signatory to most of the conventions on the environment, the most relevant of which are described below. A full list of the other relevant environmental conventions is provided in Appendix 1.

3.1.2.1 Ramsar Convention

The ecological importance of the Okavango Delta was internationally recognised in December 1996 when it was designated as a Wetland of International Importance under

the Ramsar Convention¹. At approximately 68,640 km², it is the world's largest Ramsar site.

The Convention's mission is *"the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world"*. At the centre of the Ramsar philosophy is the "wise use" concept. The wise use of wetlands is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development". "Wise use" therefore has at its heart the conservation and sustainable use of wetlands and their resources, for the benefit of humankind (www.ramsar.org).

Of particular importance in the context of the current study and the various opportunities and threats identified during the scoping study, it is worthwhile reiterating two of the articles of the Ramsar Convention.

“Article 3

1. The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.

2. Each Contracting Party shall arrange to be informed at the earliest possible time if the ecological character of any wetland in its territory and included in the List has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference...”

Article 4

1. Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.

2. Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat.”

It is thus incumbent on the GoB to ensure that decision-making about the future development of the ODRS is focussed first and foremost on its “wise use”, and that sufficient funds and manpower are provided for its “wardening” (stewardship) (www.ramsar.org).

¹ The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

3.1.2.2 World Heritage Convention

The Tsodilo Hills, lying in the north-west of the ODRS were inscribed onto the list of World Heritage sites in 2001 in terms of the World Heritage Convention (WHC). The citation on the website (whc.unesco.org) describes the area as follows:

“With one of the highest concentrations of rock art in the world, Tsodilo has been called the ‘Louvre of the Desert’. Over 4,500 paintings are preserved in an area of only 10 km² of the Kalahari Desert. The archaeological record of the area gives a chronological account of human activities and environmental changes over at least 100,000 years. Local communities in this hostile environment respect Tsodilo as a place of worship frequented by ancestral spirits.”

World Heritage sites are nominated and inscribed onto the list on the basis of one or more criteria. The inclusion of Tsodilo Hills on the list is based on criteria (i), (iii), and (vi), as follows:

Criterion (i): For many thousands of years the rocky outcrops of Tsodilo in the harsh landscape of the Kalahari Desert have been visited and settled by humans, who have left rich traces of their presence in the form of outstanding rock art.

Criterion (iii): Tsodilo is a site that has witnessed visits and settlement by successive human communities for many millennia.

Criterion (vi): The Tsodilo outcrops have immense symbolic and religious significance for the human communities who continue to survive in this hostile environment.

Paragraph 87 of the WHC Guidelines stipulates that all sites inscribed as World Heritage Sites through the Convention shall satisfy the conditions of ‘integrity’, which is defined in the Guidelines (paragraph 88) as “*a measure of the wholeness and intactness of the natural and/or cultural heritage and its attributes.*” Paragraph 78 provides more detail: “*To be deemed of outstanding universal value, a property must also meet the conditions of integrity and/or authenticity and must have an adequate protection and management system to ensure its safeguarding.*”

The Tsodilo Hills fulfil the definition of ‘integrity’, as the boundary of the area contains all the main sites. Furthermore, three basic long-term facts have contributed to Tsodilo’s outstanding state of preservation: its remoteness, its low population density, and the high degree of resistance to erosion of its quartzite rock. The considerable archaeological evidence is generally well preserved. All excavations are controlled in accordance with the national legislation. Previous excavations have been properly backfilled and, in most instances, leaving intact deposits and strata as a resource for future research.

The property attracts increasing visitor numbers, resulting in the need to manage the threat of increased litter. Despite these increased visits, there have been limited reports of vandalism and graffiti due to the compulsory guided tour regulations put in place.

The site is owned by the Government, and is currently protected in terms of the Monuments and Relics Act 2001, and by conditions of the Anthropological Research Act 1967, National Parks Act 1967, and Tribal Act 1968. Declared a National Monument in 1927, the responsibility for looking after Tsodilo Hills rests with the Department of National Museums and Monuments in collaboration with the Tsodilo Management Authority, an independent advisory group comprising the Tsodilo Community Trust, community based organizations, NGOs and selected critical government based Departments.

To ensure the conservation of all the site attributes a revised Integrated Management Plan was developed and approved by stakeholders in 1997. An Integrated Management Plan, detailing community initiatives, was developed in 2007 and is currently being implemented in the buffer area of the site. With the assistance of the African World Heritage Fund, a Core Area Management Plan was developed for the site in 2009.

The main objective of the previous and the current management plans is to ensure the conservation of the values of the site. In addition to the existing site office, and the Tsodilo Management Authority Trust, the Government has opened a regional Monument office to directly oversee the implementation of the management plan for the site.

It is noted that there are plans to nominate the Okavango Delta as a World Heritage site. If this were to eventuate, the listing comes with strict requirements regarding existing and future development. For example, exploration and mining are actively discouraged in World Heritage sites and UNESCO, in conjunction with the International Union for Nature Conservation (IUCN), monitor sites very closely.

3.1.2.3 Convention on International Trade in Endangered Species (CITES)

Botswana is signatory to the *Convention on International Trade in Endangered Species (CITES)*, which entered into force in 1975. CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to species of animals and plants.

CITES works by subjecting international trade in specimens of selected species to certain control. All imports, exports, re-export and introduction of species covered by the convention has to be authorized through a licensing system (www.cites.org).

The species covered by CITES are listed in three Appendices, in accordance with the degree of protection that the species need.

Appendices I and II

Appendix I includes species threatened with extinction, (e.g. white rhino). Trade in specimens of species is only permitted in exceptional circumstance (www.cites.org).

Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival, e.g. elephant, hippo, red lechwe.

Appendix III contains species that are protected in at least one country, which has other CITES parties for assistance in controlling the trade. Changes in Appendix III follow a distinct procedure from changes to Appendices I and II, as each party is entitled to make unilateral decisions to it (www.cites.org).

Botswana became signatory to this convention in 1997 and it is enforced nationally through the Wildlife Conservation and National Parks Act with the aim of protecting certain endangered species from over exploitation.

3.1.2.4 Convention on Biological Diversity (CBD)

The *Convention on Biodiversity*, which entered into force in 1993, is the first global agreement on conservation and sustainable use of Biological Diversity. Its objectives are to conserve biodiversity, promote the sustainable use of biodiversity components and to promote fair and equitable sharing of benefits arising from use of genetic resources. States party to the convention have sovereign right to exploit their own resources according to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas.

Botswana is made up of seven distinct eco-regions, of which four are vulnerable i.e. South African Bushveld (deforestation, overgrazing, range degradation and veldt fires), Zambezia Baikiaea Woodlands as found in the ODRS (cattle and overgrazing and change in vegetation communities), Zambezia Halophytics as found in the downstream basin of the Makgadikgadi Pans (mining, rangeland degradation, fires, wind erosion, fires, water extraction, fencing, increased salinity of surface water, decreased surface fresh water, overgrazing, lack of protection for critical avian breeding sites, uncontrolled tourism/disturbance and wildlife conflicts) and Kalahari Acacia (increased cattle ranching, land transformation and degradation, fires, fences, climate change, poaching and invasive alien species) (www.cbd.int).

The Okavango Delta is the main water ecosystem protected under the convention and is surrounded by Wildlife Management Areas (WMAs) which facilitate the free flow of animals between the core Delta and surrounding areas. Botswana's policy framework on environment guides various stakeholder activities that are in favour of conservation and protection. Some of the national targets/priorities include:

- Development of a comprehensive protected areas network to conserve ecosystems and species (taking Important Plant Areas and Important Bird Areas into consideration);
- Development of effective ecosystem management practices, including a review of current national and regional land management systems; and
- The rehabilitation and restoration of degraded ecosystems and habitats.

The Delta supports an outstanding biodiversity, including 150 species of mammals, over 500 species of birds as well as a large number of species of fish, plants, reptiles,

invertebrates and amphibians (GoB, 2009). The Delta is biologically rich and vital to sustaining the ecosystem services in the area.

3.1.2.5 Summary and analysis

Through the review of international obligations it is clear that optimal land uses are essential for the sustainability of the ODRS. Most land uses other than tourism and conservation are not compatible with the main goals and objectives of the relevant environmental international conventions that Botswana is a signatory to. However, tourism in its current state is probably a major contributor to carbon dioxide production in Botswana, when international flights, internal flights, electricity and vehicle usage are calculated.

If the Ramsar Site or World Heritage Site is threatened, these threats are addressed as follows:

- The Montreux Record is a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. It is maintained as part of the Ramsar List.
- In terms of the World Heritage Convention, State Parties have an obligation to regularly prepare reports about the state of conservation and the various protection measures put in place at their sites. These reports allow the World Heritage Committee to assess the conditions at the sites and, eventually, to decide on the necessity of adopting specific measures to resolve recurrent problems. One of such measures could be the inscription of a property on the List of World Heritage in Danger.
- Similarly, given that the Okavango Delta is a national biodiversity hot spot, the protection of biodiversity under the CBD is important.

Any of these would damage Botswana's international reputation, particularly in the tourism market where the Okavango is promoted as a 'pristine wilderness experience'. Furthermore, it would also jeopardise the whole concept of KAZA.

3.1.3 Global Economic Outlook

One of the key sectors in the ODRS is tourism, with mining emerging as another important economic activity. The tourism industry relies to a large extent on international visitors and mining outputs will be mostly exported to foreign countries. The flow of people, trade, products and materials in and out of Botswana is critical to the country's balance of trade, foreign exchange, employment and domestic economy. It is however, contingent upon the relative strength of the economies of Botswana's trading partners. Given that many international tourists are from Europe, the current state of that economy is critical to the tourism industry in Botswana. The economies in western Europe have

been in, or close to, recession since 2008 and the ongoing debt crisis in several Eurozone countries has caused the Euro to lose value and most countries have introduced severe austerity measures to cut back on government spending and debt. This has resulted in significant job losses, lower interest rates and spending on high end tourism is likely to be negatively affected.

The boom in mineral resources has largely been fuelled by the rapidly developing economies of China and India. For example, China is fast becoming the world’s largest economy: it currently has 15.2% of global incremental GDP which is predicted to rise to 20.6% by 2016². USA, on the other hand, has 14.9% and is predicted to drop to 13.0% by 2016. There is, therefore, a significant shift in where wealth and expendable income is located. However, there are indications that the current levels of economic growth and development in those countries cannot be sustained in the long-term and that demand for resources may slow slightly in the next few years.

Thus, the global economic outlook can become either more stable or more volatile and will either expand (bull market) or contract (bear market). Given these options a simplified matrix indicates the implications for the Delta as follows:

Table 3: Implications of different economic scenarios on the ODRS

	Volatile	Stable
Bull	Increase in tourism, but change in market (and countries of client origin). Growth in mining but high rates of new start-ups and closures (boom and bust scenario).	Increase in tourism, same markets and sectors. Growth in mining. Pressure on land and water for commercial agriculture.
Bear	Decrease in tourism, and change in markets. No growth in mining or agriculture. Few government projects or new infrastructure. Pressure on land for subsistence agriculture.	Decrease in tourism, but from same markets. Little growth in mining or agriculture. Few government projects or new infrastructure. Pressure on land for subsistence agriculture.

It is not possible to identify what direction the change will take, but the following conditions are likely to prevail for the next few years:

- Financial instability and depressed economic conditions in Europe;
- USA “recovery” will remain fragile;
- Chinese and Indian economies may slow down slightly.

In the long term, it is expected that the type of tourism and the sources of tourists will change.

² [http://en.wikipedia.org/wiki/List_of_countries_by_past_and_future_GDP_\(nominal\)](http://en.wikipedia.org/wiki/List_of_countries_by_past_and_future_GDP_(nominal))

3.2 Basin-wide Driving Forces

The Transboundary Diagnostic Assessment of the Cubango-Okavango River Basin (2011) commissioned by the Permanent Okavango River Basin Water Committee identified three basin-wide driving forces:

- Population dynamics
- Land-use change
- Poverty.

In addition, three additional drivers were identified during the scoping phase of this SEA, namely the KAZA initiative, SADC Protocols and governance. These are all discussed in more detail in the following sub-sections.

3.2.1 *Population increase*

The present population in the basin is 921,890. By 2025, this is projected to increase to more than 1.28 million people, with 62 percent living in Angola, 16 percent in Botswana and 22 percent in Namibia (Figure 6). Throughout the basin, there is a trend towards increasing urbanisation associated with population growth and a lack of alternative livelihood options. Although the population in the basin is predominantly rural, Angola has an urban population of about 40 percent, Botswana 30 percent and Namibia approximately 20 percent. Greater urbanisation leads to increased demand for services such as water supply and sanitation, which, if not regulated, could lead to water pollution (OKACOM, 2011).

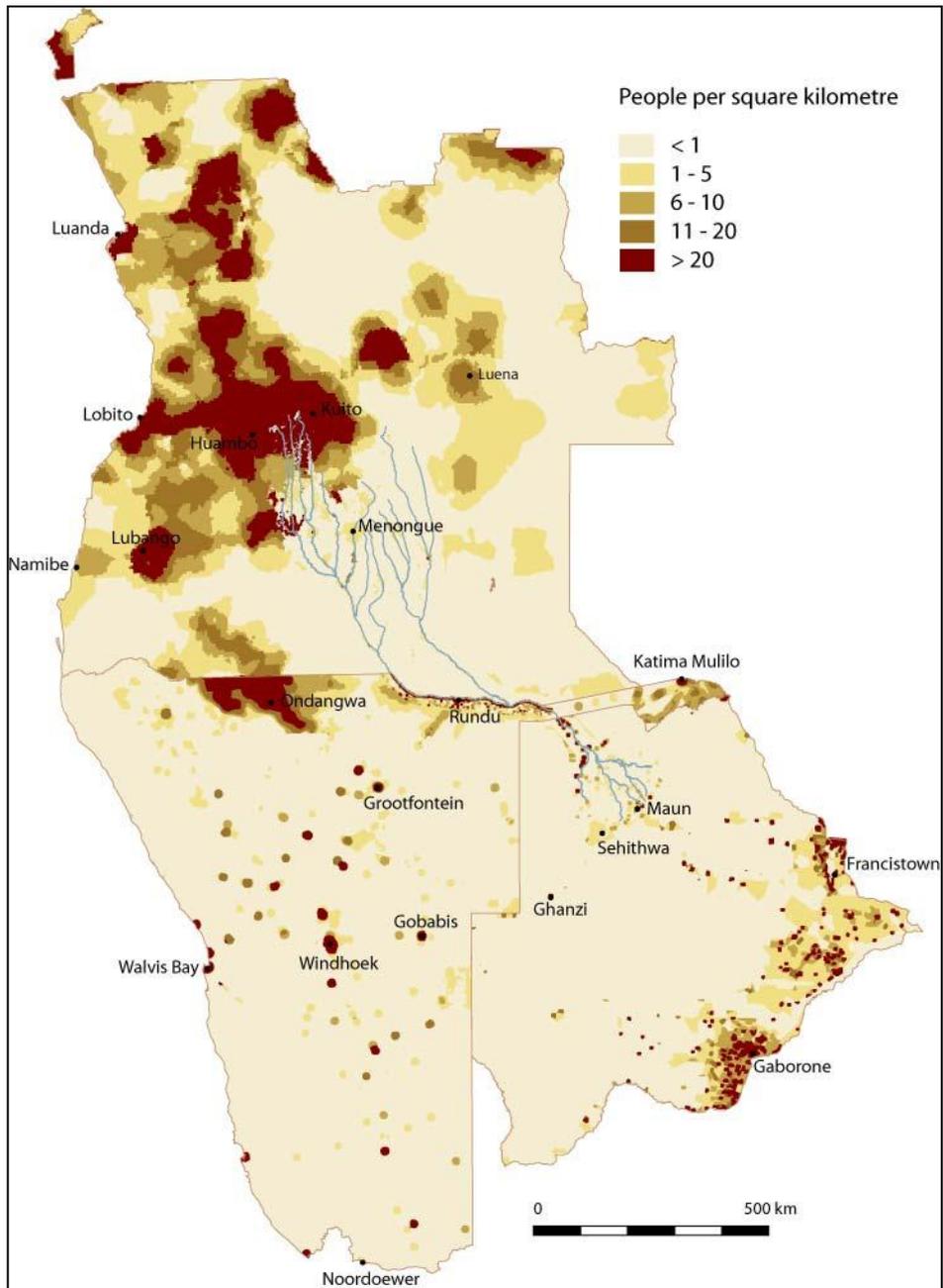


Figure 9: Population density in the Cubango-Okavango basin (OKACOM, 2011)

3.2.2 Land use change

Land use change is a driving force for changes in sediment dynamics, water quality and the abundance and distribution of biota, and has impacts on the hydrological regime through deforestation. Linked strongly to population growth, its impact is incremental and often very difficult to reverse. Despite the relatively low population densities in the Cubango-Okavango River basin, the changes in land use and vegetation cover have been marked (Figure 10). There is heightened demand for land for crops along the length of the

river from the Angolan highlands to the Panhandle in Botswana, and with an increasing population, this trend will only accelerate (OKACOM, 2011).



Figure 10: Land clearance in the Cubango-Okavango Basin (OKACOM, 2011)

The impact of land use change may be more significant than that of direct increased water use and its control a more difficult challenge. Ideally there should be a set of land use guidelines which the local authorities can follow and implement throughout the basin, aimed at preserving the ecosystem health and environmental services. The implementation of these guidelines will require extensive public education campaigns starting with basin communities and continuing through to local institutions (OKACOM, 2011).

3.2.3 Poverty

Poverty is a feature of the human populations of the basin in all three countries. This is partially due to the remoteness of the basin, but also the highly unequal distribution of wealth in the three countries. Poverty alleviation in the basin is a major investment target for governments and the three countries have national poverty reduction strategies aimed

at improving the welfare and living conditions of their populations through increased economic growth and linked to the MDGs (OKACOM, 2011).

3.2.4 KAZA Trans-frontier Conservation Area

The Kavango-Zambezi Trans-frontier Conservation Area (KAZA TFCA) was formally created when Ministers from the five participating nations, Angola, Botswana, Namibia, Zambia and Zimbabwe, signed a Memorandum of Understanding in December 2006. The KAZA TFCA covers an area of 278,132 km² (an area the size of Italy) and includes 36 protected areas (National Parks, Game Reserves, Wildlife Management Areas, Forest Reserves and tourism concession areas for consumptive and non-consumptive tourism).

The goal of the KAZA TFCA is “to sustainably manage the Kavango Zambezi ecosystem, its heritage and cultural resources based on best conservation and tourism models for the socio-economic wellbeing of the communities and other stakeholders in and around the eco-region through harmonization of policies, strategies and practices.” (www.kavangozambezi.org). The KAZA TFCA’s focus is on conservation as the primary form of land use, with tourism being a by-product thereof. This reinforces the recommended zoning and land use objectives set out in section 6.4 of this SEA.

The KAZA TFCA is supported by SADC as it fulfils a number of key SADC objectives, as set out in various protocols, described below.

3.2.5 SADC protocols

The five SADC protocols which influence the management of the ODRS are:

- The SADC Wildlife Policy and Development Strategy (1997);
- The SADC Environment and Sustainable Policy and Strategy (1998);
- The SADC Protocol on the Development of Tourism (1998);
- The revised Protocol on Shared Watercourse Systems (2000); and
- The SADC Protocol on Wildlife Conservation and Law Enforcement (1999).

All of these protocols and policies support the dual land use recommendations of conservation and the promotion of a world-class tourism sustainable tourism product in the Core delta area, while at the same time recognising the need for socio-economic upliftment and equitable use of natural resources. They also underpin the KAZA initiative. These SADC protocols are described in more detail in Appendix 1.

3.2.6 Governance (OKACOM)

The principal governance framework at basin level is OKACOM, which was established in 1994 by the ‘Agreement between the Governments of the Republic of Angola, the Republic of Botswana and the Republic of Namibia on the Establishment of a Permanent Okavango River Basin Water Commission’. OKACOM serves as a technical advisory body to the Parties on matters relating to the conservation, development and utilization of

water resources of common interest. Whereas the OKACOM Agreement does not create substantive rights and obligations of the Parties with respect to the management of the basin, it determines the issues for which OKACOM is mandated to advise the Parties (OKACOM, 2011).

In April 2007 the three Parties concluded the ‘Agreement between the Governments of the Republic of Angola, the Republic of Botswana and the Republic of Namibia on the Organisational Structure of OKACOM’ (the OKACOM Structure Agreement) which establishes the organs of OKACOM as:

- The Commission
- The Okavango Basin Steering Committee (OBSC)
- The Secretariat.

The Commission is the principal organ responsible for defining and guiding the development policy and the general supervision of the activities of OKACOM. The OBSC is the technical advisory body to the Commission, whereas the Secretariat is responsible for providing administrative, financial and general secretarial services to OKACOM.

Article 7(n) permits the Commission to establish *ad hoc* working groups or specific temporary or permanent committees. Three Task Forces have subsequently been established, namely a Biodiversity Task Force, a Hydrology Task Force and an Institutional Task Force.

In addition, the basin countries are considering maintaining National Coordination Units (NCUs) (initially established as temporary, project-specific bodies for the EPSMO project) as permanent structures in order to strengthen OKACOM’s linkages with the basin states at local, operational level. However, a final decision on the matter, as well as the exact position of the NCUs in the operational structure of OKACOM, is yet to be taken.

The Commission consists of the three national delegations, each comprising three Commissioners appointed by their respective countries. The Commissioners are representatives of relevant government departments who attend to OKACOM matters as part of their departmental functions, but do not work on OKACOM matters on a full-time basis.

The establishment of the OKACOM Secretariat and subsequent appointment of an executive secretary with support staff has put OKACOM on firmer administrative footing. Guided by the Secretariat’s three-year plan, it provides the necessary support for the Commission to operate effectively and meet its increasing responsibilities.

In line with its mandate of being an information-sharing platform for the three basin states, OKACOM has recently concluded the development of a Hydrological Data Sharing Protocol, and the development of a Stakeholder Participation Strategy for the Cubango-Okavango River basin is nearing completion.

3.3 ODRS driving forces

Four driving forces were identified during the scoping workshops in the ODRS itself:

- Population increase and poverty;
- Agriculture (livestock production and arable agriculture)
- Increase in tourism activities;
- Mineral exploration and mining
- National policies and priorities;
- National and local governance.

These are discussed in more detail below.

3.3.1 Population increase and Poverty

Population in Ngamiland is unevenly distributed with the majority of the population concentrated in major centres (Maun, Gumare, Sehithwa, Shakawe and Seronga). The population of Maun in 2001 was 43,776 and the 2011 results reveal that the population has increased to 60,263. The 2011 Population Census indicates a vast increase in growth rate of 37.6 % which is even higher than the 2001 projections for the 2011 population. Ngamiland East, which Maun and Sehithwa fall under, has the highest population (90,334) while Ngamiland West (Shakawe, Gumare and Seronga) has a population of 59,421. Table 4 presents the 2001 and 2011 population results for the entire Ngamiland.

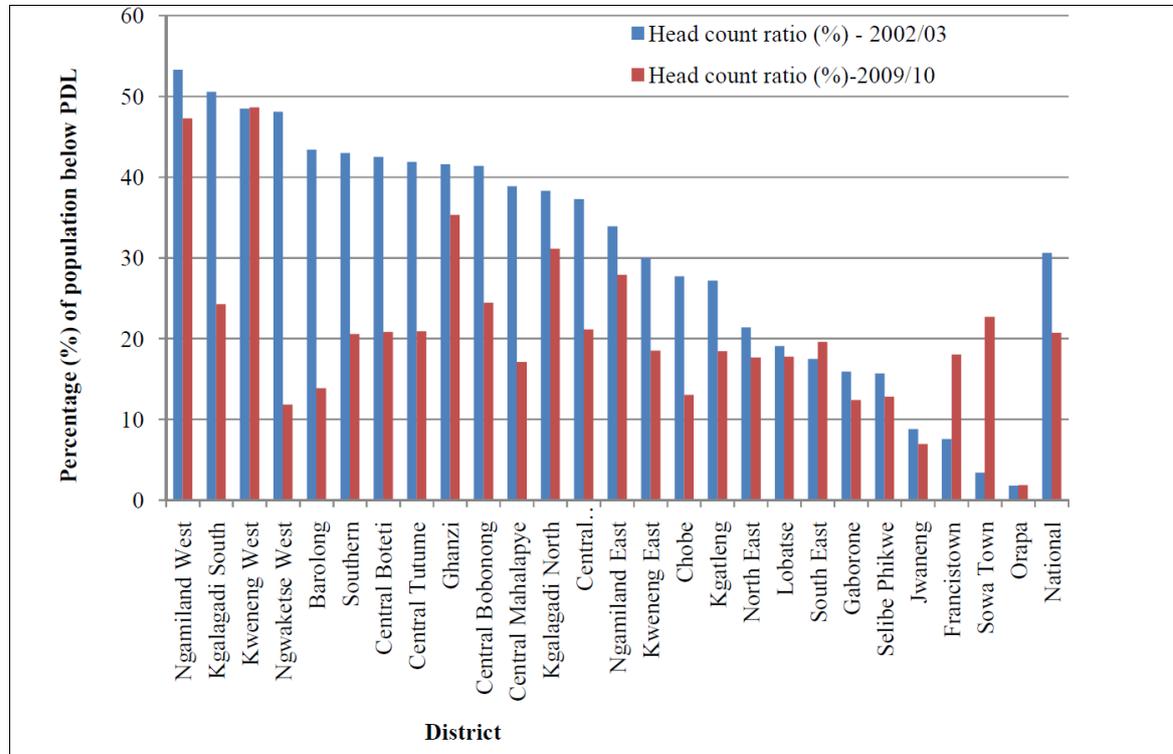
Table 4: Population of the District

Population of Major Villages		
Villages	2001	2011
Maun	43,776	60,263
Seronga	1,641	2,674
Gumare	6,067	8,532
Sehithwa	1,478	2,748
Shakawe	4,389	6,693
Total	57,351	80,910
District Population		
District	2001	2011
Ngamiland East	72,382	90,334
Ngamiland West	49,642	59,421
Ngamiland Delta	2,688	2,529
Rural population	67,361	71,374
Total	124,712	152,284

Source: CSO Population and Housing Census (2001 & 2011)

Ngamiland has one of the lowest per capita incomes in Botswana. Most of the district's population is rural and poverty is widespread. The majority of the Remote Area Dwellers (RADs) still live below the poverty datum line. The Botswana Core Welfare Indicators Survey (BCWIS) for 2002/03 indicates that Ngamiland West had the highest incidence of poverty at 53.3% in the country and Ngamiland East was at 33.9%. Results from the

BCWIS 2009/2010 show that Ngamiland West is now the second highest in the country with 47.3 % but still above the national poverty rate which is currently at 20.7 % from 30.6% in 2002/03. Though more recent results indicate a slight decrease in poverty levels, poverty still remains as one of the most critical drivers of change in the ODRS. Figure 12 presents Poverty Head Count Ratios by District-2002/03 & 2009/10.



Source: CSO, BCWIS 2009/10

Figure 11: Poverty Head Count Ratios by District-2002/03 & 2009/10

The agricultural sector, which engages most of the population in the District, is handicapped by livestock diseases. The cattle industry is still recovering from CBPP (pneumonia) which virtually eliminated all cattle at the time. This resulted in a number of people who were entirely dependent on livestock struggling to recover their economic base (Ngamiland DD7).

The high incidence of poverty in the district contribute to communities with no immediate access into the national economy moving into commercial poaching and other natural resource use (such as extraction of fencing poles for sale).

3.3.2 Agriculture

Livestock: The emphasis on livestock production and associated disease control structures, requirements for fenced ranches and the rapid spread of cattleposts into critical linkages between the Delta and wet season dispersal ranges of wildlife ungulates is a crucial and politically sensitive driver.

Recent policy emphasis on food production has resulted in the Ministry of Agriculture proposing areas of irrigated agriculture along the Okavango Delta outflows and the Panhandle area (approximately 700 ha within the ODRS and a further 8,008 ha along the lower Boteti River).

3.3.3 Increase in tourism

The World Travel and Tourism Council reported that in 2012, total spin-offs accruing to the local travel and tourism industry will reach P8.4 bn, supporting 21,000 jobs directly and a further 25,000 indirectly. It is expected that nearly 2.5 million visitors will visit Botswana in 2012, spending at least P6.5 bn. The Botswana Tourism Organisation (BTO) reports that the sector is expected to grow at an average of 7% in the next decade, exceeding projected world tourism growth figures, and in spite of the global recession. Currently, it is the second-largest earner of foreign exchange in Botswana after mining (SAIEA, 2012).

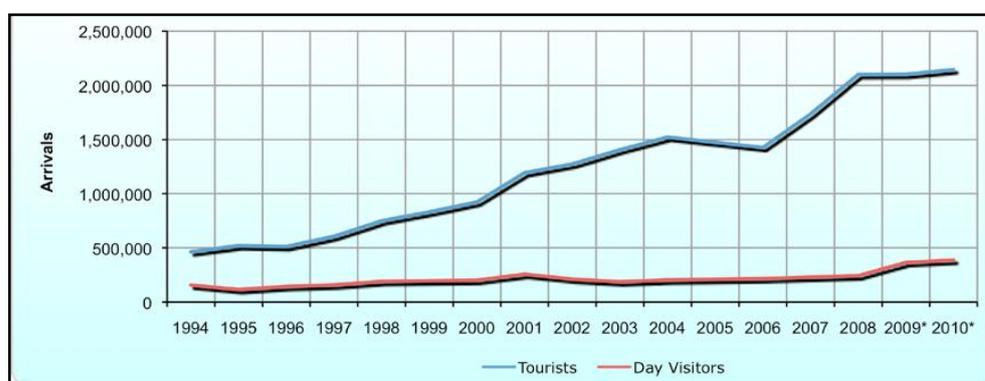


Figure 12: Tourist and day visitor arrivals in Botswana (1994 – 2010) Source: www.mewt.gov.bw (accessed 12/6/12)

Tourism growth is being driven by government strategy based on the NDP 9 objective to make tourism a driver of growth and the NDP 10 objective of diversifying tourism (widening the product from a wildlife and ecotourism base to other products) and citizen entrepreneurial development. The growth is presently largely in the mixed and low budget segment of the tourism market. This type of growth is adding low value tourism pressure on the ODRS in general and the core wetlands specifically.

3.3.4 Mineral Exploration and Mining

Although there is presently no mining within the Ramsar Site, extensive mineral exploration is occurring up to the edge of the wetlands.

The development of Bosetu and Hana mines to the south of the ODRS and recent finds of significant ore bodies in the Shakawe area and to the east of the Panhandle have raised concerns that mining within and adjacent to the ODRS will occur together with the associated resource requirements (water and power) and infrastructure developments.

3.3.5 National policies and priorities

The national policies, objectives and implications to other sectors are outlined in Table 5.

Table 5: Analysis of relevant policies indicating compatibility

National Policies, Strategies, Plans (Note: 1 = primary importance to sector, 2 = of secondary importance)	Sectors					Sector Responsible
	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	

Botswana Threatened Species Management Policy (2007)

<ul style="list-style-type: none"> Prevent the extinct of Botswana’s flora and fauna 	1	1	1	1	1	Wildlife
<ul style="list-style-type: none"> Provide for the recovery of those species that are critically endangered or endangered vulnerable as a result of human activity 	2	2	2	1	2	
<ul style="list-style-type: none"> Establish an institutional and participatory framework for the implementation of the threatened species management policy 	2	2	2	1	2	
<ul style="list-style-type: none"> Promote and ensure a responsible, accountable and transparent decision making process in threatened and endemic species management 	2	2	2	1	2	

Botswana National Water Master Plan (1992)

<ul style="list-style-type: none"> Evaluate economic, social and environmental impacts of the water systems 	2	2	2	1	1	Water
<ul style="list-style-type: none"> Identify alternative water resources 	2			2	1	
<ul style="list-style-type: none"> Ensure careful management and utilisation of available water resources 	2	2	2	2	1	

Botswana’s Strategy for Waste Management (1998)

<ul style="list-style-type: none"> Minimising and reducing wastes in industry, commerce and private households 	1	2		2	1	Waste water
<ul style="list-style-type: none"> Maximising environmentally sound waste reuse/recycling 	1					
<ul style="list-style-type: none"> Promote environmentally sound waste collection, treatment and disposal 	2				1	

Community Based Natural Resources Management Policy

<ul style="list-style-type: none"> Create conditions that promote sustainable use of natural resources 	1	1	1	1	1	Wildlife
<ul style="list-style-type: none"> Devolve management rights over natural resources directly to qualifying local communities 	2	2	2	2	2	
<ul style="list-style-type: none"> Ensure communities benefit from the management of their natural resources 	2	2	1	2	2	
<ul style="list-style-type: none"> Promote community participation in the management of National Parks and Game Reserves 			1		2	

National Policies, Strategies, Plans (Note: 1 = primary importance to sector, 2 = of secondary importance)	Sectors					Sector Responsible
	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	
<ul style="list-style-type: none"> Diversify economic development in rural areas through sustainable use of the natural resources 	2	2	1	2	2	

Community Based Strategy for Rural Development (1997)	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	Sector Responsible
<ul style="list-style-type: none"> Development of gender sensitive and environmentally sustainable approaches 	1	2	2	2	1	

Convention on Biological Diversity (1992)	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	Sector Responsible
<ul style="list-style-type: none"> Conservation of the biodiversity Promote the sustainable use of biodiversity components Equitable sharing of benefits arising out of the use of genetic resources 	1	1	1	1	1	Wildlife
		1	1	1	1	
			2	1		

The Game Ranching Policy for Botswana 2002	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	Sector Responsible
<ul style="list-style-type: none"> Increase economic returns from wildlife resources outside National Parks, Game Reserves and WMAs Promote the development of the game ranching industry Promote game ranching in the conservation of threatened and endangered species 			1	2		Wildlife
	1					
	2	2	2			

Convention on Wetlands of International Importance (RAMSAR) (1994)	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	Sector Responsible
<ul style="list-style-type: none"> Conserve and sustainably use water related ecosystems Combat pollution of wetlands 	2	2	2	2	1	Water
	1	1	1	1	1	

National Energy Policy 2006	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	Sector Responsible
<ul style="list-style-type: none"> Ensure the efficient and conservative use of energy Improve access and affordability of energy sources Encourage diversification of energy sources and routes of supply 	1	1	1	1	1	Energy
	2					
				2		

National Forest Policy	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	Sector Responsible
<ul style="list-style-type: none"> Enhance environmental functions such as soil and water conservation, biodiversity, habitat for wildlife and carbon 	2	2	1	2	2	Fores

National Policies, Strategies, Plans (Note: 1 = primary importance to sector, 2 = of secondary importance)	Sectors					Sector Responsible
	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	
dioxide fixation						
<ul style="list-style-type: none"> Assist local communities to conserve, manage and sustainably use forest resources 	2	2	2	2	2	

National Policy on Agricultural Development (1991)

<ul style="list-style-type: none"> Increase agricultural output and productivity and improve food security 		1		1			Agriculture
<ul style="list-style-type: none"> Conserve agricultural land and other resources for future generations 		1		2			
<ul style="list-style-type: none"> Prevent and control livestock diseases through safe and environmentally acceptable methods 		1					
<ul style="list-style-type: none"> Rehabilitation of forest and range resources to ensure sustainability 	2	1	2	2			
<ul style="list-style-type: none"> Ensure a secure and productive environment for those engaged in agriculture 		1	2	2			

National Policy on Land Tenure (1985)

<ul style="list-style-type: none"> Rigorous enforcement of Conservation Act in all grazing areas, including communal areas, commercial grazing areas, state land and freehold land 							
		1	2	2			

National Policy on Natural Resource Conservation and Development (1990)

<ul style="list-style-type: none"> Increased effectiveness in the use and management of natural resources 	2	1	2	2	2		Wildlife
<ul style="list-style-type: none"> Conserve all main ecosystems, wildlife and natural resources 	1	1	1	1	1		
<ul style="list-style-type: none"> Restore degraded renewable natural resources 	1						
<ul style="list-style-type: none"> Equitable distribution and use of natural resources 	1	2	1	1	1		
<ul style="list-style-type: none"> Control depletion of exhaustible natural resources 	2	2	2	2	2		

National Settlement Policy 2004

<ul style="list-style-type: none"> Protect environment through sustainable land use planning 	2	2	2	2	2		Lands
<ul style="list-style-type: none"> Ensure conservation and protection of the natural resources for future generations 	1	1	1	1	1		
<ul style="list-style-type: none"> Promote identification and development of necessary infrastructure which facilitates development of settlements 	2	2	2	2	2		

National Policies, Strategies, Plans (Note: 1 = primary importance to sector, 2 = of secondary importance)	Sectors					Sector Responsible
	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	
<ul style="list-style-type: none"> Provide guidelines and long term for strategy for development of human settlements Reduce the rate of migration to urban areas 				2		
	2	1	2	2	2	

Permanent Okavango River Basin Water Commission (OKACOM) (1994)

<ul style="list-style-type: none"> Prevent pollution of water resources Control aquatic weeds in the Okavango River Basin Ensure agreements are recognised on any development in the Okavango River Basin 	2	2	2	2	1	
			2		1	
	2	2	2	2	1	

Protocol on Shared Watercourse Systems in the Southern African Development Region (1995)

<ul style="list-style-type: none"> Develop a policy monitoring use of shared watercourses Formulate strategies for the development of shared watercourse systems Monitor execution of integrated water resource development plans in shared watercourses Promote equitable utilisation of shared watercourses 		2	2		1	
					1	
					1	
	2	2	1	1		Water

Tourism Policy (1990)

<ul style="list-style-type: none"> Maximise sustainable social and economic benefits from tourism resources (e.g. scenic beauty, wildlife and ecological, geographical and cultural characteristics) Generate employment mainly in rural areas 			2	2		
	2	2	2	2	2	Tourism

Tribal Grazing Land Policy (1975)

<ul style="list-style-type: none"> Control grazing through limitation of the stocking Grant exclusive rights to use of resources on land Set aside some land areas for future use 		2	2	2		
		1	2	2		
		1	1	2		A

Wastewater / Sanitation Management Policy (1999 Draft)

<ul style="list-style-type: none"> Provide framework for the development of affordable and sustainable wastewater/ sanitation infrastructure and management 						
	2	2	2	2	1	Water

National Policies, Strategies, Plans (Note: 1 = primary importance to sector, 2 = of secondary importance)	Sectors					Sector Responsible
	Mining	Agriculture	Tourism and wildlife	Settlements	Water and Waste water	
<ul style="list-style-type: none"> Protect and improve public health Prevent pollution of natural resources, water resources in particular Conserve water resources 	2	2	2	2	1	Sector Responsible
	2	2	2	2	1	
	2	2	2	2	1	
Wetlands Policy and Strategy						
<ul style="list-style-type: none"> Ensure conservation, sustainable use and rehabilitation of wetlands through promotion of cultural, economic and ecological values Provide an ecological sustainable framework for the management of wetlands Ensure public awareness of the value of wetlands and the public's role in the implementation of the policy Implementation of international obligations relating to wetlands 	2	2	1	1	1	All sectors
		1	1	1	1	
	1	2	2	1		
Wildlife Conservation Policy (1986)						
<ul style="list-style-type: none"> Maximise sustainable yield capacity of the wildlife resources Create economic opportunities through use of the wildlife Ensure sustainable wildlife resource utilisation 			1			Wildlife
			1			
		1	2			

All policies highlighted above emphasise natural resource conservation, management and utilization. However there is need to harmonise some of the sector policies and programmes to ensure that they do not conflict and there is need for effective implementation and monitoring of policies.

The National Settlements Policy indicates that one of its major challenges is commercialisation of natural resources which has in turn resulted in people settling permanently near a resource. Since most people prefer to exercise their constitutional rights of settling where they wish, this has led to settlements sprawling and land use conflicts. The other issue with the National Settlement Policy is that some of the major policy requirements are not adequately addressed within the ODRS. The policy indicates that *“in order for a settlement to be recognised as a village it shall have a minimum of 500 people and be more than 15 km from the periphery of the main or parent village, have a permanent water source, be located outside National Parks and game reserves, preserved fertile arable land, forest reserves and environmentally sensitive areas such as the Okavango Delta.”* However the policy obligation is not being implemented; this is

evident by a number of settlements sprawling in the core areas of the Delta and some settlements being recognised as villages, for example Khwai Village.

The NDP 10 highlights that in its planning period, the tourism sector will focus on citizen empowerment in tourism, however this undermines the CBNRM policy which states that 65% of the proceeds shall be deposited in the Environmental Fund while 35% of the proceeds may be retained with the CBO. If tourism supports citizen empowerment then the CBOs should take charge of their benefits and such an initiative may trickle down to conservation. CBNRM is also not linked to communities; in some parts of the ODRS you find that communities manage areas which are not within their settlements' sphere of influence and do not have any linkages with the area and this therefore undermines the point of conserving the natural resource (e.g. communities that manage NG 22 and 23)

The Draft Elephant Management Plan emphasises the reduction of human-elephant conflict to acceptable levels or where feasible, total elimination. This is not being implemented as the human wildlife conflict is still a major challenge in the ODRS. One of the causes is the presence of artificial watering points (AWPs), but these are not clearly identified as an issue that needs to be addressed in the management plan. The management plan also indicates the need to reduce the elephant population, with hunting being one of the possible options to achieve this, however, this option has been foreclosed by the administrative decision to stop professional hunting in northern Botswana (see below).

The agricultural sector indicates that animal diseases continue to pose a threat to the growth and profitability of the livestock sector and that their overall strategy is to put in place control measures that ensure that major diseases are controllable and manageable. It indicates that this will be attained through the establishment of buffer zones along Foot and Mouth (FMD) high risk areas; this includes Ngamiland which is one of the FMD high risk areas. The sector initiative however does consider the implications of disease control buffer zones in Ngamiland on wildlife movement corridors.

3.3.6 Recent Policy Changes and Initiatives

Tourism as the “Engine of Growth” and Tourism Diversification

The Botswana Tourism Organisation is assisting in developing new tourism products and encouraging authorities to identify additional tourism opportunities in the Panhandle and less sensitive areas of the Delta. As a result of structural changes to the tourism sector, it is expected that there will be a significant increase in types and numbers of tourists visiting Botswana and a diversification of tourism products.

Forestry

The new Forest Policy (approved 2011) includes a strategy for fire management, CBNRM and community involvement. Existing firebreaks will be maintained and in some cases extended and realigned to become more effective. A new Forestry and Range Resources Act will be promulgated. This will devolve the management of fires to a district level and allow for the formation of fire management brigades. Implementation of the new policy will affect fire management throughout the ODRS.

Reduced Control of DTRP over District Planning

Revision of the 1977 Town and Regional Planning Act will result in the Department of Town and Regional Planning (DTRP) losing control over physical planning at the district level in all but declared planning areas. As a result all planning will be through land boards and councils. These institutions have been shown, in the past, to be poor planners and development is expected to be less controlled and managed.

In terms of the ODRS, though, it is possible to declare the whole Ramsar Site as a planning area but this would require corresponding institutional capacity development at district level structures.

Ngamiland Land Use Map

The Ngamiland Land Use Map is still under review but if it is approved, it will result in allocation of leases for wildlife ranches along both sides of the Buffalo Fence and along the district boundaries. This will result in the Buffalo Fence becoming permanent and impermeable and a significant change in land within the Okavango Delta WMA from open system to controlled leasehold.

Wildlife, CBNRM and WMA Regulations

The Department of Wildlife and National Parks, through an administrative decision, has stopped sport hunting in Ngamiland as a land use. Changes to be made to the 1986 Conservation Policy will result in increased emphasis on CBNRM and non-consumptive tourism. WMA regulations are expected to be promulgated in the near future.

The stopping of sport hunting conflicts with the objective of sustainable land use in areas with low non-consumptive tourism potential and diversification of the tourism industry. It also limits elephant management and hunting of elephant in, or near, community areas to reduce HWC.

NAMPAADD, ISPAAD and Food Self Sufficiency and Biofuels

Changes in the Agricultural Policy will result in the expansion of leasehold ranches as a way to commercialise agriculture thus increasing pressure on the Tawana Land Board to allocate additional ranches. There may be development of areas of land identified by the Department of Crop Production along the Thamalakane and Boteti Rivers for irrigated agriculture while the rivers are perennial. These areas will be developed commercially. The implementation of the ISPAAD programme³ to entice people to start or increase arable farming, so as to counter urbanisation trends is also one of the most recent initiatives to the Agricultural Policy. The incentives to expand agriculture places this sector in direct conflict with wildlife based land use.

The Department of Energy Affairs aims to acquire 10% of Botswana's fuel from biofuels by 2020. One of the possible target areas for commercial production of *Jatropha* is Ngamiland, which would result in increased pressure on arable land for food crops, thus creating more barriers to animal movement.

³ Integrated Support Programme for Arable Agricultural Development

Animal Disease Control

The Department of Veterinary Services is adamant that animal disease control standards will be maintained. The FMD free zone is being moved from the Khuki Fence north to the northern edge of the Hainaveld and northern edge of the Phase 2 ranches. Fence management will be outsourced and fences will become more effective barriers. Veterinary control will become more expensive and difficult during periods of high delta flooding due to wild animals being displaced into agricultural areas. NDP 10 supports this rigid approach to disease management and describes fenced barriers as the main way to control animal disease outbreaks. The inflexibility of the Department on disease standards and the emphasis on fences as the primary management tool places livestock farming in conflict with the ODRS.

Mines and Minerals

Hanna Minerals and Boseto Mines have already commenced with copper mining operations and it is expected that additional copper mines will be developed in the future along the Ghanzi Ridge. Although these are outside the ODRS, there are resource requirements for power, water and transport links, which may add to the existing pressures on the delta.

Several stages of prospecting are required before viable mineral resources can be confirmed. This process results in opening up of tracks and outlines, drilling of boreholes and movement of people into some of the most pristine areas of the Ramsar site. The sector reviews found that most land within the Ramsar site (outside of the active Okavango Delta Floodplains) have prospecting licences issued.

Prospecting and mining have the largest potential to change the economy and settlement patterns in the ODRS of any sector.

Physical Development Plans

Future developments include:

- The ZIZABONA transmission line will increase electricity available in the Panhandle area;
- Power supply to the existing and future mines;
- Power supply linkages between Maun and the Panhandle;
- Development of mini power grids in isolated areas;
- Water pipeline down the western arm of the Okavango Delta;
- Possible rail linkages between the national line and Ngamiland;
- Establishment of quarries;
- Improved road access between Ngamiland and Chobe District via the western boundary of Chobe National Park or along the southern boundary to Pandamatenga.

3.3.7 Governance

Various institutional structures have been identified as key entities in the management of the ODRS. The ODRS is entirely managed through the ODMP. The ODMP is co-ordinated by the DEA (Gaborone) under the Ministry of Environment, Wildlife and Tourism. Above the DEA is a structure whose mandate is to provide policy guidance and

make key decisions, and this is the Project Steering Committee (PSC). The PSC comprises relevant sector/institutional directors and CEOs, donor agencies and NGOs. At a district level the DEA (Maun) coordinates the ODMP but under the supervision of the Okavango Wetlands Management Committee (OWMC) which comprises representatives from all district project partner institutions, NGOs and CBOs. The OWMC is chaired by the Tawana Land Board. Government departments that are core in the management of the ODRS include DEA, Tawana Land Board, NWDC, DWNP, DFRR, DWA, DoT, BTO, DTRP, DAHP and DCP (see Table 6).

Table 6: Outline of the ODRS institutional structures and their roles (after ODMP)

IMPLEMENTATION	RESPONSIBILITY	COORDINATION
<p>DEPARTMENT OF ENVIRONMENTAL AFFAIRS (National & international level project management)</p>	<p>National project management, Implementation support, Project monitoring, PSC (chair and secretariat), Donors relations, International relations, e.g. Ramsar, KAZA, OKACOM etc.</p>	<p>OKACOM</p>
<p>Project manager, project facilitator (Communication specialist)</p>	<p>Coordination between district & national issues, progress & financial reporting, coordination of components, reviews</p>	<p>Project Steering Committee</p>
<p>PROJECT MANAGEMENT GROUP</p> <ul style="list-style-type: none"> • Project Manager • Project Facilitator • Project Coordinator • Chief technical advisor (Communication specialist) 	<p>Day-to-day project management, coordination between components, training and capacity needs assessment and support, technical assistance and advice on consultancies, M&E, integration with district structures, projects & programmes, information and communication</p>	<p>Okavango Wetland Management Committee</p>
<p>ODMP PROJECT SECRETARIAT (District level project management)</p>	<p>Implementation of agreed component activities as outlined in the Inception Report</p>	<p>Various stakeholder consultative and participatory structures and mechanisms</p>
<p>Project coordinator, Chief technical advisor, Information and public education officer, (Communication specialist), Participatory planner, Rural sociologist, Other support staff.</p>	<p>Component Task Forces and Technical Committees</p>	
<p>IMPLEMENTING INSTITUTIONS DEA, ORI, DWA, DWNP (incl. Fisheries & Forestry), NWDC (incl. tourism, EHD & PPU), DoT, BTO TLB, DAHP</p>		

4 ENVIRONMENTAL PRESSURES

This section explains how the driving forces (described in section 3 above) put pressure on the environment. Pressures arise from both current and past driving forces, as there is often a time lag between the force and the resulting impact on the environment. Of particular concern in the context of this SEA are the future drivers and the pressures that will result in the ODRS.

Table 7 illustrates how the drivers of change relate to pressures on the ODRS environment, now and in the future.

Table 7: Relationship between driving forces and pressures

Driving force	Current resulting pressures	Expected future trends
Global drivers		
Climate change	No observable changes yet.	<p>Wetter scenario: Increase in permanent swamp area; Increase in seasonal flooding regime beyond threshold limits; Increased prevalence of human and animal diseases.</p> <p>Drier scenario: Decrease in permanent swamp area; Decrease in seasonal flooding regime beyond threshold limits; Increasing number of fires. Land use change (adaptation strategies).</p>
International conventions	<p>Unsustainable numbers of certain species e.g. elephants (CITES). Human-wildlife conflict (CITES). Pressure on GoB to manage the Ramsar site to maintain its intrinsic qualities. Pressure on GoB to manage the Tsodilo Hills World Heritage site to the standards set out in the WHC and Operational Guidelines e.g. no exploration or mining allowed.</p>	<p>If the ODRS is listed as a World Heritage site, there will be significant pressure to ensure that the criteria for the listing are not compromised. Without any intervention, the elephant population will cause irreversible damage and an increasing loss of biodiversity through habitat change and illegal killing.</p>
Macro-economic stagnation	No noticeable decline in visitor numbers reported yet.	<p>Decline in international tourism industry (in current form) with a change to high volume tourism. Decline in demand for disease-free beef and high-value agricultural products. Lower mineral prices will discourage exploration and mine development. Migration of job seekers.</p>
Macro-economic growth	None at present.	Tourism industry will remain stable (increase in occupancy rates).

		<p>Increased demand for ‘unique’ tourism products.</p> <p>Higher mineral prices will result in an increase in exploration activity and the potential for new mines to open (especially copper and diamonds)</p> <p>Increased international demand for disease-free meat.</p> <p>Increased domestic demand for agricultural products.</p> <p>Migration of job seekers.</p>
Basin-wide drivers		
Upstream economic growth and development	None at present.	<p>Increased demand for water for irrigation, industrial use and human consumption.</p> <p>Increased flow and sediment regulation (dams, weirs, etc).</p> <p>Land transformation (agriculture, settlements).</p>
TFCAs (KAZA)	Not implemented yet.	<p>Focus on increased levels of conservation and maintenance of biodiversity.</p> <p>Tourism a key by-product.</p>
SADC Protocols and governance	No noticeable positive influence at present.	<p>Proactive governance and strengthening of OKACOM will result in the implementation of sustainable development plans and programmes in the basin.</p>
ODRS drivers		
Population increase	<p>Increased demand for resources.</p> <p>Increased and concentrated generation of liquid and solid waste.</p> <p>Increased demand for municipal services.</p> <p>Increasing urbanisation.</p> <p>Village sprawl.</p> <p>Increasing number of proclaimed villages in WMAs.</p> <p>Land use changes.</p> <p>Deforestation.</p> <p>Increased water abstraction.</p> <p>Increased dryland agriculture.</p> <p>Degradation of grazing land.</p>	<p>Surface water quality will probably decline especially in the Panhandle.</p> <p>Increased risk of aquatic weeds and exotic plants becoming established in the Delta.</p> <p>Reduction in total MAR entering the delta and perturbation of the hydrograph affecting the flooding regime.</p>
Increased tourism	<p>Noise from aircraft, boats and generators is causing disturbance to other tourists, birds and animals, and negatively affecting the wilderness quality.</p> <p>Unsustainable tourism agenda.</p>	<p>These noise levels will keep increasing and will reduce the wilderness value of the prime tourism areas.</p> <p>Mass tourism (mid –to low cost) will mean a loss of wilderness qualities and the area will lose its competitive</p>

		advantage.
National policies	Ineffective and/or conflicting policies. Lack of community involvement / interest. Veterinary fences act as a barrier to wildlife.	Without policy harmonisation and clear management guidelines for the ODRS, there will be an increase in policy conflicts. More barriers to wildlife movement (especially elephant) will result in an increase in HWC, a higher incidence of livestock diseases, increased environmental degradation.
Governance	Regional politics regarding water. Vested sectoral interests. Too many plans and insufficient implementation. Lack of enforcement and control.	Continued lack of implementation will result in uncontrolled development, which will have negative consequences for tourism, conservation, biodiversity and GoB's international reputation.

4.1 Basin

The Ramsar Information Sheet notes that the main threats to the area come from possible water extraction from the Okavango and Kwando rivers and their tributaries by the fringe states (Angola, Botswana, Namibia, and Zambia (Kwando only)).

The basin supports predominantly rural communities most often located either adjacent to the river or along roads. Relative to capital cities and main centres of economic activity, the basin populations of these countries are remote; this is reflected in lower social development indicators in the basin than those for national social development. In general, the people of the basin are poorer, less healthy, and less well educated than other groups in their respective countries. This is particularly the case in Angola where the war curtailed social and economic development (OKACOM, 2011).

National social and economic development policies, including achievement of Millennium Development Goals (MDGs), target these communities and put added pressure on the water resources of the services provided by the river system. These services are important not only for the myriad of riparian community livelihoods they support, ranging from artisanal fisheries to small scale agriculture, but also a major tourism industry in the Okavango Delta. It has been recognised for many years that proposed water development projects may have an impact on the waters of the Cubango-Okavango (Figure 13). Most of the issues and problems described in this report are not new, having been identified and discussed previously. The three countries of the basin have been wrestling with these issues both internally and collectively as OKACOM, and have already put some mechanisms and policies in place to manage potential impacts. They have an opportunity to delineate a development pathway and describe a development space for the basin that will meet national objectives without compromising the ecosystem services and diminishing the Cubango-Okavango's global value (OKACOM, 2011).

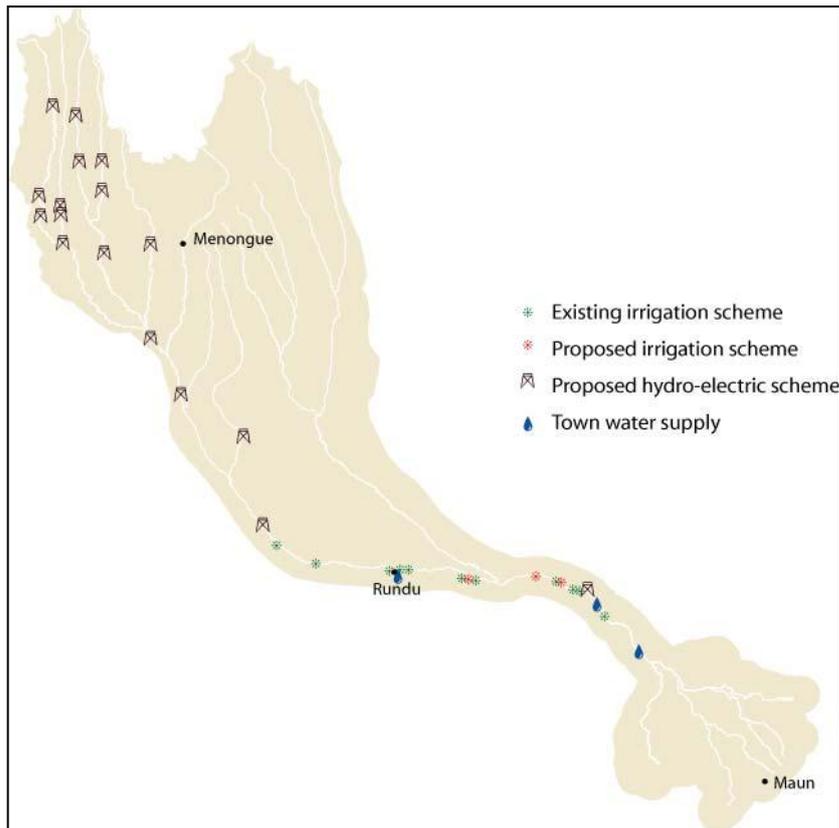


Figure 13: Existing and proposed water use in the Cubango-Okavango Basin

4.2 ODRS

The pressures, generated by the global drivers (Section 3.1), the basin drivers (Section 3.2) and the ODRS drivers (Section 3.3) are spatially described in this section.

4.2.1 Spatial Distribution of Biophysical Pressures

4.2.1.1 Settlement and Demographic Growth

Settlement and demographic growth are illustrated in Figure 14. Rates of growth vary considerably between the different settlements. The Panhandle appears to have both high levels of settlement and high growth rates while Maun, in the south, is significantly larger than other settlements.

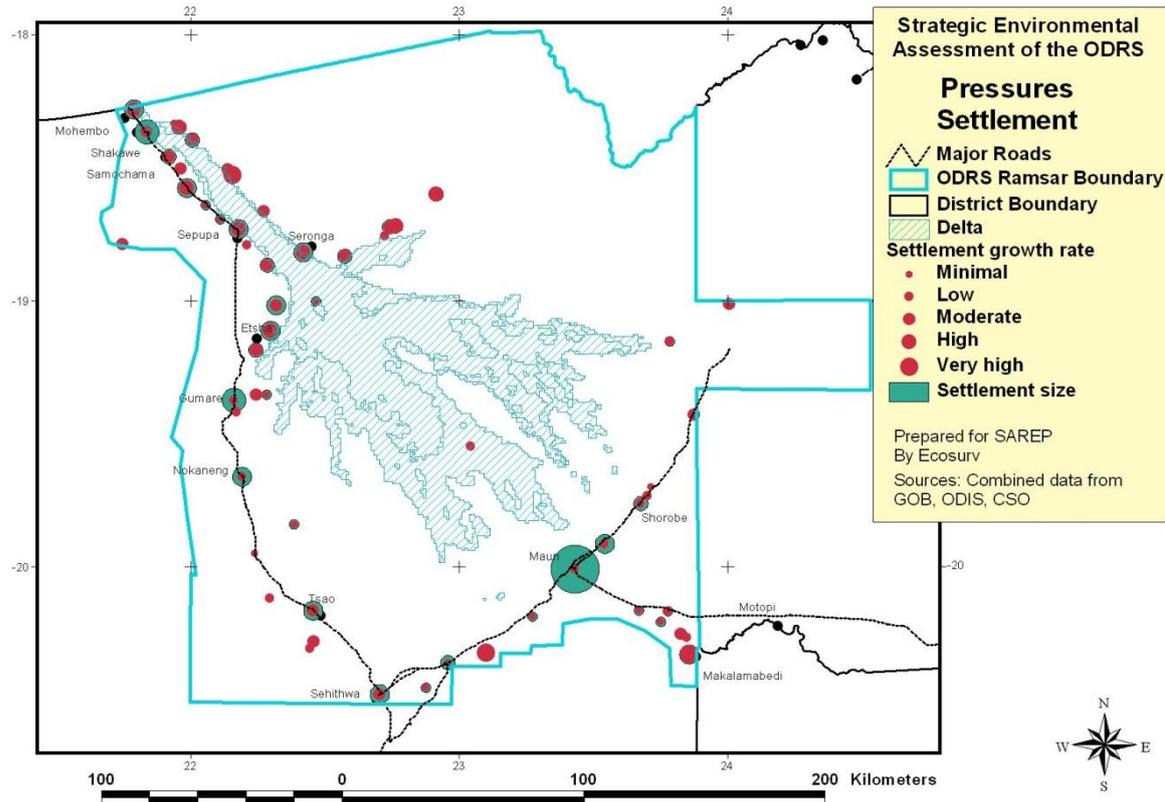


Figure 14: Pressure from settlement indicating settlement size and growth rates (CSO 1991, 2001, 2011 – for major settlements)

4.2.1.2 Arable Agriculture

Closely linked to settlement patterns is the distribution of arable agriculture (Figure 15). Most rain-fed agriculture is located on either side of the Panhandle and upper delta and along the southern rivers and Lake Ngami. Irrigation is being proposed for some areas of the Panhandle and additional areas to the south of the Delta based on outflows (Boteti and Thamalakane Rivers).

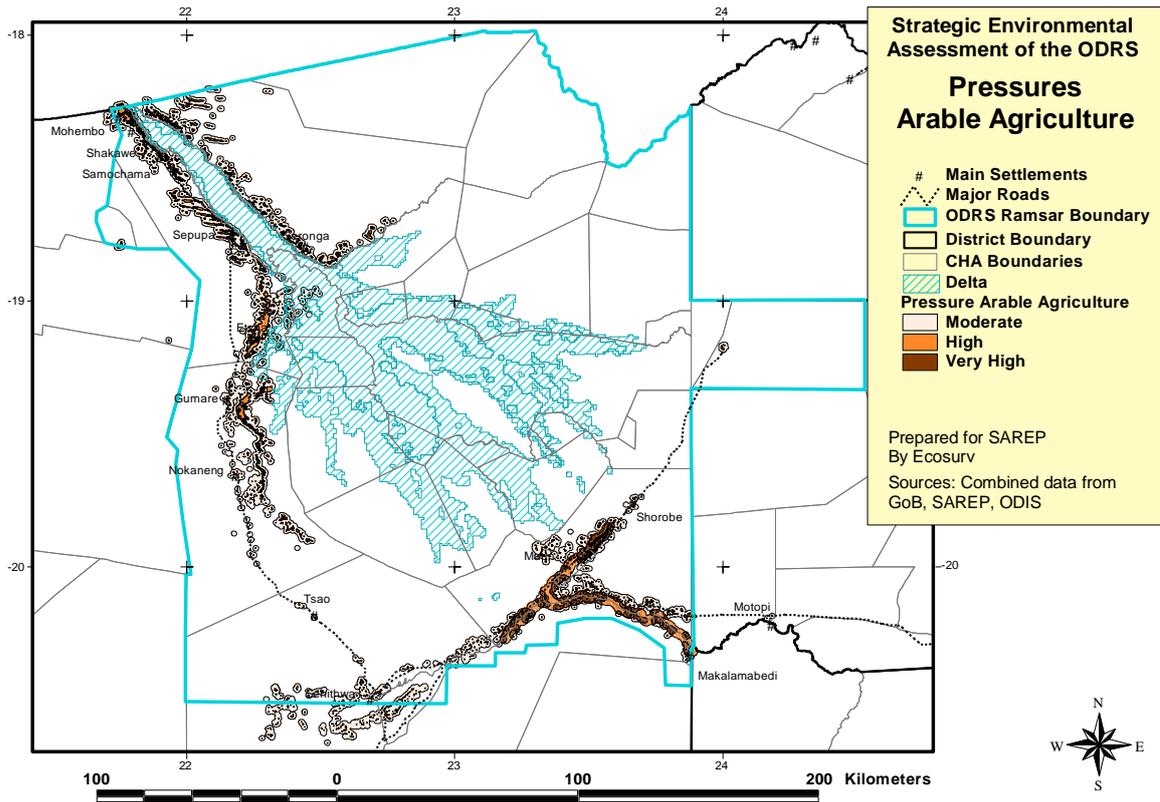


Figure 15: Existing arable agriculture, potential irrigated agriculture (ODIS and Consultations)

4.2.1.3 Livestock and Animal Disease Control

Also related to settlement to some degree is the distribution of livestock (Figure 16). Closely associated with livestock are fenced livestock ranches, animal disease control fences and veterinary zones (Figure 17).

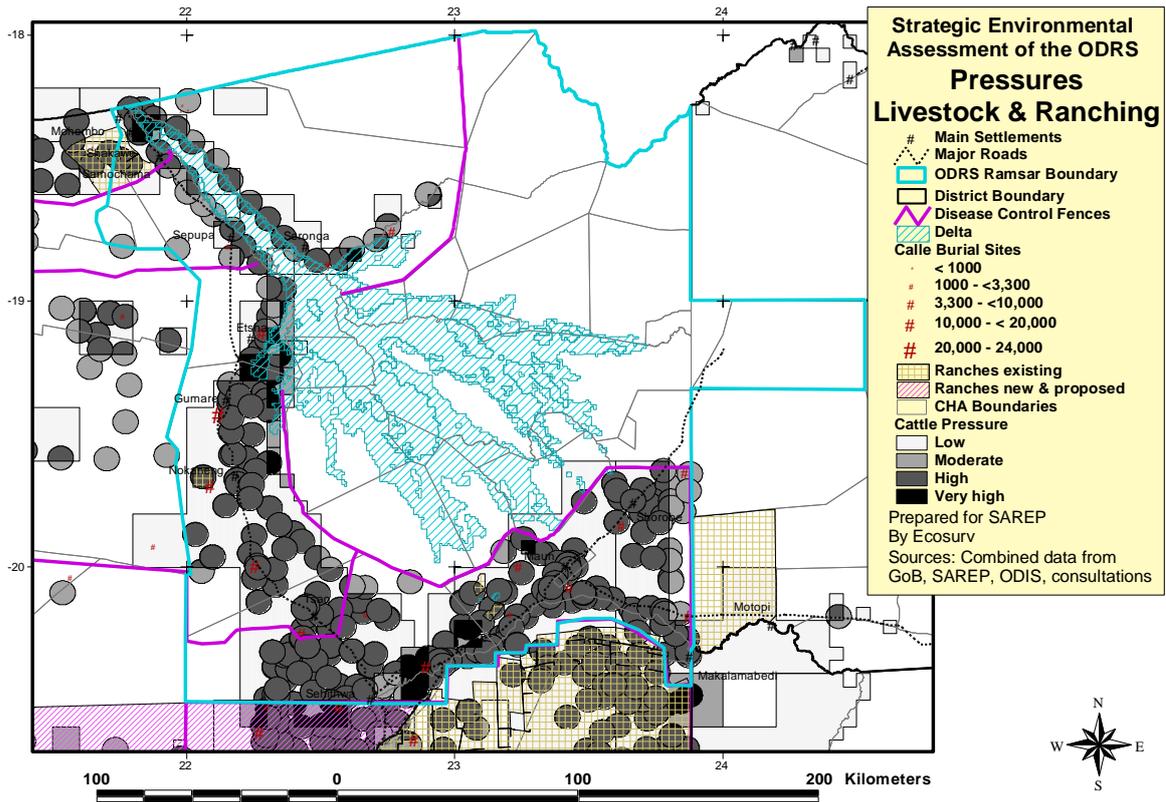


Figure 16: Distribution of livestock, disease control fences and cattle burial sites⁴

⁴ The burial sites from the cattle eradication during the Contagious Bovine Pleura Pneumonia outbreak are included as they indicate potential sites of groundwater pollution.

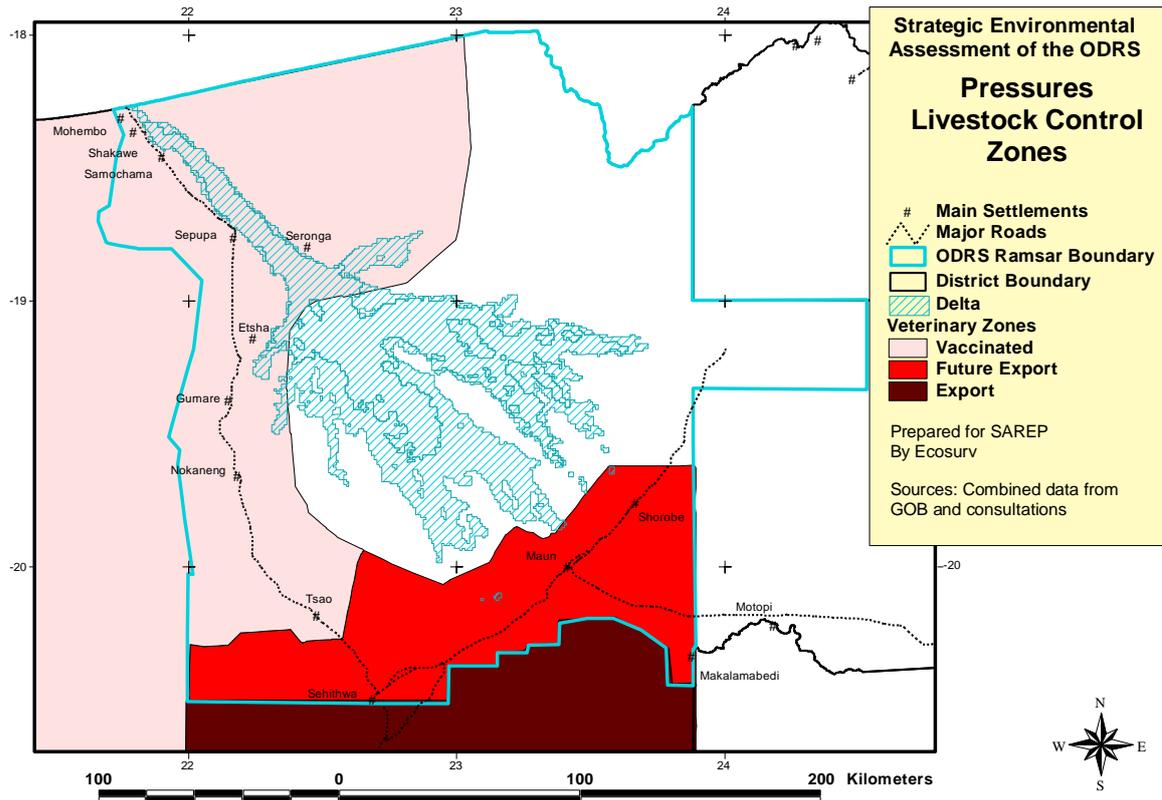


Figure 17: Livestock disease control zones (DVS consultations)

4.2.1.4 Fire Frequency and Distribution

Fire distribution and frequency indicates that there are linkages between access routes, livestock distribution, settlement, poaching and rainfall (the northern areas of the Ramsar site receive higher rainfall). The fire frequency map indicates that most of the Delta wetlands are experiencing higher than average fire frequencies. Similarly the teak woodlands of northern Botswana particularly those adjacent to cutlines, fences and access tracks are being exposed to high frequencies of fire.

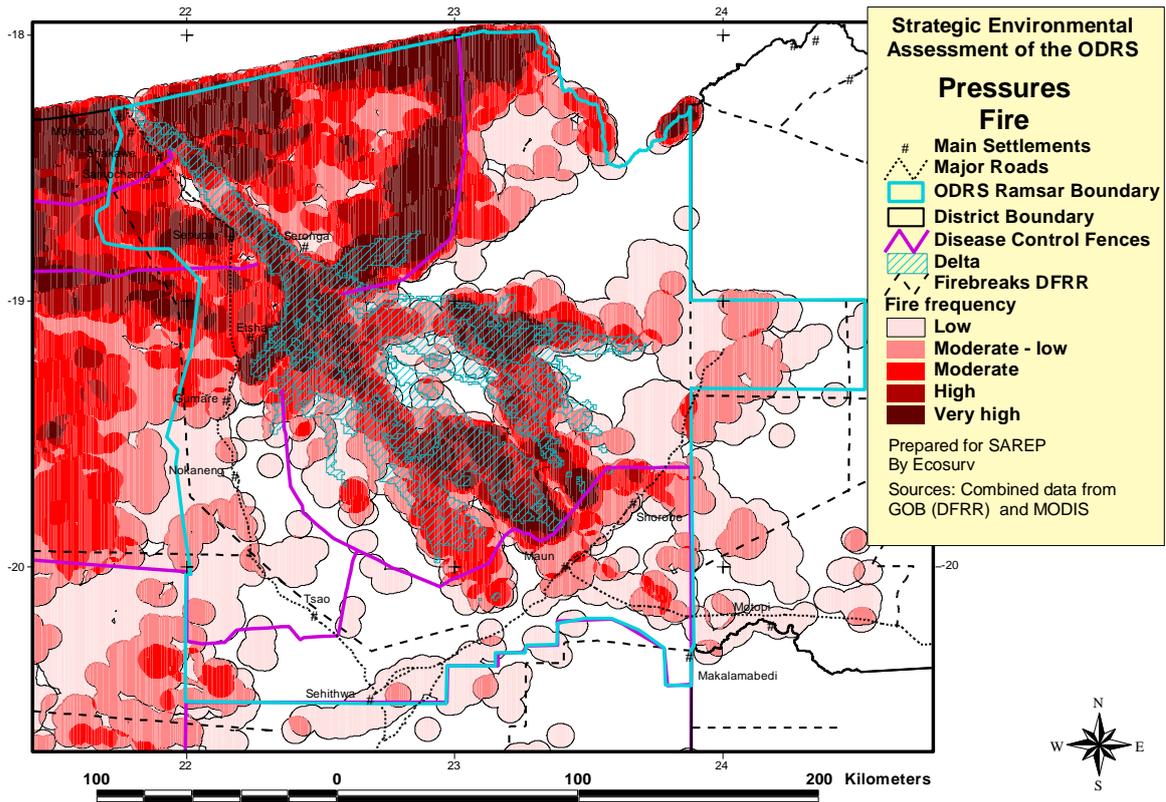


Figure 18: Fire Frequency (MODIS 2002-2008)

4.2.1.5 Mining and Prospecting

The mines that are presently being developed are outside the Ramsar site but will, in most cases; require resources such as water from the ODRS. Prospecting licences, though, have been issued for most of the Ramsar site apart from the active wetlands (Figure 19).

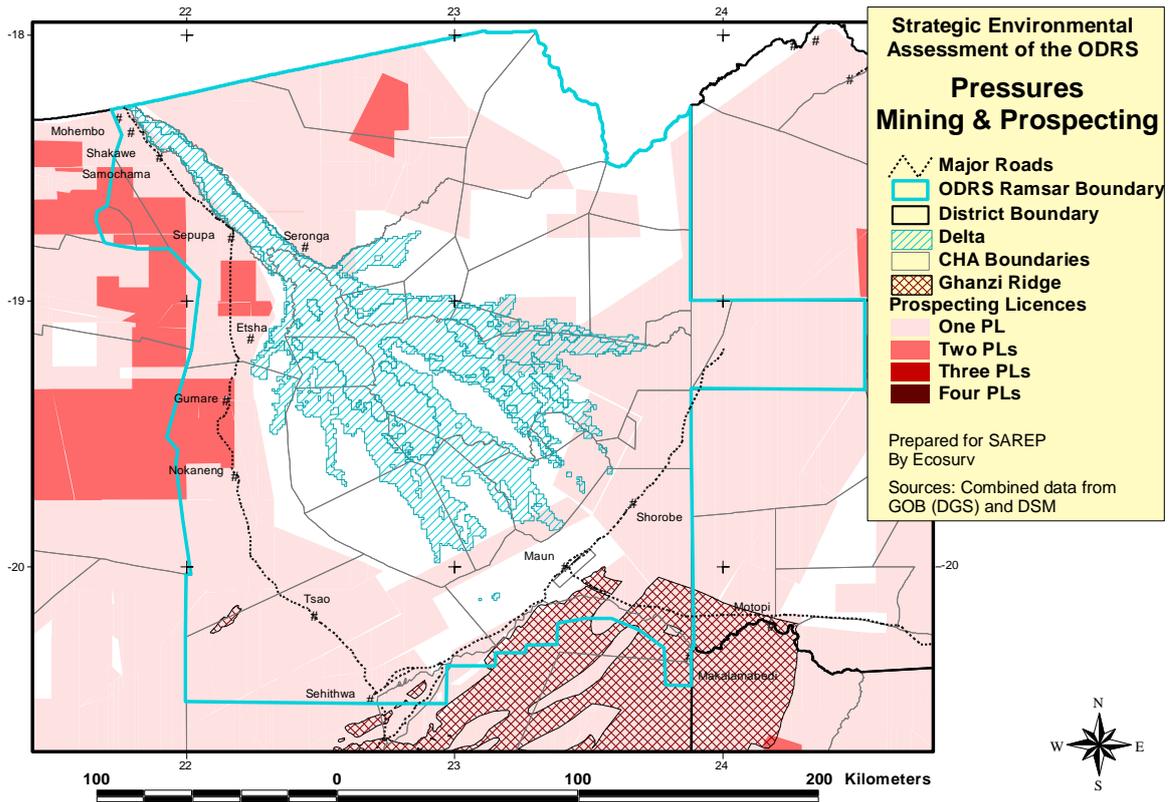


Figure 19: Mining, minerals and prosecuting licences (DGS)

4.2.1.6 Infrastructure

Associated with and linking settlements are infrastructure such as roads, power lines, and water pipelines (Figure 20). These infrastructural developments create pressures by affecting the distribution of people, availability and use of resources, change access and in some cases create barriers, fragmenting habitats and causing wildlife mortalities.

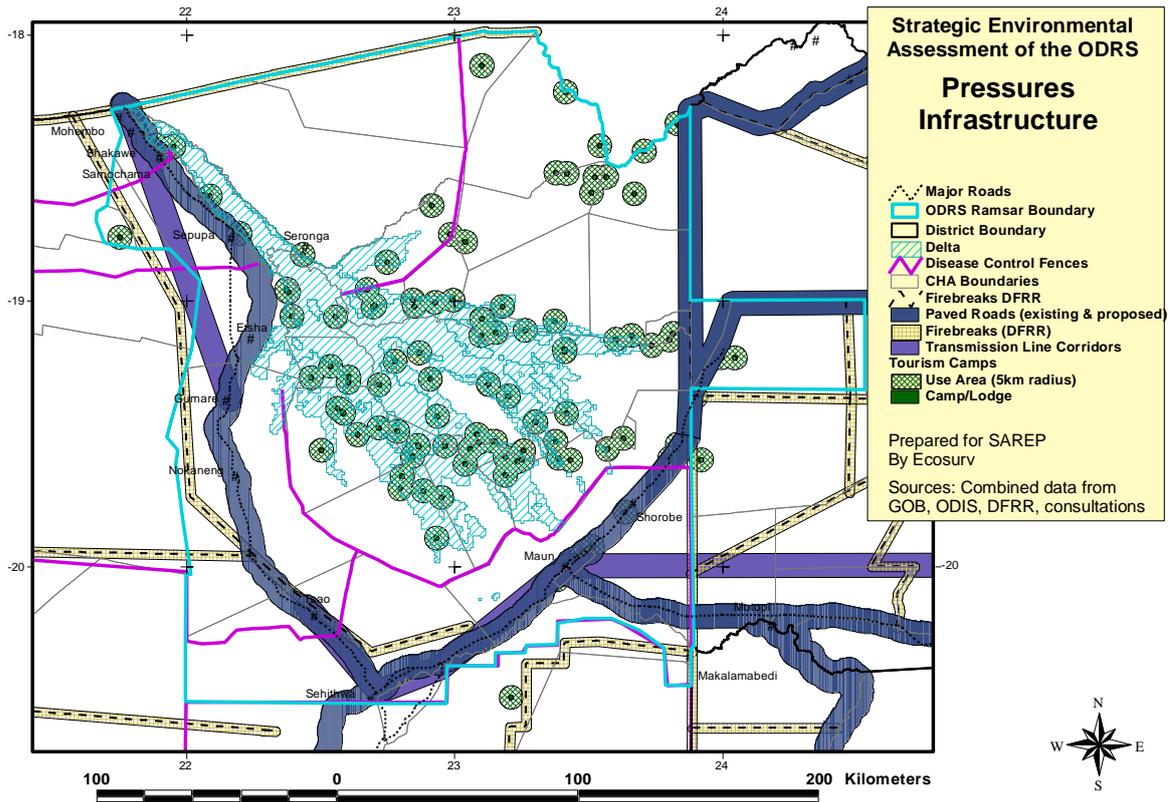


Figure 20: Existing and proposed infrastructure

4.2.1.7 Noise Levels

The international value of the ODRS is its perceived “pristine” wilderness creating a unique “sense of place” and thus a world class product. Noise is a pressure which degrades or reduces the unique value of the Ramsar Site core area. Figure 21 illustrates the areas of most pressure.

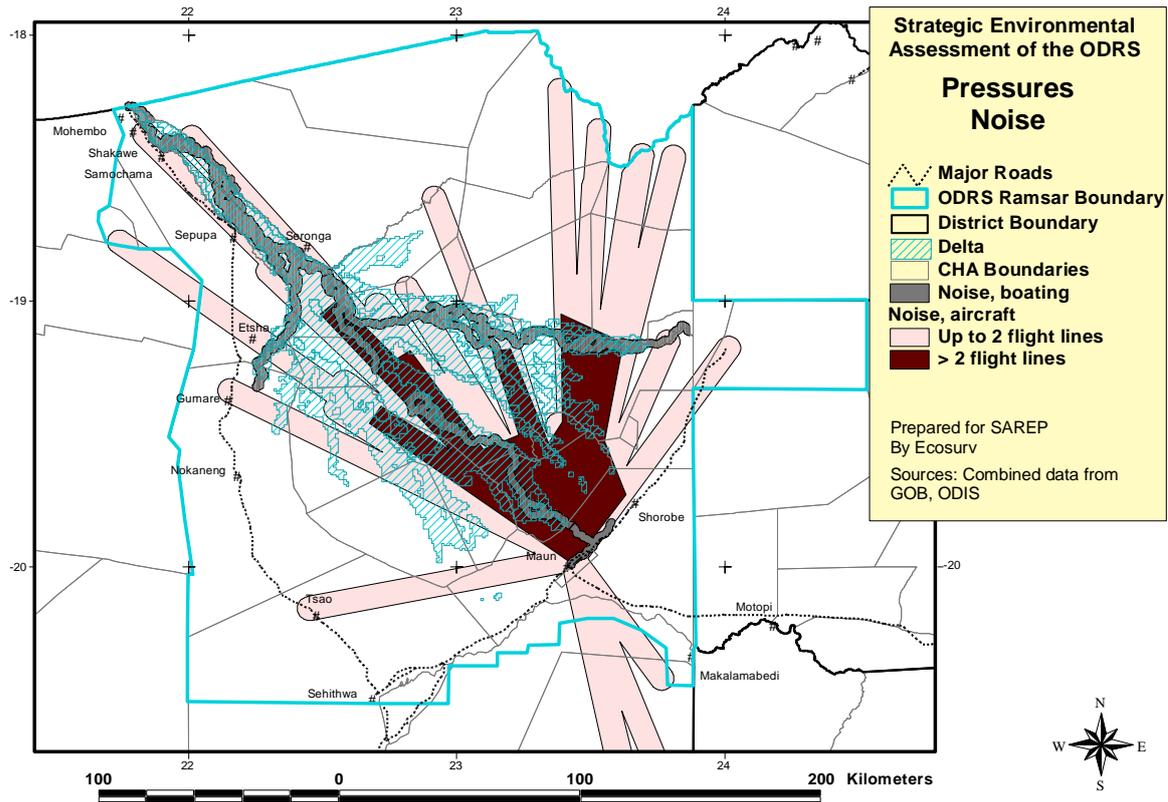


Figure 21: Sources of noise in the wilderness areas

4.2.1.8 Cumulative Impacts

The influence of all the pressures described above can be combined to create a map of cumulative impacts and areas of high concern (Figure 22). Areas with highest pressure are: the Panhandle; the eastern and western arms of the Delta fan; and the southern area of the ODRS.

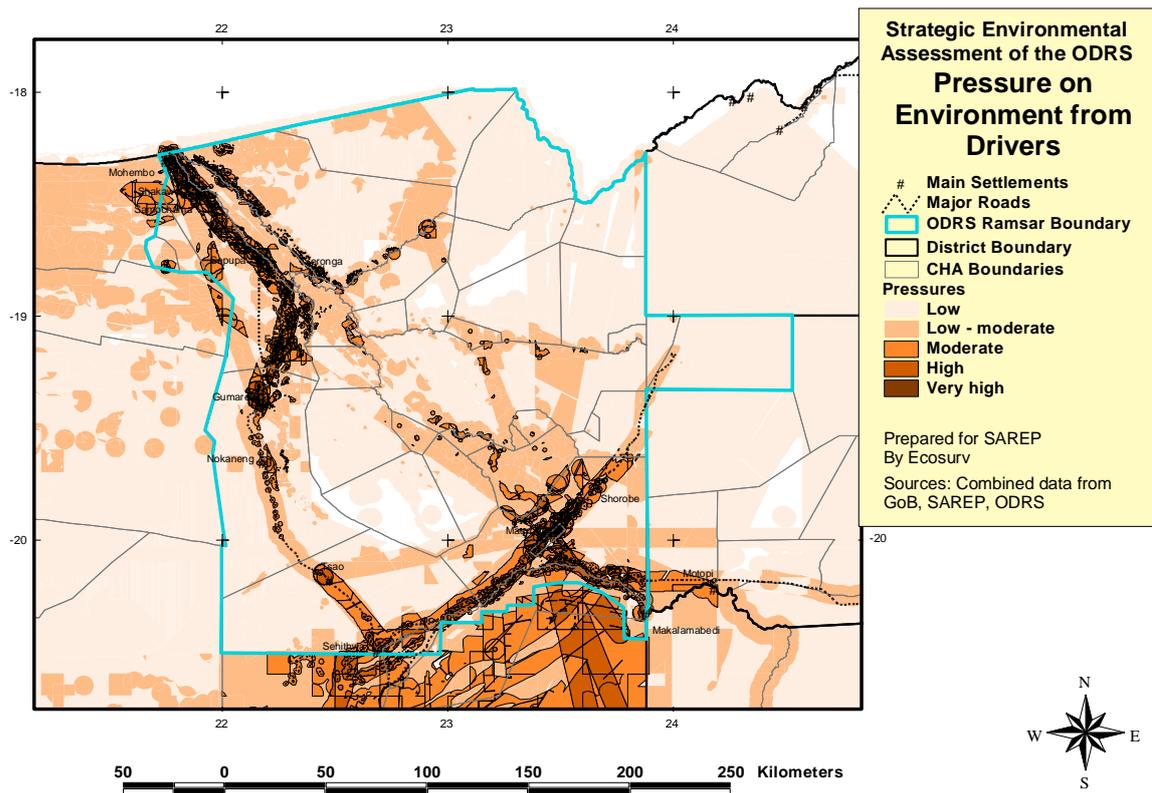


Figure 22: Total combined biophysical pressures

4.2.2 Pressures from conflicting policies and plans

Botswana has a wide range of sectoral policies most of which emphasise natural resource conservation, management and utilisation and are pertinent to the management and conservation of the Okavango Ramsar Site. Recent policy revisions will have implications for the SEA.

Agriculture

Policies and Plans	Consequences for the ODRS
Policies Revision of the 1991 Agricultural Policy	Movement from open resource access to communal and individual ranches
Plans The Proposed 120 Ranches in Ngamiland	Increased Human Wildlife Conflict
Commercial Irrigation Schemes along Thamalakane and Boteti Rivers	Abstraction of water from the delta discharge reducing downstream water availability for human populations and IBAs

Wildlife

Policies and Plans	Consequences for the ODRS
Policies Revision of the 1986 Conservation Policy Revision of the 2008 CBNRM Policy	Increase in non-consumptive tourism. Decrease in revenue from hunting Community Involvement
Plans Communities to take over some of the CHAs	Human Wildlife Conflict

Land Use

Policies and Plans	Consequences for the ODRS
Policies Revision of the 1977 Town and Regional Planning Act Revision of the 2008 CBNRM Policy	Ramsar can be declared as a planning area and this will allow it to deal with illegal settlements and tourism densities in sensitive areas Community Involvement

Pressures generated out of policy conflicts are indicated in Table 8. The table is a simple two way with the same sectors indicated in both the horizontal and vertical axes. Summaries of conflicts between policies are indicated where the one sector overlaps with another.

Table 8: Sector policy conflicts to be addressed

	Land Use	Settlements	Wildlife	Environment	Water	Mines	Tourism
Land Use	Resources use conflict	<p>Squatters (Conflict with the Land Board Policy)</p> <p>Gazetting settlements in the ODMP (Conflicts with the National Settlement Policy)</p>	<p>Closure of wildlife wet/dry links (Conflict between the Agricultural Policy and Wildlife)</p> <p>CBNRM Policy undermined</p> <p>CBNRM badly applied, dysfunction and at wrong scale</p>	<p>Clearing of riparian woodland to prevent repossession of undeveloped allocated land (Conflict between ODMP and Land Board Policy)</p> <p>High density settlements in core zones. (Conflict between ODMP and National Settlement Policy).</p> <p>Gazetting settlements in environmental sensitive areas of the ODMP(Conflicts with the National Settlement Policy)</p>		Allocation of land for new urban settlement	<p>Tourism establishments in villages within or adjacent to core zone</p> <p>High number of tourism mixed market establishments (Conflict between Land Board Policy and ODMP/BTO)</p>
Wildlife	Land allocation within wildlife movement corridors	Failure to implement the Elephant Management Plan leading to HWC		Competition for grazing between livestock and wildlife (Conflict between the Agricultural Policy and Wildlife)	Spread of artificial watering points for wildlife (Conflict Between Wildlife objectives and environmental management)		<p>De facto closure of professional hunting (Conflict between DWNP objectives and appropriate land use)</p> <p>De-facto closure of professional hunting (Conflicts with the Elephant management plan)</p>

	Land Use	Settlements	Wildlife	Environment	Water	Mines	Tourism
Agriculture (livestock)			<p>Human Wildlife Conflict (Conflict between the Agricultural Policy and Wildlife)</p> <p>Ranch Fences and Barriers (Conflict between Agricultural Policy of disease control and Wildlife Policy)</p> <p>Perverse subsidies undermine CBNRM through overvaluing livestock</p>	Competition for grazing between livestock and wildlife (Conflict between Agriculture and Wildlife Policies)			Impact on tourism sites Lake Ngami (Conflict between Agriculture and Tourism Policy)
Agriculture (Arable)			<p>Human Wildlife Conflict (Conflict between the agricultural Policy and Wildlife Policy)</p> <p>(Conflict between CBNRM and subsidisation of agricultural development)</p>				

	Land Use	Settlements	Wildlife	Environment	Water	Mines	Tourism
Mines			Allocation of prospecting licenses (PL) in the Ramsar Site (Conflict between objectives of the Ramsar and the objective of mineral exploration)	Conflict with World Heritage Site and Ramsar	Potential conflict over water resources (between environmental requirements or other land uses such as arable agriculture and mines)		Visual (Conflicts with the Tourism Policy)
Tourism		Settlement growth and formalisation in core zones (Conflict between ODMP and National Settlement Policy)					
Fire				Firebreaks increase access and influence poaching, NR use and settlement			

4.2.3 Pressures from ineffective governance

The pressures created by ineffective governance were identified from three sources; the ODMP review by Plantec, consultations, and from the resilience analysis.

ODMP Review:

- “...most of the ODMP’s issues are institutional in nature, and relate to awareness, legislative and policy inadequacies, capacity limitations, as opposed to the more technical and science oriented questions/issues” (Plantec, Draft Gap Analysis Report, 2012).
- The ODMP is a large and complicated project yet the DEA implementation office in Maun has not been strengthened. There is no ODMP specific officer.
- ODMP projects are financed by Central Government and thus tied to budgetary allocations in line with projects as contained in the National Development Plans (NDPs). This arrangement is a constraining factor in the funding of ODMP implementation.
- Officers stationed in Maun are transferred frequently and thus valuable knowledge and experience is regularly lost.

Stakeholders

- Plethora of plans prepared by consultants and government but little implementation is seen on the ground.
- Intense management focus on the specifics (e.g. waste water discharge requirements) but little on the big issues that undermine the entire Ramsar area (settlement patterns, land allocation, poaching to name a few).
- Lack of buy-in from local communities (largely due to the failure to implement past plans).

Resilience Analysis:

- Land management and allocation: the allocation of land for agriculture, ranches and settlement into areas which conflict with the objectives of the Ramsar Site, are leading to pressure on ecosystem function.
- Loss of local community support due to limited success in service delivery (plan implementation).

5 DESCRIPTION OF THE ODRS (STATE)

5.1 Cubango-Okavango Basin

The Cubango-Okavango River rises in the headwaters of the Cuito and Cubango Rivers in the highland plateau of Angola. The topographic extent of the Cubango-Okavango Basin comprises approximately 700,000 km², but derives its principal flow from 120,000 km² of sub-humid and semi-arid rangeland in the Cuando Cubango⁵ Province of Angola. The basin is drained by the Cubango (referred to as Kavango in Namibia and Okavango in Botswana), Cutato, Cuchi, Cuelel, Cuebe, Cueio, Cuatir, Luassíngua, Longa, Cuiriri and Cuito Rivers and the Okavango Delta (Figure 23). Flowing from the Angolan highlands, the Cubango-Okavango forms the boundary of Namibia and Angola, and on this stretch is joined by the main tributary, the Cuito, before flowing through the Panhandle as it enters Botswana and spilling into the Okavango Delta in Botswana. The outflow from the Delta is via the Thamakalane River. This river flows in a south-westerly direction, and during wet periods, it terminates in Lake Ngami. Just south-west of Maun the Thamakalane River bifurcates and the Boteti River branches off and flows to the east-south-east, terminating in the Makgadikgadi Pans during exceptional wet periods (Figure 24) (OKACOM, 2011).

The Cubango-Okavango River basin is internationally important for its biodiversity and biological productivity. The Okavango Delta is the best-known feature of the river basin and is the largest Ramsar Site in the world at 68,640 km² (www.ramsar.org). The Cubango-Okavango River basin thus has national, regional and, importantly, global environmental value.

⁵ Sometimes spelt 'Kuando-Kubango'.



Figure 23: Location of the Cubango-Okavango Basin

5.2 Location of the Okavango Delta Ramsar Site

The Okavango Ramsar site includes the Okavango River, the entire Okavango Delta, most of Lake Ngami, and parts of the Kwando and Linyanti river systems that fall along the western boundary of the Chobe National Park (Figure 24). The Okavango Delta System is hydrologically unique, the largest inland delta in sub-Saharan Africa after the inner delta of the Niger. Since it lies in a semi-arid area, 97% of the annual inflow of between 7,000 and 15,000 million cubic meters per annum (Mm³/a) is lost to evapo-transpiration and seepage. Only 3% of the water is discharged from the delta.

Socio-economically, the site supports the traditional lifestyles of many local communities and a burgeoning tourist industry.

With its location, variety of habitats and resulting biodiversity, it is globally one of the unique areas for biodiversity conservation. The wetland environment of the delta provides a staging post for birds migrating to southern Africa during the boreal winter and is a storehouse of globally significant biodiversity. It has a large population of sitatunga (*Tragelaphus spekei*) and red lechwe (*Kobus leche*), a significant population of wild dog (*Lycayon picatus*), and 72 small mammal species, as well as 95 species of reptiles and amphibians. Many terrestrial herbivores including buffalo, zebra, elephant, waterbuck, and common duiker, inhabit the place, as well as lion, spotted hyena, cheetah and leopard, which depend upon the high concentration of herbivores near permanent water bodies. There are also an estimated 68 species of fish in the delta ecosystem, with the sharp-tooth catfish being endemic, and some 1,061 different plant species have been recorded there (www.ramsar.org).

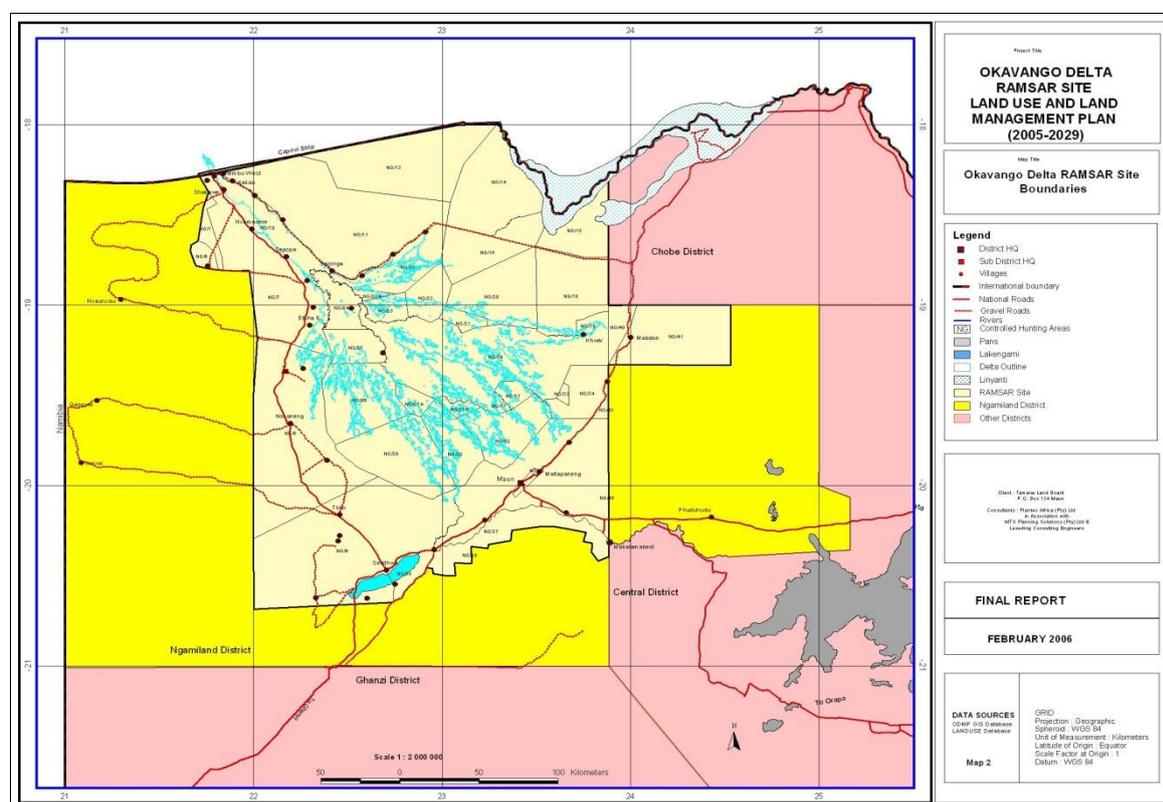


Figure 24: Location of the Okavango Delta Ramsar Site (Source: Plantec Africa (2006))

5.2.1 Basin linkages

Unfortunately, the Ramsar site does not include the downstream catchment and the hydrological linkages to the Makgadikgadi Ntwetwe Pan, Boteti River and Lake Xau. Similarly many of the wildlife movement linkages are outside the control of the ODRS such as the linkages to the southwest (to Gcwihaba WMA), to the east and southeast (to the Nxai Pan/Makgadikgadi Pans National Parks). Even though these linkages are outside the ODRS, they are either dependent on the Ramsar site (downstream linkages) or the ODRS is entirely dependent on the scale of developments in the basin for its continued functioning (upstream linkages).

5.3 Conservation and Gazetted Land Use

The entire ODRS, as a Ramsar site is to be sustainably managed and ecosystem processes maintained. In addition to the Ramsar status, there are a number of national and international conservation designations of relevance (Figure 25).

5.3.1 International

- Within the Ramsar site is the Tsodilo Hills World Heritage Site which is also protected under the National Museums and Monuments Act as a National monument.
- All the land north and east of the Buffalo Fence falls into the KAZA Trans-Frontier Conservation Area which is being managed and protected under a multilateral agreement.

5.3.2 National

The gazetted protected areas are as follows:

- Moremi Game Reserve and the Maun Education Park (protected under the Wildlife Conservation and National Parks Act of 1992) and associated regulations;
- Okavango/Linyanti Wildlife Management Area (protected under the Wildlife Conservation and National Parks Act and associated regulations);
- Important Bird Areas (IBAs) – the Okavango Delta and Lake Ngami are designated IBAs. Although these hold no legal status, they are actively monitored and promoted by Birdlife Botswana.

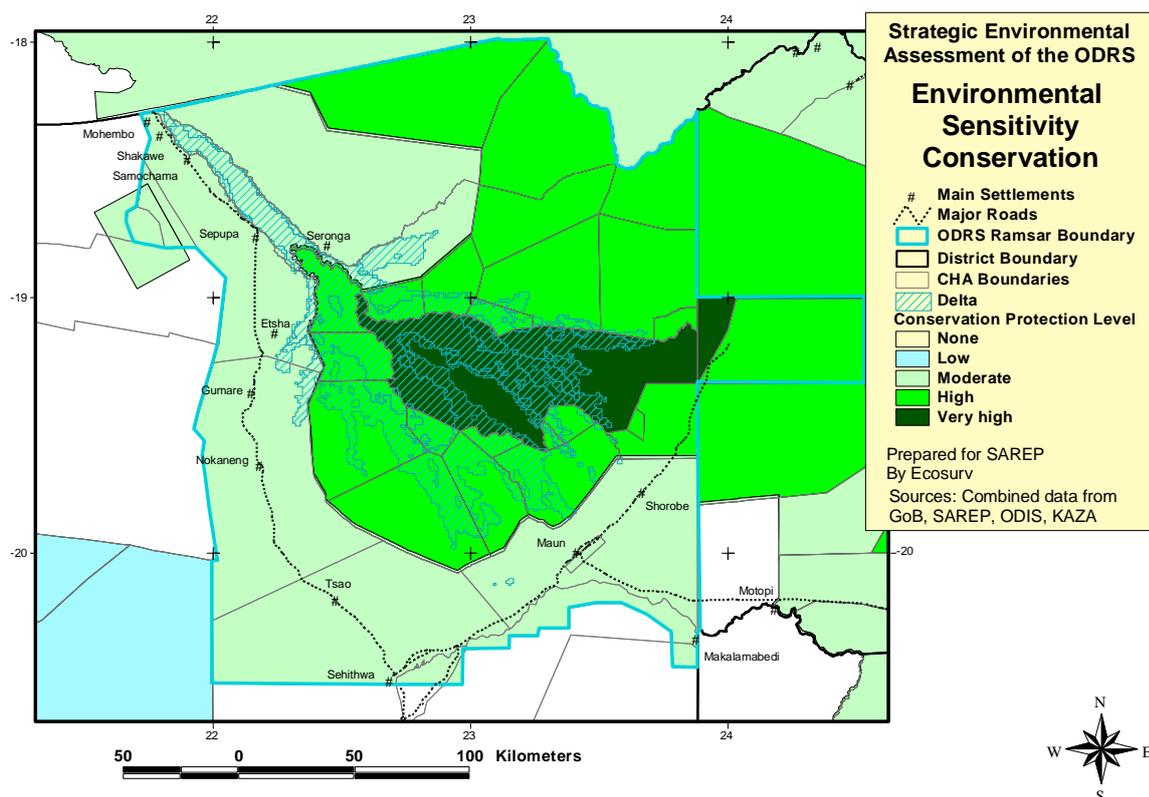


Figure 25: Levels of conservation protection within the ODRS (note that these are combined values based on overlapping levels of protection)

5.4 Key Sectors

The main sector activities within the ODRS are arable agriculture, livestock farming, tourism and, more recently (and outside of the ODRS), mining. These were described in the Thresholds Assessment (SAIEA, 2012) and summarised in the following sections.

5.4.1 Tourism (after SAIEA, 2012)

The Okavango Delta is widely regarded as one of Africa's prime wildlife tourism destinations, and tourism has emerged as a strategic sector for generating foreign exchange, attracting foreign direct investment, creating employment and reducing poverty in the country.

According to the Botswana Tourism Organisation (BTO), this sector is the country's second key national asset after mining and has the potential to become one of the primary drivers of the economy. Currently, tourism accounts for 11% of the GDP. The government of Botswana recognizes the need for economic diversification and is therefore encouraging investment into tourism. The BTO is of the opinion that there is immense potential for growth, anticipating opportunities for the development of new products in various parts of the country.

Botswana's neighbouring countries also have good tourism options so Botswana will have to maintain its high standards as well as diversify its products to be competitive. It is expected that if the plans for the KAZA Trans-frontier Conservation Area come to

fruition, there will be an increased movement of tourists through the region wanting to experience the wide range of destinations offered, of which the ODRS is but one. This will establish central-southern Africa as one of the world's most attractive tourism destinations.

According to the World Travel and Tourism Council (WTTC), tourism has proved resilient and was the only economic sector in the country that was not adversely affected by the recent world financial and economic crisis (Figure 12). Tourism is also less vulnerable to climate variability than sectors such as agriculture.

The main use of land in the Okavango Delta is wildlife based tourism, which takes place mainly in the core conservation area (Moremi Game Reserve) and Wildlife Management Areas, of which the latter are further divided into concessions for private companies and communities.

The following types of tourism have been recognised:

- Hunting Safaris (now discontinued in the majority of WMAs): sport or trophy hunting, game farming and live capture. Secondary industries associated with safari hunting include taxidermy and trophy processing.
- Photographic Safaris: game and scenic viewing, relaxing in remote camps and lodges.
- Culture and Heritage Tours: this type of tourism relies on cultural and spiritual aspects of local people as tourism products. This includes local history or heritage, song and dance, oral traditions, cultural artefacts and monuments (e.g. Gcwihaba Caves and Tsodilo Hills).

Approximately 120,000 tourists visit the Okavango Delta annually (ibid), and they either take a package tour, stay in lodges or they explore the area in their own (or hired) vehicles. The package tourists are generally transported from one lodge to another in light aircraft, after which they are shown the local attractions in safari vehicles or small boats.

5.4.2 Arable Agriculture (after SAEIA 2012)

Intensive arable agriculture has grown globally in response to increasing demands for food in terms of quantity and quality as a result of increasing global population growth and increased expectations (e.g. Ringrose, 2011).

The impact of agriculture on the GDP (Gross Domestic Product) of Botswana is small compared to other sectors of the economy (GoB, 2009). The latest National Development Plan (NDP 10) indicates that the contribution of agriculture to the national economy has declined from 42.7% in 1966 to 5.6% in 1985/6 dropping to 1.9% in 2008/9. This has led to a food import bill of about P30 million with imports coming from South Africa. Thus there is a major shortfall in all aspects of food production in Botswana.

Only about 0.7% of the total land area of Botswana is regarded as being well suited for arable crop growth and this mostly takes place on loamy soils in the eastern hardveld. The principal crops for domestic use are sorghum, maize and millet. Current figures for rain fed crops in the ODRS stand at 162 kg/ha for maize, 121kg/ha for sorghum and 144kg/ha

for millet (Vanderpost, 2009), with sorghum and maize being grown mainly in the southern part of the ODRS and millet in the north, around Gumare and Shakawe.

In terms of employment, in 1996 Central Statistics Office (CSO) found that traditional agriculture was the fourth largest employer after government and the private and informal sectors in Botswana, with 48,657 people (14.1%) being employed. About 14.5% of Ngamiland's population are employed in arable agriculture, but agriculture is important for over 23% of all households as villagers are involved in clearing, ploughing, hoeing and weeding which (after clearing) is often undertaken by women (Vanderpost, 2009).

Applications for agricultural land in the ODRS are processed through the Tawana Land Board. Molapo (flood recession) fields are not formally allocated by government but ownership is recognized within local communities. The lack of legal status means that melapo⁶ are not eligible for government grants or subsidies.

Land for irrigable horticultural development (often 5 - 25 ha) is issued through one of the district sub-land boards. The DEA determines the EIA requirements in compliance with the ODMP which requires that such land be allocated at least 200 m from the nearest surface water. However evidence exists that not all farming activities adhere to these restrictions.

Climatic and soil conditions in the ODRS are poor for arable agriculture in general and for irrigated agriculture in particular. In order to be commercially viable grain crops normally need to be grown on large mechanized farms. This is not happening in rain fed communal areas at present in the ODRS, where production is stagnating (MoA, pers com). In contrast, the commercial productivity of citrus fruits and vegetables on small irrigated plots has expanded in the last 3-5 years.

Current status of arable agriculture, emphasizing irrigated agriculture

The number of active fields in the ODRS is quite small with about 10,000 ha under rain fed arable production, 6,500 ha under molapo production and an estimated 150 ha under horticultural production.

Clearing of new land areas may take place by mechanized means but often is undertaken by teams of men with axes who burn the roots of trees to remove them (de-stumping). Large trees may be left in the fields for shade. Under drought conditions a very small proportion is ploughed (if at all) whereas under 'normal' summer rainy season conditions a small area is ploughed using donkeys, oxen or government tractor. Hence the actual area under crops is variable and fluctuates yearly in response to rainfall, flood extent and floodwater availability.

Major problems with field crops in the ODRS include raiding by elephants, hippos and cattle especially during the dry season and there is evidence that the incidence of crop raiding is increasing.

⁶ Singular: molapo; plural: melapo

Molapo farms are fenced off areas of floodplains where flood recession farming on roughly one hectare plots is practised. As the flood waters recede, some fertiliser, often chicken manure, is applied and crops are planted in the wet soil. These farms are relatively extensive along the western side of the delta, and along the Thamalakane and Boteti rivers and produce >10 times in terms of yield than basic rain fed agriculture. However Molapo farming suffers during low flow years.

Irrigated agriculture (mainly horticulture) is usually located higher up the river banks using pumps, water storage mechanisms and water distribution systems. Grains and some vegetable crops are grown under irrigation in the Panhandle. . Likewise small horticulture plots (0.5-2 ha) are located around Gumare, Maun and the upper Boteti river on soils of varying fertility, where vegetables and some tree fruits are cultivated for local markets.

Without government subsidies, much of the arable farming in the ODRS would likely revert to subsistence agriculture. Government incentives are attempting to change this pattern as a direct response to the need for greater food self-security; to redress food shortfalls and steep import requirements. Subsidies include financial and material assistance with clearing, fencing and ploughing along with seed and fertilizer packages. These were promoted in 2004 by the National Agriculture Master Plan for Arable Agriculture and Dairy Development (NAMPAAD) and later through the Integrated Support Programme for Arable Agriculture Development (ISPAAD).

ISPAAD provides funding on a 60/40 basis with government distributing grants (up to 60% of expenditures) on cluster fencing, potable water, seeds, fertilizer and draught power, the facilitation of access to credit and extension services (Republic of Botswana, 2009).

Republic of Botswana (1991a) indicated that the cost of developing an irrigated agriculture plot was around P10, 000 /ha in 2000, plus recurrent costs. This includes costs for electrical power generation, pumps, pipes, shade netting, fencing, fertiliser and labour. Because of the expensive infrastructure, it appears unlikely that larger scale irrigation will take place without Government assistance. However a number of well-equipped farms along the upper Boteti and Thamalakane near Maun appear to be flourishing in the commercial market without direct government involvement.

Estimates of water use for irrigation differ depending on the time of year and the amount of soil water lost to evaporation (which is usually 3 or 4 times the rainfall rate) and the soil percolation rate. These have been estimated in terms of per hectare water usage for irrigated crops (Figure 26) in Botswana.

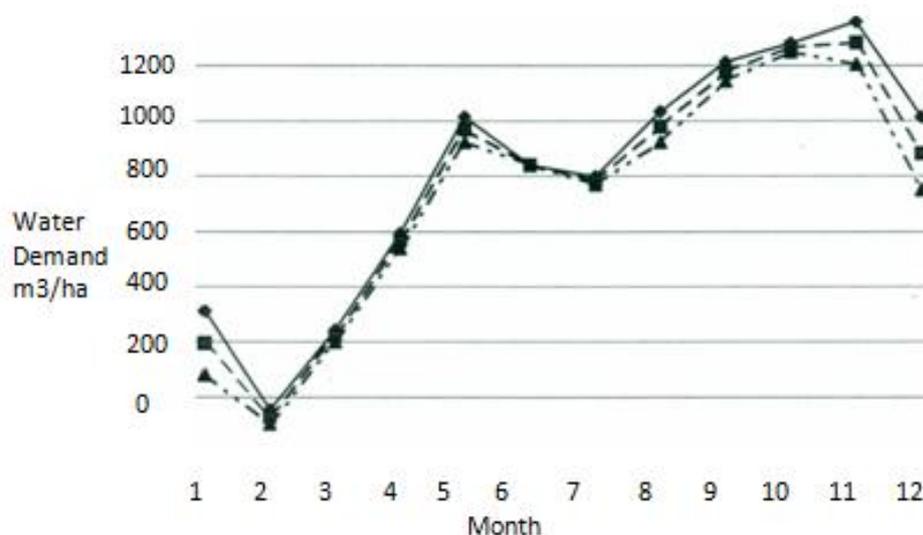


Figure 26. Estimated irrigation demand for grains/vegetables over a year in Botswana (source Republic of Botswana 2006)

Using the 48m³/ha/day estimate, irrigation demand for the existing 16.15 ha in Ngamiland West and Okavango (Maun) is 256,000 m³/a with a projected increase of 2.2 Mm³/a giving an estimated total irrigation demand of 3 Mm³/a by 2015. However this figure increases significantly if the proposed horticulture plots along the Boteti are added, as these comprise 703 ha upstream from Makalamabedi and 8,008 ha downstream from Makalamabedi. This brings the national projected water demand from the Okavango system in Botswana to about 154 Mm³/year in 2015. This is much higher than the estimates given in the TDA report for irrigated agriculture in Botswana which indicated growth to 10 Mm³/a in 2020 and to 20 Mm³/a in 2020 (OKACOM, 2011).

5.4.3 Livestock (after SAIEA 2012)

Livestock keeping in Ngamiland has been primarily determined by the availability of water. As a result most livestock are concentrated along the permanent open water sources at the fringes of the Okavango Delta or are watered from shallow wells in old river channels, inter-dune valleys, floodplains or in the old bed of Lake Ngami (CSDA, 1993). Most of this land, and 63% of tribal land in Ngamiland, is communal (Ngamiland District Council, 1997). According to customary law, all tribesmen have open access to grazing and to natural surface water for stock watering in communal areas to meet their subsistence needs.

Consequently, high livestock numbers are found along the eastern Okavango Panhandle and the western edge of the Okavango, between Ngarange and Seronga (Figure 27). The floodplains are a significant source of dry season grazing, with cattle drinking from small lagoons and/or the main river, and moving into the sandveld during the rainy season. Access to sandveld grazing has been constrained by the lack of groundwater. To distribute livestock watering points evenly and avoid over-utilization of the rangeland, the Tawana Land Board (TLB) has adopted the national allocation practice, that boreholes must be spaced at an eight kilometre distance.

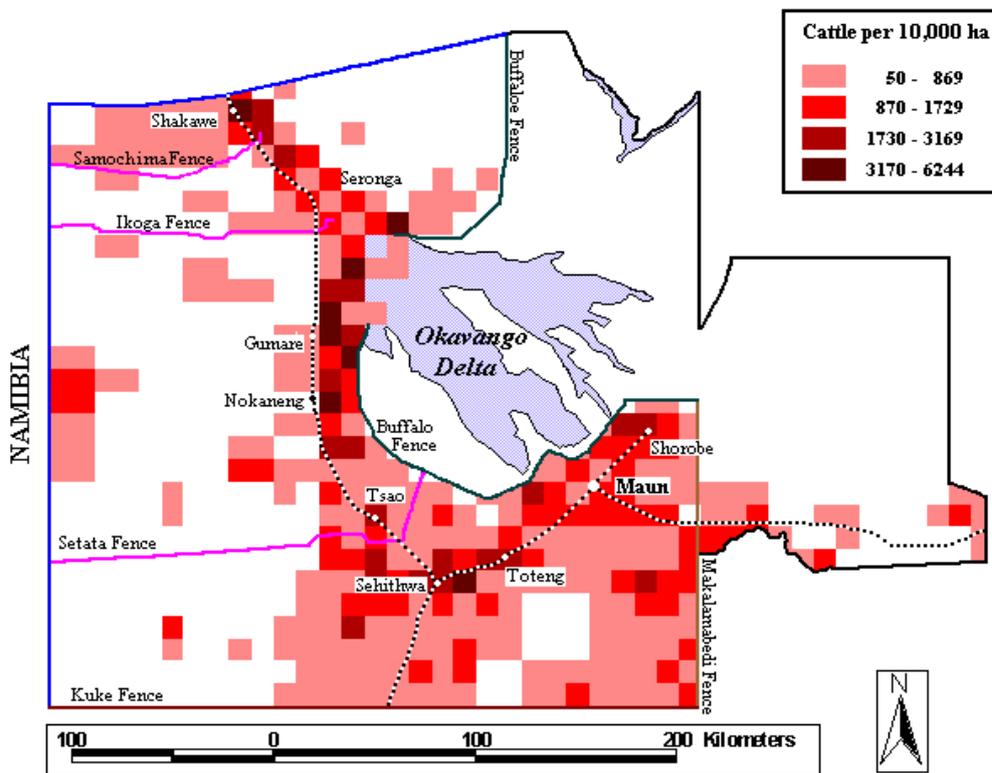


Figure 27: Cattle distribution in Ngamiland (from Bendsen and Meyer, n.d)

Disease outbreaks (foot and mouth, anthrax, blackleg, liverfluke and botulism) are a major factor influencing the development of Ngamiland in general and the development of the livestock sector in particular. The Northern and Southern Buffalo Fences were erected in 1982 and 1991-96, respectively, in order to separate domestic stock from buffalo populations, and were highly controversial at the time.

The outbreak of Contagious Bovine Pleura Pneumonia (CBPP) in the north-western corner of Botswana in 1995, resulted in the eradication of all cattle in Ngamiland (>320,000 animals) and the erection of three new veterinary cordon fences (Scott Wilson, 2000). Compensation payments and restocking programmes have enabled livestock numbers to recover to an estimated 350,000 head, with off take limited by further disease outbreaks (most recently FMD).

The aerial spraying of deltamethrin to control tsetse (*Glossina morsitans centralis*) in 2001-2002 has removed Nagana in cattle (Trypanosomiasis) as a potential threat to the livestock sector, and potentially opened up new areas of rangeland.

The Tribal Grazing Land Policy (TGLP) ranches in the Hainaveld, in the dryland south of Maun, have been developed in the last 25 years as a commercial livestock zone. The area fenced for ranch development is presently being extended to Toteng and Sehithwa under the “Fenced Ranching Component” of the National Policy on Agricultural Development.

The livestock sector continues to exert significant environmental pressure and impacts. The generation of piospheres (sacrifice, bush encroached and grazing reserve zone) has

created a major new dimension to the ecological functioning of rangelands with impacts at the farm, landscape and ecosystem levels. Many of these impacts are mediated through the process of bush encroachment, but the breakdown of the biological integrity of the rangeland is also critical. The impact of the livestock sector has been greatly accentuated by the provision of veterinary cordon disease control fencing, particularly when the fence alignments have bisected key wildlife habitats and movements, rather than strengthened existing land use planning.

Sandveld pastures, while of poor forage value due to the infertile Kalahari Sands and low rainfall, are preferred to the floodplains grazing resources along the Okavango Panhandle and delta margins. Access to surface water, however, ties the livestock to the floodplain pastures and puts the cattle into direct conflict with crop farmers, elephants and predators. Consequently, depredation (lions and leopards) and human elephant conflict, have reached unprecedented levels.

Livestock expansion, especially fenced ranching, has negative impacts on wildlife resources particularly when it occurs in key areas of wildlife mobility or compromises the wildlife and tourism based CBNRM activities in the WMAs.

5.4.4 Mining (after SAIEA, 2012)

Botswana's economy is heavily dependent on mining (particularly diamond mining) and associated industries since the discovery of diamonds at Orapa in 1971 and Jwaneng in 1982. Since then, a substantial coal deposit at Morupule, and various minor copper-nickel and manganese deposits have been mined. Mineral development is integrated into Botswana's National Development Plan, and encourages prospecting and new mining developments. A 2004 study (in Mengwe 2010) found mining to have enabled Botswana to amass foreign exchange reserves in excess of two years' worth of country imports, accounts for 70% of the country's GDP and 5.5% of employment (direct employment only). In addition to this, indirect income, employment, royalties and taxes, and joint venture mining partnerships such as Debswana, have provided additional revenue for the country.

Prospecting activities continue across the country. There are a few areas (such as the Delta and Panhandle) that are not currently subject to mining or prospecting licences. Even though exploration does not occur in the Delta and Panhandle, there are no guarantees that this will remain the case.

Recently the Botswana Copper Belt (Kalahari Copper Belt) has been identified as a southern extension of the Central African Copper Belt of Zambia and the Democratic Republic of Congo (DRC) and the north eastern extension of the Namibian Matchless and Damara ore deposits. Considered a low political risk, exploitation of the Botswana section of the Belt is an attractive prospect. This factor, together with the current high global demand for copper, is resulting in a "Copper Rush". The proximity of this Belt to the Delta and Panhandle makes it relevant to this study. Various operations are already in production or in the process of developing mining operations in this belt.

The mining industry in Botswana is well regulated, with a legislative framework akin to some of the world's leading mining nations.

5.5 Environmental Sensitivity

The spatial assessment of environmental sensitivity is based on those areas identified by stakeholders during the consultations, the thresholds study and existing information on the ODRS. The sensitivities were brought into a single assessment framework by buffering line and point data and adding rankings (outlined in Section 2.8).

The combined wildlife survey data (total wildlife biomass for years 1994-9 wet season and years 2003-7 during the dry season) was used to identify wet and dry season distribution and to infer connectivity between these ranges. The results indicate the importance of the Okavango Delta, the Panhandle and the Kwando/Linyanti as critical dry season refuge areas with the southern Gcwihaba WMA playing a role for species that are less surface water dependent. Wet season dispersion of wildlife occurs mainly into the area between the Panhandle and the Kwando River and east of the delta into WMAs and Chobe and Nxai Pan National Parks. A second dispersal of wildlife occurs out of the Okavango Delta (near the northern end of the Southern Buffalo Fence) into western and south-western Ngamiland thus linking the Gcwihaba WMA to the ODRS (Figure 28).

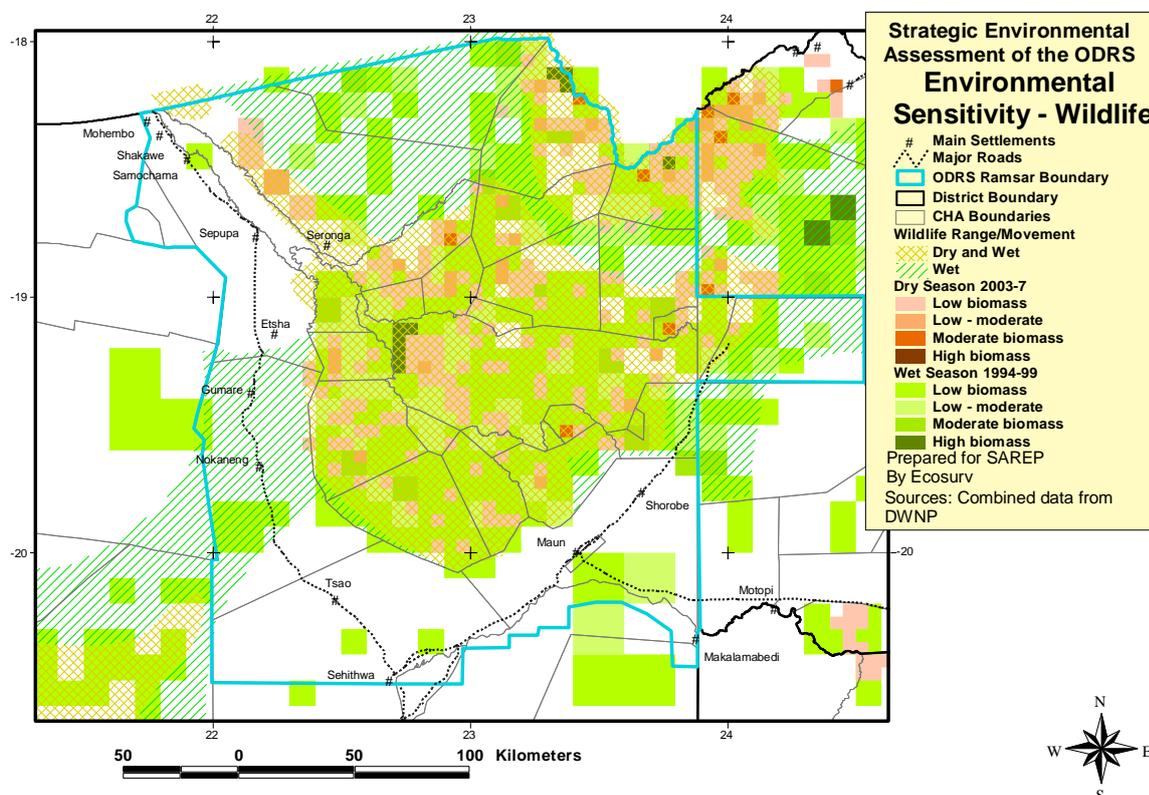


Figure 28: Wildlife distribution and densities wet and dry season (DWNP Aerial Surveys)

The DEA submitted an update of biodiversity issues in the 4th Annual Report to the Convention on Biological Diversity (Ecosurv, 2009). The report combined biodiversity concerns (rare and endangered species, endemic species and those of concern) into a single distribution map.

Figure 29 illustrates the fact that the ODRS contains most of the rare, threatened and endemic species in Botswana and is thus the country's biodiversity hot spot.

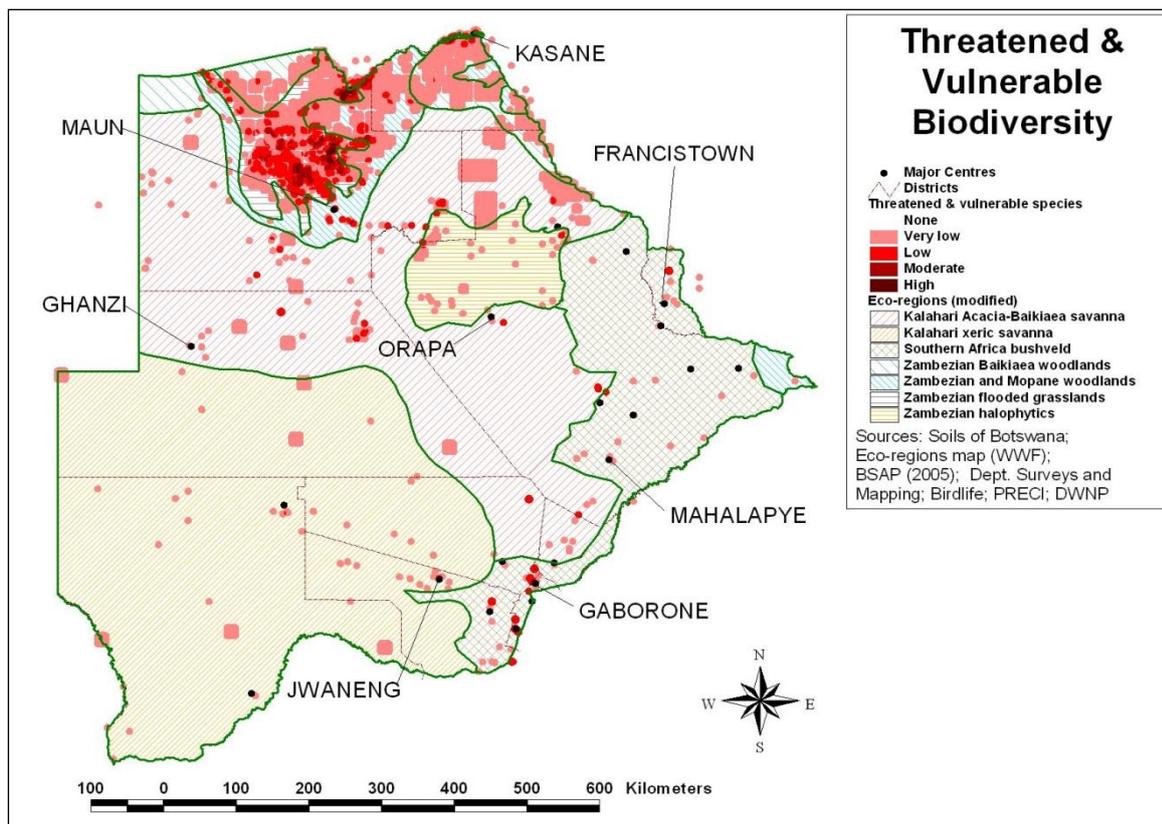


Figure 29: Distribution of threatened and vulnerable species in Botswana (plants, birds and wildlife)
 (Source: 4th National CBD Report, 2009)

The detailed biodiversity map (Figure 30) indicates that most of the biodiversity is contained within the Okavango Delta (particularly the seasonally flooded areas), with a further concentration occurring adjacent to the Linyanti River and the lower reaches of the upper Boteti River.

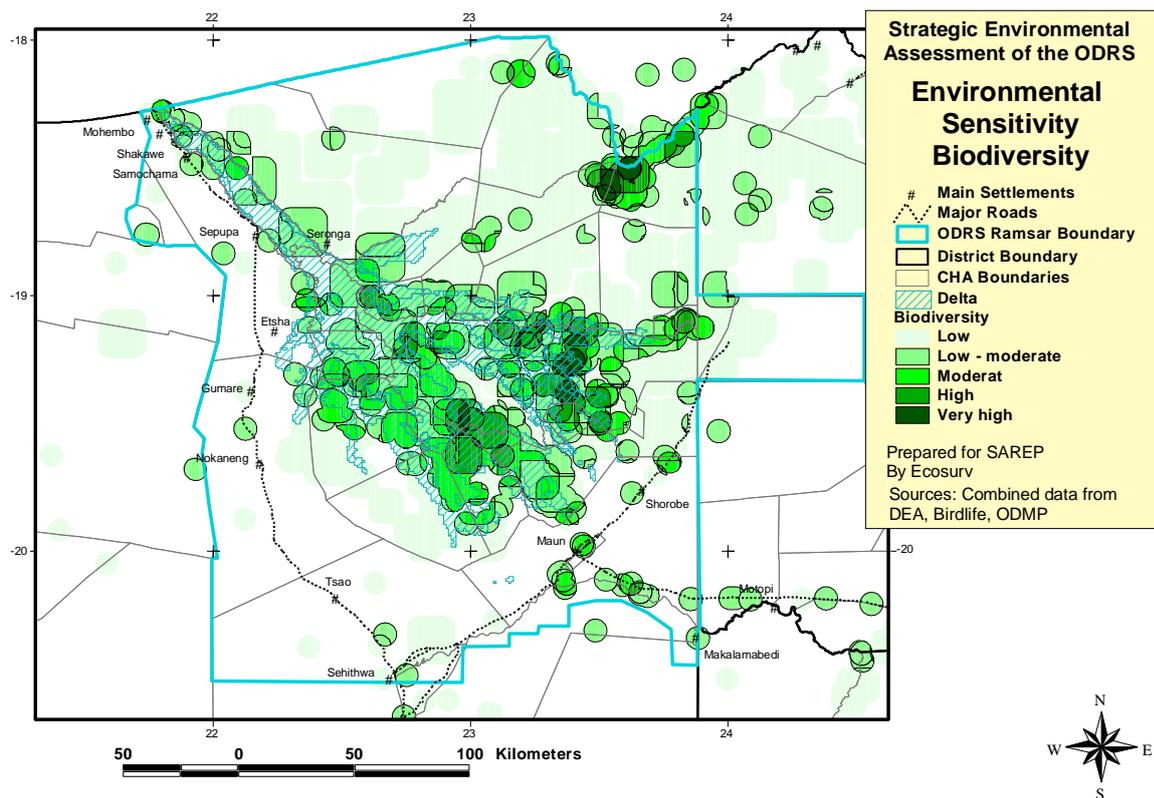


Figure 30: Biodiversity – combined rare, endemic, threatened and sensitive species (DEA)

Wetlands

The combined sensitivities (including level of protection) (Figure 31) highlight the importance of the following:

1. The core Delta system including the seasonally flooded areas;
2. The Panhandle particularly the eastern bank;
3. The link between the Okavango and the Linyanti systems;
4. The Kwando/Linyanti river system.

To a lesser extent the following areas are also important:

5. Upper Boteti River;
6. Lake Ngami;
7. Linkages between Gcwihaba WMA and the ODRS;
8. Tsodilo Hills World Heritage Site.

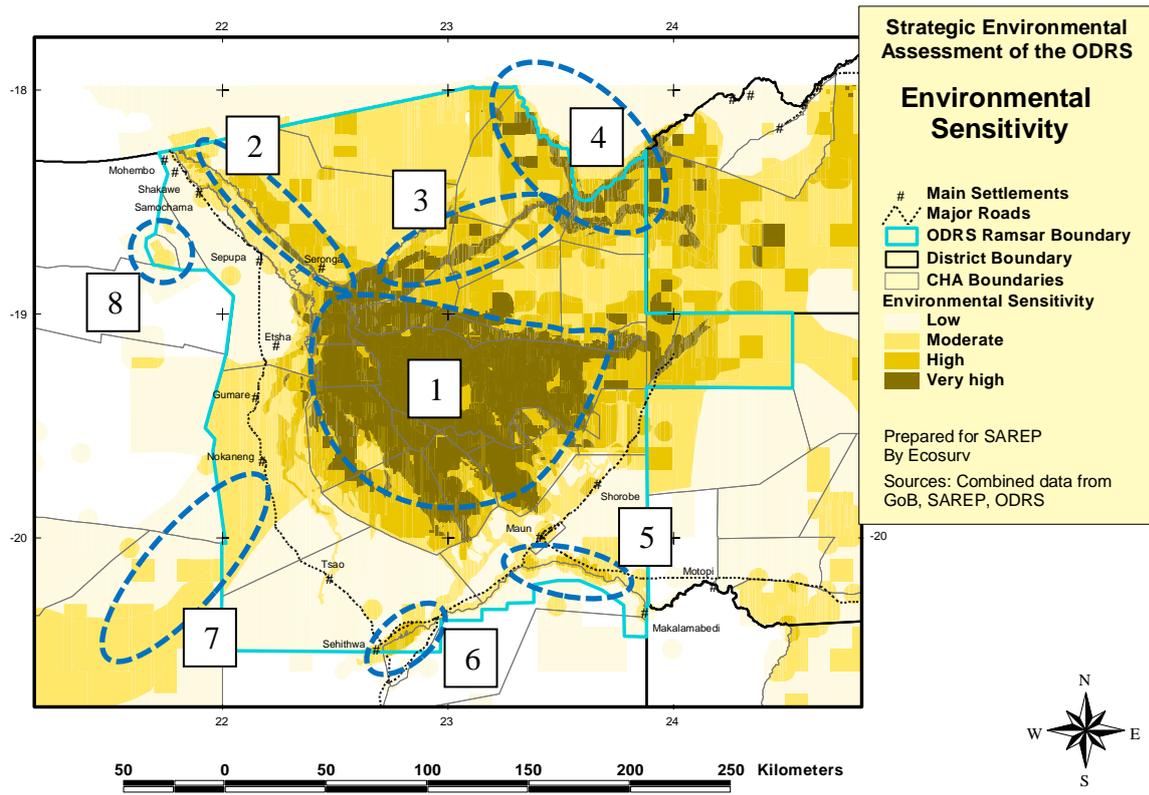


Figure 31: Combined environmental sensitivity of the ODRS

6 STRATEGIC IMPACT ASSESSMENT AND THRESHOLDS ANALYSIS

6.1 Introduction

In sections 3, 4 and 5, we looked at the drivers of change, the resulting pressures and the current state of the ODRS respectively. The next step in the D-P-S-I-R model is to consider the impacts caused by the pressures. The aim of this section, therefore, is to provide an assessment of the strategic-level impacts resulting from current and future pressures emanating from the basin and from within the ODRS. It is not the aim of this SEA to assess site-specific impacts.

This section discusses global, upstream, downstream and ODRS impacts and is followed by an assessment of cumulative impacts. The impacts are followed by a section from the thresholds and resilience analysis which prioritises the major changes occurring which have the potential to push the system over a threshold. The final section of the impact assessment is a root cause analysis which is used to identify solutions to the underlying rather than the direct causes of critical impacts.

These priorities and associated solutions form the basis of the SEMP.

The following principles are critical to understanding the impacts and the response:

- There is usually a significant lag effect before the effect of impacts are felt;
- Impacts often only become obvious when a combination of events lead to the perfect storm;
- Most impacts relate to the biophysical environment but the solutions lie with the underlying causes of the impacts, normally governance, policy or socio-economic causes.

6.2 Assessment of Impacts caused by Global Level Pressures (external)

The impact of international conventions can be significant. Botswana is signatory to most of the environmental conventions which bind the country to meeting long term environmental objectives that may differ with existing planning objectives. The treaties can affect how and why an area is managed e.g. the ODRS should be managed for the comprehensive protection of wetlands as important ecosystems for the maintenance of biodiversity. Similarly Botswana is committed to conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources based on the CBD Convention.

The impact of climate change is difficult to quantify at this point. The most recent review of climate change within the Okavango basin was carried out by Wolski 2009. It was concluded that the region may become hotter and wetter. The impact of such a change could be significant. From a negative perspective a hotter wetter regime would increase the intensity of bush fires. On the other hand increased rainfall could, to some degree, offset upstream water abstraction and reduce the need for and demand from irrigated agriculture. Although the modelling results are not conclusive, it would be prudent to plan for a hotter and wetter scenario in the river catchment.

Global economy is important to the ODRS. A strong global economy would increase demand for mineral resources and tourism while a weak global economy would reduce the

economic opportunities available for the ODRS, increase poverty and have a negative impact on natural resource use. Long term there is a shift in dominance from the western economies to the Asian and BRICS economies. The implications of such a change would be a shift in demand for natural resources and a gradual change in tourist type of product requirements.

6.3 Assessment of Impacts Caused by Basin-Level Pressures (external)

6.3.1 Increased upstream demand for water

6.3.1.1 Impact statement

At present there are very low levels of development in the catchment and those that are occurring have very little impact on the water resources and hydrological functioning of the basin.

However, there are a number of developments planned in the catchment such as hydropower projects and commercial irrigation schemes (Figure 13). It is also likely that there will be an increase in demand for domestic water supplies. Most of these schemes would require regulation of river flows in some way or other – from small weirs and river diversion channels to large impoundments.

Table 9: Relative impact of flow regulation structures on downstream hydrological functioning and sediment transfer

Type of river regulation structure	Total flow volume (MAR)	Low flow volume	Flood hydrograph	Flow variability	Sediment yield
Weir for water offtake	X	XX	-	-	X
Run-of-river hydropower	-		X	X	XX
Channel diversion (through HEP)	-		-	-	-
Small earth dam (no spillway)	X		X	-	XX
Large impoundment (with release structures)	XX	XXX	XXX	XXX	XXX

Negative impact X

Positive impact ✓

Neutral impact -

It can be seen from Table 9 that any proposed flow regulation structures in the Cubango-Okavango basin would have a significant impact on sediment transfer. Due to the coarse and sandy nature of the soils over much of the catchment, the river system is unusual in that the bulk of the sediment is moved through bedload transfer, rather than in suspension. Therefore any structure in the river which prevents sediment movement downstream will a) rapidly silt up; and b) cause erosion downstream of the structure. The reset distance (i.e. the distance before a new sediment equilibrium is reached) is unknown, however, the key concern for the ODRS is that the sediment load at Mohembo (entry to ODRS) should

be at current average levels (117,000 tpa or between 70,000 – 100,000 m³/year (Ecoplan 2003). If the water entering the Panhandle is depleted of sediment, it will cause widespread erosion of the river banks, sandbars and islands for some distance (not yet known). This could affect structures located on the river banks (lodges, dwellings, pumps, viewing decks, landing stages), and riparian vegetation could be lost. Many of the steep banks provide nesting sites for bee-eaters, kingfishers, swallows, swifts and martins, which could also be affected by erosion. The sandbars in this section of the river are important breeding areas for African Skimmers and are used by crocodiles and other animals to access drinking water.

Removal of bedload would also significantly alter existing ecosystem processes. As noted by Ecoplan (2003).

Most of the smaller river regulating structures which might be contemplated in the upstream basin would have a limited impact on hydrological functioning in the Delta, but one or more large impoundments will have a major impact on the shape of the hydrograph: flood peaks would be lower and flatter, seasonal variability would be lost (if the dam releases are not sensitively managed) and the total flow in the river (mean annual runoff) would be reduced.

Ecosystem function of sediment bedload

Bedload is transported in river channels which become progressively narrower downstream. Their ability to transport bedload declines and sediments accumulate on the channel beds, causing shallowing of the channels. Accumulation of bedload on channel beds is accompanied by upward growth of the flanking vegetation, and channel depth remains unchanged. In effect, the entire channel and its flanking wetland are slowly elevated by bedload accumulation. Down-stream channel gradient declines as channels aggrade, and plants begin to encroach upon the channel. This culminates in aggradation and channel failure. Water diverts elsewhere to form new channels.

Failure of a distributary channel and the consequent diversion of flow into new channels have secondary effects important to the functioning of the Delta. Regions that previously did not receive water become inundated whilst other dry out. Areas deprived of water also undergo important changes – wetlands begin to desiccate. The peat catches fire, burns down, changing the topography and releasing accumulated nutrients. This constant change in water distribution means that vegetation communities are constantly being disturbed, and thus can never achieve climax status. It is this constant change which is responsible for the biological diversity of the Okavango Delta.

Channel failure has another important consequence, related to toxic salt accumulation on islands. The life of a distributary channel is about 100 to 150 years, of the same order as the time required to salinize islands. As a consequence of channel failure, islands in the affected region are deprived of water. The water table beneath these islands falls. Rain flushes sodium bicarbonate from the soils, and the toxicity is removed. The precipitated silica and calcite remain, however, so the islands retain their form. In this way, channel failure results in the restoration of areas affected by toxic salt accumulation.

In the Panhandle, bedload sedimentation also plays an important role. Here, salt accumulation is not prominent. The Okavango River in the Panhandle meanders strongly, and the region is a mosaic of old, abandoned channels and other meander-related features. A large proportion of the introduced bedload appears to be accumulating in the Panhandle, and its primary effect is to induce channel aggradation. As these channels aggrade, water is diverted to form new channels. In this way, the Okavango River constantly changes its meandering course across the width of the Panhandle. It is possible that channel switching in the Panhandle is very rapid, which is why salt accumulation does not occur on the islands in this region.

The Delta ecosystem thus functions as an integrated system which minimises the potential negative impacts of the high water deficit in the region and maximises the use of the limited nutrients available. In all of this, sedimentation, especially of bedload, plays a pivotal role.
(Source: Ecoplan 2003)

Lower flood peaks would affect the annual flooded area moving the seasonally flooded grasslands and sedgelands closer to the permanent swamp. The hydrograph shape and scale of the flood pulse is critical to the ecological functioning of the Okavango Delta. How the system will react to a flattening of the hydrograph and shape of the pulse (intense and fast to long and slow) has not been quantified but will change a number of processes at the fine scale with cascading effects across the system at the focal scale (e.g. fish breeding success affecting fisheries, which in turn will affect livelihoods and poverty). Flood pulse will be affected by the establishment of large storage dams for either irrigation or hydropower.

A reduction in total flow would cause a decrease in the area of the permanent swamp, and recharge and renewal processes at the extremities of the Delta would cease and permanent dryland conditions would prevail.

The resilience analysis identified a key variable as dry season or low flow reduction on drying out of the permanent swamp and disruption of ecosystem services. The abstraction

for arable agriculture and other uses upstream of the permanent swamp is predicted to be 1,857.8 Mm³/a by 2020 (OKACOM, 2011). This is three times the ecological flow requirement identified by the Thresholds Team Hydrologist (600 Mm³/a, SAIEA, 2012). Given that most water abstraction will be for irrigation (98%, OKACOM 2012) and will occur during the low flow period of August, September and October (Figure 26), the Okavango River could stop flowing for up to three months a year during droughts within the next decade (Figure 32).

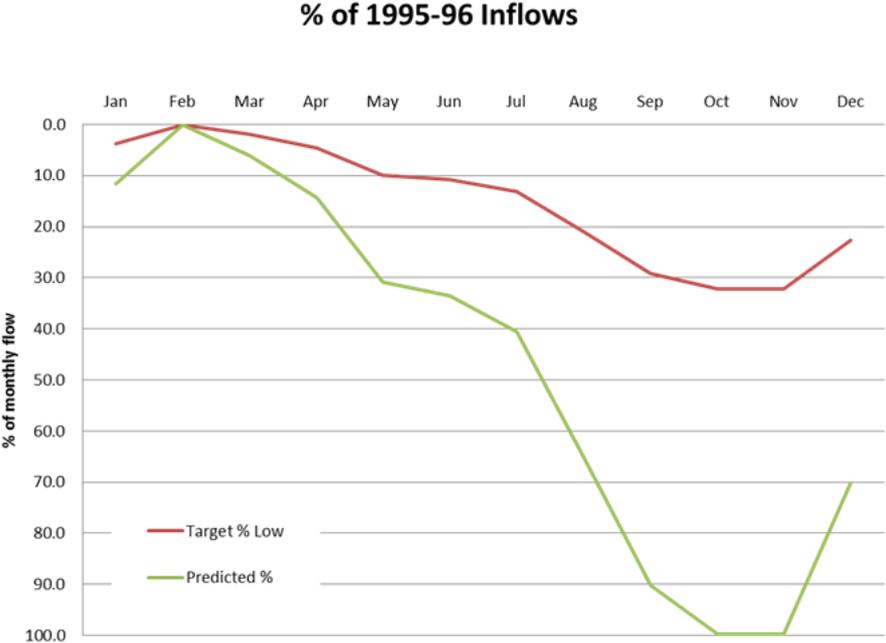


Figure 32: The impact of water abstraction on Okavango River flow based on predicted (by 2020) and target off take levels if they had occurred during the 1995-6 flood which was very low

Reduced variability in flow (seasonal, annual, decadal) (i.e. there would be a more regular inflow at Mohembo), would affect the current dynamic equilibrium of the ODRS, which relies on the high variability of flows to create a multitude of habitat types and support the wealth of biodiversity that depends on, and has adapted to, these variable conditions. A more constant system would result in a reduction in biodiversity, especially niche species which respond on a daily basis to the presence or absence of wet, semi-wet and dry conditions, such as plants of the seasonally flooded areas. This effect would compromise the obligations made by the Government of Botswana in terms of the Ramsar Convention, the CBD, SADC Protocol on Wildlife and the commitments made to the objectives of the KAZA TFCA.

A loss of biodiversity would also affect the pristine wilderness qualities for which the ODRS is famous, in turn affecting the high-end ecotourism market.

Any consideration of variation in flow must also take into account the varying impact on human populations of the extremes of flooding in the Cubango-Okavango river basin, which is characterised by annual flood events. Depending on flood peak magnitude and volume, the floods could have severe impacts on the livelihoods of people living in flood-prone areas. Socio-economic impacts include loss of natural resources or access to these resources, loss of access to areas where traditional molapo farming is practised, and

tourist lodges may be flooded. A larger area of flood also forces many animal species away from traditional migration routes, possibly leading to increased HWC. Loss of infrastructure due to exceptional flooding could lead to millions of pula worth of damage.

At the other end of the scale, severe droughts can reduce the resilience of local communities who are reliant on the annual flood for water supply, fish, reeds, grasses, grazing for livestock, foods and medicine. The productivity of the floodplains would diminish without the regular inputs of nutrients and recession farming would be negatively affected. Tourist lodges could be left high and dry and water-based tourism could suffer.

Throughout the system, changes in flow may also lead to increased water-borne diseases. Lower flows in the river mean less dilution of pollution, with greater risks of gastrointestinal disease. Slower flows and greater human use of the river may lead to increases in the habitat for the snails that carry the bilharzia parasite (OKACOM 2011).

6.3.1.2 Threshold analysis

The threshold where the ecosystem function and services will be significantly affected is at present unknown. The target is set based on the lowest flow recorded for the Delta and is simply number based on the precautionary principle. It is critical that ODMP can identify and justify the threshold should these proposed targets be challenged in the future.

6.3.1.3 System resilience

System resilience is expected to be high as both the ecosystem and communities are used to high variability in flows on a seasonal and long term basis.

6.3.2 Increased demand for water within the ODRS affecting downstream users

6.3.2.1 Impact statement

Current water users within the ODRS include: Maun and other settlements (domestic supply, with some industrial use), livestock watering, the tourism industry and existing irrigation agriculture (see Table 10).

Table 10: Current and projected water use in the ODRS

Water use sector	Current use Mm³/a (2009)	Projected use Mm³/a (2020)	Projected use Mm³/a (2025)
Domestic use (rural and urban)	3.84	4.7	5.1
Livestock watering	15.92	13.7	13.6
Irrigated agriculture projects	0.52	10.0 (154.4 in Thresholds Study)	20.0 (164.4 in Thresholds Study)
Tourism industry	0.2	0.2	0.3
TOTAL	20.48	28.6 – 154 (based on MoA plans)	40.0 - 164

Sources: OKACOM, 2011; SAIEA, 2012)

Most of the proposed irrigation development is at the distal end of the delta based along the banks of the outflowing rivers (Thamalakane and Boteti). The water requirement for the proposed irrigation in the upper and lower Boteti River is 151,302 Mm³/a. The average annual outflow at Maun is approximately 200 Mm³ (SAIEA, 2012). If one considers that most of the irrigation demand for water is during the flood recession period from August to November, the river will be pumped dry.

This potential demand on water flowing out of the delta is over 75% of **average** annual outflow. If this is considered in relation to the proposed cap on upstream water use to 10% of the **lowest** recorded annual flow, Botswana may be undermining its bargaining position with upstream nations.

The Boteti River feeds Botswana's second Ramsar Site – the Makgadikgadi Pans. The Boteti River is an important tributary and the only active tributary on the western side of the Makgadikgadi Pans Ramsar Site. Over 15,000 people live along the Boteti River and a further 3,000 people live along the Nhabe (lower Thamalakane) and Lake Ngami. This is some 17.5% of the total ODRS population. These people depend on the critical surface water and groundwater recharge of the river. The impact of reducing groundwater recharge on village water supply and livestock farming will be significant and very costly to replace.

The desertification study of the lower Boteti River (Arntzen *et al*, 1994) highlighted the impact of loss of river flow and groundwater recharge on people and habitats. Significant among impacts was the loss of riparian woodlands and trees adjacent to the river and reliant on groundwater recharge. These impacts are exacerbated by the fact that the groundwater, surrounding and below the fresh water lens that the Boteti River provides, is saline.

Use of the water is further complicated by the presence of an Important Bird Area (Lake Ngami BW004 and the Makgadikgadi Pans BW005) both distal sumps for the river systems (Fishpool and Evans, 2001).

6.3.2.2 Threshold analysis

No threshold was identified for the use of water in rivers draining the Delta.

6.3.2.3 System resilience

The social systems are not very resilient to drying up of the Delta outflows. The desertification study (Arntzen *et al* 1994) carried out less than 10 years after the Boteti River stopped flowing found high levels of desertification occurring due to a combination of increasing poverty leading to increased reliance on natural resources and a cycle of degradation. The resilience of communities living along the main (Boteti) outflow of the delta, to loss of river flows, is low.

6.3.3 *Deterioration of water quality*

6.3.3.1 Impact statement

At present the water quality of the Okavango system is considered to be very good, characterised by low suspended solids and turbidity, with clear waters, low nutrients and low organic content. It is an oligotrophic river, with dissolved oxygen content adequate for maintaining biological diversity. The extensive reed beds extract most of the nutrients from the water providing a high level of natural buffering within the system as any additional nutrient inputs will be taken up by the aquatic plants (SAIEA, 2012). There are, however, some local areas of reduced water quality caused by:

- Geological conditions such as increased levels of iron and manganese;
- Urban areas where untreated waste water and solid waste leachate may be discharged untreated, raising the organic content and nutrients of the water in localised places;
- Areas where livestock are watered, increasing solids in suspension and organic matter from excrement;
- Agricultural areas, especially where irrigation water is returned to the river, carrying nutrients such as nitrates and phosphates and agricultural chemicals such as pesticides.

There may also be seasonal shifts in water quality as runoff carries sediment, organic matter and nutrients into the rivers during the rainy season. During dry periods, the conductivity and nutrients may become more concentrated because of evaporation. However, these cyclical changes in quality are within the normal range of water quality parameters.

The concern is that with the proposed basin developments, irrigation schemes in particular, and the change in land use, there could be a serious decline in the water quality entering the Panhandle from upstream. With a concomitant reduction in flow, the dilution capacity of the river would be compromised and changes in riparian vegetation could limit the system's natural buffering capacity and channel evolutionary processes. The impacts of reduced water quality in the Okavango would be wide-ranging and could severely impact on ecosystem services. There are currently no permanent monitoring systems on the river and no record of pollution sources and their discharges.

Within the ODRS, there is a relatively new sewage treatment plant in Maun designed in 1993 but this experiences regular breakdowns and may be reaching its capacity by now (ODMP, 2008). Other waste water treatment systems include a 100 m³/day plant at Boro Farm, a constructed wetland facility at Thuso Rehabilitation Centre, and a new sewer network and treatment plant at Gumare. Within the Delta each camp or lodge is required to have its own waste water disposal system. There is concern that there may be localised water pollution and eutrophication of the wetlands around tourist facilities.

With the forecast increase in population and a trend towards urbanisation, local sanitation might deteriorate further, threatening potable supplies of water and public health (OKACOM, 2011).

If a significant increase in nutrients occurs, it is likely that there will be a change in the growth/production rate of channel-bank vegetation communities – for example a sharp increase in growth rates of papyrus, or a switch in dominance from *C. papyrus* to *Typha capensis*, with feedback effects on channel evolution and other ecological processes. We

do not at present have a suitable model to assess the significance of impact nor the thresholds.

An increase in water nutrient levels will also provide conducive conditions for the spread of alien and/or invasive aquatic weeds into the the Delta system.

Inorganic chemicals present in the inflowing water (Ca, Mg, Na, Si) are not significantly affected by vegetation uptake and recycling and are subject to evaporative concentration in the downstream direction. Concentrations in flowing water increase fourfold between inflow and outflow (Maun), but can reach much higher values in isolated floodplains and pools. As relatively large quantities of surface water infiltrate into groundwater, taking with them dissolved chemicals as well as components leached from soil, there is no build-up of precipitates at the surface. The process is driven by island/dryland woodland vegetation (riparian woodland) evapotranspirative uptake of groundwater. This induces replenishment of island/dryland groundwater by floodplains groundwater, which in turn is supplied by infiltrating flood water. Since climatic conditions do not support high rain-induced groundwater recharge, build-up of island/dryland groundwater is not significant and reversal of island-floodplain groundwater flow virtually does not occur, thus trapping dissolved solids in the island/dryland groundwater. There, solute concentrations increase to the levels facilitating precipitation into solid phase, ultimately leading to the build up of the island body, and density-driven sinking of saline groundwater to the deeper parts of the aquifer (SAIEA, 2012).

Possibly the biggest threat to water quality is large-scale land conversion and increased erosion in the catchment which could result in higher loads of suspended sediment (as opposed to bedload). Increased turbidity limits light penetration through the water column and affects water temperature, both of which can result in fundamental changes to the composition and functioning of the aquatic ecosystem. The crystal clear water is one of the many attractions of the Delta for tourists and the aesthetic impact of turbid water would be high.

6.3.3.2 Threshold analysis

Water nutrient quality varies seasonally in relation to water volume, spatially and with land uses (such as burning of reed beds). Solutes also vary considerably with concentrations increasing by a factor of four between Mohembo and Maun.

The evolution of the system as a low nutrient system and the importance of river fringe vegetation in its dynamics make the Delta vulnerable to long-term changes in water quality, particularly suspended sediments and salts. At the same time there are increases in settlement and irrigation immediately upstream of the Ramsar site and proposals for irrigation within the Ramsar site. These pose immediate concerns.

Given that the impacts of change in water quality will be initially subtle and not recognised in a standard EIA, the cumulative effects combining over time are of serious concern.

6.3.3.3 System resilience

The system is resilient to short term changes in water quality but long term persistent changes could have a significant effect on ecosystem processes and the very core of the Delta's functioning.

6.4 Assessment of impacts caused by pressures occurring in the ODRS (internal)

6.4.1 Failure of conservation and governance and the decline in non-elephant wildlife populations

6.4.1.1 Impact statement

Chase (2010) argues that elephant numbers have reached a density dependent equilibrium. This suggests that elephants have reached the density limits within their range and are stabilised possibly through emigration (to Namibia and Angola), dispersal into new areas within Botswana or internal mechanisms. At the same time that elephant numbers grew and stabilised, large mammal (non-elephant) populations have declined on average at 10% per year between 1996 and 2010 and wildebeest and tsessebe numbers are vulnerable. Chase concludes that the species that have declined are dependent on moving outside the protected areas to wet season components of their range and are exposed to threats such as illegal hunting, fence related mortalities and habitat fragmentation. He concludes that the decline could also be related to both the 20 year climatic cycle and the high elephant numbers. Figure 33 clearly indicates that wildlife numbers of major ungulates (except impala, hippopotamus and elephant) have been rapidly declining in Ngamiland for the last 15 years. The situation is reminiscent of the collapse of the ungulate populations of the Kalahari where changes in land use and barriers preventing ungulate populations accessing critical dry season water and forage lead to a threshold being crossed and a permanent change in wildlife density.

Figure 7. Trends in the numbers of selected wildlife species in Ngamiland district.

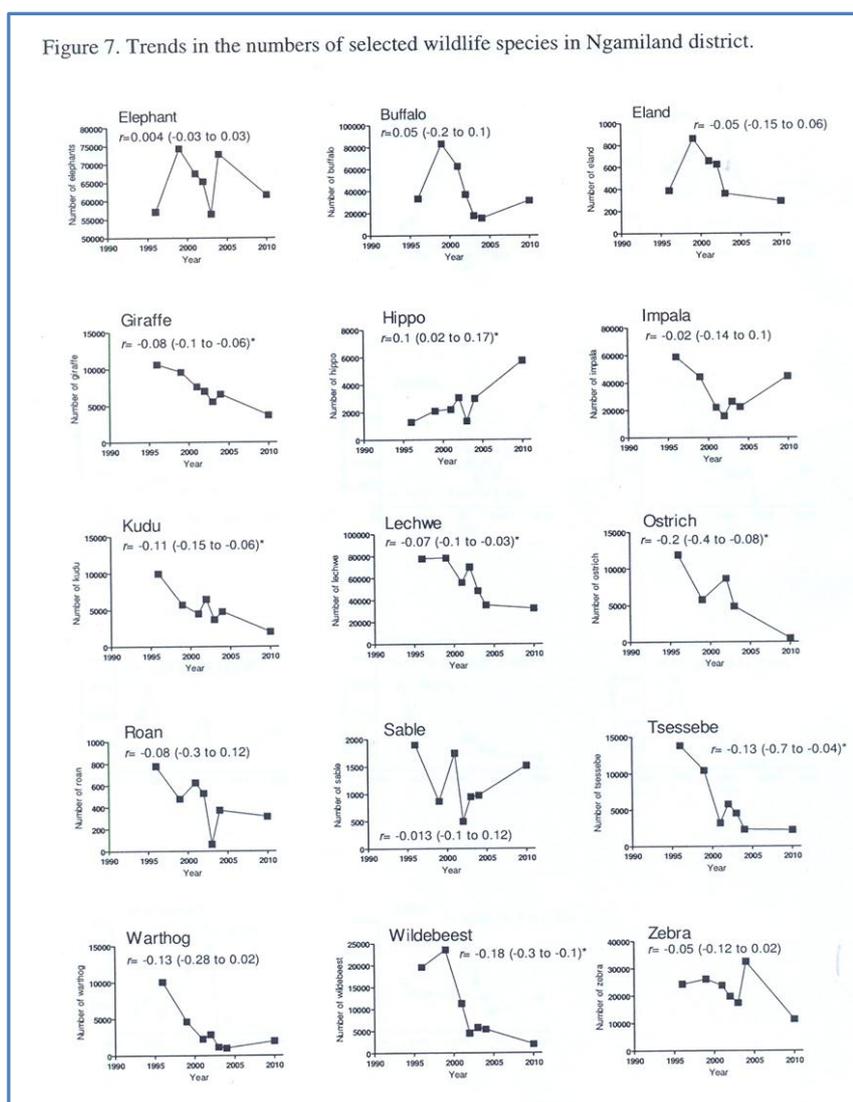


Figure 33: Trends in the numbers of selected wildlife species in Ngamiland between 1995 and 2010 (Chase 2010)

The *de facto* cessation of sport hunting, the difficulties in implementing an elephant management plan and the rapid increase in watering points in the dry season range of mobile ungulates are resulting in a general increase in elephant numbers and their uniform distribution across the available range. These numbers are exceeding environmental thresholds for sensitive species such as roan, sable, wildebeest and gemsbok.

Illegal hunting (poaching) was identified during the SEA workshops as a major source of concern which is impacting on wildlife populations when they move out of the protected areas. Increase in poaching is thought to link to ineffective governance in the wildlife dispersal areas, reduced tolerance by communities to HWC and a failure to implement effective CBNRM in the critical areas of concern.

Habitat fragmentation is of most concern. This is a result of cumulative impacts from poor land use decisions, unregulated land allocation and the impact of animal disease control fences.

Failure of CBNRM as a mechanism to address habitat fragmentation and poaching has been seriously undermined by changes in government policy, limited linkages between CBNRM areas and location of communities, and an absence of structure to support CBNRM developments.

The root cause analysis (Figure 39) indicates the complexity of the system and the underlying causes leading to wildlife population decline.

6.4.1.2 Threshold analysis

The concern is that the relationship between wildlife population decline and habitat fragmentation (and other variables) is not linear. The crashes in the Kalahari wildebeest populations and wildlife biomass have shown that these events are rapid and result in a change to a new state with very low biomass. This will expose most of the system to encroachment by the livestock sector.

There is also concern that the approach to the threshold is masked and not felt until there is a combination of unsuitable conditions (e.g. drought, overgrazing, disease control fences and expansion of livestock ranches and cattleposts – as occurred in the Kalahari situation).

The numbers of wildebeest, zebra and hartebeest in the central Kalahari collapse during the early 1980s drought due to critical components of their range being lost to other land uses. Their numbers declined from 700,000 to 73,500 and remain, 25 years later, at just 10% of the original population.

6.4.1.3 System resilience

There is little remaining resilience. Land authorities appear unable to control settlement into critical areas, and administrators are powerless to prevent the impact of closure of the system. The ungulate populations to the east of the Panhandle, to the west of the Delta and towards (and in) Gcwihaba WMA are in imminent danger of collapse.

6.4.2 Increase in number and size of settlements

6.4.2.1 Impact statement

As noted in Section 3.2.1, the population in the ODRS is estimated at 162,456 (2010) and expected to increase by some 29% to over 200,000 by 2025 (Table 4). In terms of overall impact, it is the increase in the rural population that is of more concern, as this implies an increase in the number and size of settlements in the ODRS. The two key issues of concern are:

- Settlement size;
- Settlement sprawl (corridor effect).

In terms of the National Settlement Policy, when a settlement has 500 or more residents, it can be proclaimed as a village, e.g. Khwai and Mababe. Once this occurs, the village is entitled to a range of government services, which in turn attracts more people. The result

is a rapid increase in population, with concomitant changes in land use from natural bush to arable agriculture and livestock ranching. Pressure on indigenous natural resources (INR), such as reeds, grasses, veld foods and medicinal plants, can also be expected to increase – perhaps beyond sustainable limits.

Achieving village status also means the development of infrastructure, such as roads, power lines and water supply schemes, which all have a small but additive or cumulative effect on landscape quality and biodiversity. Implicit in formalisation of village status is the rapid increase in immigration, together with a change in cultural and community values, which together undermine the CBNRM initiatives in these areas.

In areas where settlement density is already high, e.g. along the Panhandle and existing roads, settlements tend to develop in a linear fashion along the road or river bank, with few controls. This can cause settlements to coalesce, thus creating a low-density belt of disturbance over long distances, which acts as a barrier to the movement of wild animals.

The combined effects of settlement density and village size can have a number of impacts on biodiversity and landscape quality, including:

- Restrictions in the range and migration routes of species, leading to an increase in HWC and killing of ‘problem’ animals (notably lions, elephant);
- Deforestation, leading to a direct loss of biodiversity. Where this occurs in the riparian zone, the impacts include accelerated erosion, loss of habitat and the loss of migration corridors;
- Increased levels of general disturbance from people, livestock, dogs, vehicles, boats, fishing, which all affect biodiversity and wilderness qualities;
- Increased solid waste and pollution which could lead to localised eutrophication, deterioration in water quality, and raise the threat of water-borne disease. Aquatic alien plants also thrive in nutrient-enriched water.

6.4.2.2 Threshold analysis

There are a number of thresholds that get crossed with regard to settlement:

- Closure of linkages between wet and dry season ranges of wildlife ungulate populations. This is occurring on the east side of the Panhandle and to the west of the Delta in the Tubu – Gumare area (see Figure 36 areas 3 and 6). As pointed out by Chase (2010) there is a population of 14,000 elephant trapped between the Okavango River and the Northern Buffalo Fence.
- The switch between a settlement and a formally gazetted village is significant. Once a village is declared, the state provides infrastructure and immigration occurs. There is a change in social structures, settlement patterns and agriculture such as allocation of arable land areas and overall access to the new settlement.

6.4.2.3 System resilience

In many areas the resilience is limited and the system is close to crossing the threshold. General resilience is also limited as there is little effective governance, few CBNRM options and low social capital to work with.

6.4.3 Increase in agriculture

6.4.3.1 Impact statement

Closely linked to an increase in population and the size and number of settlements is the likely increase in agriculture. The main changes which could have a significant impact on the ODRS include:

- Increase in the number and size of irrigation projects;
- Increase in the area under dryland agriculture;
- Increase in the number and density of cattle posts;
- Increase in the number and size of cattle ranches.

The MoA, Department of Crop Production have ambitious plans to expand irrigated agriculture within the Ramsar Site. This is described in the Thresholds Report (SAEIA, 2012). Most of the proposed irrigation would be on the outflows of the Okavango Delta, a system with highly variable river flows. Such developments will place enormous pressure on downstream water supplies and will prove to be poorly planned and wasteful development when the region enters a dry phase again. Figure 34 area No. 6 highlights a conflict between proposed irrigation and high environmental sensitivity along the upper Boteti River.

The expansion of dryland arable agriculture and its conflict with important wildlife movement corridors and expanding elephant populations is leading to high levels of HWC and negative sentiment against the ODRS and wildlife. This is particularly true of areas 1, 2 and 3 (Figure 34).

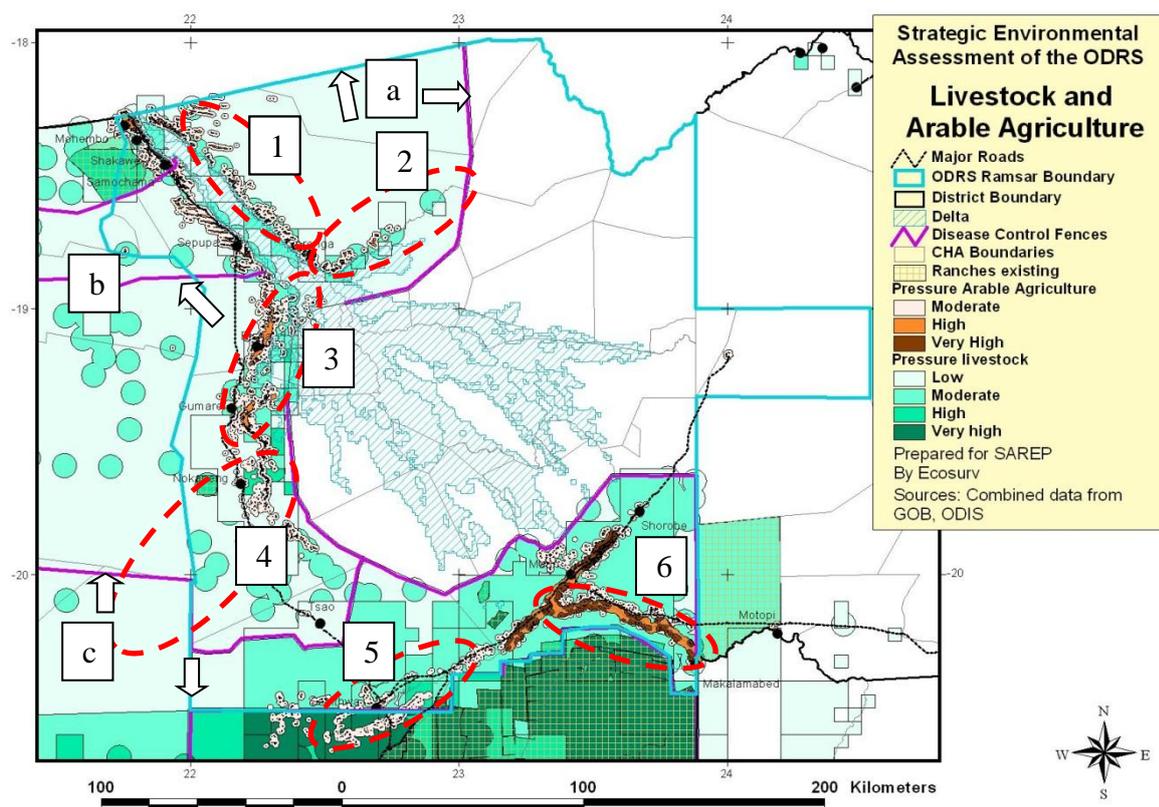


Figure 34: Conflict areas between livestock and wildlife systems in the ODRS

Livestock numbers have increased since the Contagious Bovine Pneumonia outbreak in 1996 when all cattle in Ngamiland were eradicated. Numbers are now at higher levels than before the eradication and pushing into new areas (areas 1 and 2 of Figure 34) and expanding around Lake Ngami (area 5 Figure 34) an Important Bird Area. Present expansion of cattleposts and ranches into NG/5 (Part of the Gcwihaba WMA) is threatening the integrity of the WMA.

The livestock expansion is leading to decimation of the predator population as livestock owners protect their livestock. It is also leading to abnormally high fire levels throughout the northern ODRS.

Directly associated with the livestock industry are the disease control measures. These include veterinary disease control fences and the allocation of fenced ranches to livestock farmers. Both systems have high impact on wildlife mobility and cut of linkages between components of the ecosystem. In 1999-2000 Scott Wilson conducted an extensive environmental assessment of the impact of the fences and provided a comprehensive and Reference Group approved set of recommendations. These are still to be implemented. The key recommendations are as follows:

- Northern Buffalo Fence (Area (a) Figure 34) is to be realigned along the southern boundary of NG/13 and the section dissecting the CHA and the northern border fence (along NG/13 boundary) are to be removed.
- The Ikoga Fence (Area (b)) serves no essential purpose and could be removed to facilitate linkages between the Tsodilo Hills WHS and the western Delta.

- The Setata Fence (Area (c)) was to be decommissioned from within the Gcwihaba WMA and the remaining fence to follow the eastern boundary of the Gcwihaba WMA down to the Khukhi Fence.

6.4.4 *Human Wildlife Conflict*

6.4.4.1 Impact statement

The numbers and distribution of elephant together with expansion of arable agriculture will result in a significant increase in HWC and a loss of community support for wildlife (see Sections 5.4.2 and 5.4.3). Figure 9, Figure 10 and Figure 11 highlight the expansion of settlement and agriculture in a linear form along either side of the Panhandle and both east and west along the arms of the Delta fan.

Most of the animal biomass within the Delta must annually move out of the wetlands into areas that provide wet season forage. Settlement and agricultural development is increasingly occurring in these migration corridors, thus placing people and wildlife in direct conflict.

At the same time it appears that the elephant population is reaching its density limits across the existing elephant range thus elephant are beginning to move into new ranges which leads to conflict between elephant and communities not used to HWC. Tolerance in these communities is low and knowledge of adaptive mechanisms to deal with wildlife conflicts is not inherently available within these newly exposed communities.

6.4.4.2 Threshold analysis

The resilience analysis indicated a potential threshold has probably been crossed and communities are now less tolerant of wildlife depredations than in the past.

6.4.4.3 System resilience

Resilience has been reduced through a number of factors:

- Poor land use decisions and land allocation into critical movement corridors;
- Limited CBNRM options available due to the undermining of the CBNRM Policy, perverse subsidies into other sectors, spatial separation between communities and CBNRM areas and limited implementation support from state or NGOs;
- Agriculture sector policy decisions and implementation that places the Ramsar objectives in direct conflict with sector developments.

6.4.5 *Increase and change in tourism*

6.4.5.1 Impact statement

Before NDP 9 the policy for tourism could be summarised as “Low volume – high value”. NDP 9 and the establishment of the Botswana Tourism Organisation changed the status of tourism from a secondary industry to “an engine of growth” and have resulted in the policy being understood differently i.e. high value and low densities in sensitive areas and mixed value and mixed densities in less sensitive areas.

It was mentioned in one of the stakeholder meetings that the word “Okavango Delta” is searched for in Google more than twice as often as “Botswana”. In other words, the

Okavango Delta is one of the main reasons visitors come to Botswana; the majority of visitors want to experience a visit into the Delta.

The increase in budget visitors coming to Botswana and wanting to enter the Delta has created enormous pressure on the core due to budget level tourists coming through the community areas and newly declared villages adjacent to the core. This approach may be diversifying ownership in the tourism industry but it is increasing pressure on the core Delta by budget level tourism activities, i.e. the Okavango Delta will generate less per visitor than in the past while tourist on tourist impacts and tourist on environment impacts will increase. These impacts include noise, pollution, waste generation, waste water discharge, traffic, and alien invasive plants, all of which will eventually lead to a loss of wilderness value. Given that Botswana can justify its high tourist package prices on the basis of the ‘pristine’ wilderness qualities of the Delta, any deterioration in quality will affect the country’s ability to market the destination as a ‘pristine wilderness’ and to justify the high prices. There is strong competition from all Botswana’s neighbours who offer cheaper, game-viewing experiences.

“Botswana’s African wilderness status and icons are clearly the brand assets that differentiate the destination from its competitors. These assets have huge emotional appeal to the growing global tourism market that is increasingly in search of enriching experiences by exploring new horizons.”

“The true “wilderness” experience and resources should be **protected at all costs**. Visitor pressures are mounting in areas such as Chobe and Moremi and unless these are subjected to proactive planning and controls the industry could lose its wilderness advantage.”

(World Bank-BIDPA Report: Developing tourism in Botswana: Progress and challenges – Working Draft 2005) Note bold emphasis added

There has been a significant change in tourism from mixed consumptive and non-consumptive to focus entirely on non-consumptive. This has removed the consumptive land use option in areas which have low intrinsic tourism value.

6.4.5.2 Threshold analysis

There is insufficient capacity within BTO and GoB to manage and control access into the Delta by budget tourists through newly declared villages and arrangements made between budget tourism operators and community trusts.

In many areas, the threshold between a wilderness experience and a lower tourism experience has been passed e.g. much of NG 19, Moremi Game Reserve (particularly north gate) southern Okavango Delta (e.g. NG32) and the Panhandle where visitor crowding, boats, expansion of arable lands areas and natural resource use undermine the aesthetic quality of the area. Tourist operators and authorities seem to have lost sight of the need to protect the wilderness experience “at all costs” (BIDPA- World Bank, 2005)

6.4.5.3 System resilience

Tourism surrounding the Delta has entered the new phase where there is little control or management. Institutions do not have the capacity or the political will to manage the budget type of tourism.

The loss of the consumptive tourism option of land use is creating a situation where the economic value of some of the more financially marginal CHAs has been reduced. This is particularly important in CBNRM areas (which are often of marginal photographic tourism value).

6.4.6 Increase in exploration and mining

6.4.6.1 Impact statement

Botswana's diamonds are running out and getting far more expensive to mine. The government has embarked on a drive to diversify the mining industry. The effect of this diversification together with the value of base metals has led to a number of exploration companies actively prospecting for other minerals. The rate of exploration has also increased rapidly and there are numerous Prospecting Licences throughout the Ramsar site.

The establishment of the Boseto Copper Mine (South of Lake Ngami) has begun the shift of increasing reliance on minerals in the Ngamiland economy. It is only a matter of time before large copper and iron ore deposits within the Ramsar Site are exploited.

The development of mines will place enormous burden on existing infrastructure and natural resources (particularly water).

The impacts relating to exploration and mining, both positive and negative, are discussed in Section 5.4.4 and in the Thresholds Report (SAIEA, 2012).

6.4.6.2 Threshold analysis

There are a number of significant mineral resources in Ngamiland. The threshold for mining them is linked to the world economy (metal prices) and the state of infrastructure. Should a large mine be established and the power and transport network upgraded then a number of other resources will begin to be mined. This change will transform the Ngamiland economy from one based on subsistence livelihoods, conservation and tourism to that of minerals, tourism and possible commercial agriculture.

6.4.6.3 System resilience

The direct environmental impacts of mineral abstraction can be managed but the secondary socio-economic ones are more difficult to manage.

6.5 Cumulative and antagonistic effects

6.5.1 Cumulative impacts on environmental components (now and future)

On the basis of the spatial mapping of the drivers and pressures, the sensitivity analysis, thresholds assessment and the resilience workshop, we recommend that the ODRS should be zoned as follows:

1. Primary Zone: This zone has been expanded from the traditional core zone based on the permanent swamp to include the Magwegana and the Kwando/Linyanti systems (1a). The zone also includes the Tsodilo Hills WHS (1b), and the isolated Lake Ngami (1c) (Figure 35).
2. Secondary Zone: This zone includes the critical linkages between components of the core zone and contains the main wet season dispersal range of the ungulate populations.
3. Tertiary Zone: This zone highlights the linkages between the Gcwihaba WMA and the Okavango Delta ungulate populations (3a) and the upper Boteti River (3b).
4. Remaining ODRS: These are areas with high human populations, extensive development pressures and relatively low environmental sensitivity.

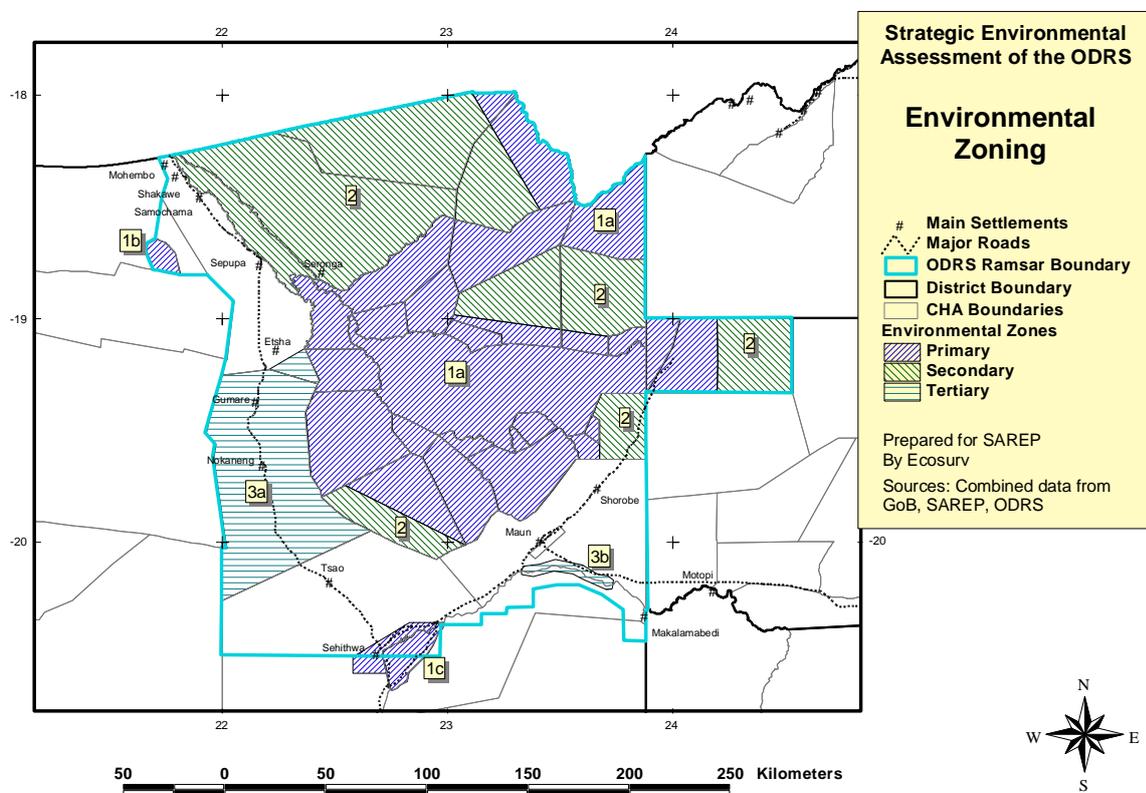


Figure 35: Zoning of the Okavango Delta Ramsar Site based on environmental sensitivity

In order to determine the optimum land uses and management objectives within each of these zones, an opportunities and constraints analysis was conducted for each zone. Based on the findings of this analysis, we conducted a cumulative effects assessment to understand which aspects of the environment are being most affected by the various land uses and to determine which land uses are having (current) and will have in future, the most impact on the environment. The results of these analyses are presented below for each of the four zones.

6.5.1.1 Core Zone

It is clear from the opportunities and constraints analysis (Table 11) that the greatest opportunities are provided by the rich and largely unaltered natural environment, which is

already protected by various statutes and laws. This favours conservation and ecotourism land uses and underlines the fact that the Delta is one of the priority destinations in Botswana for tourists. While the presence of water provides an opportunity for some other forms of land use, there are many constraints militating against its use for any other purpose.

Table 11: Opportunities and constraints – core zone

Land use	Opportunities	Constraints
Conservation	Statutory protection (Moremi GR, WMAs, GMAs) Ramsar World heritage site (Zone 1b) IBA (Zone 1c) KAZA High levels of biodiversity Low levels of disturbance (natural ecosystem) 'Unique' inland delta in an arid area	Some parts of Core Zone do not have statutory protection e.g. Lake Ngami Competition from mining and its high economic benefits
Tourism	Protected status International recognition (Ramsar, WHS) High levels of biodiversity Low levels of disturbance (natural ecosystem) 'Unique' inland delta in an arid area Wilderness experience	Reliance on high end tourists from overseas Global recession High running costs Competition from mining and its high economic benefits
Arable agriculture	Water availability Recession farming (melapo)	Area of permanent flood Area of seasonal swamp Conservation status (no agriculture allowed in GR) Relatively poor soils HWC
Livestock	Water availability Dry and wet season grazing	Disease Far from villages HWC
Mining and exploration	Presence of minerals? Water	Land use conflict Exploration or mining in the Core area would cause seriously negative PR for GoB
Settlement	Land availability for settlement and agriculture Existing roads Job opportunities at lodges and in tourism concessions Water availability	No services Far from market and urban centre
Natural resource use	High abundance of materials and food resources Little enforcement or control Tourism provides market for crafts	Distance to travel HWC

The objective of the Core Zone, therefore, should be conservation of ecosystem processes, heritage and biodiversity. Appropriate land uses are: conservation, non-consumptive tourism and consumptive tourism (hunting, angling) – the latter only in areas of limited

scenic appeal. With this as the objective, we can examine how the other sectors are currently impacting on the desirable environmental qualities of the Core Zone (Table 12).

The main causes of cumulative impact on environmental quality are tourism itself and settlements. As tourism increases in the area, a number of impacts are experienced including: crowding, noise from boats and aircraft, and visual impacts, all of which are slowly eroding the sense of place associated with the Delta. Since the mid-1980s, the number of lodges in the Core/primary Zone has increased from no more than 5 to 81. Airstrips have proliferated at the same rate and most camps in the Delta are serviced by air. The chances of seeing other tour groups, boats and aircraft are much greater than a decade ago and for some, the wilderness qualities have already been lost. There are, therefore, indications that the threshold of what defines 'wilderness' and 'sense of place' may have been reached, or indeed, already crossed and the tourist experience is being compromised by its own existence (area 7 on Figure 36).

This should serve as a warning for future planning, as any more tourist developments in the Core Zone will further degrade the very qualities that visitors to the swamps cherish; there will be more boats, aircraft, airstrips, lodges and higher visitor numbers creating more disturbance and incremental destruction of habitat. The tourism product will then have shifted to another 'state', appealing to a different market, and visitors will not be willing to pay such high prices for a non-exclusive experience.

The second current cause of cumulative impacts on the Core Zone is settlement, and all that goes with it: roads, fields, livestock, and demand for natural veld resources for building, crafts and nutrition. Although currently at a relatively small scale in the Core Zone, the number and size of settlements could increase rapidly in the absence of sufficient planning and enforcement. If the objective of the Core Zone is biodiversity conservation, the proliferation of settlements is in direct conflict with this goal (area 8 on Figure 36).

Table 12: Cumulative impacts of current land use on the objectives of the Core Zone

Sector		Water Quantity		Water Quality		Environment-Terrestrial			Environment-Aquatic			Sense of Place		Socio-economic		Comments
		Surface	GW	Surface	GW	Key Habitats	Movements	Species Composition	Key Habitats	Movements	Species Composition	Noise	Visual	Settlement	NR Use	
Tourism	Non-consumptive	x		x	x	x		x	x		x	XX	x	XX	X	Tourist on tourist impacts
	Consumptive	x		x				x				X		X		
Agriculture	RF Arable	Commercial														No commercial farming allowed
		Subsistence					x		x				x	X	x	
	Irrigation	Commercial														No commercial farming allowed
	Livestock	Ranches														
Cattleposts		x	x		x	x			x				x	X	x	
Mining	Prospecting		x										x			Occurring along border of core area
	Mining															No mining occurring
NR Use	Vegetation					x		x			?					
	Wildlife							x								
	Fish										?	X	X	X		
Settlement		x	X	x	x	X			X			XX	XX		XX	Potential for exponential growth

x minor negative impact (does not impact ecosystem functioning or wilderness qualities at basin scale)

X moderate negative impact (may have small localised effects on ecosystem functioning and/or wilderness qualities at basin scale)

XX high negative impact (significant effects on ecosystem functioning and/or wilderness quality may be widespread through the system. Approaching limits of acceptable change)

XXX irreversible changes to the ecosystem and wilderness qualities are occurring (beyond threshold limits)

The expansion of livestock farming is threatening three areas within the Core Zone: the Tsodilo Hills (area 1 on Figure 36), the Selinda spillway and its connection to the Kwando-Linyanti swamps (areas 4 and 5 on Figure 36), and Lake Ngami (area 10 on Figure 36). At present, the impacts are at a local level only (Table 12), but with time, and in the absence of adequate controls, the impact of livestock farming could start to have a significant effect on wildlife numbers, water quality and rangelands, the latter being primarily affected by fires which are set every year to promote early grazing.

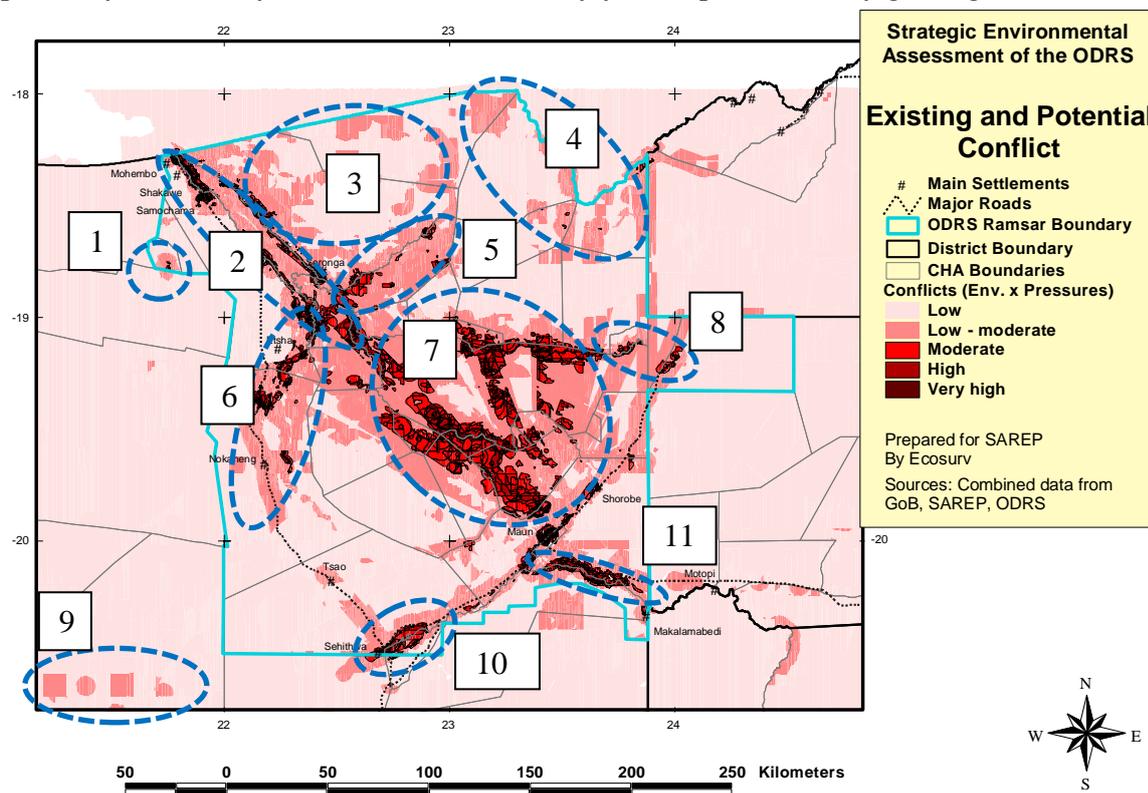


Figure 36: Areas of conflict within the ODRS (based on threats multiplied by sensitivity values) (Note details of each area of conflict are included in Section 8.1.2)

There are concerns that one of the outlying Core areas, the Tsodilo Hills, may be threatened in future by mining, which may impinge directly or indirectly on this World Heritage Site. Given the cultural and spiritual significance of this site, impacts from mining on aesthetics (noise, visual), sense of place, and air pollution impacts on the rock art, could threaten the World Heritage status of this site.

It is therefore recommended that the Core Zone should be managed for conservation and consumptive and non-consumptive tourism within threshold limits. This means that the following land uses should not be allowed within this area:

- Exploration and mining (within the area or within a 10km buffer);
- Commercial agriculture (dryland, irrigation);
- Livestock ranching;
- Development of cattle posts;
- Proclamation of settlements as villages.

6.5.1.2 Secondary Zone

Most of the Secondary Zone is located in remote parts of the ODRS (Figure 35), which reduces many of the land use options (Table 13). Given that the Core Zone is completely dependent on the Secondary Zone for its successful functioning, and given the importance of the Primary or Core Zone for tourism and international conservation efforts, it becomes imperative to maintain the connections between these two zones. The Core Zone cannot function in isolation - it is not a closed system - and the flux of wildlife, water and nutrients between the wet and dry season grazing lands is crucial to maintain its dynamic equilibrium. Closing off the Core through uncontrolled linear development of villages, roads, powerlines and arable lands will strangle the Core to death.

Table 13: Opportunities and constraints – Secondary Zone

Land use	Opportunities	Constraints
Conservation	Wet season dispersal and grazing Ramsar KAZA Low population density Remote	Vet fences Annual fires
Tourism	Consumptive tourism (hunting) Game viewing (vehicle safaris) Remote	Difficult to access High business costs Lack of statutory protection Policy against hunting
Arable agriculture	Available land Water (along east bank of Panhandle)	Poor soils Distance to market HWC
Livestock	Available land Water (along east bank of Panhandle) Vet fences to control disease	Bush encroachment HWC
Mining and exploration	Mineral deposits in economically viable quantities? High mineral prices Perceived water availability (surface and groundwater) Conducive policy environment	Remote Lack of infrastructure Low mineral prices
Settlement	Land availability Water Proximity to existing villages and urban areas (on west side of Panhandle and Maun to the south) Lack of planning and enforcement	HWC Lack of infrastructure Remote
Natural resource use	Abundance of resources	Distance to markets

The primary objective, therefore, for the Secondary Zone is to maintain the linkages with the Core, so that wildlife can access wet season ranges. To do this, detailed zoning plans need to be developed to define the size (width) and location of the wildlife corridors. Development within these corridors needs to be strictly limited to enable the free flow of wildlife and limit incidences of HWC. Village development, cattle posts and arable agriculture outside of these areas also needs to be set out in a development plan and planning restrictions must be enforced. This will require extensive consultation and cooperation from local communities and revitalisation of the CBNRM programme.

Tourism, including activities such as sport angling would be suitable along the Panhandle, while hunting would be acceptable in areas with limited scenic appeal.

However, an analysis of the current status of development and land use within the Secondary Zone shows that there are already several cumulative impacts which are threatening the Zone’s objectives as set out above. Figure 37 indicates a strip of almost continuous development along the Panhandle (area 2 on Figure 36), which is having a minor to moderate impact on water resources, the terrestrial and aquatic environments, and the sense of place (wilderness qualities) (Table 13). The Panhandle plays an important role as a conduit of water and sediments to the Delta fan. It has a number of biodiversity hot spots and is important for dry season water for wildlife. The presence and growth of human population is resulting in pressure for land and an increase in HWC. However, it is not just human settlement causing impacts in this area – tourism itself is adding to the impacts on water resources and sense of place due to the number of houseboats, lodges and sport fishing operations (Table 14).

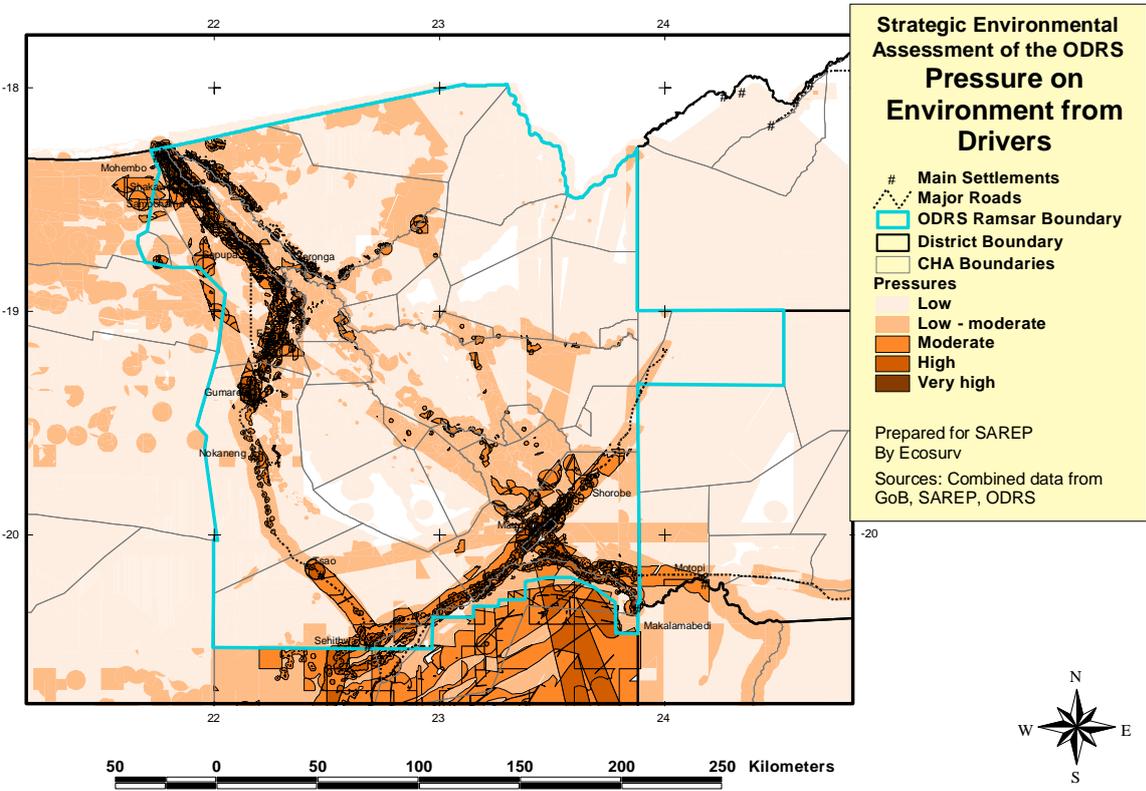


Figure 37: Combined developmental and use pressure (biophysical) on the ODRS

Although not as great, there are increasing land use conflicts in the area to the east of the Panhandle (NG11, 13, 14) (area 3 on Figure 36). This area, which is a critical wet season range for wildlife (having a population of 14,000 elephant), is also being prospected for minerals, targeted for livestock expansion and is subject to regular fires (Figure 18).

The Secondary Zone, therefore, needs to be considered as a critical part of the functioning of the Core Zone and managed accordingly. Thus it is recommended that:

- Wildlife corridors need to be defined (width, location);
- The CBNRM programme needs to be revitalised and promoted so that the wildlife corridors are respected and preserved by local communities;

- Village boundaries are clearly defined and future development is limited to these areas;
- Arable agriculture and livestock farming (ranches and cattle posts) are prohibited from the wildlife corridors;
- Tourism and sport fishing take place in zoned areas along the Panhandle. Development limits (number of lodges, beds, fishing quotas, etc) need to be determined and not exceeded;
- Consumptive tourism (hunting) to be allowed in designated areas with strict controls on the number of concessions, number of lodges, quotas, etc).
- No renewal of prospecting licences allowed.

Table 14: Cumulative impacts of current land use on the objectives of the Secondary Zone

		Water Quantity		Water Quality		Environment-Terrestrial			Environment-Aquatic			Sense of Place		Socio-economic		Comments
		Surface	GW	Surface	GW	Key Habitats	Movements	Species Composition	Key Habitats	Movements	Species Composition	Noise	Visual	Settlement	NR Use	
Sector																
Tourism	Non-consumptive	x	x	X	x			x	x		x	XX	X	X	x	Houseboats and large lodges in Panhandle. Potential for alien exotic species
	Consumptive		x					x			x	XX	x			
Agriculture	RF Arable	Commercial														
		Subsistence			x		x	X		?		x	X	X	X	Ribbon development is major impact on dry season refuges, need conservation corridors linked to tourism. Major HWC issues
	Irrigation	Commercial													Potential conflict and increase in HWC	
	Livestock	Ranches														Ranches a major threat
Cattleposts		X	X	x	x	X	X		x		X	X	X	X	Riparian zone affected. Barriers and HWC	
Mining	Prospecting		x			x						x	x	x	x	
	Mining															Potential impact on GW, surface water, settlement
NR Use	Vegetation					x		X	X		x					
	Wildlife							X			x					
	Fish										?	X	X			
Settlement		X	X	X	x	X	X	x	X		XX	XX				

x minor negative impact (does not impact ecosystem functioning or wilderness qualities at basin scale)

X moderate negative impact (may have small localised effects on ecosystem functioning and/or wilderness qualities at basin scale)

XX high negative impact (significant effects on ecosystem functioning and/or wilderness quality may be widespread through the system. Approaching limits of acceptable change)

XXX irreversible changes to the ecosystem and wilderness qualities are occurring (beyond threshold limits)

6.5.1.3 Tertiary Zone

Two areas have been delineated as the Tertiary Zone, for different but important reasons: Zone 3a provides an important link between the ODRS and the Gcwihaba WMA to the south-west for large populations of ungulates; and Zone 3b lies along the upper reach of the Boteti River which is a critical source of water for dependent downstream populations and wildlife (Figure 35).

There are few opportunities for conservation and tourism in the Tertiary Zone, although as argued in Section 6.5.1.2 above, it is essential to delineate wildlife migration corridors through Zone 3a in order to maintain the biodiversity of the Core area and to minimise HWC (Table 15). The main opportunities in the Tertiary Zone are for the consolidation of settlements within existing nodes (densification, rather than sprawl), where services and infrastructure already exist.

The current availability of water in the Boteti River is perhaps misleading; the amount of water flowing in this river depends on seasonal hydrological factors (flood peak, total flow volume, etc.), basin developments (water abstraction, regulation of flow and land conversion), and cyclical fluctuations in flow, when the river may not flow at all. Furthermore, a minimum amount of natural flow should be available for downstream users, who are dependent on the flow in the river (and its groundwater recharge function) for their livelihoods. Thus, while commercial irrigation farming may seem attractive, the unreliability of water flow and intermittent availability of allocated quota amounts may militate against the economic viability of such developments.

Table 15: Opportunities and constraints –Tertiary Zone

Land use	Opportunities	Constraints
Conservation	Ramsar Biodiversity of Boteti River Wildlife corridors	High population density and development Extensive agricultural development Exploration activity Road infrastructure Low density of wildlife
Tourism	Cultural tourism CBNRM campsites	High population density and development Extensive agricultural development Exploration activity Low scenic value Low density of wildlife
Arable agriculture	Water availability Alluvial soils along the Boteti Close to local markets Existing infrastructure (roads, power, etc.)	Unreliable water flow – irrigation quotas cannot be guaranteed Minimum flow requirements to ensure water availability for downstream users will limit quantity of water available for irrigation High costs of operation (power, fertiliser inputs, transport)
Livestock	Water availability (groundwater) Close to local markets Existing infrastructure (roads, power, etc.)	Global market downturn High cost of commercial production Available, good quality grazing year round
Mining and exploration	Water availability (groundwater) Presence of minerals in	Low or fluctuating mineral prices High cost to develop

Land use	Opportunities	Constraints
	economically viable quantities? High mineral prices Conducive policy environment	Lack of infrastructure and support services for mining
Settlement	Existing villages and nodes Infrastructure (roads, power, water)	HWC
Natural resource use		Far from ODRS where many resources are harvested from

If the objective of the Tertiary Zone 3a is to maintain wildlife migration corridors, a spatial analysis of the levels of development (settlement, arable agriculture and livestock farming) shows that the almost continuous linear development strip along the main road from Maun to Shakawe is having a significant impact on ecosystem functioning, by creating a barrier to wildlife movement. This also increases interactions between humans and wildlife (area 6 on Figure 36, Figure 37, and Table 16). The amount of development is also having an inevitable cumulative impact on water resources (quantity and quality). With time, and if the situation continues in an uncontrolled manner (no planning and/or enforcement), the cumulative effects will only get worse and the impacts on wildlife may move to the point where irreversible changes occur. This would cause a crash in animal populations in the Core area and would lead to significant escalation in HWC.

The current levels of agricultural development along the upper Boteti (Zone 3b) are having a moderate but local effect on the hydrological functioning of this river (Table 16), but with time, and given the proposed area to be converted to irrigation, the water demand will outstrip the sustainable flow in the river in all but the wettest years. This would cause significant hardship for downstream users and the river would become a trickle at best with concomitant irreversible changes in biodiversity downstream (area 11 on Figure 36).

The recommended land use options for Zone 3a are:

- Delineation of wildlife corridors (width, location);
- Consolidation of villages (densification) to take advantage of existing infrastructure and services;
- Revitalisation of CBNRM policy;
- Prohibit the development of agriculture (arable and livestock) in the wildlife corridors.

The recommended land use option for Zone 3b is limited irrigation development, keeping quotas within the sustainable minimum flow requirements determined by downstream users.

Table 16: Cumulative impacts of current land use on the objectives of the Tertiary Zone (black for Zone 3a; green for Zone 3b)

Sector		Water Quantity		Water Quality		Environment-Terrestrial			Environment-Aquatic			Sense of Place		Socio-economic		Comments
		Surface	GW	Surface	GW	Key Habitats	Movements	Species Comp.	Key Habitats	Movements	Species Comp.	Noise	Visual	Settlement	NR Use	
Tourism	Non-consumptive															Limited potential (Possibly on the Boteti) Potential
	Consumptive															
Agriculture	RF Arable	Commercial														
		Subsistence			x			x		x						
6.5.1.4	Irrigation	Commercial	X		X	X	X		x			x	x	X		Boteti has non consumptive tourism attributes
		Livestock		x		x		x								
	Cattleposts	X	X	X	x	X	X		X							Barriers due to veterinary controls
Mining	Prospecting			x								x				
	Mining			X								x		XX	X	If mining of Ghanzi Ridge occurs
NR Use	Vegetation						x				x					
	Wildlife								x							
	Fish											?				
Settlement			X	X		X		XX				x	x			Assuming increase in settlement

x minor negative impact (does not impact ecosystem functioning or wilderness qualities at basin scale)

X moderate negative impact (may have small localised effects on ecosystem functioning and/or wilderness qualities at basin scale)

XX high negative impact (significant effects on ecosystem functioning and/or wilderness quality may be widespread through the system. Approaching limits of acceptable change)

XXX irreversible changes to the ecosystem and wilderness qualities are occurring (beyond threshold limits)

6.6 Thresholds and Resilience

The resilience analysis identified similar impacts but approach the interpretation from a different perspective (see Section 2.7 and Figure 4). For each major variable of interest, there is probably a single controlling variable, if pushed beyond a certain limit will result in a change to the system to a new and probably irreversible state.

Table 17 and Table 18 outline the controlling variables and potential thresholds while Table 19 and Table 20 discuss elements of the resilience of the system. Details and terminology are discussed in Appendix 2.

Table 17: Variables and thresholds at the scale above the focal scale (i.e. the Okavango Basin) The colour coding indicates thresholds that are being or likely to be crossed red = likely to be crossed in the near future (one decade); orange = two or more decades

Drivers	Variable of Interest	Controlling Variable	Threshold
Water off take, irrigation schemes, diversion weirs and storage dams	Dry season inflows	Ecosystem services linked to the permanent swamp reduced or collapse	Swamp desiccation (area) below the lowest recorded (1995-96) would be outside the normal variability of the system.
Irrigation runoff, discharge from urban waste water treatment	Water quality	Total N and Total P.	Simple thresholds may be to start with TN 9.4mg/l; TP 0.950 mg/l – suggested threshold target of <10mg/l TN and <1mg/l TP
Dams and large weirs as sediment traps removing sediment. Main threat is from the Popa Falls area (Namibia)	Sediments (bedload) being removed resulting in high rates of erosion, loss of river banks and breeding areas in the Panhandle.	Sediment hungry river entering Panhandle	The distance upstream of Moheumbo that is needed for the river to replenish its sediments. If a sediment hungry river enters the Panhandle it will permanently increase the rate of erosion.
Land use and land cover change in the upper catchment,	Change in flood regime	Area of miombo woodland cleared for agriculture.	Changes in the amount and pattern of runoff and river flow. Dynamics not fully understood, but could result in increase in wet season runoff and reduced dry season flows. The impact of land clearing on dry season flow needs to be quantified and included

Drivers	Variable of Interest	Controlling Variable	Threshold
			in the water demand scenarios. Clearing will result in a reduction in evapotranspirative losses. This could be manifested as a combination of increased infiltration, storage and slow release, so increasing base flow
Large dams for hydropower and irrigation. Not an immediate threat as all proposed hydropower dams are run-of-river	Reduced flood pulse and peak	Reduced Delta flooding. Ecosystem processes linked to flood pulse will cease	Hydrograph flattened (peak flow reduced and low flow potentially increased) to a point that biodiversity resilience in the Delta is reduced.
Large storage dams for dry season hydropower generation. Not an immediate threat as all proposed hydropower dams are run-of-river	Maintaining high natural variability in seasonal and long term flows to protect biodiversity resilience	High seasonal variability of delta hydrology	Hydrograph significantly flattened during low flow years. As there are few large reservoirs planned for the upstream catchments this threshold is unlikely to be exceeded during the next two decades.
Pressures coming from the higher scale (policy) but being implemented at the focal scale			
(1) focus on livestock development and disease management (2) mining developments, (3) pressures to change the type of tourism from low volume-high fee to high or intermediate volume-lower fee tourism.	(1) Expansion of livestock, existing and proposed barriers from disease control and ranching (2)Expansion of mining and associated infrastructure and resource requirements (3) The quest to make tourism an economic driver	(1) Presence of barriers in critical areas. (2) Establishment of large scale mining operations (3) Quality of the Delta wilderness experience (4) Support for CBNRM	(1) Closure of wildlife access to critical range (2) Infrastructure changes making less viable mineral deposits economically viable. (3) Quality of the delta wilderness experience deteriorates so that the high value tourism market is lost (4) Support, taxation and subsidies for CBNRM the same as for livestock development

Drivers	Variable of Interest	Controlling Variable	Threshold
(4)The problems with CBNRM - national polices and governance	is creating changes that are threatening the tourism value of the Delta (4) Restrictions on CBNRM and subsidies in other sectors have undermined the growth of CBNRM		
Implementation of national sector based policies and strategies at the focal scale without adapting to the objectives of the ODRS. Limited and slow feedback mechanisms to address existing and potential impacts.	Conflict between sector strategies and ODRS objectives undermining sustainable development	Appropriate land use and support packages	Isolation of the Okavango Delta wildlife mammal populations from seasonal range leading to collapse of the wildlife populations

Table 18: Variables and thresholds at the focal scale (i.e. ODRS)

Drivers	Variable of Interest	Controlling Variable	Threshold
New settlement, expansion of arable lands, veterinary control fences, commercial ranches	High non-elephant biomass and biodiversity	Mobility between wet and dry season ranges; access to dry season refuge areas	Denial of access to full resource distribution. Wildlife can no longer utilise the full foraging range, and populations will continue to decline because of this. This threshold has been crossed in the Panhandle, the western Delta, and Lake Ngami.
Political/economic pressure to expand tourism and tourism revenues	Quality tourism product	Noise and visual disturbance	Loss of perceived pristine wilderness value by visitors. This threshold is being

Drivers	Variable of Interest	Controlling Variable	Threshold
resulting in increasing tourist levels, mixed segment tourism, Settlement policy, Agricultural livestock programmes, Increasing INR use,			crossed around the edge of the core area in most places
High elephant densities creating high levels of HWC, settlement into wildlife corridors, few on-the-ground projects, limited delivery of the ODMP, CBNRM undermined	Community support (social capital) of the ODRS	Willingness of affected communities to tolerate wildlife	Value of wildlife to affected communities, which is very low at present. This must be when the value of wildlife is equal to that of livestock/ha land allocated. In the past communities were tolerant of wildlife but with high HWC and exposure of communities, historically free from depredations, intolerance has developed.
High elephant densities (high growth and compression of range) as a result of limited off take of elephants, limited emigration, AWP in wet season range,	Changes in biodiversity and habitats (e.g. island woodlands), decline in sensitive ungulate species and decline in non-elephant biomass	High elephant densities across available range	0.5 elephant per km ² in key habitats is a threshold for elephant impact on vegetation (Cumming <i>et al</i> , 1997). We are at presently averaging between 1.85 (WMA) – 2.53/km ² (Moremi Game Reserve in the Okavango Delta) in Ngamiland
High rates of hot fires started deliberately from fence lines, firebreaks and INR collection areas. Impacts exacerbated by elephant in island	Biodiversity loss of woodland islands and the northern teak woodlands	Frequent hot fires in the teak woodlands and Delta floodplains	Tree canopy cover reduced to a point where hot fires increase in teak woodlands. Less is known about riparian woodlands that may be driven by a combination of herbivory, hydrology

Drivers	Variable of Interest	Controlling Variable	Threshold
woodlands			and fire. Riparian density may be critical so that transpiration can keep ground water levels deep enough to reduce salt build up on surface soils in island woodlands.
Use of resources for mining, competition with ecosystem processes, visual impacts and loss of wilderness value	Mineral exploitation	Large scale mineral exploitation within the ODRS	The first large scale mining operation that changes transport infrastructure, power and water supply will tip the economic value of other resources to a point where they will be exploited thus changing the economy of Ngamiland

Table 19: Resilience at the high scale (Basin)

Variable of Interest	Controlling Variable	Specific Resilience	General Resilience and Opportunities for Increasing Resilience
Water yield from catchment i.e. increased flood pulse and peak	Vegetative/land cover in the catchment: tree canopy; shrub and grass cover	Roughly 15 – 20 % of the upper catchment has been cleared. The buffering capacity of the river system between the upper catchment and the Panhandle is not known	Existing farm support services and land management practices in the catchment are probably limited; this combined with poverty will reduce the resilience of the upper catchment. Opportunity for catchment management programmes, agro forestry and conservation farming. Although OKACOM exists there are no feedback loops linking impacts felt in the Delta and land use activities in the catchment
Reduced flood pulse and peak	Reduced Delta flooding. Ecosystem processes linked to flood pulse cease	As most of the proposed off take is linked to irrigation, the wet season off take, that	

Variable of Interest	Controlling Variable	Specific Resilience	General Resilience and Opportunities for Increasing Resilience
		creates the flood pulse, should be resilient and largely unchanged	
Dry season inflows	Ecosystem services linked to the permanent swamp annually reduced	The permanent swamp is probably quite resilient to large fluctuations in incoming flow but not repeated low flows	The political need to improve livelihoods of people in the upper catchment and world demand for agricultural products will probably reduce general resilience
Maintaining high natural variability in annual and long term flows to protect biodiversity resilience	High annual variability of delta hydrology	The delta floodplains are highly resilient at present. Removal of flood variability will increase the impact of episodic events	
Sediments (bedload)	Sediment hungry river entering Panhandle	The Panhandle is bounded by highly erodible Kalahari sands. Any change in river erosive power will be immediately felt. Little natural resilience	Namibia is located immediately upstream of the Panhandle as is the Popa Falls area (potential for hydropower). The only general resilience is to increase the influence of OKACOM
Water Quality	Total N and Total P.	The Delta system is efficient for stripping out nutrients but it is suspected that change in water quality will change river fringe plant community dynamics and composition impacting on river channel dynamics	The change in water quality will accelerate as dry season flows are reduced through upstream abstraction
Policy conflicts due to strategy implementation at the wrong scale undermining appropriate land use	Isolation of the Okavango Delta wildlife mammal populations from seasonal range leading to collapse of the wildlife populations	The conflicting land uses will get worse as the different sectors promote their sector strategies. Much of the resilience within the system has been lost as population has increased and conflicts remain	Government structures are command and control strongly controlled from the top. Decisions at the central government level are implemented uniformly across the country resulting in conflicts at the appropriate

Variable of Interest	Controlling Variable	Specific Resilience	General Resilience and Opportunities for Increasing Resilience
		unresolved	scale.

Table 20: Resilience at the focal scale (ODRS)

Variable of Interest	Controlling Variable	Specific Resilience	General Resilience and Opportunities for Increasing Resilience
High quality tourism product	Noise and visual disturbance	The Delta is marketed as one of the few aquatic wetlands in pristine condition and as a result has a high “willingness to pay” factor. This will change rapidly as visitors receive a poor quality product.	Set limits to tourism developments within the Primary Zone. Strong emphasis on management of non-tourism products affecting the product such as NR use, settlement and incursions of mixed level tourism into the area from the fringes. The modular nature of tourism is being eroded. Noise to be managed.
Non-elephant biomass and biodiversity	Mobility between wet and dry season ranges; access to dry season refuge areas	The resilience in the system is being rapidly reduced through agricultural development, disease control barriers and settlement isolating the delta. Resilience also lost as permanent elephant densities in both the wet and dry season ranges are high due to AWP being constructed for tourism and elephant management.	The system of governance is not flexible enough to manage policy implementation to suite local conditions, high conflict between policies, low social capital to implement CBNRM options. The failure to implement the consumptive component of the Elephant Management Plan is exacerbating the situation
Biodiversity: Loss of habitat diversity (island woodlands), decline in sensitive ungulate species and	High elephant densities across available range	Natural resilience has largely been lost due to spread of high elephant densities across the entire available elephant range	The modular nature of the system reduced as AWP have been developed throughout the wet season range reducing spatial diversity. The failure to implement the consumptive component of the Elephant Management Plan is

decline in non-elephant biomass			exacerbating the situation
Maintaining high social capital in support of the ODRS	Willingness of affected communities to tolerate wildlife	Value of wildlife to affected communities. At present very low.	Poverty greatly reduces the ability of affected communities to absorb increased HWC. The near total absence of on the ground support for CBNRM to assist communities benefit from wildlife and tourism is important. Perverse subsidies and the undermining of CBNRM through government interventions
Biodiversity loss of woodland islands and the northern teak woodlands	Frequent hot fires in the teak woodlands and Delta floodplains	Teak: Climate change (hotter and possibly wetter) will increase fire temperatures increasing rate of change. The teak woodlands are probably in the state of change. Island woodlands are at differing states linked to the island life cycle. Young woodlands are probably more resilient than mature woodlands.	Teak: Normal fire management techniques (such as firebreak) ineffective. Traditional use of fire to manage grazing in tall grass areas. No incentives to limit fire usage High elephant densities are opening up island woodlands and increasing the impact of hot high fire frequency on riparian woodlands.

In summary there are nine key variables that need to be managed if the ODRS is to meet the Ramsar objectives; five from upstream and four within the ODRS. These are the areas on which the SEA focuses.

Threats from upstream

- Reduction in dry season (low) flows and impact on perennial swamp and ecosystem services
- Decline in water quality and impact on ecosystem dynamics
- Loss of river sediment and increased rates of erosion and change in channel formation processes
- Change (reduction) in flood pulse – impact on ecosystem services and size of the wetland system
- Reduced variability in flood events

Threats within the ODRS

- Isolation of the Delta and collapse of the wildlife system
- Increased HWC due to expanding elephant populations - loss of support for ODRS
- Increase and change in tourism and potential loss of the high end market
- Increase in mineral exploration and mining – change in settlement and resource use in the ODRS

6.7 Root Cause Analysis and Identification of Remedial Actions

The major threats from upstream can be analysed through a single diagram (Figure 38) which outlines the most suitable remedial actions. Similarly the wildlife related threats such as collapse of the system, expanding elephant populations and HWC are analysed in Figure 39 as are the tourism related concerns Figure 40.

The underlying causes for changes in water demand are the need for upstream nations to develop and the lack of a framework controlling abstract types and volumes.

The underlying causes for wildlife decline are both the over valuing of livestock (and provision of associated disease control barriers) and the sector specific developments which conflict with wildlife movements. These, together with poverty driven poaching are leading to collapse of the non-elephant wildlife populations.

The root cause of loss of wilderness tourism attributes is the change in interpretation of the tourism policy, increase in rural populations, poverty and increase in formal and informal settlements in prime areas.

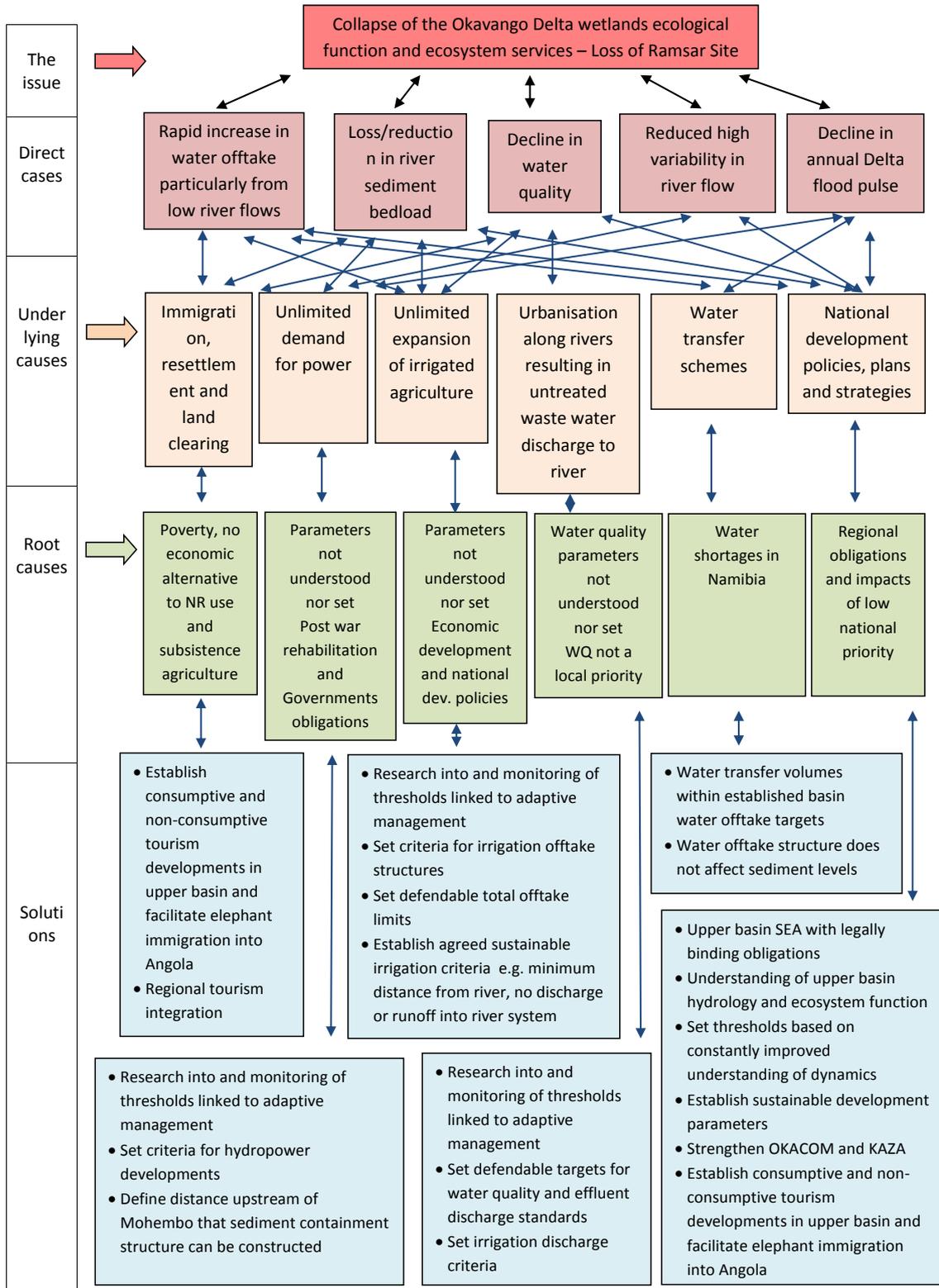


Figure 38: Root cause analysis of upstream hydrological issues

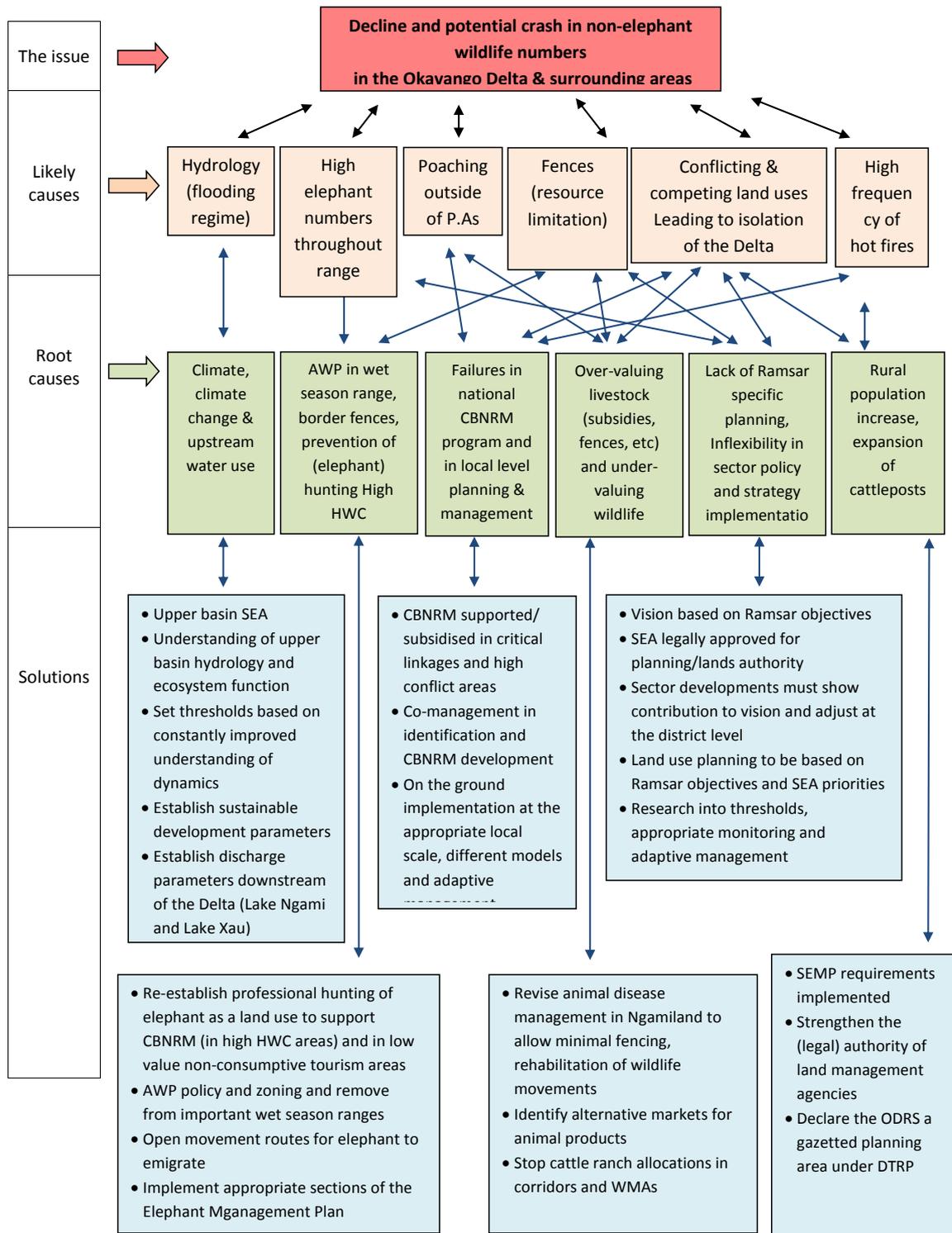


Figure 39: Root cause analysis of wildlife related issues. (Partially after C. Brown – output from the SAREP workshop on wildlife decline)

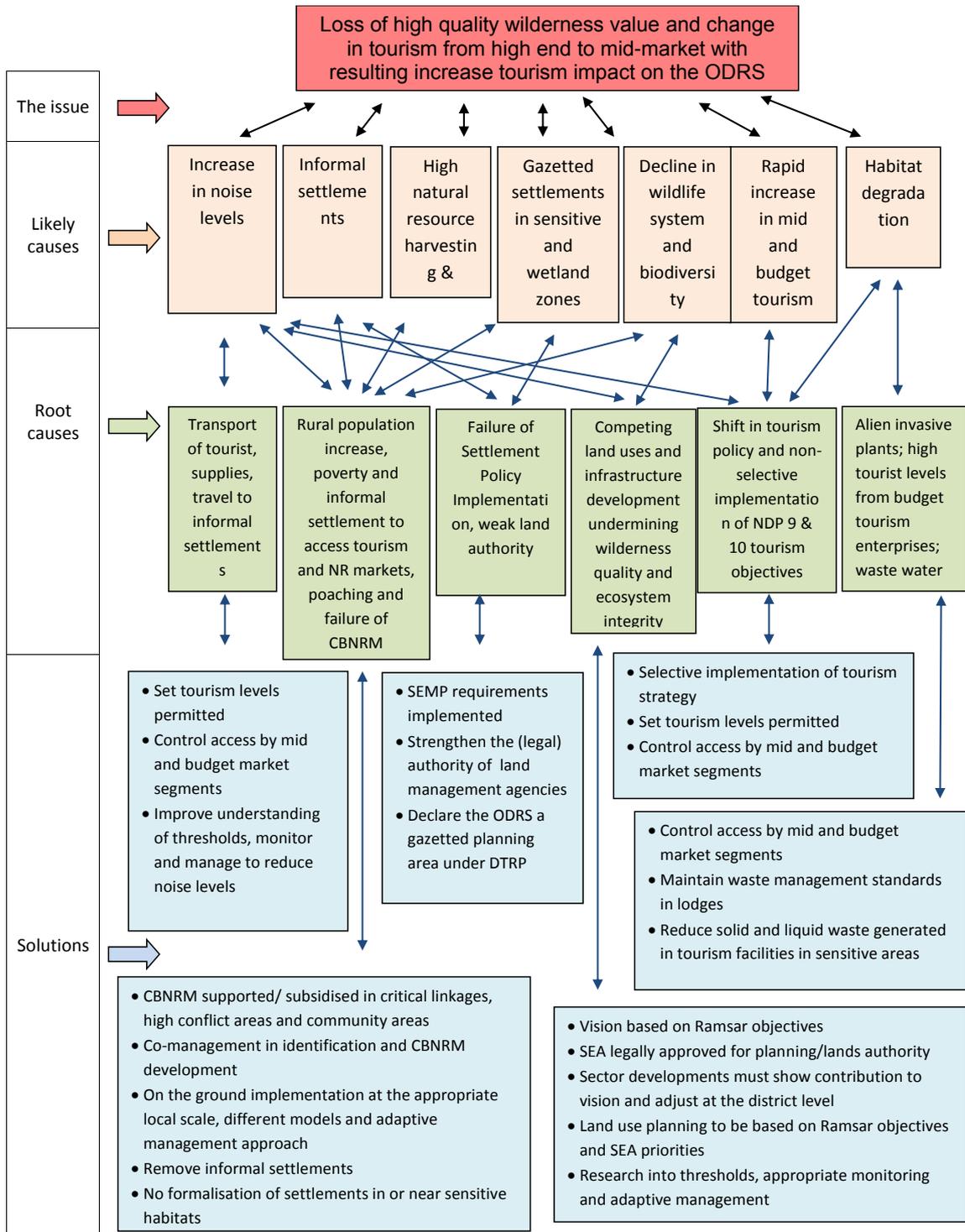


Figure 40: Root cause analysis of tourism related issues

The underlying causes and the solutions are largely similar and are outlined in the SEMP.

6.8 Scenarios

The above analysis of impacts leads to the conclusion that the present business-as-usual approach will lead to the long term loss of the Ramsar Site

- Scenario One in which there is business as usual
 - Isolation and collapse of ungulate populations;
 - Decline in high value unique tourism segment and increase in tourism related impacts;
 - Failure to maintain ecologically acceptable inflows, pulse, variability, sediment loads and water quality;
 - Increased HWC, reduced public support and loss of the key Ramsar site attributes.

- Scenario Two where the Ramsar objectives (and sustainable development) takes priority
 - Critical linkages recognised and protected through changed land use;
 - Understanding of critical thresholds improved so that targets can be effectively set;
 - Sector strategies modified, revised or even reversed to facilitate Ramsar objectives;
 - Restructuring of CBNRM to be effective and appropriate and fully supported;
 - Vision modified so that it is Ramsar focused and supported nationally;
 - An appropriate land planning authority established;
 - Increased focus on sustainable basin management.

7 STRATEGIC ENVIRONMENTAL MANAGEMENT PLAN (RESPONSE)

7.1 Introduction

The thresholds and resilience studies clearly indicate the limitations of a SEA which is based on the ODRS rather than the basin. Most critical impacts will come from upstream while those areas downstream of the ODRS will be affected by water use within the Ramsar site.

This section initially outlines the spatial zoning of the system, followed by an outline of institutional structures and then the management requirements for each environmental zone.

The SEMP must not be viewed as a blueprint. It has to be implemented using the strategic adaptive management approach. Initially, this can be applied to the “Overriding and cross cutting issues” Section 0 (Figure 41). No amount of management will be able to address the uncertainties of future threats unless it is continually adapting to the results of monitoring of actions being carried out and improvements in our understanding of the thresholds of concern.

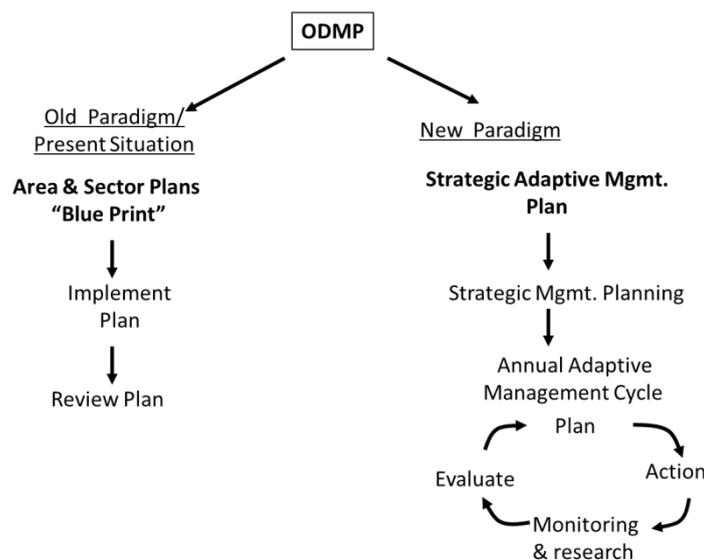


Figure 41: The difference between a blueprint plan and adaptive management (Adapted from the Resilience presentation by D. Cumming)

7.2 Scales and Environmental Zoning

The initial description of the system outlined in the Resilience Workshop identified the ODRS as the focal scale of the SEA. The upper basin, the downstream basin and other biophysical and social linkages made up the higher or basin scale. The fine scale is outlined below as the zones.

Given the highly variable distribution of biodiversity and environmental sensitivity within the ODRS, it is necessary to delineate the ODRS into a number of zones, each of which

have different environmental objectives as described in Section 6.4. These differences will follow through into the specific EIA requirements.

The zoning of the ODRS (Figure 42) is based on the environmental sensitivity and has four levels:

1. Primary or core Zone: This zone has been expanded from the traditional core zone based on the permanent swamp to include the Magwegana and the Kwando/Linyanti systems (1a). The zone also includes the Tsodilo Hills WHS (1b), and the isolated Lake Ngami (1c)
2. Secondary Zone: This zone includes the critical linkages between components of the core zone and contains the main wet season dispersal range of the ungulate populations.
3. Tertiary Zone: This zone highlights the linkages between the Gcwihaba WMA and the Okavango Delta ungulate populations (3a) and the upper Boteti River (3b).
4. Remaining ODRS: These areas with high human populations, extensive development pressures and relatively low environmental sensitivity do not currently warrant a higher status.

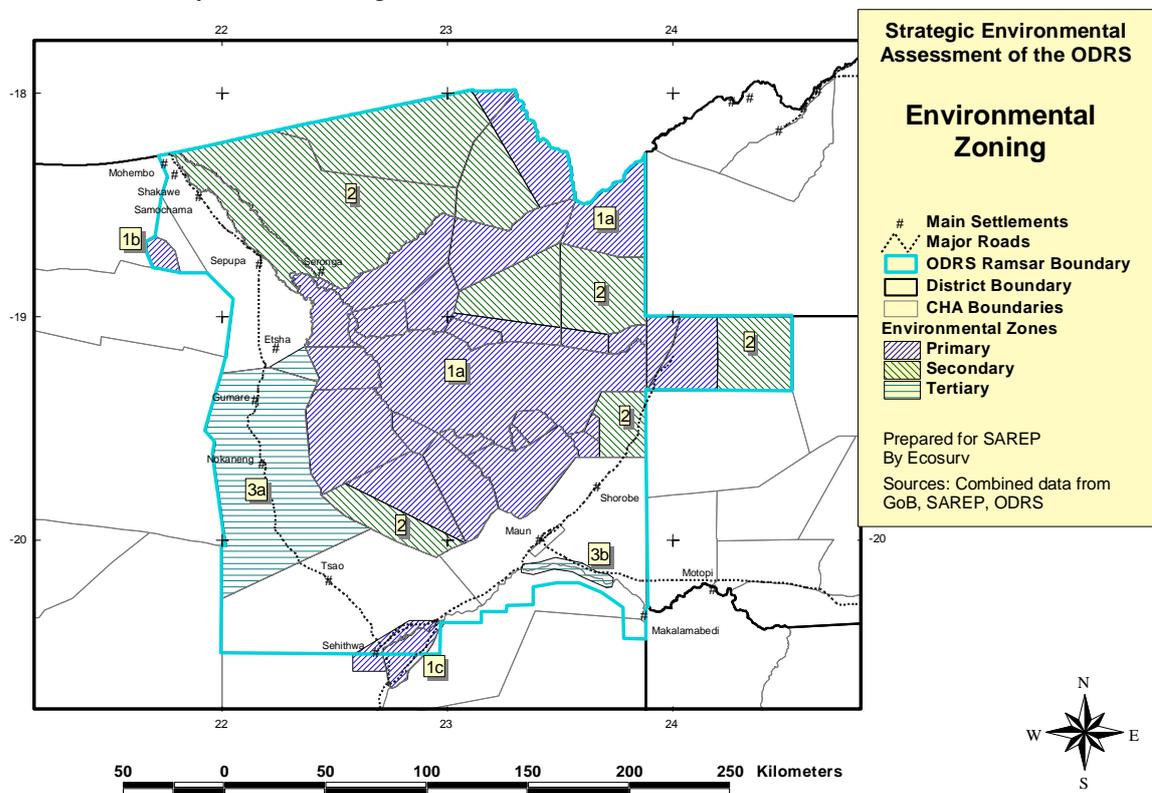


Figure 42: Zoning of the Okavango Delta Ramsar Site based on environmental sensitivity

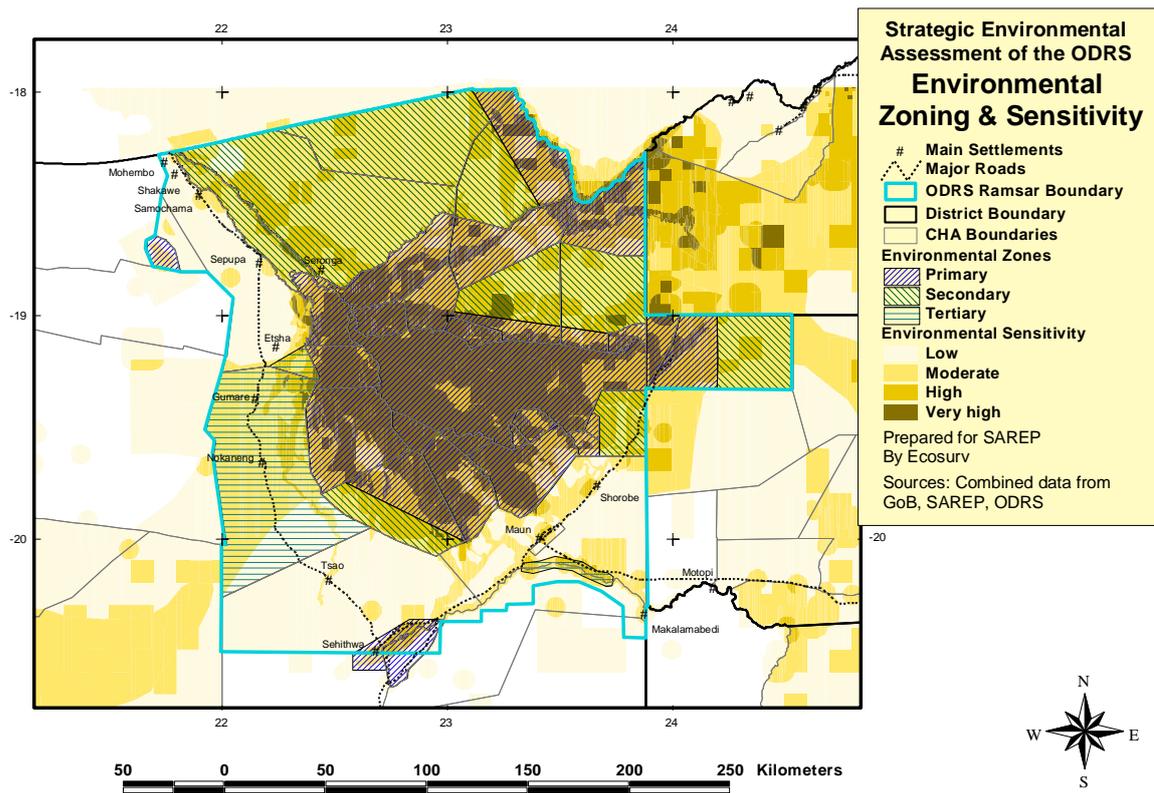


Figure 43: Environmental zoning in relation to sensitivity

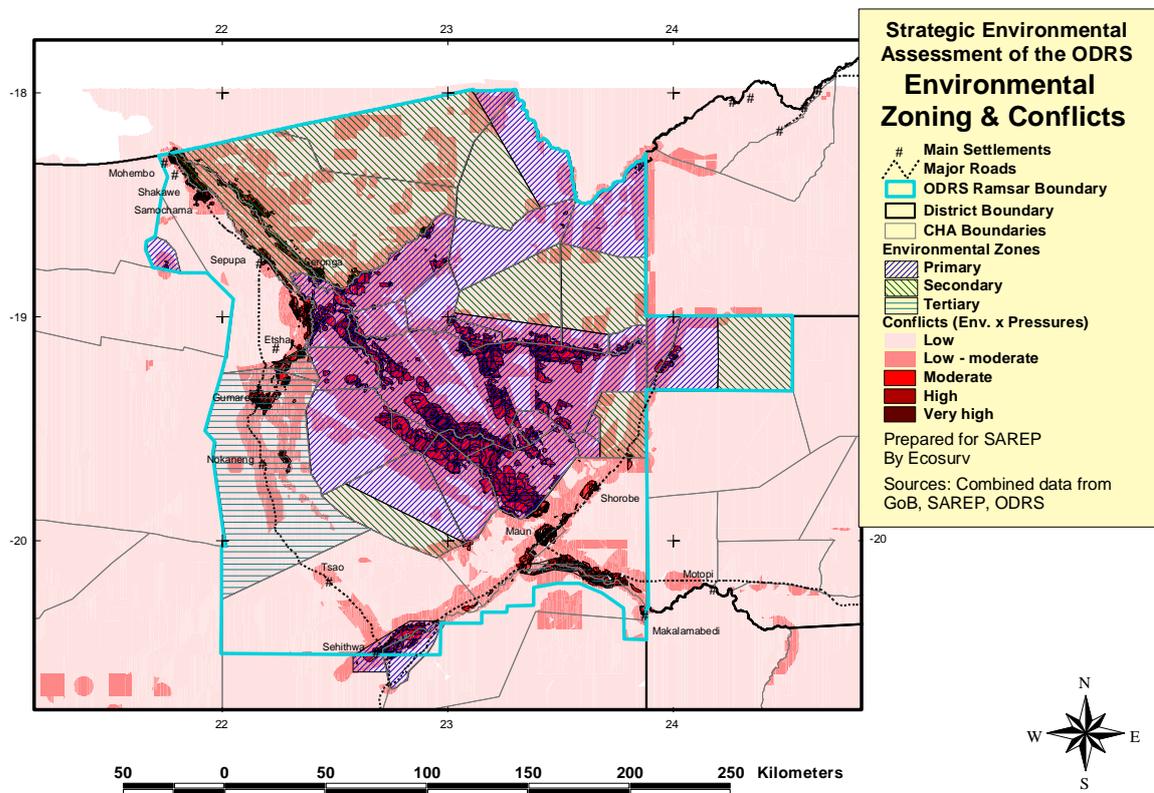


Figure 44: Environmental zoning in relation to conflicts

7.3 Vision

The ODMP has a shared vision of “a carefully managed, well functioning ecosystem that equitably and sustainably provides benefits for local, national and international stakeholders by 2016”.

The SEA found that:

- The vision may be shared at the ODRS level, but is not shared at the national level and as a result; some policies and strategies conflict with the objectives of the Ramsar site.
- The ecosystem is far from “well functioning” and is under threat from both upstream changes and internal sector and land use conflicts.
- Sustainable benefits are being undermined through loss of wilderness value and the potential collapse of ecosystem services.
- The overall objectives of Ramsar i.e. “the comprehensive protection of wetlands as important ecosystems for the maintenance of biodiversity” are not being met and are not incorporated into the vision statement.

The government and the district hosting the Ramsar site must decide whether the objectives of the Ramsar site are important to Botswana and if so, share and support a vision for the ODRS that meets the overall Ramsar objectives.

The proposed vision, objectives and associated actions are outlined in Figure 45.

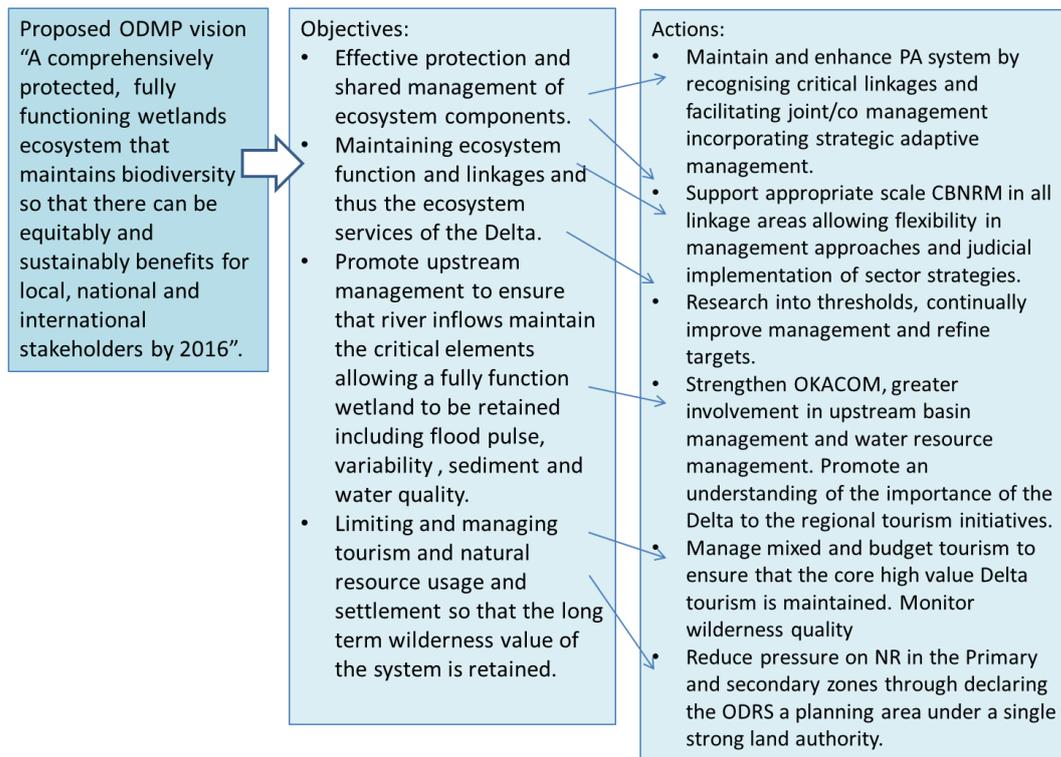


Figure 45: The proposed revised vision and objectives for the ODRS

7.4 Institutional Responsibilities and SEA Enforcement

The different review processes have all contributed to the SEMP. For example, the thresholds/targets/objectives for each zone and each sector have been derived from the ODMP Review and Thresholds Assessment while the roles and responsibilities were obtained from the ODMP implementation review.

Within the ODRS, the existing roles and responsibilities and the proposed roles are outlined in Table 21 below.

Table 21: Institutional Roles and Responsibilities

Institution	Role	Required Role for ODRS
OKACOM	Promote coordinated environmentally sustainable regional water resources development	Establish sustainable thresholds; identify environmentally suitable development and use options; increase understanding of ecological function of the basin as a whole;
Government of Botswana	To direct the national resources towards attaining the national objectives as agreed in Vision 2016. The theme for NDP 10 is “Creating the conditions for accelerated private sector growth, in order to reach Vision 2016 targets”	Within the national theme, support the objectives of the Ramsar site. At the OKACOM level: <ul style="list-style-type: none"> Articulate effectively the reason for setting targets and the implications of exceeding such targets. Identify where Botswana can effectively pay for ecosystem services in the sustainable development of the upstream river basin
Ministries	Responsible for a sector of government public administration. Formulate policy and strategies	Allow for selective implementation of policy on a site specific basis where objectives at the appropriate scale are different to that of the ministry
Departments (Central Government)	Implement policy objectives through plans and programmes	Judicial implementation of plans and programmes so that they support the objectives of the ODRS and do not undermine ecosystem integrity or lead to the collapse of ecosystem services. Support DEA in identifying how and where the integrity of the ecosystem can be improved and impacts on biodiversity reduced.
Line ministry departments at the district level	Implement departmental plans and programmes at the district level	Selectively implement programmes that support the ODRS objectives and dismantle plans and programmes that are undermining the system integrity. Increase flexibility in responding to impacts identified and providing feedback to policy makers.
Representative bodies for user groups (BOCCIM, HATAB, BOGA, BWPA, BWMA etc)	Promote the interests of members and maintain standards	Inform and educate members as to the ODRS objectives, identify areas of impact created by interest group activities and means to reduce or remove impacts, actively participate in the management and monitoring of the ODRS
ODMP Authority	To facilitate the management of the ODRS to meet its principal objective i.e.” the comprehensive protection of	Unchanged, but focus on the big issues, be aware of thresholds being crossed and bring resilience thinking into management approaches. The core focus areas are:

Institution	Role	Required Role for ODRS
	wetlands as important ecosystems for the maintenance of biodiversity” (Ramsar convention objectives)	<ul style="list-style-type: none"> • Upstream flows and water quality • Isolation of the wetland system and impending collapse of ungulate wildlife biomass and loss of biodiversity • Policy conflicts and implementation of strategies judiciously and at the correct spatial scale • Land management and the establishment of a competent land authority through declaration of the ODRS as a planning area.
DEA		Environmental authority auditing to ensure that the requirements of the SEMP are being implemented by the various responsible parties
Okavango Delta Wetlands Committee (ODWC)	Coordination	Coordination, awareness of institutional responsibilities and the courage to reject inappropriate development strategies
Council	Community representation	Represent communities and provide informed feedback so that the ODMP becomes a reality on the ground.
District Development Committee	Coordinates district development activities and serves as a planning body for the district. Supported at the village level through village development committees	Place the ODRS and its objectives at the centre of district planning and coordination.
Land Board	Tribal Land Act describes the objective of land boards to “efficiently and effectively manage land”	This requires a change in emphasis to efficiently and effectively manage land within the objectives of the ODRS ensuring that land allocation does not undermine ecosystem function.
Okavango Research Institute	University of Botswana research and monitoring institute,	Improve understanding as to system thresholds, with a focus on thresholds of potential concern, so as to refine and strengthen targets and contribute to strategic adaptive management.
NGOs (at the district level)		To support the implementation of the ODMP within their specific mandates.
Village authorities	Tribal administration supports development initiatives and implements customary law.	Implement CBNRM at the appropriate scale and locations.
Communities and local associations		
CBOs	Represent specific interest groups and CBNRM	

Legality: This strategic environmental assessment has been undertaken as required under the EIA Act 2011. The appropriate authority (Department of Environmental Affairs) is

required to review and approve the SEA which will then require the land authority for the Ramsar Site to ensure that the strategic management plan requirements are implemented.

The SEA would fall under the custodianship of the Tawana Land Board while monitoring and enforcement of the SEA would be the responsibility of DEA as per the Environmental Assessment Act of 2011.

7.5 Implementation Framework

The SEA preparation is the first stage in the process and probably the simplest. It needs to follow a path in which the SEA urgency and requirements are transmitted to the people, users, sectors and administrators of the ODRS (see the DEA actions in Figure 46). To support this process a number of recommendations have been made (Section 8.2).

Once the SEA is approved, management actions have to be monitored and evaluated and the actions updated and improved while at the same time research into the thresholds needs to be on going so that the targets can be refined or changed.

A feedback loop allowing for adaptive management is crucial. The loop seeks to improve management and refine the targets by responding to research, monitoring and evaluation on an annual basis. The link to the public (both in terms of information distribution and consultations) is crucial to maintaining support. Where issues arise and focused stakeholder meetings can address the issues, these should be held by the appropriate authority and supported by DEA through SAREP.

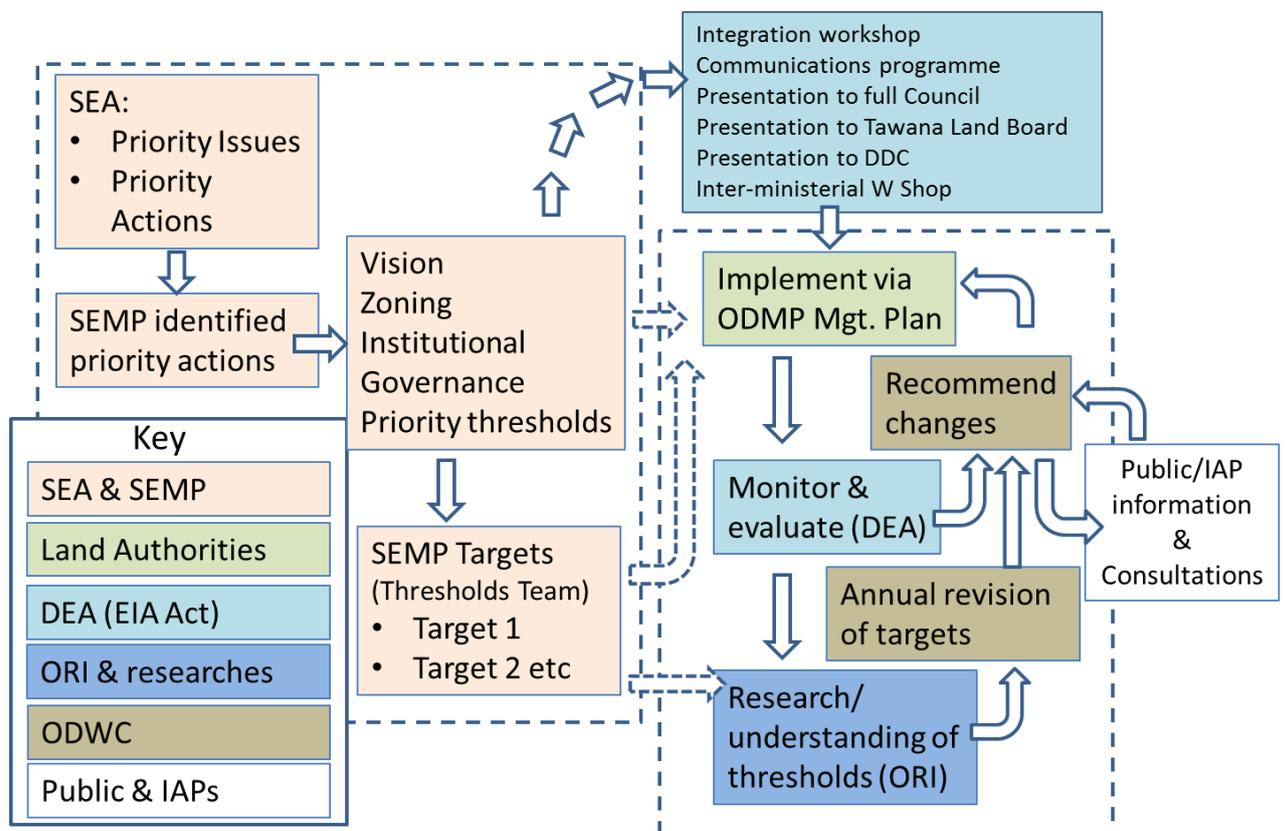


Figure 46: Institutional framework to allow for adaptive management of the ODRS

7.6 EQOs

A number of environmental quality objectives (EQOs) were identified based on national obligations and in response to pressures, these are:

1. To prevent further loss of biodiversity and to restore ecosystem functioning to 1994⁷ levels, thus maintaining the flow of ecosystem services to the ODRS and her people.
2. To prevent loss of wilderness qualities as this is the foundation of the tourism product.
3. To maintain the hydrological flow regime and water quality at the entry point to the ODRS (Mohembo). Maintaining the flow of ecosystem services to the ODRS and her people.
4. To maintain the hydrological flow regime for rivers discharging from the ODRS thus maintaining the flow of ecosystem services to downstream communities.

The targets linked to EQO specific actions were prepared by the thresholds team (SAIEA, 2012). These are included in Table 22 to Table 25. The Tables present the concern, proposed management action, target and indicator and suggest a responsible party and time frame.

The responsible party and timeframes need to be adjusted based on the outcomes of the integration workshop.

To incorporate the adaptive management approach, the targets linked to EQO specific actions are to be reviewed annually and, based on improved understanding of the thresholds, revised, made available for public consultation and then approved by the ODWC and authorised by the DEA and. It is critical that revisions are made based on improved information only and not in response to pressure from user groups.

⁷ The Thresholds Team identified 1994 as date when a high quality aerial survey of wildlife populations was carried out for both wet and dry seasons and thus provides a reasonable baseline.

EQO 1: To prevent further loss of biodiversity and to restore ecosystem functioning to 1994 levels, thus maintaining the flow of ecosystem services to the ODRS and her people. This goal is consistent with the objectives articulated in Ramsar, CBD, KAZA TFCA, SADC protocols and the ODMP. (Ranked **Highly Significant** and **Significant**)

Table 22: EQO1: Prevention of biodiversity loss and restoration of ecosystem function

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
Land allocation areas and the declaration of villages in sensitive and wetland areas (Highly Significant)	Establish an effective land planning authority for the Ramsar site;	1) Declare the ODRS a planning area and ensure that in wetlands and environmentally sensitive areas National Settlement Policy settlement constraints are applied 2) Enactment of the WMA regulations	No further allocation of land or settlement within the primary zone or within wildlife movement corridors. Settlements that have been mistakenly declared villages within the primary zone have development restrictions imposed	1) DTRP with support from DEA 2) DWNP	Within one year of the SEA approval
Implementation of sector strategies conflicting with the objectives of the ODRS and creating long term impacts that undermine the functioning of the wetland system. (Highly Significant)	Selectively and judiciously implement national sector policies and strategies at the ODRS level prioritising Ramsar sustainability objectives over sector objectives	All sector conflicts that are occurring or may occur at the ODRS level are settled in favour of the ODRS/Ramsar objectives. Existing impacts mitigated	Sector conflict addressed Sector 1 Sector 2 etc	DEA supported by MEWT and sectors responsible. Working group established for each sector conflict	Concerns and agreed changes documented and approved by the OWMC within 12 months of SEA approval
Closure of wildlife	Provide a framework	Identify appropriate	CBNRM constraints	MEWT to remove	CBOs and functional

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
corridors; increasing HWC; CBNRM policy undermined; loss of professional hunting as a land use option in CBNRM areas. (Highly Significant)	for realistic, appropriate and scale suitable land use alternatives based around CBNRM that focus on priority areas Determine location and width of wildlife corridors. Impose planning and development restrictions in these corridors.	and scale CBNRM sites that address biodiversity concerns. Remove constraints on CBNRM. Identify and fund support areas Wildlife migration corridors identified and agreed with all stakeholders.	removed; key CBNRM sites identified that address HWC and corridor requirements; Non-governmental structures in place to support on the ground CBNRM developments No barrier developments occur in the designated wildlife corridors	constraints; DEA/ORI to identify sites at the appropriate scale; DWNP to implement administrative decision on non-hunting zones selectively; DWNP and BTO to obtain NGO funding. Corridors to be delineated as CBNRM areas by Land Board and agreed with local communities	CBNRM projects established at key corridors on Panhandle eastern river bank, west of the “gap” in the Southern Buffalo Fence within two year of SEA adoption
Overgrazing by livestock. (Significant)	Limit cattle numbers to MoA stated carrying capacity	Floodplain: 23ha/LSU Sandveld: 16ha/LSU No livestock watering boreholes within 10 km of river channels	Livestock densities	MoA	Within two years of the SEA
	No new ranches in Primary, Secondary or Tertiary Zones	0 new ranches	No ranch developments approved	Land Board and MoA	With immediate effect
	Exclude cattle from Core Zone	0 cattle posts in Primary 0 cattle grazing in	No cattle in Core Zone	MoA	With immediate effect

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
		Primary			
	Prohibit expansion of Disease Free Area into WMA	No new veterinary fences allowing cattle into WMA	No disease free areas within WMAs	DVS and DWNP	With immediate effect
	All exploration boreholes to be closed on cessation of prospecting	No exploration-related boreholes left open	Closure certificates obtained after verifying that all water points have been closed	Department of Mines based on EIA/EMP requirements	Within 1 month of expiry of PL
Over-concentration of game and impact on wildlife movement due to disease control fences. (Highly Significant)	Remove of the Caprivi Cordon Fence along northern side of NG 13; western arm of the Setata fence and the Ikoga Fence (which cuts off the Tsodilo Hills from the Delta). Realign Setata fence to follow south along boundary of Gcwihaba WMA to Khukhi Fence, Realign Northern Buffalo Fence along southern side of NG 13 (while removing the section bisection NG13	Free flow of wild animals between: Core and Kwando-Linyanti system; Re-establish linkages between the primary/core and western Ngamiland (Gcwihaba WMA) Implementation of the Scott Wilson EIA (2000)	Fences removed or realigned. No new fences constructed in Core, Secondary or Tertiary Zones. Other new fences subject to EIA with emphasis on cumulative impacts and their lag effect.	DVS, with support from DEA and DWNP	Immediate commencement of planning and implemented within two years of the SEA

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
	Prohibit construction of new veterinary fences in Core, Secondary and Tertiary Zones.				
	Implement Elephant Management Plan	To establish an elephant population equilibrium that allows for high variability in elephant densities across their range (reduced AWP), high emigration rates (reduced barriers). Elephant hunting and implementation of the Elephant Management Strategy.	Hunting zones established (near communities); number of AWP in wet season range reduced by 50%, Management plan implemented; Barrier to northern emigration removed; Elephant numbers stabilise at lower than present levels	DWNP (EMP, hunting and AWP); DVS (Northern Buffalo Fence and Border Fence). Included in all CHA management plans in primary and secondary zones	Commence within 6 months of SEA approval
	Identify and zone wildlife corridors along Maun-Shakawe road and the eastern Panhandle and establish CBNRM	Free flow of wild animals between: Core and Kwando-Linyanti system; Between the Core Delta and to the west and south west (Gcwihaba WMA)	Corridors are identified, zoned and incorporated into the CBNRM programme No development transgressions reported in wildlife corridors.	Identified by DWNP. CBNRM development in these critical areas facilitated by BTO and DWNP, but driven by NGOs and private sector	Identification within 6 months of SEA. Implementation to start within a year of area identification
Land clearance and	Prohibit development	No commercial	No schemes	DEA and MoA	With immediate

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
degradation of habitat. (Significant)	of commercial irrigated agriculture in Primary/Core and Secondary Zones	irrigation schemes to be developed in Zones 1 and 2	approved.		effect
	Only allow commercial irrigation schemes in Zone 3 after a full EIA has been conducted. The EIA must take into consideration the cumulative impacts and targets identified in EQOs 4 and 5	Comprehensive EIAs to be undertaken for any new irrigation schemes and for all expansions of existing schemes, where the new area under irrigation exceeds 10% of the existing irrigated area. Total cumulative water use (for all downstream purposes) on ODRS outflows not to exceed the agreed target (ca 10% of actual outflow of the specific tributary)	Comprehensive EIAs conducted. DEA subjects EIAs to critical appraisal. DEA only approves proposed projects if they fall within the thresholds and targets set in this report. Water use records show total abstraction is less than maximum allowable total.	MoA, Dept. Crop Production and EIAs authorised by DEA	With immediate effect. Retrospective EIAs on already approved schemes
	No new commercial irrigation schemes allowed if cumulative water use downstream of exit	Development is limited by the availability of the resource	No schemes are approved where the total water use will exceed the maximum allowable total.	MoA, Dept. Crop Production and EIAs authorised by DEA	With immediate effect. Retrospective EIAs on already approved schemes

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
	point will exceed 10% of actual outflow of the specific tributary				
	Prohibit agriculture development in designated wildlife corridors	CBNRM to be developed with existing (compatible) agriculture	Designated wildlife corridors identified together with communities and CBNRM established at the appropriate level	DWNP and BTO	Identification within 6 months of SEA. Implementation to start within a year of area identification
	Prohibit agriculture along banks of rivers, lakes and wetlands	No arable agriculture allowed within 200m of riparian zone.	No further agricultural plots allocated within 200 m of the water's edge	Land Board or appropriate planning authority	Immediate
	No mining for sand, stone or any mineral allowed in Zone 1.	No mining or exploration activity in Primary/Core Zone or buffer (Figure 47). Managed excavation of gravel and quarried stone permitted in the buffer zone	No PLs are issued in core zone. All exiting PLs withdrawn at end of licence period.	DGS to be informed by Land Board and DEA that all exploration licences that fall within the Primary Zone or buffer are to be withdrawn at the end of the existing licence period. DEA to require at a minimum an EMP for gravel, sand and quarry extraction	Immediate effect

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
				activities	
	Any application for a PL in Zones 2 and 3 for sand, stone or minerals must be accompanied by an approved EMP.	No exploration or sand and stone operations allowed in Zones 2 and 3 without an approved EMP.	No applications are approved without approval of an EMP. The EMPs must be appraised using the checklist in Appendix.	DoM and DEA to require at a minimum an EMP for gravel, sand and quarry extraction activities	Immediate effect
	All applications to mine in Zones 2 and 3 must be accompanied by a full EIA done within the framework of this SEA and must comply with the thresholds and targets identified in this SEA.	High quality EIAs compiled and vigorously implemented. Mine companies CRS programmes to support SEMP implementation.	No significant direct impact on the primary or secondary zones	Dept. of Mines and DEA	With immediate effect
	No channel dredging allowed within the ODRS	No dredging/canalisation of channels	No dredging/canalisation of channels	DWA	With immediate effect
Spread of alien species. (Significant)	Information and awareness of species and invasive pathways both within the ODRS and from upstream	Information of awareness, species, and management requirements published	Threats assessed and prioritised. Extend, species and responsibilities made available to all users of the Delta	DEA/SAREP ORI and DFRR for assessment of threats	With immediate effect
	Dips and cleaning of	Threat from alien	Programme in place	DFRR	Within 2 years of the

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
	vehicles, boats and equipment	plant species reduced	to address high risk categories		SEA
	Biological controls and naturalisation		Biological controls tested where applicable	DFRR and ORI	Within 2 years of the SEA
	Eradication programmes	Eradication targets set for key species of concern	All camps and lodges within the primary/core zone implementing approved eradication programmes of key species of concern	DFRR and DWNP (coordination). Stakeholders to implement (Communities, natural users and tourism operators accessing the Delta)	Immediately after the programme is finalised
High frequency of fires in the northern section of the ODRS. (Significant)	Information on woodlands condition and value improved to allow decisions on declaration of Forestry Areas	Declare Forest Areas where tree species composition and densities meet DFRR criteria	Forestry areas declared	DFRR	Suitable areas identified within 1 year of SEA and declared within 3 years of SEA
	Improved fire management (not firebreaks)	Effective fire management approaches identified and fire frequency reduced to an average of < 1 in three years	All high fire frequency areas under community or operator management to prepare and implement fire management plans	DFRR supporting communities and operators	Within 2 years of SEA
Loss of biodiversity (Highly Significant)	Understanding of the implications of low	Thresholds identified	Defendable targets based on	ORI and DEA	Within 2 years of SEA

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
	flow reductions (loss of permanent swamp) on biodiversity and ecosystem processes improved		understanding of thresholds		
	Understanding of the implications of change in water quality on biodiversity and ecosystem processes improved	Thresholds identified	Defendable targets based on understanding of thresholds	ORI and DEA	Within 2 years of SEA
	Understanding of the implications of change in sediment input on biodiversity and ecosystem processes improved	Thresholds identified	Defendable targets based on understanding of thresholds	ORI and DEA	Within 2 years of SEA
	Stop illegal killing of problem animals through education campaigns, CBNRM and better land management	No further cattleposts in wildlife corridors. Cattleposts in high predator conflict areas to be relocated	Depletion of predator populations halted	Land Board	Within 1 year of corridors being identified and high conflict areas identified
	Prevent poaching	Reduced to zero	CBNRM established in corridors, high conflict areas.	DWNP and BTO	Year 5
	EIAs for all new	As per the EIA Act	EIAs to review	DEA	With immediate

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
	transmission lines		transmission line alignment and visual impacts		effect
	No transmission lines through Zones 1 and 2	No transmission lines	No transmission lines in the primary and secondary zones	DEA	With immediate effect

EQO 2: To prevent loss of wilderness qualities as this is the foundation of the tourism product. This goal is consistent with the objectives articulated in Ramsar, CBD, KAZA TFCA, SADC protocols and the ODMP

Table 23: EQO 2, Preventing of loss of wilderness qualities

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
Noise impact on wilderness quality. (Highly Significant)	Aircraft noise	Reduced levels at peak of tourism season	Overall Delta noise levels lowered and visitor satisfaction (of wilderness value) of repeat visitors remains high (Measured as per BoBs standards)	BTO with support of CAA	Immediate baseline situation taken including visitor perception. Repeated monitoring at peak if tourism season
	Boat noise	Reduced levels at peak of tourism season ⁸		BTO with support of WUC	
	Vehicle noise	Reduced levels at peak of tourism season		BTO	
	Camp generators	Thresholds set as per Photographic areas management plan (Ecosurv 1996) at max of 5 dBA above ambient levels at 50 m from generator		BTO	
	Growth of informal and formal settlements in Primary Zone	Zero further growth and reduction in informal settlements	No additional land allocated in formal settlements within the Primary Zone. Formal management plans to control natural resource use,	Land Board and DTRP	With immediate effect

⁸ Note recently developed guidelines on house boats and motor boats in the Okavango Delta and Chobe River

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
			tourism and waste. No arable lands allocated. Informal settlements constrained and closed		
Environmental impacts. (Significant)	Pollution and waste	Targets as per Botswana Certification System	All facilities within the Primary Zone meet standards	DWMPC, Land Board, BTO	With immediate effect all facilities adjacent to open water
	Vehicles and roads	Track network density within Primary Zone set at present levels	Track densities established	Leaseholders, Land Board (lessor), DWNP	Within 2 years of the SEA
	Alien species	As per EQO 1	As per EQO 1	As per EQO 1	As per EQO 1
	Disturbance of bird breeding sites and heronries	Disturbance levels with zero impact on biodiversity	Breeding success	DWNP, support on monitoring ORI and Birdlife	Disturbance parameters confirmed within 1 year of SEA. Changes (if required) to breeding sites protection implemented within 2 years of SEA
Visual impact. (Significant)	Communications masts	Existing masts in Primary Zone with a visual impact > 1 km to be re-sited/modified to <	Impact of communications masts on wilderness quality reduced	BTC, leaseholders, Land Board, CAA	With immediate effect

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
		1km impact. All future masts to be subject to visual impact assessment. No lights on masts			
	Transmission lines	No TL in primary and secondary zones	No TL in Zones 1 & 2 and visual impact assessments undertaken for all other zones	DEA	With immediate effect
	In Primary/Core zone, visual impact assessment of all future infrastructural developments. Retrospective assessments on existing structures significantly reducing wilderness value.	Reduced impact on wilderness value	Impact of future infrastructure developments in Primary Zone significantly reduced and existing impacts reduced through retrospective visual assessments	All infrastructure providers	With immediate effect
	High levels of natural resource harvesting	Limits set for NR use within Primary Zone based on impact on wilderness value	Parameters set	BTO together with stakeholders	Parameters to be set within 18 months of SEA
Visitor crowding (Highly Significant)	Control visitor numbers and maintain high value	Limit visitor numbers and maintain high value	Target set and incorporated into future planning	Land Board and BTO	With immediate effect

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
	segment in Primary/Core zone	segment in Primary Zone. Set at 1,410 beds. Presently distributed as per Annexure 1			
	Manage tourism in secondary zone and settlements adjacent to the Primary/Core zone	No spill over if tourism pressure from Secondary zone and settlements in or adjacent to Primary Zone	Wilderness value and high quality tourism in Primary Zone not negatively affected by tourism in other zones	Land Board and BTO	With immediate effect
	Diversification of tourism to allow consumptive tourism in areas of low non-consumptive value	Consumptive tourism in low value conservation anon consumptive tourism areas and CBNRM areas with high HWC	Optimal use of the ODRS meeting the objectives Ramsar Objectives	DWNP	Immediate review of suitable areas. Implement within 1 year of review

EQO 3: To maintain the hydrological flow regime and water quality at the entry point to the ODRS (Mohembo). This goal is consistent with the objectives articulated in Ramsar, CBD, KAZA TFCA, SADC protocols, OKACOM and the ODMP

Table 24: EQO 3, Maintaining hydrological flow and water quality

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
Reduction in flood peaks. (Highly Significant in the long term)	Scale and operation of upstream structures (and land clearing) agreed through OKACOM	Flood peaks unaffected by upstream developments	Flood pulse dynamics unaffected	OKACOM, national water authorities; national agricultural authorities and national power generation authorities	Post basin wide SEA
Reduction in flow volume with most impact on the volume of the low flow. (Highly Significant)	Understanding of the thresholds required. Identification of development options and payment for ecosystem services	Max upstream flow abstraction not to exceed 10% of MAR of the lowest recorded flow i.e. 600 Mm ³ /a	Low flows maintained at a minimum of 70% natural volumes	OKACOM, national water authorities; national agricultural authorities	Post basin wide SEA
Perturbation of natural hydrograph. (Highly Significant in the long term)	Maintain natural seasonal fluctuations in flow	Annual and cyclic variation in the flows maintained	River flow variability unaffected	OKACOM, national water authorities; national agricultural authorities and national power generation authorities	Post basin wide SEA
Reduction of sediment movement into the ODRS and within the ODRS. (Highly Significant)	No structures which impede the free flow of sediment to be constructed that will reduce existing	Sediment loads to be consistent with current levels	The distance that the Okavango River will need to flow to re-establish sediment load established and	OKACOM, national water authorities; national agricultural authorities and national power	Post basin wide SEA

	bedload sand levels entering at Mohembo		agreed through OKACOM	generation authorities	
Reduced water quality due to upstream urban discharge, runoff from irrigated and rain fed agriculture and the clearing of woodland for arable agriculture. (Highly Significant)	Improved water management from urban centres. Irrigation schemes designed to prevent return flows and runoff to the river	Target of <10mg/L total nitrogen (TN) and <1mg/L total phosphorus (TP)	Water quality at low flow	OKACOM, national water authorities; national agricultural authorities. Note that OKACOM is involved in upstream integrated water management to address impacts associated with changes in land use and loss of woodlands	Post basin wide SEA

EQO 4: To maintain the hydrological flow regime downstream of the ODRS. This goal is consistent with the objectives articulated in Ramsar, CBD, KAZA TFCA, SADC protocol on.... and the ODMP....

Table 25: EQO 4, Maintaining hydrological flow downstream of the ODRS

Pressures and Impacts	Management Actions	Target / Goal	Indicator	Responsible Party	Time frame
Reduction in flood peaks. (Significant)	Do not reduce flood peaks	Flood peak	Downstream terminal lakes function naturally	Water apportionment Board, DWA	With immediate effect
Reduction in flow volume. (Highly Significant)	Limit offtake	No more than 10 % of annual release from the Delta in any one year to be abstracted	Downstream user requirements met and ecosystems processes such as ground water recharge maintained	Water apportionment Board, DWA	With immediate effect
Reduced water quality due to upstream urban discharge and runoff from irrigated and rain fed agriculture. (Significant)	Improved water management from urban centres. Irrigation schemes designed to prevent return flows and runoff to the river	Target of <10mg/L total nitrogen (TN) and <1mg/L total phosphorus (TP)	Water quality at Samadupi meets standards	DWA	With immediate effect

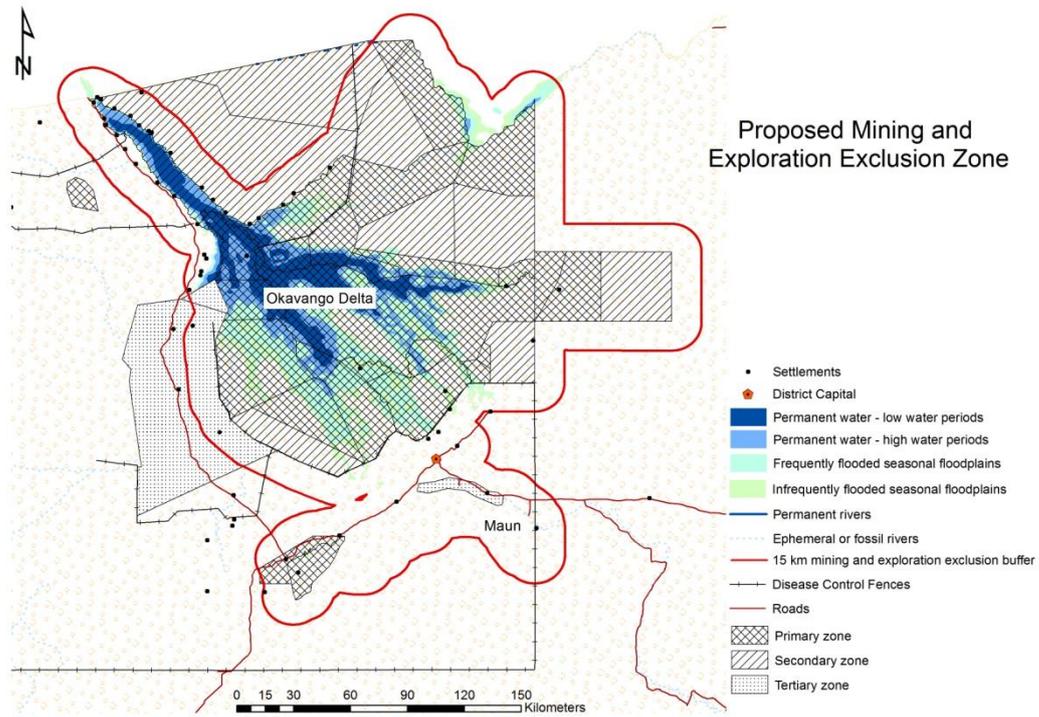


Figure 47: Mine and exploration exclusion zones (SAIEA 2012)

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Key Issues Identified at the ODRS Level

The Okavango Delta is unique within the continent and Africa in that it is largely pristine in nature and has maintained its core ecosystem functions. This fortunate situation has allowed the Delta to become the emblem or ambassador of tourism for Botswana. The existence of such a large and pristine fresh water system is not due to chance, it is a result of planning and foresight where the Department of Wildlife and National Parks had, through its protected area and wildlife management system, managed to keep intact much of the ecosystem components.

This fortunate situation cannot be taken for granted as population growth and development within and upstream of the inland delta are inevitable. The area faces enormous pressure, both physical and political, on its resources. Even tourism, an industry directly linked to the wilderness characteristics of the Delta, is growing to a point where it has the potential to destroy its own resource base.

The waters of the Okavango Delta are a primary draw for people, agriculture, livestock, wildlife and tourism thus the periphery of the delta is quite heavily settled and large numbers of wildlife move into and out of the system annually.

The main drivers in the system are the rapidly growing human population, urbanisation, growth of communities within the WMAs. The main externalities are climate change, the world economy, cyclical changes in flooding and, above all, changes in upstream water use and quality.

A number of policies and policy changes will have significant impacts on the Ramsar site. The Department of Wildlife and National Parks has declared a stop to hunting in all CHAs within 25 km of a National Park, Game Reserve or Forest Reserve and within 10 km of the national borders. This has effectively eliminated all consumptive use of wildlife resources from northern Botswana. The Department of Crop Production is aiming to facilitate irrigated agriculture in Ngamiland, while the Department of Veterinary Services aims to maintain its EU level disease control standards and move the disease control “green” zone north to the southern boundary of the ODRS. The outsourcing of key activities such as veterinary disease control fence maintenance may result in more effective barriers and have a secondary impact on animal movements. Expansion of BPC’s power network will accelerate growth and development in the urban centres. Botswana Tourism is driving a process of rapidly expanding tourism facilities which will in turn increase pressure on the core Ramsar Site.

Institutionally there are many changes such as the new water management authority, the clustering of agricultural skills to suit the specific districts and the shift in planning authority from DTRP to the districts. The process to declare of the Ramsar Site as a World Heritage Site is underway.

Plans and programmes existing and planned will influence land ownership (emphasis on commercialisation of agriculture in both livestock and crop production), distribution and type of tourism, settlement patterns, and the Ngamiland economy (shift towards commercial agriculture and mining).

Climate plays a major role in influencing events in the ODRS. During the last decade the low flood conditions in the Delta have allowed people, livestock, lodges and other

physical developments to use or develop the floodplains and dry river systems. The recent flooding and expansion of waters within the Delta, Lake Ngami and down the Boteti has served to push people and their stock away from grazing areas and compress them into smaller and smaller areas. Lodges and homes are being flooded and even wildlife is being pushed into shared grazing areas. The cumulative impacts of changes in flooding on livelihoods, disease control, tourism, grazing and other land uses are difficult to predict and become increasingly important as infrastructure is developed and land and grazing restricted.

The increase in perennial water and the opportunities it presents has attracted the attention of some sectors who are preparing plans to capitalise on the waters. The tourism industry is viewing Lake Ngami as a growth area, while Department of Crop Production is planning large areas of irrigation along the Thamalakane and Boteti river systems.

New economic developments such as mining could change the economy of Ngamiland and provide opportunities for people to move into the wage economy. These developments also place pressure on land, water and energy resources. At present the most significant of these developments fall outside of the ODRS but, due to their resource requirements and effect on the local economy, they have potential to have significant impacts.

The SEA has identified the environmental sensitive areas of the ODRS, the pressures to which these areas are exposed and through the review process identified ecological thresholds and system resilience. It has also assessed high level and cumulative impacts, the results of which have been brought into the Strategic Environmental Management Plan.

8.1.1 Stakeholder Concerns

During the stakeholder engagement process, a number of common issues were identified by the participants. The main issues were:

- **Over-planning, but lack of implementation.** There is a plethora of plans and programmes for the Okavango region, but a common complaint was that few of them are actually being implemented in a systematic and structured way. The sentiment was expressed that action, rather than words was required more than anything else.
- **Inadequate enforcement and control** of, for example animal diseases, urban and village sprawl, etc. This issue is closely linked to the previous point, but it goes beyond planning and applies to the perceived lack of enforcement of laws and regulations, and the inadequate management of existing controls, such as the disease control fences.
- **Lack of monitoring.** Although numerous studies have been done on the ODRS, it was felt that there is little empirical information about causes and effects, in both the short- and long-term, relating to anthropogenic changes. The Ramsar Convention is quite explicit about the need for scientific data: “Essential to wetland management is baseline data that establishes the range of natural variation in components, processes and benefits/services at each site within a given time frame, against which change can be assessed.”

- **Conflicting policies, laws and regulations.** Much of the existing legislation is outdated, fragmented and difficult to implement. In many instances policies conflict with each other e.g. wildlife use with rapid growth in non-consumptive tourism, hunting exclusion zones with Wildlife Conservation Policy, CITES elephant protection with agricultural development and Elephant Management Strategy; food security with KAZA, etc. There are therefore, great expectations that the current law reform process in most relevant sectors, will resolve this problem. However, it is strongly recommended that new policies should be subjected to a SEA (as required in law) to ensure that they are not in conflict e.g. some of the proposed elements of the energy project, such as growth of biofuels, and a coal-based economy might conflict with climate change, water, agricultural and land policies if they have not been properly aligned.
- **Lack of understanding and buy-in from local communities** about the ecology, value and sensitivity of the ODRS. It is clear that there is little actual understanding of the ODRS ecosystem and how it functions within the many spheres of government that are mandated to manage its resources. It is also apparent that there has been little buy-in from the local people living in the Delta as to its global importance on the one hand, and the benefits it provides for their wellbeing on the other. Concepts of sustainability are not foreign to local people, but they are sometimes powerless to ensure that the limits of acceptable change or sustainability thresholds are not exceeded.
- **Ever-increasing demands for natural resources** (water, energy, land). This is an issue at global, national and local level and needs to be resolved through harmonised and wise policy-making as mentioned above, combined with effective implementation, monitoring, enforcement and control.

8.1.2 Spatial Analysis

The Spatial analysis (Figure 48) identified a number of areas of high conflict and thus major concern. These may be summarised as follows:

1. Tsodilo Hills World Heritage Site: A nationally important site which is becoming isolated from the rest of the wildlife system and under pressure from livestock farming and mineral exploration.
2. Okavango Delta Pan Handle: The Pan Handle plays an important role as a conduit of water and sediments to the Delta fan. It has a number of biodiversity hot spots and is important for dry season water for wildlife. The presence and growth of human population is resulting in pressure for land and increase in HWC
3. Pan Handle East (NG11, 13, 14): An important wildlife system providing wet season dispersal for ungulate populations. The area is under pressure from livestock expansion, mineral exploration and high frequencies of fires.
4. Kwando/Linyanti River system: A largely neglected component of the Ramsar site which provides a critical dry season refuge for ungulate populations has a number of biodiversity hot spots and is threatened by potential upstream water usage. The fencing of NG 13 has increased pressure on the system increasing access and livestock distribution and limited natural expansion of ungulate ranges. The area has significant cross border issues with high population densities in Eastern Caprivi.

5. Magwegana/Selinder Spillway (NG12): An environmentally important and sensitive area under pressure from livestock expansion and high frequencies of fire.
6. Western delta, Thaoge River: Pressure from rapidly expanding human population which, due to the poor economy and limited levels of education, has increased pressure on arable land and range.
7. Central and southern Delta: An environmentally sensitive area (within the core zone), threatened by increase in upstream water use and commercially valuable as an international tourism destination based on wilderness value. Increase pressure from settlement (largely linked to tourism opportunities), the desire to increase tourist numbers and the negative impacts of tourists on the wilderness value of the area.
8. Khwai and Mababe: A sensitive area within the Ramsar site (within the core zone) Pressure due to change in settlement to village status, and related infrastructure developments and immigration issues. Increasing pressure on natural resources.
9. NG5, Gcwihaba WMA: The area has important linkages to the Okavango delta in terms of wildlife populations. The viability of the area is threatened through expansion of the livestock industry (ranches) and allocation of cattle posts in NG5.
10. Lake Ngami: A sporadically flooded lake which when filled is an important bird area meeting some of the Ramsar wild bird population criteria. The area is an IBA (Important Bird Area – Birdlife Botswana) but under pressure from surrounding land use, livestock and water demands for mining.
11. Upper Boteti River: A sporadically flooded river system along which water flows to the Nxai Pans National Park and provides critical recharge of groundwater for communities living downstream. The area has a number of biodiversity hot spots (mainly bird related) and is under pressure from irrigated agriculture.

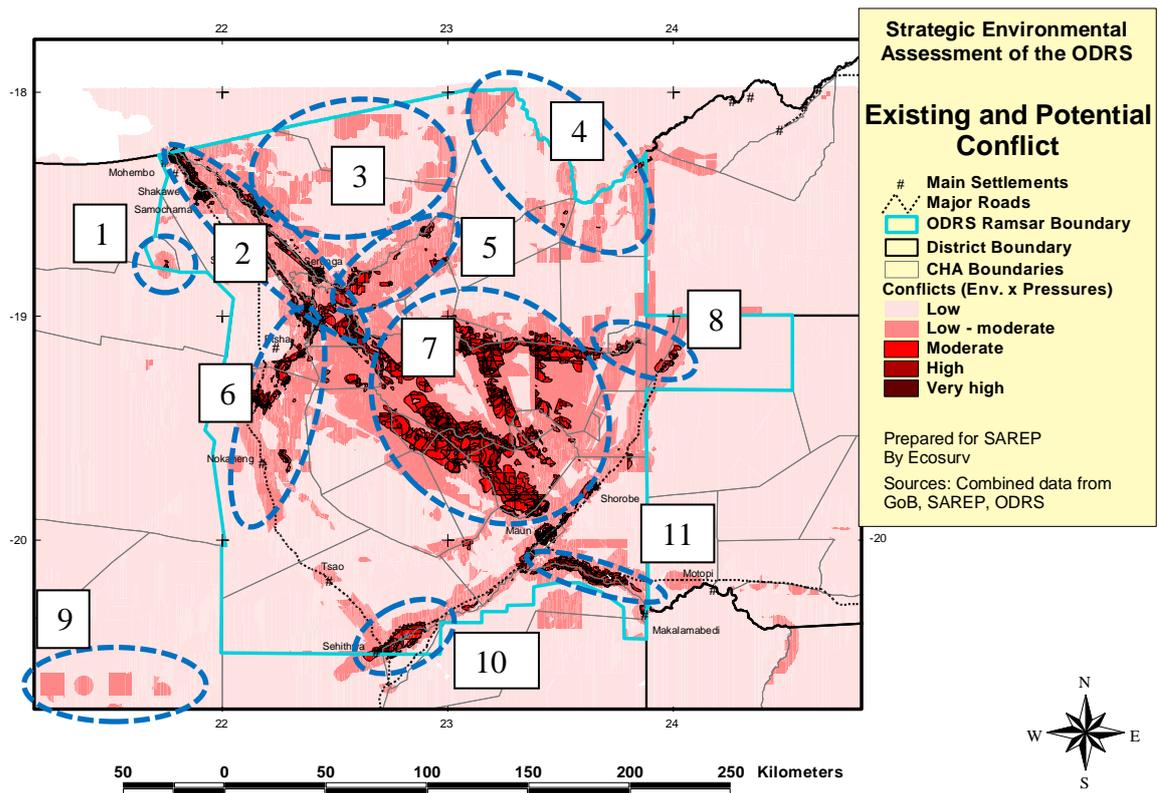


Figure 48: Areas of conflict within the ODRS (based on threats x sensitivity values)

8.2 Recommendations

A Strategic Environmental Management Plan has been prepared that outlines the strategic targets and actions required beginning a process of change. The SEMP must become the overriding framework guiding future management decisions.

At a minimum the following requirements are to be brought into the ODRS Action Plan:

- a) Vision
 - Vision and objectives to be revised to be based on Ramsar objectives.
- b) Legality
 - SEA legally approved by DEA for implementation by the planning/lands authority.
 - Legal authority of land authorities strengthened through:
 - Authorisation of the SEA and SEMP;
 - Gazetting the ODRS a planning area;
 - Enactment of the WMA Regulations;
 - Establishment of the ADRS as a WHS;
 - Finalisation of the Wetlands policy and Strategy.
 - Under Article 3 of the Ramsar Convention, the contracting parties should be informed that, in the near future there is likely ecological change to the ODRS as a result of upstream technological developments, pollution and development upstream of the Ramsar Site. Minimum Required For the ODMF Action Plan.

- c) Planning ODRS
 - The ODRS is to be primarily managed as a Ramsar Site;
 - The land authorities to be fully aware of their role and responsibility in implementation of the ODRS and the SEA;
 - Ngamiland land use planning to fall within the framework of the SEA;
 - Create a philosophy of adaptive and flexible management which responds to new information, research and monitoring;
 - Ensure that national priorities, policies and strategies are implemented in an appropriate manner at the ODRS level;
 - Consider splitting the following CHAs to separate consumptive from non-consumptive tourism: NG/13, 14, 15, 16, 18, 20, and 41.

- d) Institutional
 - DEA to ensure that SEA is implemented by the relevant authorities.

- e) Planning Upper Basin
 - Strengthen OKACOM and KAZA;
 - Prepare a basin SEA with legally binding obligations for implementation by OKACOM;
 - Sustainability parameters set for upstream development (area of land that can be cleared; proportion of wetlands to be converted; types and size of structures that will not affect the downstream ecosystem);
 - Establish agreed sustainable irrigation criteria e.g. minimum distance from river, no discharge or runoff into river system;
 - Set criteria for hydropower developments e.g. run-of-river schemes which allow sediments to bypass the off take;
 - Define distance upstream of Moheumbo that sediment containment structure can be constructed;
 - Set defensible off take targets based on an understanding of thresholds. These are to be constantly refined based on improved understanding of the basin ecology and thresholds;
 - Establish consumptive and non-consumptive tourism developments in upper basin and facilitate elephant immigration into Angola;
 - Regional tourism integration.

- f) Sector developments
 - Sector developments must show contribution to vision and adjusted to be suitable at the district level;
 - Revise animal disease management in Ngamiland to allow minimal fencing, rehabilitation of wildlife movements and (possibly) process based rather than area based, animal disease management.

- g) Implementing EIAs and Strategies
 - DWNP to implement the appropriate components of the Elephant Management Strategy;

- Ministry of Agriculture to implement the Reference Group approved recommendations of the Environmental Assessment of Fences in Ngamiland (Scott-Wilson, 2000).
- h) Rationalise and strengthen CBNRM
- Focus on critical CBNRM areas where there are high HWC and ecological/conservation issues. These areas need to be identified and given active support and funding to develop CBNRM models. In these areas reruns from CBNRM are often low and incentives such as reduced contributions to the Environmental Fund and reduced taxes would be important;
 - Re-establish professional hunting of elephant as a land use to support CBNRM (in high HWC areas) and in low value non-consumptive tourism areas;
 - determining the **appropriate local scale** at which people can work together, plan and prioritize together, and undertake / implement actions together (this could be key corridors or high biodiversity areas outside of the WMAs, or a concession area plus the immediately adjacent rural community);
 - bringing the potential partners together (Wildlife Dept., community, private sector concessionaire, and relevant NGOs working in the area) to:
 - Create a vision for the area with some key objectives;
 - Identify the key issues that need to be addressed (e.g. how to work together, how to communicate effectively, how to jointly control illegal activities, how to jointly manage fires, how to address land-use issues such as settlement patterns, wildlife corridors, etc., how to jointly monitor relevant trends, how to optimize and share benefits, etc., etc.); and
 - Develop an action plan for implementation; and moving into joint implementation with regular reviews and improvements to the approach.
 - On the ground implementation of different CBNRM models and spread successful models to other areas.
- i) Elephant
- Re-establish professional hunting of elephant as a land use to support CBNRM (in high HWC areas) and in low value non-consumptive tourism areas;
 - Prepare a strategy on artificial water point (AWP). Focus on reduction of AWP and zoning important wet season ranges to be free of artificial water supply for wildlife. Prevent uniform distribution of elephant across the wet and dry season ranges;
 - Open movement routes for elephant to emigrate. This would include removal of border fences in some areas and realignment of the Northern Buffalo Fence to the west of NG13;
 - Develop CBNRM in key elephant movement corridors (eastern edge of the Panhandle);
 - Implement appropriate sections of the Elephant Management Plan.
- j) Research and Monitoring
- Obtain a functional understanding of ecosystem processes in the upper basin, the buffer effect or ecosystem services of the upstream wetlands systems in relation to discharge, maintaining water quality, sediment supply or deposition;
 - Applied research into each of the main hydrological thresholds:

- Failure or collapse of ecosystem processes and services fail with declining low flows;
- Change in vegetation dynamics and river channel composition with determination of water quality;
- Minimum distance upriver of the Panhandle needed to re-establish fine sand sediment levels to presently carried by the river at Mohebo;
- Feedback into thresholds understanding so that targets can be refined.
- Applied research into each of the main ecological thresholds:
 - Wilderness value;
 - Elephant densities/riparian woodland condition;
 - Artificial water points.
- Establish discharge parameters for drainages leaving the Okavango and Linyanti/Kwando systems. These are to incorporate groundwater recharge requirements, downstream users based on user and ecological requirements;
- Monitoring of critical variables to indicate when we are nearing thresholds and at what rate.

The plan implementation should be assisted through a number of critical future activities:

- The SEMP needs to be work shopped with all implementing parties (public and private sectors) to ensure that the recommendations are realistic, practical. The implementing parties need to know what is expected of them so that they can plan and budget for the necessary management actions to be taken. A detailed work plan will be required to ensure a logistical flow of actions, based on an agreed set of priorities. Central to this activity would be the creation of a SEMP Steering Committee, preferably within an existing management authority, to ensure that the action plan is being implemented within the defined timeframe.
- A Strategic Environmental Assessment at the Okavango River Basin level. This is critical if upstream developments are to be guided into a sustainable development direction.
- A facilitated workshop to integrate resilience thinking into the future management of the Delta. This needs to be undertaken at the ODRS level and should be linked to the ODMP Review Workshop. In addition, a short introduction to resilience should be provided at the Sector Permanent Secretary level to ensure support throughout government.
- A facilitated scenario planning session held with key sector representatives at the district level together with a results presentation to senior central government personnel.
- Integrated land use planning based on the findings of the SEA and using the land-use conflict identification strategy (LUCIS), or similar, approach would assist in addressing land use conflicts.

These activities will cement and embed the SEA within the planning process.

9 REFERENCES

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10 ANNEXURE 1: ACCOMMODATION WITHIN THE PRIMARY ZONE

The following numbers of units and tourism beds have been recorded for the Primary Zone. Estimates have been made for management plans currently under revision. Data supplied by BTO, estimates added by the SEA team.

CHA	Zone	Facility	Beds	Certainty
NG12	1	Mapula	16	No
NG12	1	New Allocation	16	Estimate
NG14	1	Lebala	16	Yes
NG14	1	Lagoon	16	Yes
NG15	1	King's pool	18	Yes
NG15	1	Savute	14	Yes
NG15	1	Duma Tau	20	Yes
NG15	1	Linyanti	16	Yes
NG16	1	Zarafa	10	Yes
NG16	1	Motswiri	8	Yes
NG16	1	Selinda	18	Yes
NG16	1	Under Construction	6	Yes
NG18	1	Tau	9	Yes
NG18	1	Discoverer	10	Yes
NG18	1	Hyena	16	Yes
NG18	1	Wilderness Tented	16	Yes
NG18	1	Banoka	16	Yes
NG19	1	Khwai River	30	No
NG19	1	New allocation	16	Estimate
NG19	1	Sango Safaris	12	Yes
NG19	1	KDT Camp sites x 3	30	No
NG19	1	Bed & Breakfast	16	Estimate
NG19	1	Guest House	16	Estimate
NG20	1	Kwara	16	Yes
NG20	1	Little Kwara	8	Yes
NG21	1	Camp Okavango	24	Yes
NG21	1	Shindi	16	Yes
NG21	1	Xugana	16	Yes
NG21	1	African Footsteps	16	Estimate
NG22		Vumbura Plains	28	Yes
NG22	1	Little Vumbura	12	Yes
NG23	1	Duba Plains	12	Yes
NG24	1	Old Jedibe Lodge	16	Estimate
NG24	1	Community camp	15	Estimate
NG25	1	Jao	18	Yes
NG25	1	Jacana	10	Yes
NG25	1	Kwetsani	10	Yes
NG25	1	Tube	22	Yes

NG25	1	New Lodge	10	Yes
NG26	1	Abu	12	Yes
NG26	1	Seba	16	Yes
NG26	1	Horse Back Safaris	12	Yes
NG27	1	Nxabega	18	Yes
NG27	1	Nxabega Trails	6	Yes
NG27	1	Pom pom	18	Yes
NG27	1	Kanana	16	Yes
NG27	1	Xaxaba	24	Yes
NG27	1	Moremi Crossing	34	Yes
NG27	1	Gunns	16	Yes
NG27	1	Delta Camp	16	Yes
NG27	1	Oddballs	40	Yes
NG28	1	Mombo	18	Yes
NG28	1	Little Mombo	6	Yes
NG28	1	Xigera	28	Yes
NG28	1	Xakanaka	24	Yes
NG28	1	Camp Moremi	24	Yes
NG28	1	Okuti	24	Yes
NG28	1	Chief's camp	24	Yes
NG28	1	Xakanaka Camp sites	30	Yes
NG28	1	Third Bridge Camp sites	72	Yes
NG28	1	Khwai Camp sites	80	Yes
NG29	1	Xudum	18	Yes
NG29	1	Macateers	6	Yes
NG30	1	Xaranna	18	Yes
NG30	1	Kujwana	12	Yes
NG31	1	Chitabe	16	Yes
NG31	1	Chitabe Lediba	10	Yes
NG31	1	Sandibe	16	Yes
NG32	1	Stanleys	16	Yes
NG32	1	Qorokwe	4	Yes
NG32	1	Ivory	8	Yes
NG32	1	Mekoro Camp sites x 34	16	Estimate
NG33	1	Santawani	12	Yes
NG34	1	Kazikiini/Shandereka	8	No
NG34	1	Mokolwane	6	No
NG34	1	New Camp	16	Estimate
NG34	1	Moremi Tented Camp	24	No
NG41	1	Joverega	8	Yes
NG41	1	Kuumaqzanga	8	Yes
NG41	1	Dizhaana	20	Yes
NG17	1	?		No Data
NG13		Not included		

11 APPENDIX 1: KEY LITERATURE AND PLANNING FRAMEWORK

11.1 Legal Status of the Ramsar Site

The ODRS lies entirely within Ngamiland and is subject to district management and national policies and laws.

The Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat adopted at Ramsar on 2 February 1971 as amended by the Protocol of 3 December 1982) came into force four months after the deposit of its instrument of accession, on 9 April 1997. As such the Okavango Delta Ramsar Site is a Ramsar area and has obligations under the convention and other bi and multi-lateral agreements.

Most of the area also falls within the Kavango Zambezi Trans Frontier Conservation Area (KAZA TFCA). The Treaty was signed on the 18th August 2011 in Luanda, Angola and binds the countries in a shared development of tourism based on the natural resources of the area.

11.2 Key Literature Applicable at the Strategic Level

Department of Mines

Draft Mines Policy: This important document (not yet received) must be reviewed as part of the sector assessments during the ODMP review and action plan formulation

Coal Road Map: This document does not appear critical for Ngamiland as energy resources have not been found in important quantities but will give an indication of the direction government is taking with regard to mineral abstraction. This document was to be released at the end of January 2012 and is still awaited.

Draft mine rehabilitation legislation/ Act will guide future closure planning of mining and quarry sites and will ensure that funds are set aside for rehabilitation

Department of Forestry and Range Resources

Draft Natural Resources Policy which will combine forestry, range resources and veld products. The document also contains a strategy on fire management.

Department of Energy Affairs

Draft Revised Energy Policy: A draft of this policy is with DEA (Maun).

Department of Wildlife and National Parks

Draft Elephant Management Policy. The existing elephant management policy was reviewed late 2011 and the revised elephant policy is expected. This will have major implications relating to elephant distribution, wildlife conflicts and the hunting industry.

Rhino Management Strategy: This strategy relates to biodiversity conservation – not yet seen

National Aquaculture Strategy: Not seen

Draft Exotic Species Guidelines: This critical biodiversity issue is addressed in these guidelines. The document has not been seen by the SEA team

Draft Fishing Protection Regulations and voluntary guidelines

Department of Animal Health

Alignment of the proposed new animal disease control buffer fence which lies along the northern boundary of the Hainaveld farms and the ranches. This fence will either swing south to the Ghanzi District boundary adjacent to NG/5 (the Cgwihaba WMA) or continue directly across to the Namibian border cutting across NG/4 and 5.

The Department indicated that there a World Bank Study on Human Wildlife Conflict in

Ngamiland is currently underway

Department of Water Affairs

Proposed route for western Delta pipeline is important and can change the settlement patterns along the western delta.

Draft Water Conservation Policy is being prepared

Department of Geological Surveys (DGS)

Progress Report on the Monitoring of Micro-seismicity in the Okavango Delta Region, North-western Botswana: 2010. A useful document indicating the importance of seismic activity in the Ngamiland areas.

Mineral exploration activities in Ngamiland: DGS has accurate tenement data on exploration activities in Ngamiland. There are uranium deposits to the immediate west of the delta, base metal exploration (e.g. for copper, iron ore) is ongoing around the entire Delta, and diamond prospecting is being carried out to the west and south of the Delta.

Management Plans

Okavango Delta Management Plan: This plan contains the inputs from a number of thematic studies, these are;

- a) Biodiversity
- b) Tourism
- c) Agriculture
- d) Hydrology

Due to inherent weaknesses that are a result of compartmentalised reports, each with sector specific recommendations, single resource/sector decisions and recommendations can have multiple consequences, often with negative implications. The recommendations identified were in some cases unrealistic.

To address the weaknesses, SAREP (through DEA) is undertaking a review and gap analysis that will be developed in harmony with the Strategic Environmental Assessment (SEA).

SAREP requires that the review of the ODMP be structured to ensure “that information on pertinent environmental thresholds is fed into the SEA process in order to assist with the development of Environmental Quality Objectives (EQOs). These are closely related to the more commonly known ‘Limits of Acceptable Change’ (LACs) providing broadly stated desired future outcomes that are based on a combination of public input, expert opinion, scientific research and an examination of policy, ethical and legal requirements. Information extracted from the ODMP should therefore be structured to assist in the development of these environmentally founded objectives for the Ramsar site.” (TOR for the ODMP review)

National Land Use Map: The national and Ngamiland land use maps suggest significant land use changes which will alter the present land use and land rights.

Ngamiland Integrated Land Use Plan

Environment and Natural resources

Chase, M. 2011. *Dry season fixed wing aerial survey of elephants and wildlife in Northern Botswana*. Elephants Without Borders. 2010.

Mendelsohn J, vanderPost C. Ramberg L. Murray-Hudson M. Wolski P. Mosepele K. 2010 *Okavango Delta: Floods of Life*. Published by RAISON. This is an excellent overview of the status and function of the Okavango Delta.

SMEC 1989 Ecological zoning of the Okavango Delta, Final Report. A useful document which includes much of the vegetation and plant habitat knowledge accumulated by P. Smith.

2000 EIA of the Veterinary Fences in Ngamiland

Cumming D. H. M. 2008. Large scale conservation planning priorities for the Kavango-Zambezi Transfrontier Conservation Area.

The Permanent Okavango River basin Commission (2011) Cubango-Okavango River basin Transboundary Diagnostic Analysis. OKACOM

Policy

Botswana Biodiversity Strategy and Action Plan (BSAP).
 Botswana Threatened Species Management Policy
 Botswana's National HIV/AIDS Policy, Strategic Framework
 Community Based Natural Resources Management (CBNRM) Policy, 2007
 Vision 2016
 Tourism Policy, 1990.
 Millennium Development Goals
 Botswana National Settlement Strategy
 The National Energy Policy (2006).
 Wildlife Conservation Policy, 1986.

International Obligations

Convention on Biodiversity, 1992.
 The Ramsar (1971) Convention on Wetlands of International Importance.
 Convention on International Trade in Endangered Species (CITES).
 United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Convention of 1972.
 United Nations Framework Convention on Climate Change (UNFCCC), 1994
 United Nations Convention to Combat Desertification (UNCCD), 1994
 SADC Protocols

11.3 Relevant Policies

The *Tourism Policy* came into effect in 1990 outlining the key objectives for tourism development in Botswana. The basic objective being to ensure tourism is developed sustainably whilst maximising the social and economic benefits for Botswana.

This policy aimed at changing the balance of the type of tourist visiting Botswana with more emphasis on tourists making use of permanent or semi-permanent accommodation and reducing the volumes of casual campers. This effectively gave rise to the overall concept of; "Low volume – high value" tourism.

This policy was applicable to areas located in sensitive habitats. However, much of the Ramsar site would be affected by the Botswana Tourism Master Plan, 2000, which highlights the; 'Modified high volume – mixed price'

A *National Forestry Policy* is currently at the draft stage and its purpose is to define basic principles and goals for conservation, development, management and sustainable utilisation of forest resources in the country to meet social, economic, environmental and ecological needs. Among the objectives of the draft policy are to strengthen the role of forest resources and forest land in enhancing environmental functions including soil and water conservation, biodiversity, recreation, habitats for wildlife, and carbon dioxide fixation. A strategy for fire management will be included in the proposed policy.

The *Wildlife Conservation Policy of 1986* calls for the preservation of wildlife as a way of economic diversification. It also points out that wildlife areas are not restricted to Game Reserves and National Parks, but can also be found in communal areas

The wildlife policy also outlines the framework for WMAs (which form a large proportion of the ODRS) including the need for regulations, management plans and sustainable wildlife use appropriate to each area).

The *Botswana Biodiversity Strategy and Action Plan* (BSAP) was compiled in compliance with the Convention on Biological Diversity, to which Botswana is a signatory. The BSAP consists of eleven objectives which are aimed at achieving the BSAP guiding vision. These eleven objectives are as follows:

- Better understanding of biodiversity and ecological processes;
- Long-term conservation and management of Botswana's biodiversity and genetic resources;
- Efficient and sustainable utilisation of all components of biodiversity in Botswana through appropriate land and resource use and management;
- Coping with environmental change and threats to biodiversity;
- Appropriate valuation/appreciation of biodiversity and raised public awareness on the role of biodiversity in sustainable development and public participation in biodiversity related activities and decision making;
- Fair access to biological resources and equitable sharing of benefits arising from the use of these resources;
- Safe industrial and technological development and other services based on national biodiversity resources for future prosperity;
- Improved availability and access to biodiversity data and information, and promotion of information exchange;
- Recognition of Botswana's and the Southern African Region's roles with regards to biodiversity; and
- Implementation of the Biodiversity Strategy and Action Plan.

The *Botswana Threatened Species Management Policy, Implementation Strategy and Action Plan Implementation Strategy (2007)* establish a complete scheme for the protection and recovery of Threatened Species and for the inventorying of endemic species for the purpose of protecting them when Threatened or Data Deficient. The purpose of the policy is to implement measures to:

- Prevent the extinction of Botswana's flora and fauna;
- Provide for the recovery of those species that are Critically Endangered, Endangered, or Vulnerable as a result of human activity and other threats;
- Inventory Botswana's endemic species so as to be able to identify those that are Critically Endangered, Endangered, or Vulnerable and to provide for their recovery and to provide protection for and a research plan that determines the actual status of those deemed Data Deficient;
- Establish an institutional and participatory framework for the implementation of the Threatened Species Management Policy; and

- Promote and ensure a responsible, accountable and transparent decision making process in Threatened and endemic species management.

The *National Energy Policy (2006)* aims at providing a least cost mix of energy supply, which reflects total life cycle costs and externalities, such as environmental damage. The energy policy objectives are mainly that:

- Energy users should have access to appropriate and affordable energy services;
- Energy should be used efficiently;
- The energy supply industry should be economically sustainable and efficient;
- All users should have security in their access to energy;
- Energy extraction, production, transport and use should not damage the environment or people's health and safety; and
- In the long term sustainable energy usage needs to be implemented.

Special emphasis will also be put on developing new and renewable sources of energy as alternatives or complementary supplies of affordable and sustainable sources of energy.

The *National Policy on HIV/AIDS Prevention and Care* outlines the national response to the epidemic in Botswana. It describes the roles of national leaders, various government ministries, the private sector and community based organizations and the general public in the national response. The policy forms the basis for developing a national strategic framework. It is based on current scientific, epidemiological and medical knowledge about the distribution and transmission of HIV and other sexually transmitted diseases (STDs) and proven effective interventions in prevention and care.

The management of HIV/AIDS prevention and care within the Ramsar site is to be carried out in line with this policy.

11.4 Strategies

The *National Conservation Strategy (Coordinating) Agency (NCSA) 1990 White Paper* provides for the use and conservation of natural resources. It captures the polluter pays principle and contains rather general solution packages for several environmental concerns from activities that might harm natural resources.

The *Waste Management Strategy of 1998* states that waste management will be carried out in a manner that protects human health and the environment, and that ensures prudent use of natural resources. It captures the principles of pollution prevention, the polluter pays and the principle of cooperation. Pollution due to waste from future developments should be considered in the management plan to prevent pollution to the environment. The strategy has adopted an internationally acceptable Waste Management Hierarchy (i.e. Waste reduction→Waste Reuse and Recycling→Treatment→Disposal) to minimise waste.

This strategy influences the waste management of the ODRS by establishing the need for a prudent approach to waste management such that human health is not compromised by an insanitary environment.

The main purpose of the *Botswana's National HIV/AIDS Strategic Framework (2003-2009)* is to articulate, disseminate, and educate the public at large on agreed national priorities and strategies within the scope of Vision 2016 and to provide clear guidance for

Ministries, Districts, NGOs, and the Private Sector to enable them to work in a collaborative manner in achieving the intended goal of the National Response to HIV/AIDS.

The *National Eco-tourism Strategy* (NES) came into effect in 2002 and is guided by the main goal of:

“creating an environment in which all elements of tourism development planning and management facilitate, promote and reward adherence to the key ‘principles’ of ecotourism by all of those involved in the tourism industry”.

The five ‘principles of ecotourism’ include:

1. Minimising negative social, cultural and environmental impacts;
2. Maximising the involvement in, and the equitable distribution of economic benefits to, host communities;
3. Maximising revenues for re-investment in conservation;
4. Educating both visitors and local people as to the importance of conserving natural and cultural resources; and
5. Delivering a quality experience for tourists.

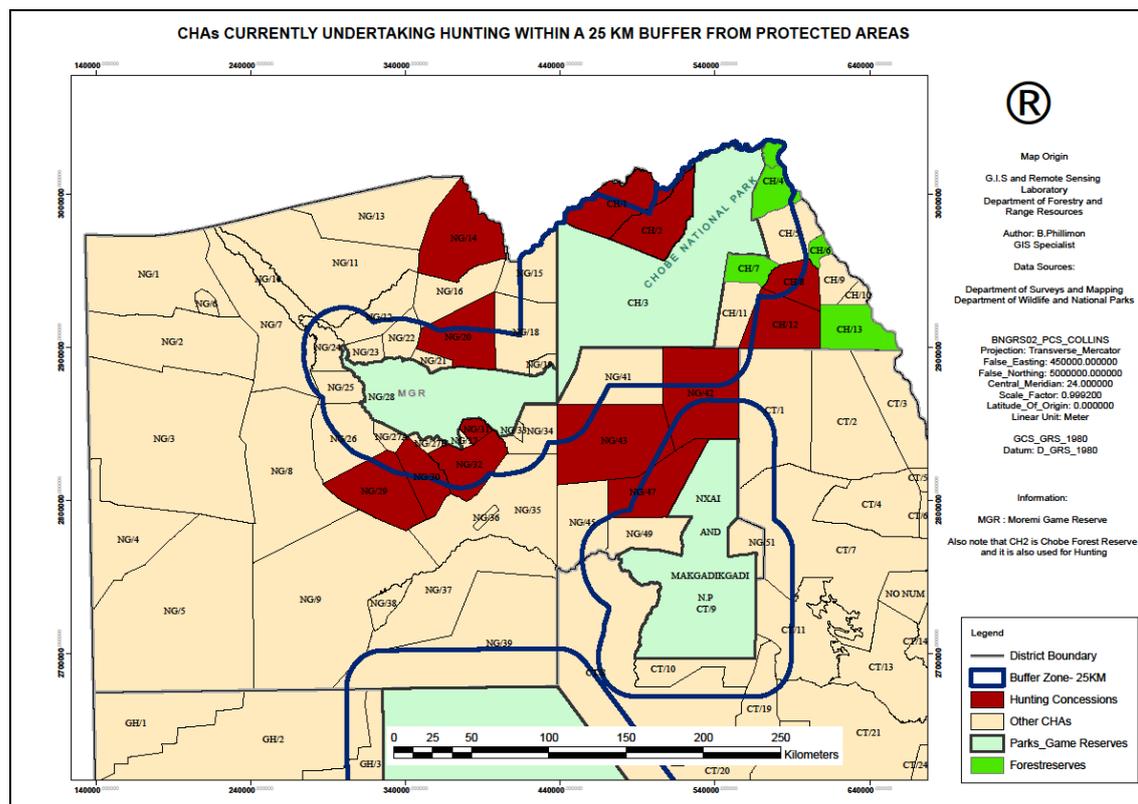
11.5 Legal Framework

Wildlife Conservation and National Parks Act of 1992

The Act provides for the conservation and management of the wildlife of Botswana, giving effect to CITES and any other international convention for the protection of fauna and flora to which Botswana is a part. It also provides for the establishment, control and management of national parks and game reserves.

Under this Act, the Minister may, by order published in the Gazette, declare any area of land in Botswana to be a Controlled Hunting Area, and may in like manner, abolish declared CHAs or amend the boundaries of declared CHAs by adding new areas thereto or by deleting areas therefrom.

Given this, there exists an administrative 25km non-hunting buffer zone around protected areas (National Parks and Game Reserves) and a 10km buffer zone along international borders as per the Minister’s deliberations on the recurrent budget estimates for the 2011/2012 financial year. In all CHAs affected by these no hunting buffer zones are to become non-consumptive tourism areas at the end of existing leases.

Figure 49: Non-hunting buffer zones around protected areas

Source: Department of Wildlife and National Parks

Wildlife Management Area Regulations of 2009 (Draft)

Supporting the Wildlife Conservation and National Parks Act of 1992, the WMA regulations have the following objectives:

- To maintain and improve the biodiversity within the promulgated WMA in all its natural facets and fluxes;
- To ensure that the primary use of the land in each WMA remains focused upon the management and use of wildlife; and
- To allow for the provision of benefits to the direct stakeholders and residents of the promulgated WMA.

As much of the ODRS falls within the Okavango, the Kwando and the Ngamiland State Lands WMAs, management planning of the CHA should be in line with the objectives of the WMA regulations.

Botswana Tourism Organisation Act of 2009

The Act highlights the management role of BTO in the tourist industry. BTO's mandate is to market the Botswana tourist product, grade and classify tourist accommodation facilities as well as to promote and facilitate business investment in the tourism sector. This Act repealed the Botswana Tourism Board Act [CAP 42:10].

State Land Act of 1966 [CAP 32:01]

The Act defines state land of Botswana and provides for its disposal. It provides for the imposition of a service levy as may be considered necessary to defray any expenditure incurred or to be incurred for the grant of such land and for the provision of services and other amenities in connection with the use of such land.

Fees due to the state for the use of areas on state lands are to be administered under this Act.

Forest Act [Cap 38:03]

This Act provides for the better regulation and protection of forests and forest produce in Botswana. Under this Act, the Minister may declare any tree or class of trees to be protected in Botswana. No such declaration can be made in respect of a tree in tribal territory without the consent of the Land Board acting in accordance with advice of the local authority. Protected trees found within the Ramsar site include *Adansonia digitata* (baobab tree) and a number of commercial timber species. This Act is under revision.

Public Health of 1981 [Cap 63:01]

This Act is to make the notification of certain diseases compulsory and to control such diseases; to make provision regarding diseases subject to the International Health Regulations; prevent the spread of smallpox; prevent the introduction of diseases into Botswana; regulate sanitation and housing; to provide for the protection of foodstuffs and of water supplies; to regulate the use of cemeteries; and generally to make provision for public health.

Tourism Act of 2009

This is an Act for licensing and regulating the tourist industry with a view to promoting its development and well-being. It provides for the establishment of a tourism licensing committee and gives the Minister the power to make regulations reserving certain licences of prescribed tourist enterprises for citizens or to companies wholly owned by citizens of Botswana to ensure their active involvement and participation in areas where their involvement is otherwise deemed minimal.

Tourism Regulations of 2010

These Regulations concern the tourist accommodation sector setting the minimum requirements with which the operations of any tourist accommodation (graded or non-graded) must comply. It describes the issuance of tourism license, the conditions of a licence, and annual licence fees to be paid.

Waste Management Act of 1998 [Cap 65:06]

The Act makes provision for the planning, facilitation and implementation of advanced systems for regulating the management of controlled waste in order to prevent harm to human animal and plant life; to minimise pollution of the environment, to conserve natural resources, and to cause the provisions of the Basel convention to apply in regulating trans-boundary movement of hazardous wastes and their disposal.

The Act requires that there be registered and licensed waste management facilities and waste carriers charged with managing and collecting waste from the area.

Agricultural Resources Conservation Act of 1974 (as amended 2011) [CAP 35:06]

The Act provides for the conservation and improvement of agricultural resources of Botswana. Agricultural resources in this Act refer to soils, waters, vegetation and animals in Botswana. The 2011 amendment of this Act focuses on the utilisation of veld products. In the amendment it is noted that veld products of category C (such as *Gonimbrasia belina* (mopane worm)) and veld products of category F (such as *Eragrostis pallens* (motshikiri thatching grass)) require a permit if the amount to be harvested exceeds 10kg for category C, and 800 bundles of a maximum diameter of 20cm for category F, per household. There are a number of loopholes in this act and it is being revised.

Herbage Preservation Act of 1977 [CAP 38:02]

This Act was instituted to control bush and other fires. It states that every person before burning of vegetation on land of which he is the owner or on which he is permitted or authorised to burn, shall give reasonable notice to all owners or occupiers of the adjoining land of his intention to do so and of the time at which the burning is to begin. This Act is under revision.

Environmental Impact Assessment (EIA) Act of 2005

The Act provides for environmental impact assessment to be used to assess the potential effects of planned developmental activities; to determine and to provide mitigation measures for effects of such activities as may have a significant adverse impact on the environment; to put in place a monitoring process, and to conduct evaluation of the environmental impacts of implemented activities.

Environmental Assessment (EA) Act of 2010

The Environmental Assessment (EA) Act provides for environmental impact assessment to be used to assess the potential effects of planned developmental activities; to determine and to provide mitigation measures for effects of such activities as may have a significant adverse effect on the environment; to put in place a monitoring process and evaluation of the environmental impacts of implemented activities. Additional development activities within the project area have to conform to this Act.

Despite repealing the EIA Act of 2005, the EA Act of 2010 has not yet come into force hence the EIA Act of 2005 is still in use. The EA Act of 2010 has provisions similar to the EIA Act of 2005, the main difference between the two being the provision in the EA Act of 2010 for the establishment of a board. The board's functions under the new Act are to register environmental practitioners and provide quality assurance regarding practitioners appointed to conduct environmental assessments. Within 12 months of enactment of the 2010 Act, all EIAs are to be carried out by a practitioner registered with the Board of the Botswana Environmental Assessment Practitioners Association.

Monuments and Relics of 2001 [CAP 59:03]

The Act provides for the declaration and protection of national monuments and relics in Botswana. The Minister may, after consultation with the commissioner, by order published in the Gazette, declare any monument, relic or recent artefact to be a national monument. Land on which a national monument is situated shall not be used for purposes other than the protection and preservation of national monuments, without the Ministers written approval.

11.6 Existing District and National Plans

Land use and development plans that could influence activities within the project area have been reviewed and their implications have been captured.

Table 11 Plans that could affect the project area

Planning Tool	Implications of the Tool
Ngamiland District Development Plan 7 (2010 to 2016).	Tourism and other physical developments should take into cognisance the planning recommendations in the DDP 7.
Ngamiland Intergraded Land Use Plan	Ngamiland integrated land use plan provides the basis for developments within the region that contribute to livelihoods through sustainable resource use. This plan incorporates the regional with the national policies and is based on the land and natural resource, human potential and physical infrastructure evaluated through research and field work. The plan intends to facilitate smooth implementation of national projects and policies and avoid land use problems.
National Development Plan (NDP 10)	The plans described in this section govern and shape the economic, social and physical development of the entire country following Vision 2016. The <i>National Development Plan (NDP10) prepared in 2010</i> , is a six year national plan and is an amalgamation of all 16 development plans prepared for both the urban and rural districts of the country. The plan calls for a systematic approach towards the product and geographical diversification of Botswana tourism and that it needs to be championed at the highest level if its potential is to be fully realised.
Botswana Ecotourism Best Practices Manual (and Technical Report), 2000	This manual is designed to guide the tourism industry in Botswana, ensuring both physical developments and operations are undertaken in an environmentally friendly and sustainable manner. The manual identifies key best practice areas for tourism developments outlining the issues relating to these and the improvements or requirements necessary to develop an eco-friendly tourism product.
Botswana Tourism Master Plan 2000	The Botswana Tourism Master Plan serves as a basic guideline for development of tourism enabling the decision-makers to agree on the principles for the direction for the next decade. One of the key results of this plan is the change made to the approach to tourism with a new policy being adopted. 'Modified high volume – mixed price'.
Okavango Delta Management Plan 2006	The long term objective of the ODMP is to integrate resource management for the Okavango Delta that will ensure its long-term conservation, and that will provide benefits for the present and future well-being of the people through sustainable use of its natural resources. The plan aims to integrate the management planning of the Okavango Delta with the Ramsar convention as one of its tools. DEA, through support from SAREP is about to review the ODMP.
Ngamiland Tourism Development Plan (2007)	The Ngamiland Tourism Development Plan is a thirty-year strategic plan. It is designed as a Tourism Development Manual that includes more detailed development plans for a number of Tourism Development Areas (TDAs). The Tourism Development Manual is a dynamic document, which includes recommendations for the development of specific tourism products. The dynamic nature of the document allows the implementation agencies to keep the manual current.

11.7 Standards for Tourism Accommodation

11.7.1 BOBS Standards

The Botswana Bureau of Standards (BOBS) has also compiled specific standards for 6 different types of tourism accommodation for grading purposes. These include:

1. BOS 50 – 1:2001. Hotels and related establishments – Grading requirements – **Part 1: Fully serviced hotels.**
2. BOS 50 – 1:2001. Hotels and related establishments – Grading requirements – **Part 2: Selected serviced hotels.**
3. BOS 50 – 3:2009. Hotels and related establishments – Grading requirements – **Part 3: Game lodges and camps.**
4. BOS 50 – 1:2001. Hotels and related establishments – Grading requirements – **Part 4: Domestic guesthouses.**
5. BOS 50 – 1:2001. Hotels and related establishments – Grading requirements – **Part 5: Commercial guesthouses.**
6. BOS 50 – 6:2009. Hotels and related establishments – Grading requirements – **Part 6: Self-catering establishments.**

11.8 International Obligations

The *Ramsar (1971) Convention on Wetlands of International Importance* is an inter-governmental treaty and provides a framework for national action and international cooperation for the conservation and Wise Use of wetlands, and to contribute to sustainable development worldwide. The convention provides a List of Wetlands of International Importance for waterbirds, which includes the Okavango Delta, while the Makgadikgadi Pans has been proposed as a future Ramsar site.

Originally, the convention put emphasis upon the conservation and wise use of wetlands primarily as habitat for waterbirds. Over the years, however, the convention has broadened its scope to cover all aspects of wetland conservation and wise use, recognising wetlands as ecosystems that are extremely important for biodiversity conservation and for the well-being of communities.

The *Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA)* is a planned conservation area spanning five countries – Angola, Botswana, Namibia, Zambia and Zimbabwe. The memorandum of understanding between the countries was signed in 2006. The MOU was recently signed into a treaty on the 18th August 2011. The conservation area/park aims at linking many of the existing protected areas in the various countries thus protecting wildlife movement routes and increasing the tourism potential for these areas.

The KAZA Park should provide easy access to the different countries with the implementation of a single visa for the entire area. This single visa should provide easy access and is likely to rapidly increase the self-drive and mobile tourism potential in these areas.

Botswana is signatory to the *Convention on International Trade in Endangered Species (CITES)*. Its aim is to ensure that international trade in specimens of wild animals and

plants does not threaten their survival and it accords varying degrees of protection to species of animals and plants.

The *Convention on Biodiversity (1992)* is the first global agreement on conservation and sustainable use of biological diversity. Its objectives are to conserve biodiversity, promote the sustainable use of biodiversity components and to promote fair and equitable sharing of benefits arising from use of genetic resources. States party to the convention have sovereign right to exploit their own resources according to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas.

Contracting parties are obliged to develop national strategies for the conservation and sustainable use of biological diversity, including birds and to integrate the conservation and sustainable use of biological diversity into relevant sectoral plans, programmes and policies. Botswana has developed its Biodiversity Strategy and Action Plan (BSAP) to comply with these obligations.

The *United Nations Framework Convention on Climate Change (UNFCCC)* (1994) is an international environmental treaty aimed at stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Convention therefore provides the basis for global action “to protect the climate system for present and future generations”.

Parties to the UNFCCC have a number of commitments under the convention, including:

- Submitting a national inventory of emissions and removals of greenhouse gases;
- Implementing national programmes to mitigate climate change and adapt to its impacts;
- Strengthening scientific and technical research and systematic observation related to the climate system, and promoting the development and diffusion of relevant technologies;
- Promoting education programmes and public awareness about climate change and its likely effects;
- Periodically submitting comprehensive reports on activities to implement commitments under the Convention.

The ODRS provides an essential carbon sink, but this compromised by the number and extent of annual fires.

The *United Nations Convention to Combat Desertification (UNCCD)* was established in 1994 after the Rio Earth Summit identified desertification, along with climate change and loss of biodiversity as the greatest challenges to sustainable development in 1992. The UNCCD was recognised as a sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as dry lands, where some of the most vulnerable ecosystems and people can be found. The 10-year Strategy of the UNCCD (2008-2018) that was adopted in 2007 by the Parties to the Convention further specified their goals: “to forge a global partnership to reverse and

prevent desertification/land degradation and mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.”

Botswana is signatory to the UNCCD and the Government adopted a National Action Plan (NAP) to combat desertification and drought in 2006. NAP has sound assumptions and provisions which include:

- Community capacity building to combat desertification;
- Facilitating the establishment of alternative livelihood projects particularly for people living in marginal and degraded areas;
- Assisting Community Based Organizations (CBOs).

The *Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)* is the largest of its kind developed so far under Convention for Migratory Species (CMS). In November 1999, after the required number of at least fourteen Range States, comprising seven from Africa and seven from Eurasia had ratified, the Agreement has become an independent international treaty.

The Agreement provides for coordinated and concerted action to be taken by the Range States throughout the migration system of waterbirds to which it applies. The AEWA covers 235 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns and even the South African penguin.

Parties to the Agreement are called upon to engage in a wide range of conservation actions, which are describes in a comprehensive **Action Plan**. This detailed plan addresses key issues such as: species and habitat conservation, management of human activities, research and monitoring, education and information, and implementation. Botswana has not yet joined the treaty and has not ratified the agreement.

The SADC Wildlife Programme of Action consists of a portfolio of projects that address some of the regional wildlife constraints identified in the **SADC Wildlife Policy and Development Strategy** adopted by the SADC Council of Ministers in March 1997. The seven key constraints identified in the Wildlife Policy are:

1. Human resources development, and management;
2. Management of wildlife in semi-arid areas;
3. Disparity in knowledge of resource base;
4. Inadequate resource management and control mechanisms;
5. Inadequate development of, and access to resources;
6. Land practices and conflicts; and
7. Inadequate co-ordination among stakeholders.

The above constraints have been updated and detailed in the Protocol on Wildlife Conservation and Law Enforcement (see below). Several programmes have been initiated to address some of these constraints; the SADC Regional Wetlands Conservation Project is particularly pertinent to the ODRS, and addresses constraints 3, 4 and 6. This project promotes awareness of the role, value and appropriate uses of wetlands amongst policy-makers, resource planners, resource managers, extension workers and users, in particular

where they are shared between countries through the formulation of management plans that congregate efforts and cooperation from the riparian countries in implementing of such plans (see <http://www.sadc-wetlands.org/> for more information).

The overall objective of the **Environment and Sustainable Development Policy** is to ensure the equitable and sustainable use of the environment and land based resources for the benefit of the present and future generations. The economies of SADC Member States are mainly based on agriculture, however the region continues to experience high levels of environmental degradation manifested, among other things, by deforestation, loss of biodiversity, pollution, soil erosion, decreasing quality and quantity of water, poor sanitation services and poor urban conditions. The Cubango-Kavango Basin is relatively undeveloped and some of these environmental pressures are not too serious at present. However, the challenge is to ensure that they do not become a problem in future.

The SADC Regional Indicative Strategic Development Plan (RISDP) realizes the importance of sustainable use and management of the environment in fighting against poverty and food insecurity and it identifies environment and sustainable development as one of the key intervention areas (www.sadc.int).

The objectives of the **Protocol on the Development of Tourism** are:

1. To use tourism as a vehicle to achieve sustainable social and economic development through the full realisation of its potential for the Region;
2. To ensure equitable, balanced and complimentary development of the tourism industry region-wide;
3. To optimise resource usage and increase competitive advantage in the Region vis à vis other destinations through collective efforts and co-operation in an environmentally sustainable manner;
4. To ensure the involvement of small and micro-enterprises, local communities, women and youth in the development of tourism throughout the Region;
5. To contribute towards the human resource development of the Region through job creation and the development of skills at all levels in the tourism industry;
6. To create a favourable investment climate for tourism within the Region for both the public and private sectors, including small and medium scale tourist establishments;
7. To improve the quality, competitiveness and standards of service of the tourism industry in the Region;
8. To improve the standards of safety and security for tourists in the territories of Member States and to make appropriate provision for disabled, handicapped and senior citizens in their respective countries;
9. To aggressively promote the Region as a single but multifaceted tourism destination capitalising on its common strengths and highlighting individual Member State's unique tourist attractions;
10. To facilitate intra-regional travel for the development of tourism through the easing or removal of travel and visa restrictions and harmonisation of immigration procedures;
11. To improve tourism service and infrastructure in order to foster a vibrant tourism industry (www.sadc.int).

The **Protocol on Shared Watercourse Systems** regards and incorporates the following:

- The Helsinki Rules on uses of the waters of international rivers and the work of the International Law Commission on the non-navigational uses of international watercourses;
- The relevant provisions of Agenda 21 of the United Nations Conference on Environment and Development, and the concepts of environmentally sound management, sustainable development and the equitable utilisation of shared watercourse systems in the SADC region;
- The existing and emerging socio-economic development programmes in the SADC region and their impact on the environment;
- Judicious and coordinated utilisation of the resources of the shared watercourse systems in the SADC region;
- The need for coordinated and environmentally sound development of the resources of shared watercourse systems in the SADC region in order to support sustainable socio-economic development and the common utilisation and management of the resources of these watercourse systems; and
- Other agreements in the SADC region on the common utilisation of certain watercourses (SAIEA, 2009).

The Protocol on Wildlife Conservation and Law Enforcement is an interstate regulation affirming that member states have the sovereign right to manage their wildlife resources and the corresponding responsibility for sustainable use and conservation of these resources. The aim is to establish a common framework for the conservation and sustainable use of wildlife resources in the SADC region and to assist with the effective enforcement of laws governing those resources. All the states of the Okavango Basin have signed this Protocol (SAIEA, 2009).

12 APPENDIX 2: SUMMARY OF RECOMMENDATIONS AND TARGETS IDENTIFIED IN THE THRESHOLDS AND TARGETS REPORT (SAIEA, 2012)

Recommended local and regional interventions:

Strategic, trans-frontier level

- Initiate a dialogue (through OKAKOM) that achieves agreement on catchment management, water offtakes and developments in and along the Okavango. This may be done immediately (on the basis of the TDA and the SEA) or possibly by extending the SEA to be basin-wide, and thus co-owned by all Riparian States.
- Take the lead (or apply pressure) so that the KAZA initiative gains new and sustained momentum. KAZA is the key mechanism for achieving the desired opening of systems that will enable improved mobility for wildlife and tourists, and socio-economic synergies between the participating States.

Strategic, local level

- Restore connectivity, by reducing barriers that prevent wildlife from moving through the system, and between the Delta and neighbouring systems. The barriers of concern are inappropriately aligned fences, and human settlements. Fences (or critical sections) should be removed, and corridors kept open between human settlements and fields. These corridors must correspond with known wildlife movement paths, and the gaps need to be wide enough so that they are used.
- Avoid allocating exploration or mining licenses within the core area of the ODRS or within a 15km buffer around this area.
- Engage with the mining sector, so that a partnership can be established between mining, conservation and CBNRM. On the one hand, mines must be forced to adhere to international “best practice” in terms of applying environmental safeguards to their operations, and on the other, the GoB must set the agenda in terms of mines’ Corporate Social Responsibility.

Local level

- Show commitment to CBNRM by selecting a small number of ‘pilot’ areas, and then developing a programme that builds on successes achieved in other countries in the region. A key strategy for achieving quick benefits to the community could be re-introducing hunting in certain areas, especially of elephant, which are regarded as locally over-abundant. It is essential to demonstrate intent to communities that may feel marginalized and disillusioned, and that have few incentives to tolerate or conserve wildlife.
- Promote “conservation agriculture”, so that people in certain areas can grow crops in an ecologically appropriate way and so that the best possible yields can be eked out of the marginal soils on offer.
- Get the tourism sector to commit to achieving ‘best practice’, by implementing the Botswana Ecotourism Certification System (BECS). This will enable the sector to address many of the negative impacts attributed to tourism, and help the establishments to earn a reputation for being ‘eco-friendly’. This will benefit them and Botswana’s reputation in the long term.

- Actively protect the riparian woodland by whatever means possible, especially enforcing a ban on tree cutting within 200 metres of a water body, preventing fires along the riparian fringe, and reducing elephant numbers.

Proposed targets

1) Hydrological functioning, water quality and biodiversity

- No significant human-induced change in the natural flood pulse peak (the extent of peak flooding that provides the maximum area of seasonal and occasional floodplain) or loss of permanent swamp beyond the lowest dry period flood level, recorded in 1995. Annual offtake from the entire basin must not exceed 600Mm³ per annum (based on inflow at Mohembo).
- No upriver dams or other impoundments other than ‘in-flow’ hydro-electrical weirs that are designed to allow the flow of river with its sediment load and that pumps any excess sediment build-up downstream.
- Sediment loads to be consistent with current levels to maintain habitat diversity.
- Water quality to be within 5% of current fluctuations as measured over the past 15 years.
- Existing fences are removed wherever possible, especially in areas where wildlife migrations in-and-out of the Okavango Delta are required.
- Reverse declines of indicator species.
- Reverse large mammal species population declines to 1994 levels; e.g. lechwe, buffalo, tsessebe, and zebra.
- Maintain integrity of riparian fringe (ref to 200m buffer zone in the Ngamiland integrated land use plan) – no more clearing of riparian habitat for agricultural or any other form of land use and implement rehabilitation of already impacted areas.
- No introduction of alien invasive species (especially plants and invertebrates) and eradication of aliens where they exist already.
- Reduce human-wildlife conflicts: farming must avoid prime wildlife areas with defined wildlife corridors and installation of protection devices/ strategies used to mitigate further conflict.
- Implement Elephant Management Plan.
- Maintain viable populations of endemic, rare and endangered species.
- Promote and improve support to CBNRM projects in order to enable communities to earn tangible benefits from sustainable natural resource management and, thereby,

actively participate in natural resource conservation through wise use practices and appropriate monitoring, i.e. using MOMS

- Poaching should be reduced to zero (CBNRM and law-enforcement are key tools in this regard).
- Reduce fire frequency to a rate of one in 3-5 years and promote cool burns.

2) Livestock farming

- Limit livestock to rangelands further away from key biodiversity areas (e.g. riparian fringe) and stock appropriately through:
 - Providing boreholes, approx. 8 km apart, in the area to the west of the panhandle
 - No boreholes within 10km of the main river.
- Stick to recommended stocking rate -16ha/LSU in sandveld and 23ha/LSU on floodplains.
- Encourage diversification in farming – e.g. game farming together with cattle (good for biodiversity and livelihood diversification while game should be promoted in areas with *Mogau*).
- Fences are removed wherever possible, especially in areas where wildlife migrations in-and-out of the Okavango Delta are required. In particular, northern buffalo fence realigned along southern boundary of NG13 and sections of border fence with Caprivi need to be rolled back.
- Promote the area west of the panhandle as the main livestock area (less wildlife conflicts), and avoid allowing livestock in areas with more wildlife conflicts.
- No fenced commercial ranches or disease-control fences – unless EIAs show they will not impact biodiversity significantly.

3) Arable agriculture

- Water offtake (all sectors combined) should be limited to less than 600 Mm³/a so as not to compromise ecological integrity of the wetlands.
- Future molapo and horticulture farms should not be placed within nor extract wood from, the riparian fringe for any purpose whatsoever (under GoB legislation).
- Human-wildlife conflicts need to be reduced by locating fields away from prime wildlife areas, including migration routes.
- Principles of conservation agriculture should be rigorously applied to reduce habitat alteration and soil exposure while improving farming efficiency and crop yields.

- Levels of fertiliser and chemical inputs need to be controlled/reduced to minimise toxic inputs into return flows to surface waters or pollution of groundwater.
- The GoB subsidies need to be revisited as there are unintended negative consequences from the ‘free’ distribution of inorganic fertilisers and agro-chemicals.

4) Tourism

- Maximum 700 beds in core area and maximum 24 beds per lodge - no determination yet for other areas, but expansion probably possible in panhandle.
- Improve equity (through local ownership and improved benefit sharing)⁹.
- Improve sector diversification, connectivity and viability of WMAs, through un-banning of safari/trophy hunting in certain areas (especially regarding elephant, so that communities can get tangible benefits quickly).
- Reduce conflicts with subsistence fishers/villagers. There are opportunities to develop fish guiding activities, zoning areas exclusively for recreational fishing within CBNRM arrangements, promoting mentorship and joint ventures with the existing private sector / NGOs, and cultural tourism activities based on the traditional fishing practices used by the subsistence fishers.
- Improve general housekeeping at tourism establishments – including issues such as solid & hazardous waste management, avoiding creation of artificial waterpoints, reducing boating impacts on wildlife and habitats (especially riverbanks), reducing vehicle disturbance of wildlife, reducing noise (aircraft, generators, boats¹⁰), avoiding artificial alterations of water flow (through erecting barriers & establishing/maintaining channels), ensuring appropriate architecture, limiting footprint of lodges, avoiding proliferation of vehicle tracks and reducing traffic congestion (especially in self-drive areas). Targets are contained in the Botswana Ecotourism Certification System.

5) Mining

- The overall objective is (1) no prospecting and/or mining licenses issued within the delta and panhandle, (2) no new prospecting and/or mining licenses be issued within a buffer of 15kms of the delta and panhandle (figure 24), and existing licenses that are a concern from a conservation perspective to be withdrawn by the GoB as soon as they are relinquished by the current license-holder.
 - Government, mining companies and the minerals industries should as a minimum recognise environmental management as a high priority, notably during the licensing process and through the development and implementation of environmental management systems. These should include early and

⁹ See ODMP Tourism and CBNRM volume for more detailed targets – endorsed by this consultancy

¹⁰ See recently developed guidelines on house boats and motor boats within the Okavango and Chobe Rivers

comprehensive environmental (including social) impact assessments, pollution control and other preventive and mitigation measures, monitoring and auditing activities, emergency response procedures, closure and rehabilitation plans.

- Water management is a key concern to the ecological and social integrity of the delta, and it is essential that mining operations fully assess and mitigate as far as possible impacts on water quality and quantity. Principles such as water recycling, dry production and tailings and separation of blue and grey waters should be integrated into the mine EMS.
- Tailings containment is similarly highlighted as a result of numerous cases where inadequate tailings containment resulted in spillages or leakages of tailings into water courses. Design and management (short and long term) must be adequately addressed in the EIA, EMP and EMS of mines.
- Corporate-Social Responsibility Investments in livelihood activities which adhere to sustainable resource utilization in the delta should be considered. Possible areas to consider are:
 - Conservation agriculture farming (supporting activities to amend crop farming practices to include indigenous species for mulching and nutrient fixation);
 - Integrated livestock and rangeland management (supporting livestock management to reduce the stocking rate of cattle but increase their value through husbandry and genetic management, as well as implementing holistic rangeland management strategies);
 - Human wildlife conflict resolution and research initiatives; and
 - Community Based Natural Resource Management (CBNRM).