DEPARTMENT OF WILDLIFE AND NATIONAL PARKS

WILDLIFE CONSERVATION RESEARCH

STRATEGIC PLAN: 2014 - 2018

Draft 12 October 2014

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Summary:

WILDLIFE AND STATISTICS DIVISION - RESEARCH STRATEGY OBJECTIVES TREE

Long term/Overall Goal: To contribute to the conservation of biodiversity and sustainable use of wildlife in Botswana by conducting exemplary research and providing scientific information and advice to policy makers, resource managers, stakeholders,and the public.

Short term/Immediate Goal: Develop and implement a research strategy that will:

(a) Provide science-based information on wildlife conservation and management options to support the implementation of the 2013 Wildlife Policy and the 2014 National Biodiversity Strategy and Action Plan;

(b) Focus and coordinate wildlife research in Botswana on key wildlife conservation and management issues; and,

(c) Build wildlife research capacity in the DWNP and associated research partners in the country.

Theme 1 *Transparent, participatory, and inclusive conservation planning and implementation*	***Theme 2*** *Conservation of threatened and keystone species, habitats, and processes*	***Theme 3*** *Sustainable and resilient protected areas as integrated landscape components*	***Theme 4*** *Natural resource use policies and decisions are based on sound information*	***Theme 5*** *Build research capacity in DWNP and partners to meet demands of national conservation policy*
Output #1 Systematic conservation planning processes at national, regional and local levels facilitated	**Output #2** Risk analyses for endangered, endemic, and keystone species and habitats conducted	**Output #3** Protected areas as resilient social-ecological systems investigated and assessed	**Output #4** Ecological, economic and social tradeoffs between alternative land uses fully researched	**Output #5** Capacity of DWNP's Research & Statistics Division to meet national research obligations established
Activities: 1. Conduct baseline species and habitat inventories for each ecoregion (NBSAP) 2. Conduct landscape and institutional mapping of target areas 3. Facilitate the various activities required to carry out conservation assessments, e.g. - Problem definition - Objectives - Spatial databases (GIS) - Alternative scenarios - Land management model - Spatial prioritisation 4. Provide technical support to planning authorities and stakeholders on systematic conservation planning	**Activities:** 1. Assemble and review available information on status and trends in endangered, endemic, and ecologically and economically important species of fauna and flora, and habitats 2. Conduct risk analyses on vulnerable species and identify key drivers of change 3. Establish appropriate monitoring and response protocols (thresholds of potential concern) to reduce risk factors and to facilitate adaptive management	**Activities:** 1. Conduct a resilience analysis of each protected area, involving key stakeholders and explore alternative plausible futures for the protected area and its neighbouring areas 2. Explore the potential for developing adaptive co-management arrangements for each protected area (**Note:** this theme, and output and activities, address the DWNP and NBSAP policy directives on CBNRM and community involvement in protected areas, and Botswana's participation in TFCAs and transboundary disease management)	**Activities:** 1. Identify areas/regions of land use conflicts that are impacting on biodiversity 2. Conduct EIAs / SEAs and related analysis to inform land use decisions 3.Monitor impacts of land use / conservation decisions on biodiversity and socio-economics of associated households and communities 4. Conduct integrated research (ecological, economic and social) on human-wildlife conflicts, and wildlife-livestock interface, and alternative options for mitigating conflict	**Activities:** 1. Motivate for: a) Effective operational research budgets b) Dedicated staff development c) Incentive structures for advancement d) Conditions of service that retain trained staff e) Establish training and retraining programmes 2. Build collaborative research partnerships with Universities (local and abroad), NGOs and the private sector 3. Develop incentives and guidelines that will attract private / visiting researchers to contribute to the country's research agenda
Cross-cutting strategic approach: Explore key conservation issues by developing conceptual models and using systems models, complex systems theory, social-ecological systems and resilience concepts to develop qualitative and quantitative models to explore alternative conservation and resource management options				Capacity building in theory and application of systems and modelling approaches

Table of Contents

Acronyms

CBD	Convention on Biological Diversity
CBNRM	Community Based natural Resource Management
DWNP	Department of Wildlife and National Parks
EIA	Environmental Impact Assessment
GIS	Geographical Information System
MEWT	Ministry of Environment, Wildlife and Tourism
MOMs	Management Oriented Monitoring systems
NACSO	Namibian Association of CBNRM Support Organisations
NDSAP	National Biodiversity Strategic Action Plan
NGO	Non-Governmental Organisation
ORI	Okavango Research Institute
SEA	Strategic Environmental Assessment
TFCA	Transfrontier Conservation Area

1. Introduction and background

1.1 *Policy framework and mandate for a review of the wildlife research strategy*

The Department of Wildlife and National Parks (DWNP) wildlife research strategy of 1993 was last revised in 2005. The most recent Republic of Botswana's Wildlife Policy was passed by parliament in 2013. The Wildlife Conservation and National Parks Act is being revised. The Wildlife Policy document calls for a strengthening of wildlife research and monitoring (Section 5.10) with the following statement of intent (paragraph 5.10.1):

> " Wildlife research and monitoring will be strengthened and given more emphasis in wildlife management. Research is a key component of sustainable utilisation and management of wildlife resources. The results of research and monitoring need to be incorporated into decision-making processes for wildlife management and shared with all stakeholders. Current research and resources monitoring activities such as aerial surveys (DWNP), ground counts, specific research projects (e.g. predator research) and private initiatives (e.g. bird inventories and monitoring) will be enhanced."

The Objective and Strategies are:

> 5.10.2 *Objective*
>
> 5.10.2.1 "To undertake research on wildlife species, habitats, ecosystems and the value of wildlife resources"
>
> 5.10.3 *Strategies*
>
> 5.10.3.1 Macro and micro level policy analysis and economic research and analyses related to land-use systems, conflicts between wildlife and other sectors, wildlife utilisation and management, economic contributions of the wildlife sector to the national economy, local level returns and financial benefits at household levels.
>
> 5.10.3.2 Socio-economic research and monitoring of and research into human-wildlife conflict.
>
> 5.10.3.3 Ecological, habitat and biological research and monitoring of wildlife including wildlife population trends.
>
> 5.10.3.4 Conduct research and monitoring of the wildlife resources to support adaptive wildlife management.
>
> 5.10.3.5 Collaborate with independent researchers as well as credible research institutions and organisations on wildlife research.
>
> **5.10.3.6 Undertake a comprehensive review of the strategic plan for wildlife research in Botswana.**

The present draft wildlife conservation research strategy is responding to the 2013 Wildlife Policy and particularly to paragraph 5.10.3.6 as given above.

It should be noted that the term "wildlife" is defined as follows in the Wildlife Policy, 2013:

> "*Wildlife* means flora and fauna occurring within natural and artificial ecosystems and habitats and this includes fish", and
>
> "*Wildlife conservation* means the proper care, protection, management and utilisation of wildlife resources."

The Wildlife Policy 2013 document thus provides an opportunity and clear mandate to DWNP and its partners to review the strategic plan for wildlife research in Botswana. This is further re-enforced by the revised and updated National Biodiversity Strategy and Action Plan of 2014 that endorses the

Ecosystem Approach to conserving and managing renewable natural resources adopted by the Convention on Biological Diversity (CBD).

The five goals of the 2014 National Biodiversity Strategy and Action Plan (NBSAP) are:

1. Biodiversity is mainstreamed and valued across all sectors of society.
2. The pressure on biodiversity is reduced and natural resources are used sustainably.
3. Ecosystems, species and genetic resources are protected through sound management.
4. Fair and equitable access to the benefits of biodiversity is secured.
5. Participatory planning, knowledge management and capacity-building are in place to support NBSAP implementation.

The DWNP is clearly an important stakeholder with major responsibilities in relation to implementing the NBSAP and its Research and Statistics Division is responsible for contributing knowledge and information towards the achievement of all of the goals, particularly the fifth goal.

The tables of Strategic Actions for each of the NBASP targets include actions for all of the departments within the Ministry of Environment, Wildlife and Tourism (MEWT) with the DWNP expected to take the lead in implementing strategic actions within many of the 20 targets. For example:

1. Target 2, Strategic Action 2-2: "Starting in 2015, all MEWT departments report both ecological and socio-economic data according to ecoregions."

2. Target 5, Strategic Action 5-2: " To conduct, by 2017, strategic environmental assessments (SEAs) of a) all veterinary and game fences, b) the national road networks, c) the national powerline grid, in terms of their impact on wildlife (including birds), and to adopt the assessment recommendations."

3. Target 5, Strategic Action 5-7: " To conduct, by 2016, a SEA of the SW Kalahari Conservation Corridor, and implement the assessment recommendations."

4. Target 6, Strategic Action 6-1: "To establish, by 2015, and develop monitoring mechanisms for, by 2018, the list of key plant, insect, fish and animal resources in each ecoregion for which offtake limits should be set, and add these as guidelines to the relevant legal acts."

5. Target 10, Strategic Action 10-2: "To ensure that, by 2018, all protected areas (parks, game reserves, WMAs) and forest reserves in all ecoregions are actively managed using the ecosystem approach."

These obligations, and others, will require the services of a competent Research and Statistics Division within the DWNP. They also provide guidance on the direction in which scientific capacity within the Division will need to be developed.

1.2 *Analysis of past and current wildlife research*

A listing of 257 research projects carried out by organisations other than DWNP and by private individuals between 1996 and 2014 (**Figure. 1**) indicates a major focus on large predators and herbivores, which together with elephants, accounted for 84 (33.6 %) of the listed projects.

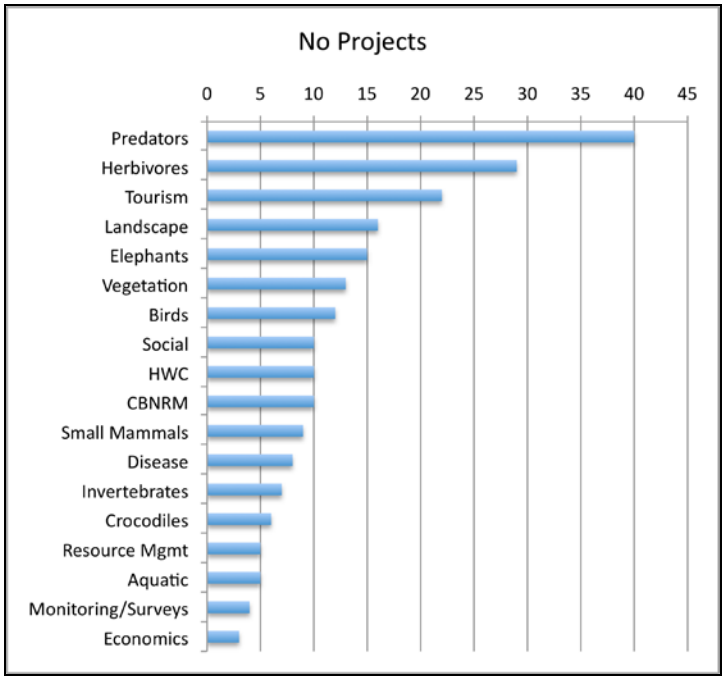

Figure 1. Number of private research projects in different categories carried out in Botswana between 1996 and 2014. An additional 31 projects did not fall into the list of categories shown.

Projects dealing with tourism (n = 22) made up 8.5% of listed projects while only three projects dealt with economics of wildlife and resource use.

Research by DWNP staff over the last few years has focused on aerial surveys and monitoring, with some thirty specific research projects on topics such as human-wildlife conflict, predators, large herbivores, use of water points, disease, effects of fences, and fish surveys.

Both the 2014 NBSAP and the 2013 Wildlife Policy emphasise, in line with the Convention on Biological Diversity (CBD), the need for an ecosystem approach to the conservation and management of biodiversity and wildlife. The CBD website lists twelve principles for implementing an ecosystem approach and these are provided in **Annex 1.**

The stated policy direction for conservation and natural resource management that embraces an ecosystem-based approach will require new approaches to wildlife research if it is to effectively inform policy and management. The Wildlife Policy also emphasises the need for adaptive management, which will require effective monitoring systems and establishing appropriate feedback loops and close links between research and management. In essence, this requires the development of a learning organisation that involves all staff in monitoring and research of one form or another and in establishing a new framework and orientation for research in the DWNP.

2. Current challenges and constraints

The present departmental structure where research staff are dispersed throughout the country and fall under the direction of Regional Wildlife Officers with no dedicated budget allocations or resources to pursue research has contributed to the loss of experienced and qualified research workers. The present research establishment of 45 members is broken down by qualifications as follows: PhD - 1, BVSc. - 3, BSc. - 22, Diplomas - 6, Certificates 9, Not specified - 4. Apart from the Chief Wildlife Officer (Research and Statistics) who holds a PhD, the present establishment reflects minimal formal postgraduate training in research. The lack of trained and experienced research staff places a major

constraint on the DWNP research and monitoring capacity. The lack of dedicated resources to carry out research further inhibits the ability of graduate staff to engage effectively in research and develop their research abilities.

Capacity building within the research division is clearly a priority if the DWNP is to meet its research and information obligations in terms of the national Wildlife Policy and the NBSAP.

3. Major conservation issues facing the country

3.1 *Threats to Okavango's Wildlife - January 2012*

At the January 2012 meeting in Maun on the "The future of Okavango's wildlife" the following issues were raised, as threats that restrict the effective management of Botswana's wildlife resources, with recommendations made to improve the current situation.

1. "Lack of appropriate data
   1.1. Data is patchy, sector or species specific and very often not coordinated or standardised; required monitoring programs must be developed that respond to the critical threats to the system / wildlife populations.
2. Poor analysis of existing data
   2.1 Data is available from previous research / monitoring but often un-digitised, not disseminated or analysed. An assessment of the existing data such as the quarterly reports and final reports must be undertaken, with the results disseminated to all relevant stakeholders.
3. Unclear Role of Stakeholders
   3.1. The role of some stakeholders is not made clear enough.
      3.1.1. The current level of collaboration between stakeholders is very poor and improved coordination is required – possibly through an appropriate organization such as the Okavango Wetlands Management Committee, or through an improved community based NGO to fulfil a similar role as NACSO in Namibia.
      3.1.2. Concessionaires are obligated to undertake monitoring but do not, or undertake poor quality monitoring – standardized, simple monitoring protocols should be introduced, which are cost effective, but maintain high data quality standards, with data outputs that can be used to detect trends over time.
      3.1.3. Communities are not participating in any form of monitoring such as MOMS with no incentives provided to communities to undertake monitoring – multi-faceted community based programs should be introduced that incentivize communities to benefit from their local natural resources, with associated monitoring of these resources. Bottom-up processes must also be put in favour of top-down processes, with adoption of co-management practices, support of CBNRM initiatives and improved ecotourism benefits for communities. There should also be rapid implementation of locally based methods to incorporate and incentivise communities into the wildlife sector – these strategies should not wait until the policy background and monitoring framework is developed.
      3.1.4. Independent researchers do not currently undertake standardised monitoring as part of their obligations to DWNP - standardized, simple monitoring protocols should be introduced, which are cost effective that all researchers can undertake as part of their studies, regardless of their focal species.

4. Poor Data Sharing Protocols
   4.1 There is a lack of data sharing between stakeholders, with improved collaboration between the University of Botswana's Okavango Research Institute (ORI), DWNP and DEA required. An open access, data base system with an update link must be developed that can serve all relevant stakeholders.

5. Limited use of existing legislation
   5.2 There is poor enforcement of existing legislation. Improved awareness and capacity to implement existing legislation is required for Government departments.
   5.2 Poor policing of poaching activities across all regions, with very poor conviction rates for those poachers caught. Improved integrated anti-poaching activities are required by the Police / BDF / DWNP / concessionaires and communities.
6. Lack of Implementation of existing Management Plans
   5. Existing management plans, such as the Okavango Delta Management Plan (ODMP) and the Ngamiland Integrated Land Use Plan are not implemented. A review of these plans must be undertaken to improve the awareness of the existing recommendations made within them to improve implementation. An assessment of those constraints limiting implementation must be undertaken.
   5. The ODMP contains a research and monitoring strategy that should be used as a foundation for moving forward."

3.2 *Botswana Wildlife Research Symposium - February 2014*

The symposium held sessions in which papers were presented on wildlife monitoring, CBNRM, human-wildlife conflict, human-wildlife-livestock interface, transboundary conservation, and critical management issues.

The following critical management issues were identified in a concluding wrap-up session:

- Protected area functionality and land use planning
- Provision of artificial water supplies
- Illegal hunting
- Fire
- Increasing tourism
- Financial sustainability of protected areas
- CBNRM policy
- The ban on hunting
- Human- Wildlife conflict
- Fragmentation of habitats

Following the discussion on conservation issues three working groups (Human wildlife conflict, CBNRM and Tourism, and Biodiversity conservation) were formed to discuss and report back on the issues identified. The working group reports, in tabular form, covered conservation issues, research needs, monitoring needs, and climate change targeted studies. The two tables included in the symposium report are provided in **Annex 2**.

The biodiversity conservation group advocated limited management intervention in large open ecosystems with effective functional heterogeneity. They considered it essential to use a systems approach that considered the entire ecosystem when making management decisions. To achieve this it would be important to harmonise policies and land use interventions between the ministries and departments involved in rural development and land use planning. In developing a whole ecosystems approach it would be necessary to ensure that wildlife was able to move between wet and dry season habitats and to obtain key resources in appropriate seasons.

The working group on CBNRM and tourism focused on questions relating to the extent of community use of natural resources, the contribution of CBNRM to resource management, constraints on areas that communities could use and variation in the levels of benefits to different communities.

See the tables in Annex 2 for further details.

3.3 *National Biodiversity Strategy and Action Plan (NBSAP)*

The 2014 NBSAP lists the following as the primary threats to biodiversity conservation in Botswana (See **Annex 3**): habitat conversion and destruction, barriers to wildlife movement, high elephant populations, closure of the safari hunting industry, disruption of natural fire regimes, unsustainable use of wild plant and animal species, alien invasive species, climate change and changing hydrology and water flows and water quality. Indirect threats arise from development programmes and policies that may undermine biodiversity management.

4. Strategic directions, options and proposed research themes

Views of nature and our approaches to conservation continue to change and accompanying these changes are changes in research agendas and methods that are required to meet and inform the new challenges that arise. Changing views of nature and conservation are well summarised (**Figure 2**) in a paper by Georgina Mace in the 24th Sept. 2014 issue of Science. The current focus on environmental change, adaptability, resilience and social ecological systems, and interdisciplinary / trandisciplinary approaches (Max-Neef 2005) provides a sound guide to the direction in which wildlife research in Botswana should move. Mace's (2014) brief paper is well supported by a very large body of research and, increasingly, of practice. References to some key papers in this regard are provided below.

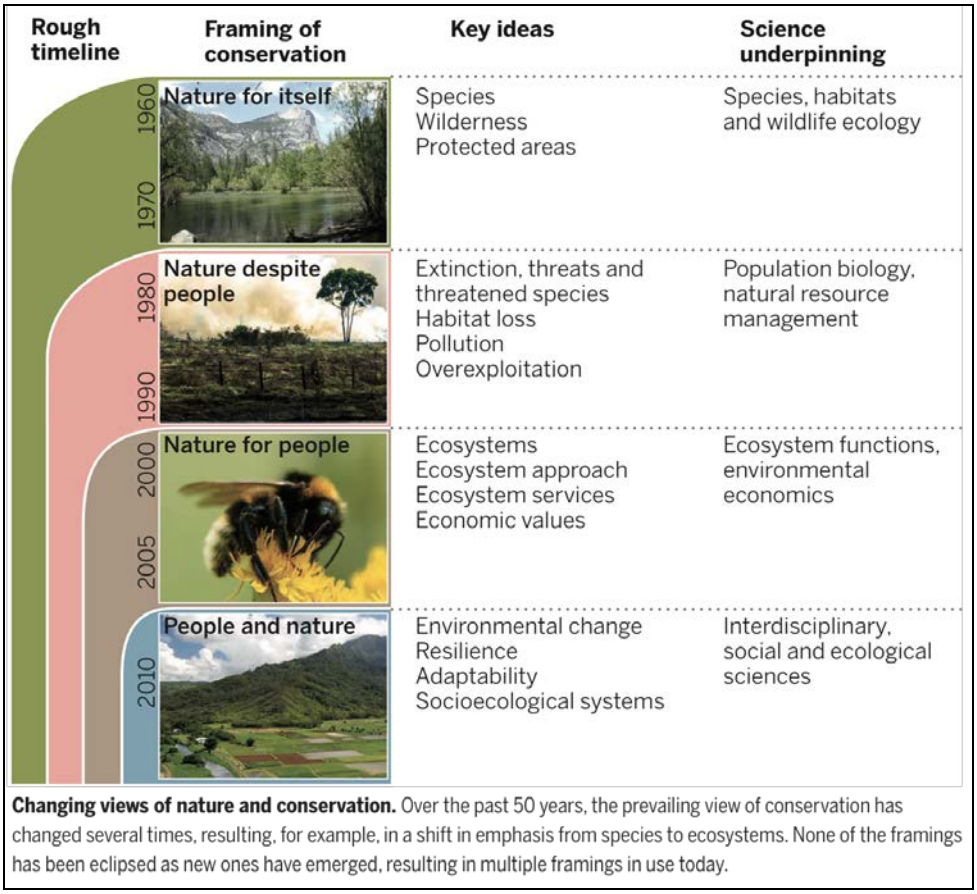

Figure 2. Changing views of nature and conservation (Source: Mace, 2014)

What is the long term or overall goal of wildlife research in Botswana? The following is suggested:

> **Long term/Overall Goal**:
> To contribute to the conservation of biodiversity and sustainable use of wildlife in Botswana by conducting exemplary research and providing scientific information and advice to policy makers, resource managers, stakeholders, and the public

Together with the following short term or immediate goal:

> **Short term/Immediate Goal:** Develop and implement a research strategy that will:
> (a) Provide science-based information on wildlife conservation and management options to support the implementation of the 2013 Wildlife Policy and the 2014 National Biodiversity Strategy and Action Plan;
> (b) Focus and coordinate wildlife research in Botswana on key wildlife conservation and management issues; and,
> (c) Build wildlife research capacity in the DWNP and associated research partners in the country.

In order to meet these goals and to effectively contribute to national policy objectives, the following five themes are proposed as the primary focus of a research strategy for the DWNP's Research & Statistics Division. These themes represent broad areas of research to which partners and private researchers may be encouraged to contribute.

1. *Transparent, participatory, and inclusive conservation planning and implementation, the core of which involves systematic conservation planning (e.g. Margules and Pressey 2000, Knight et al 2006) at local, eco-regional and national levels.*
2. *Conservation of threatened and keystone species, habitats and processes.*
3. *Sustainable and resilient protected areas as integrated landscape components.*
4. *Natural resource use policies and decisions are based on sound, science-based, information.*
5. *Build research capacity in DWNP and partners to meet the demands of national conservation policy*.

These themes can readily be framed as *Outputs* or *Strategic Targets* with a set of necessary and sufficient *Activities* that need to be implemented to achieve the outputs or targets. Outputs and activities are outlined above and summarised in a one page Objectives Tree (See **Summary**, page i)

Theme 1: *Transparent, participatory, and inclusive conservation planning and implementation, the core of which involves systematic conservation planning at local, regional and national levels*.

Output #1: Systematic conservation planning processes at local, eco-regional and national levels facilitated.

Systematic conservation planning helps to provide an objective, rational and transparent basis on which to plan and implement agreed conservation measures *(e.g. Margules and Pressey 2000, Knight et al 2006)*. It is widely practiced and has been well developed both in theory and practice in South Africa. The process is outlined in **Figures 3 and 4** and involves an extensive use of spatial analysis

and decision-making tools (e.g. Knight et al 2006, Smith et al 2006) that assist in the analysis of tradeoffs between alternative conservation options and land uses.

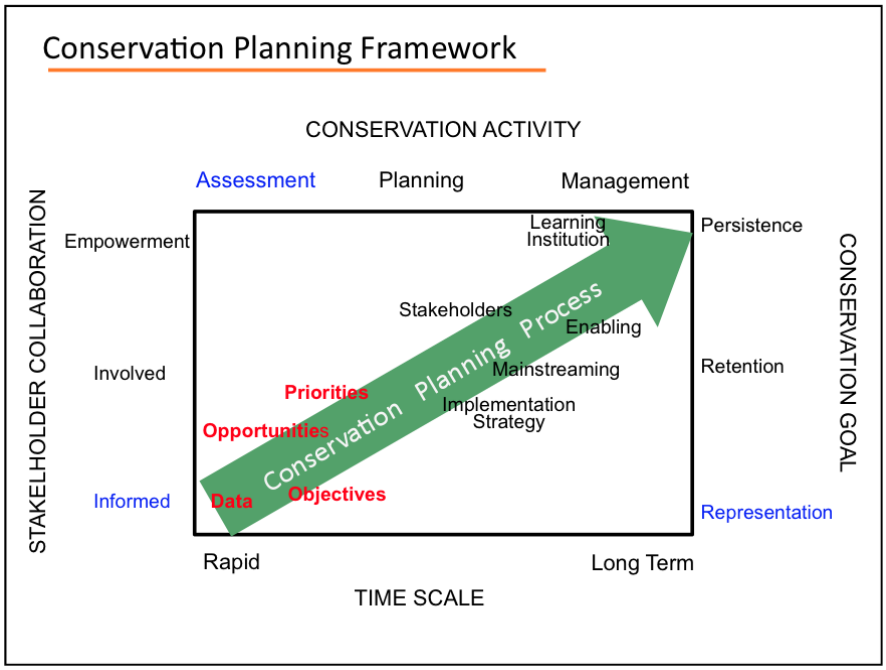

Figure 3. Summary of conservation planning processes that are required to deliver effective conservation action (Source: Knight, Cowling and Campbell 2006).

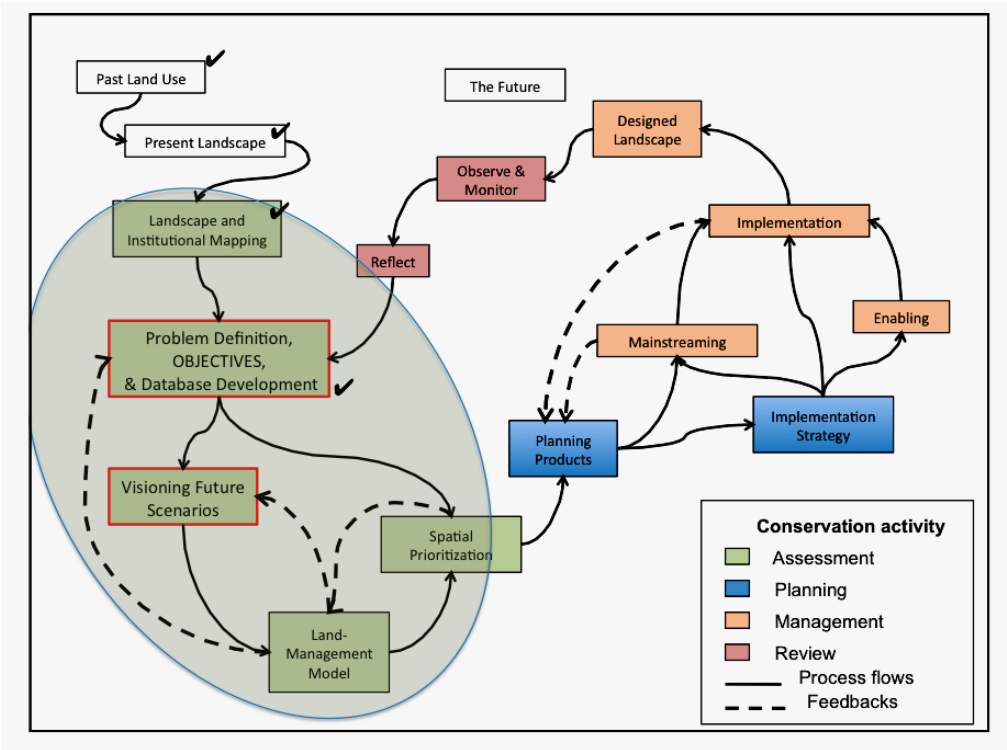

Figure 4. An operational model for conservation planning that illustrates the links between major phases of conservation planning, namely, conservation assessment, planning, management and review of progress. Feedbacks (dashed lines) are required between stages to ensure the effectiveness of conservation planning processes and stakeholder

engagement and ownership of the process. Research involvement is mainly in the conservation assessment component. (Adapted from Knight et al 2006, and Grantham et al 2010)

Conservation assessments would deal with most of the inventory of species and habitats in ecoregions that is required under both the 2013 Wildlife Policy and the NBSAP.

Output #1: Activities

1. Conduct baseline species and habitat inventories for each ecoregion (NBSAP).
2. Conduct landscape and institutional mapping of target planning areas and rates of change in key landscape and social components.
3. Facilitate the various activities required to carry out conservation assessments, e.g.
    a. Problem definition
    b. Objectives
    c. Spatial databases (GIS)
    d. Alternative scenarios
    e. Land management model
4. Provide technical support to planning authorities and stakeholders on systematic conservation planning.

Indicative specific projects under this theme would include completing bird, mammal, reptile, and tree species atlases for the country, identifying biodiversity hotspots and key ecological processes (e.g. migrations, seasonal dispersal areas, migratory bird sites) within Botswana. Tracking historical changes, using satellite imagery, in land use and current trends and rates of change in, for example tree cover, cropping areas, bare ground, primary production, and fire frequency, would provide important information for effective conservation planning and also feed into Theme #2.

Theme #2: Conservation of threatened and keystone species, habitats and processes.

Output #2: Risk analysis for endangered and threatened species and habitats conducted.

Risk analysis in this context can involve either the risk of losing a species as a result of existing conditions or the risks associated with actions designed to conserve that species. Here the focus is on assessing the risks of losing species, habitats and processes and reducing risk factors and developing appropriate protocols to sustain viable populations, habitats and processes.

Output #2 Activities:

1. Assemble and review available information on status and trends in endangered, endemic, and ecologically and economically important species of fauna and flora, and habitats.
2. Conduct risk analyses on vulnerable species and identify key drivers of change.
3. Establish appropriate monitoring and response protocols (thresholds of potential concern) to reduce risk factors and to facilitate adaptive management.

Indicative specific projects might include a review of the schedules of protected animals and plants in Botswana in the Wildlife Act, developing thresholds of potential concern for selected priority species and habitats, risk analyses of transboundary animal diseases in transfrontier conservation areas and in relation to threatened and keystone species.

Theme #3: Protected areas are integrated, resilient and sustainable components of larger landscapes.

Output #3: Protected areas as resilient social-ecological systems (SES) investigated and assessed.

Analysing protected areas through a SES lens will help to address the policy directives in the 2013 Wildlife Policy and the 2014 NBSAP that call for decentralisation and co-management of wildlife resources. It may also include resilience analysis and scenario planning (**Figure 5**) to involve a full range of stakeholders in park planning and management.

(See Walker et al 2002 on resilience analysis and Peterson et al (2003) on scenario planning in conservation)

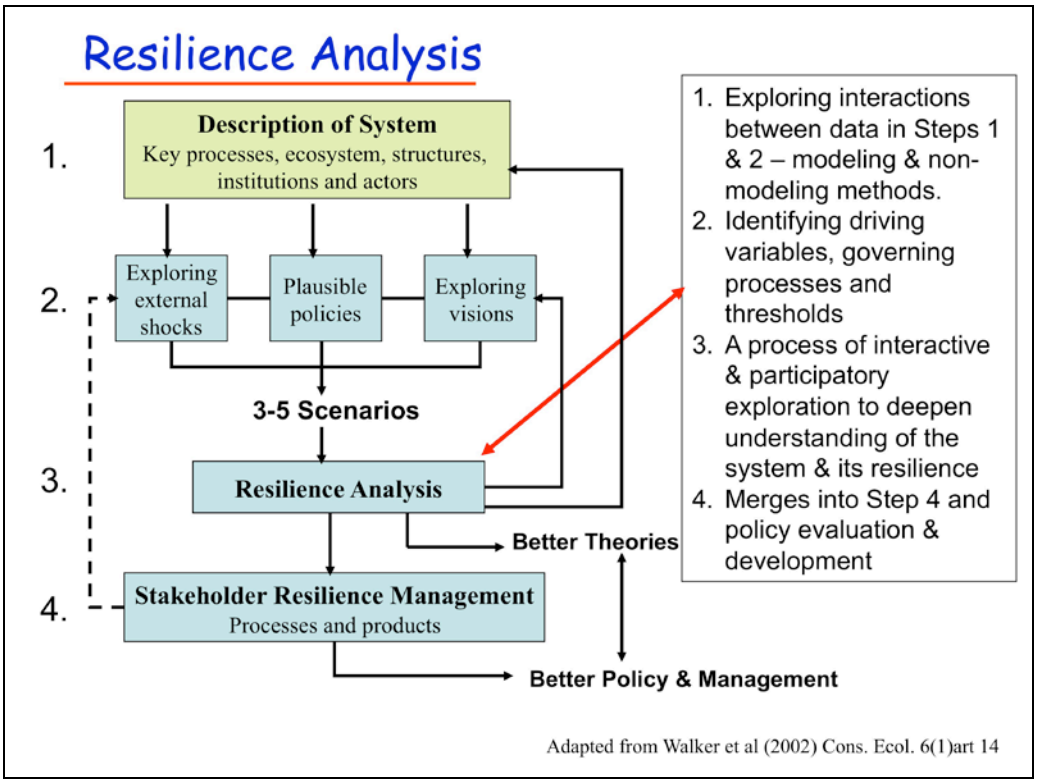

Figure 5. Outline of resilience analysis process

Output #3: Activities:

1. Conduct a resilience analysis of each protected area, involving key stakeholders and explore alternative plausible futures for the protected area and its neighbouring areas.
2. Explore the potential for developing adaptive co-management arrangements for each protected area.

Note: this theme, and output and activities, address the DWNP and NBSAP policy directives on CBNRM and community involvement in protected areas, and Botswana's participation in TFCAs.

Theme #4: Natural resource use policies and decisions are based on sound information and valuation of ecosystem services.

Output #4: Ecological, economic and social tradeoffs between alternative land uses / resource uses fully researched.

This theme will encompass needed economic and social research and include issues relating to CBNRM policy, human-wildlife conflict, and wildlife-livestock interface issues (this will also be needed for, and feed into, Theme #1 on systematic conservation planning). Most importantly, this

theme would provide key information for policy makers on the values of alternative land uses and alternative uses and management of key elements of biodiversity and ecosystem services.

Output #4: Activities:

1. Identify areas/regions of land use conflicts that are impacting on biodiversity.
2. Conduct EIAs / SEAs and related analysis to inform land use decisions.
3. Monitor impacts of land use / conservation decisions on biodiversity and socio-economics of associated households and communities.
4. Conduct integrated research (ecological, economic and social) on human-wildlife-livestock conflicts and alternative options for mitigating conflict.

Theme # 5: Build research capacity in DWNP and partners to meet the demands of national conservation policy.

Output #5 Capacity of DWNP's Research and Statistics Division and partners to meet national research obligations established.

Two parallel developments are needed. One is to build capacity within DWNP to carry out research. The other is to involve qualified and experienced staff within the department who can effectively interpret and use the research carried out by others in the country and elsewhere, in guiding conservation, natural resource management, and policy.

Output #5: Activities:

1. Motivate for:
    a) Effective operational research budgets
    b) Dedicated staff development
    c) Incentive structures for advancement
    d) Conditions of service that retain trained staff
    e) Establish training and retraining programmes
2. Build collaborative research partnerships with universities (local and abroad), NGOs and the private sector.
3. Develop incentives and guidelines that will attract private / visiting researchers to contribute to the country's research agenda.

References:

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ANNEX 1. Convention on Biological Diversity - Ecosystem Approach Principles

Principle 1:The objectives of management of land, water and living resources are a matter of societal choices.

Different sectors of society view ecosystems in terms of their own economic, cultural and society needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

Principle 2: Management should be decentralized to the lowest appropriate level.

Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.

Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:

a. Reduce those market distortions that adversely affect biological diversity;

b. Align incentives to promote biodiversity conservation and sustainable use;

c. Internalize costs and benefits in the given ecosystem to the extent feasible.

The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favor the conversion of land to less diverse systems.

Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (e.g. pollution) escape responsibility. Alignment of incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than simply protection of species.

Principle 6: Ecosystem must be managed within the limits of their functioning.

In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity, ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different

degrees by temporary, unpredictable, and artificially maintained conditions and, accordingly, management should be appropriately cautious.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems.

Principle 8: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.

Ecosystem processes are characterized by varying temporal scales and lag-effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.

Principle 9: Management must recognize the change is inevitable.

Ecosystems change, including species composition and population abundance. Hence, management should adapt to the changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning, and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater for such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against available knowledge and views of stakeholders.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

Annex 2: Workshop Session Outputs from 2014 Symposium

Biodiversity conservation

Conservation issues	Research needs	Monitoring needs	Climate change targeted studies
(i) Be wary of over-management of wildlife. The Northern Conservation Area of Botswana is a vast ecosystem with good functional heterogeneity of resources and, therefore, need very limited management interventions. Keep the system open and natural. *(ii)* Critical to use a systems-approach which will consider the whole system when making management decisions. Management plans for individual concessions must be made keeping in mind the whole ecosystem and its functioning and interconnections. In this regard, land, tourism and wildlife authorities need to ensure that individual management plans from concessionaires are implemented in a manner that is in line with the overall wellbeing of the whole ecosystem. As noted above, management of individual concessions should be kept to a minimum. *(iii)* To facilitate a whole system approach to conservation management there needs to be explicit harmonization of policies between the Ministries of Agriculture, Environment and Veterinary. Greater dialogue also needs to take place between the various Ministers. For example, promotion of crop production in the northern plains near Pandamatenga is a policy that conflicts with MEWT's goals of building the Tourism industry because certain parts of the northern plains are key wet-season range for Chobe River Fronts zebra population, as well as for sable and roan antelope. Areas for expansion of crop production need to be very carefully considered so that they do not impact on Chobe River Front wildlife numbers (Botswana's flagship wildlife area) nor compromise movements within the KAZA region. *(iv)* To further facilitate a whole systems approach of conservation management wildlife conservation across regional landscapes should be promoted to ensure that critical wet and dry season habitats and connecting corridors are all linked. This will require TFCA's when critical seasonal habitats occur across international borders. For example, while the Okavango Delta provides a key dry season habitat for wildlife in the west of the northern conservation area, most of the northern conservation area between the Delta and Zimbabwe is wet season habitat (Pans and woodland) with wildlife relying on wetlands and floodplains in Namibia during the dry season. Most of the good floodplain grazing in the Linyanti Swamps is in Namibia and many buffalo herds that spend the wet season in Botswana rely on these floodplains on islands within the swamps on the Namibian side of the border during the dry season (Sianga et al. in review). Similarly, much of Chobe River Fronts zebra and buffalo population also rely on floodplains in Namibia between the Chobe River and the Zambezi river over the dry season (Naidoo et al., in review). Thus the future well-being of northern Botswana's wildlife depends on the conservation status and management of habitats across the border in Namibia. This can only be secured if the KAZA TFCA is fully operational. *(v)* Address existing and predicted constraints to wildlife movements across landscapes (strategies	*(i)* There is need to identify key biodiversity indicators and analyse their influence on conservation of wildlife. *(ii)* More knowledge is needed on which wildlife species have declined the most and what are the mechanisms contributing to this decline? *(iii)* Collaborative research with neighbouring countries (e.g. within TFCA framework) to meet conservation objectives. *(iv)* Make use of expert opinion and knowledge in gaining a greater understanding of the functioning and structure of the whole ecosystem and how to conserve and manage it. *(v)* Innovative thinking and problem solving at the wildlife/livestock/human health and livelihoods interface to effect policy change. *(vi)* A wildlife disease framework/policy is needed for Botswana.	*(i)* Critical to ensure that detailed long-term monitoring of population demography and dynamics is carefully carried out by concessionaires and by DWNP staff within National Parks and Game Reserves. *(ii)* A fully integrated and comprehensive approach to disease surveillance and management. *(iii)* Better data on diseases of conservation, agro-economic and public health significance *(iv)* While the current aerial census method is needed and provides useful information, it has much uncertainty around animal population estimates, which makes it difficult to examine clear trends in population size with time (wide confidence limits around estimates). To supplement this census, attempts should be made to get very accurate counts of key animal populations. For example,	*(i)* Ensure functional connectivity across landscapes to enable wildlife to adapt to predicted rainfall variability and patchiness under climate change. TFCA's are a key way to maintain functional connectivity. For example, the importance of wetland systems in Namibia as dry season habitats will become more important for Botswana's wildlife with global warming and greater drought frequency.

include: land-use planning & designation, disease management / fencing realignment) *(vi)* With regards the importance of TFCA's for conservation in Botswana there is now an urgent need to create a policy framework in Botswana that recognizes the critical role of TFCAs. Of the five KAZA countries, only Namibia has only just developed policies which even make mention of TFCAs specifically. All other countries, regardless of how many TFCAs they are party to, don't make specific mention of them in their supporting policies & legislature. It is now critical that this is attended to. *(vii)* To promote a whole ecosystem approach to conservation there need to be solutions to improved transboundary animal disease management from the perspective of biodiversity conservation (ones that don't rely on geographic zonation through veterinary cordon fencing). Much effort should be directed towards promoting and researching the commodity-based trading approach to beef marketing. A general adoption of this approach could have a great positive impact on large-scale conservation management and the success of TFCA's as well as greatly improve the viability of the beef industry. *viii)* Clear-cut conservation goals – what is conservation success? With clear-cut goals one can more efficiently direct research. Biodiversity indicators (DEA). *(ix)* Translocations of wildlife – It is important to be careful about what is introduced where because the genetics of introduced species may corrupt and weaken the genes of the local population. Eg the wildebeest moved to Makgadikgadi from a Ghanzi game farm where blue and black wildebeest had been mixed, thereby allowing for mixed genes, which could have a negative impact on the locally adapted Makgadikgadi wildebeest population. *(x)* Anti-poaching strategy – involving communities, monitor the effect of poaching. What is poached and who is doing it. *(xi)* Development of productive game farms to provide game meat to reduce the demands for bushmeat. *(xii)* Not all fences are bad – need to understand when fencing could be helpful to wildlife (e.g. the Boteti fence which reduces cattle grazing within the dry season range of zebra. In general dry season ranges are more vulnerable to competition for grazing because forage is a limiting factor during this season.	*(vii)* More research is needed on rare antelope species such as sable, roan, eland and tsessebe. What is their distribution, what are their core habitats and key movement corridors and what are their population sizes? *viii)* Research on vegetation, birds, amphibians, and fish is critical in understanding the functional importance of biodiversity	very detailed surveys could be flown on seasonal home ranges of wildebeest and zebra when the population is concentrated in open habitats such as the Makgadikadi, Nxai pan and Mababe populations in the wet season ranges (open grassland habitat) and the Chobe riverfront during the dry season. This would enable an accurate count of the population as a baseline, which could then be resurveyed every five years to monitor trends. *(v)* Another supplement for the aerial census could be to fly certain blocks in greater detail. *(vi)* Long-term monitoring plots of woody and herbaceous vegetation should be established in key areas. These would need a detailed baseline survey and then surveys every five years thereafter. *(vii)* Important to monitor the effects of artificial waterholes on wildlife populations such as sable and roan.	

CBNRM and Tourism

Conservation issues	Research needs	Monitoring needs	Climate change targeted studies
(i) How much are communities utilizing natural resources? *(ii)* How has CBNRM contributed to natural resource management? *(iii)* Effect of tourism on conservation *(iv)* Why are communities being denied access to areas e.g. Delta-What can be done to fix the situation? *(v)* Only a few communities that are within the wildlife areas benefit from wildlife under CBNRM (Khwai, Sankoyo, Mababe, Katchikau, Parakarungu, etc). Many communities on the edge of the wildlife areas (e.g. Shorobe, Maun region, Komana, Toteng, Habu, Gumare, Etsha, etc) do not benefit significantly from CBNRM and wildlife and, therefore, bare the costs of living next to wildlife areas (crop raiding by elephant, livestock depredation) while not receiving any significant benefits. This is likely to be a significant factor leading to negative attitudes of communities to wildlife conservation. This situation is aggravated by the fact that these communities do not have any access to resource use and ecosystem services within wildlife areas such as grass collection, letlhaka, fishing and dry season grazing.	*(i)* Spinoffs as a result of tourism (not adequately documented) the people working in lodges have a trickling effect as they always have to share their money with other members of their families. *(ii)* Need to do research to determine who is benefiting from tourism. *(iii)* While there is the perception that people don't want to work in the bush this research was done 10 years ago; today these perceptions may have changed. *(iv)* Design strategies for community beneficiation. *(v)* Comparative research should be extended to other parts of the country (not only northern parts). *(vi)* What effect is the current hunting ban going to have on CBNRM? *(vii)* Conduct a comparative study on hunting vs. photographic safaris benefits. *(viii)* Research on possible benefits to communities on photographic tourism. *(ix)* How are we going to get funding for the research?	*(i)* Communities have been involved in monitoring of natural resources. Is that enough e.g. MOMs. *(ii)* What criteria used for moving people out of resource rich areas. *(iii)* Targeted enactment of laws to disadvantage property owners	*(i)* What will happen to communities when the Delta dries up? *(ii)* Targeted communities should be asked what they want done if environment changes due to climate change. *(iii)* Need for formal / informal education on climate change as related to tourism e.g. photographic safaris. *(iv)* Study on impact of what communities have seen in terms of climate change influences e.g. rainfall patterns, agriculture, etc.

Conservation issues	Research needs	Monitoring needs	Climate change targeted studies
(i) Problem Animal Control (PAC) is reactionary; more resources need to go into prevention *(ii)* Blocking of important corridors by development, management policies and human encroachment. *(iii)* Not enough collaboration between stakeholders when it comes to resolving and planning 'land-use' (see above). *(iv)* Exclusion of communities when polices are planned. *(v)* Sink outside of protected areas (PA), i.e. predators (small & large) in particular are leaving PA's and not coming back into PA – presumably being killed whilst outside. *(vi)* Apparently more predators and herbivores are being killed by man *(vii)* Law must change so humans cannot kill problem predators – as they currently get compensation & are allowed to kill them. *(viii)* Hunting ban, cannot be changed lets rather monitor it.	*(i)* Collaboration of data on different species for corridor protection. *(ii)* More research required into sustainability of agricultural policies (e.g. government decision to increase Botswana's cattle herd by 1million. *(iii)* Research must have management application. *(iv)* Understanding of habitat use, patterns & strategies for livestock *(v)* Government departments to review research priorities and communicate to stakeholders. *(vi)* Collection of better and consistent data on animals numbers, so we do not have to 'make do'. *(vii)* Some leadership is needed on how do we incorporate & partner with communities to work towards solutions for HWC.	*(i)* Long term monitoring of indicator species & keystone species. *(ii)* Participatory monitoring to include. Standardised monitoring system has been developed by SAREP, needs to be successfully communicated and implemented. a. Communities b. DWNP c. Researchers d. Tourism sector *(iii)* PAC need to monitor the perpetrators to understand the drivers & external monitoring of PAC decisions. *(iv)* Effective monitoring.	*(i)* Focus more on human-livestock side. Include other experts such as social biologists and anthropologists. *(ii)* Collaboration and co-ordination between researchers and government (DWNP, MEWT & Ministry of Agriculture). *(iii)* Better & more consistent data on animal numbers and dynamics. *(iv)* More research focused on movement policy/implementation of our research findings. ***(v)*** Research on the effectiveness of mitigation techniques here in Botswana.

ANNEX 3: Table 2 from NBSAP

Table 2 : Summary of stakeholder-identified threats to biodiversity, and potential consequences of its loss in Botswana

Threat	Underlying Causes	Main Impacts	Key Implications
Internal threats			
Habitat destruction, habitat conversion and disturbance	• Changes in land use (e.g., settlement expansion, agricultural expansion	• High levels of human-wildlife conflict (HWC) and predator depredations (problem animal control and poaching) Prevention of seasonal wildlife movements (e.g., through the Schwelle) • Disturbance of communally nesting birds' nesting sites • Reduction in air and water quality	• Reduction in likelihood of some WMAs being legislated • Reduction in populations of migratory species • Implications for ecosystem services in both aquatic and terrestrial environments, especially for rural poor
Barriers to wildlife movement	• Need to control veterinary diseases, EU subsidies, increased fencing of rangelands through ranch creation	• Reduction in populations of migratory species • Isolation of protected areas (PAs) • Increased pressure on wildlife in PAs	• Further separation of direct benefits from natural resources by local communities, and increased HWC, reduction in quality of rural livelihoods. • With warming and erratic rainfall under climate change, links between dry and wet season wildlife ranges become even more important to maintain.
High populations of elephant	• Dispersal into new ranges, reduction of range in neighbouring countries	• Habitat modification and disturbance • Reduction of biomass, and plant and animal species	• Loss of habitat diversity, loss of biodiversity, undermining of the ecotourism potential of the country
Closure of the safari hunting industrydue to Government order prohibiting hunting	• Blanket approach to policy development and implementation • Centralised top-down governance • Insufficient research into wildlife population trends, and causality behind changes in trends	• Termination of pro-conservation presence and management in remote areas, and of patrolling against poaching by safari companies • Loss of key revenue streams from and to conservation • Botswana becomes a source, and other countries sinks, for wildlife	• Increased rural poverty through job loss in remote areas • Increased poaching
Increase in poaching	• Loss of benefits from wildlife • Increased rural poverty • Penetration of illegal international wildlife trade • Loss of management presence in remote areas	• Decline in populations of large mammals, including some globally threatened species • Increased social conflict	• Breakdown of rural support for conservation

Threat	Underlying Causes	Main Impacts	Key Implications
Disruption of natural fire regime	• Unmanaged use of fire, fire use pushed underground by legislation. (Fires used to stimulate sprouting for grazing, clear bush to improve visibility, etc.)	• Unseasonal fires, and in some areas too-frequent fires, affect recruitment of key tree species, and disturb bird breeding, especially in riparian zones	• Currently unknown, as insufficient research has been done.
Overuse and over-collection of wild plant species	• Poverty • Insufficient management and enforcement of legislation	• Localised impacts, pressure on certain valuable or medicinal species	• Potential loss of key species, but also ultimately reduction in availability of resources important to rural livelihoods
Alien invasive species	• Habitat degradation (e.g., overgrazing, nutrient loading in riparian systems)	• Displacement / replacement of indigenous species • Change in water quality • Reduction in range quality	• Potential loss of key species, but also ultimately reduction in availability of resources important to rural livelihoods
External threats			
Climate change	• Global carbon emissions, overconsumption of fossil fuels • Greed and inequality	• Warming, particularly over the dryland ecoregions, especially the Kalahari xeric savannas. Increase in extreme weather events, and increasing weather unpredictability	• Reduction in ecosystem services and natural resource availability, with negative consequences for rural livelihoods • For biodiversity, linkages between wet and dry season ranges will become increasingly important, increasing the need to address barriers to movement
Changes to hydrology and water quality of inflowing rivers	• Nutrient runoff in catchment in neighbouring countries • Increased development, industrialisation, mining and urbanisation • Land & resource use practices (e.g. agriculture and water harvesting) • Leaching of soil salts and nutrients due to poor irrigation practices • Deforestation and proliferation of alien plant and animal species • Dams	• Decreasing variability in flow, cessation of low season flow, eutrophication, decreasing water quality, decrease in sediment inputs, decrease in sediment carrying capacity • Change in the timing, duration, quality and extent of annual floods • Algal blooms & proliferation of alien aquatic plant species	• Loss of floodpulse would likely convert the deltaic systems to a single course river channel, losing extensive seasonally flooded floodplains • Change to the character and functioning of Botswana's primary biodiversity hotspot – the Okavango, leading to loss of ecosystem services and natural resources for both rural livelihoods and the national tourism industry. • Change from fresh water to more saline conditions