WILDLIFE RESEARCH STRATEGY

(2018-2022)

Zimbabwe Parks and Wildlife Management Authority

Zimbabwe Parks and Wildlife Management Authority – Wildlife Research Strategy (2018-2022)

FOREWORD BY THE DIRECTOR GENERAL

The Zimbabwe Parks and Wildlife Management Authority (ZPWMA) is mandated through the Parks and Wildlife Act Chapter 20:14 as the custodian of wildlife on both private and state property. The management of wildlife in the country is anchored on a solid and sound scientific basis to which adaptive management and best practices are derived. In attaining its mandate, the Authority therefore strives to be guided by scientific judgements. It is without doubt that through its management practices Zimbabwe remains one of the countries in the world that is highly regarded for its conservation practices.

However, over the past decade, or more, the Authority has been faced with operational challenges largely around administration, human resource capacity, and funding constraints that have affected the discharge of its research and monitoring mandate. In light of these challenges the Authority has sought to review its 1992 research plan in order to speak to current operational environment. It is the Authority's favoured hope that through the dispensation enshrined in this plan, the Scientific Services Unit and the Authority in general will be able to aptly spell the way forward for wildlife research and conservation in the country.

I would like to thank the contributions made by all stakeholders to this plan and the sterling efforts put in by Dr. David Cumming who facilitated the drawing up of this strategic research plan and indeed his overall contribution to research and conservation efforts in Zimbabwe. We would also like to thank Conservation Force our partner in sustainable conservation of wildlife for funding this process. The mantle is now in our hands to see to the complete execution of the issues outlined in this plan bearing in mind that we cannot compromise the gains scored thus far therefore it should take Zimbabwe's conservation efforts to greater heights.

F. U MANGWANYA

DIRECTOR GENERAL OF PARKS AND WILDIFE MANAGEMENT AUTHORITY

Approval Page

The Zimbabwe Parks and Wildlife Management Authority Board of Directors and the Director General have approved the implementation of the Wildlife Research Strategy (2018-2022).

Signature: _____ Date: 25/06/18

Mr. Fulton Mangwanya

Director-General - Zimbabwe Parks and Wildlife Management Authority

Signature: _____ Date: 27/06/18

Approved by Board Chair - Zimbabwe Parks and Wildlife Management Authority

SUMMARY

The Scientific Services Unit of the Zimbabwe Parks and Wildlife Management Authority (ZPWMA) has been using a research plan developed in 1992 for the branches of Aquatic and Terrestrial Ecology in the former Department of National Parks and Wild Life Management. The plan was updated with minor changes in 2004 and again in April 2017. Recent changes in national legislation, policy and the development of the Zimbabwe National Biodiversity Strategy and Action Plan (NBSAP-2) in 2014 have resulted in the development of the strategy presented here. Conservation paradigms have developed during the last two decades and there is an added need to update research approaches to meet the advances that have occurred.

This strategy, therefore, seeks to respond to the legal and policy changes that have occurred, the current conservation challenges facing the country, and the scientific advances in conservation theory and practice that have occurred.

The strategy focuses on the following long term and short-term goals and six research themes. These are:

> ***Long term/Overall Goal****: To contribute to the conservation of biodiversity and sustainable use of wildlife in Zimbabwe by conducting exemplary research and providing scientific information and advice to policy makers, resource managers, stakeholders, and the public.*
>
> ***Short term/Immediate Goal:*** *To 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 Environmental Management Act, the Parks and Wild Life Act, the National Biodiversity Strategic Action Plan, and other relevant provisions;*
>
> *(b) Focus and coordinate wildlife research in Zimbabwe on key wildlife conservation and management issues; and,*
>
> *(c) Build wildlife research capacity in the ZPWMA and associated research partners in the country.*

In order to meet these goals and to effectively contribute to national policy objectives, the following six themes are proposed as the primary focus of research for the Scientific Services Unit. These themes represent broad areas of research to which partners and private researchers will be encouraged to contribute.

1. *Transparent, participatory, and inclusive conservation planning and implementation, the core of which involves systematic conservation planning at local, eco-regional and national levels.*
2. *Monitoring of, and conservation research on, threatened and keystone species, habitats and ecological processes.*
3. *Research to enable protected areas, conservancies, and CAMPFIRE areas to function as sustainable, resilient and integrated components of larger landscapes.*
4. *Research to support the conservation and management of wildlife on agricultural, communal lands and in transboundary ecosystems.*
5. *Natural resource use policies and decisions based on sound, science-based, information.*
6. *Build research capacity in ZPWMA and partners to meet the demands of national conservation policy*.

These strategic themes can readily be framed as *Outputs* or *Strategic Targets* with a set of necessary and sufficient *Activities and Key performance Indicators* that need to be implemented to achieve the outputs or targets. These are framed at a strategic level from which detailed annual action plans that fit available resources can be developed.

Four annexes provide a glossary of some of the less widely known terms used, the twelve principles of the Ecosystem Approach of the Convention on Biological Diversity, additional references to pertinent literature on conservation planning and an Objectives Tree that provides a two-page summary of the strategy (which is included below).

OBJECTIVES TREE

Long term/Overall Goal: To contribute to the conservation of biodiversity and sustainable use of wildlife in Zimbabwe 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 provisions of Environmental Management Act, the Parks and Wild Life Act, and the 2015 National Biodiversity Action Plan and other relevant provisions

(b) Focus and coordinate wildlife research and monitoring in Zimbabwe on key wildlife conservation and management issues, and

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

Theme 1 *Transparent, participatory, and inclusive systematic conservation planning and implementation at local, ecoregional and national levels*	***Theme 2*** *Monitoring of, and conservation research on, threatened and keystone species, habitats, landscapes, and processes*	***Theme 3*** *Research to enable protected areas, conservancies, and CAMPFIRE areas to function as sustainable, resilient, and integrated components of larger landscapes*	***Theme 4*** *Research to support conservation and management of wildlife on agricultural land, communal land and in transboundary conservation areas*	***Theme 5*** Natural resource use policies and decisions are based on sound scientific information and evidence	***Theme 6*** *Build research capacity in ZPWMA and partners to meet demands of national conservation policy*
Output #1 Systematic conservation planning processes at national, regional, and local levels facilitated	**Output #2** Monitoring, research, and risk analyses for endangered, endemic, and keystone species and habitats conducted	**Output #3** Resilience and sustainability of protected areas as social-ecological systems (SES) investigated and assessed	**Output #5** Ecosystems and flora and fauna of importance outside the Parks & Wildlife Estate identified and researched to achieve sustainable use	Output #5 Ecological, economic, and social tradeoffs between alternative land and natural resource uses fully researched	**Output #5** Capacity of ZPWMA Scientific Services Unit to meet national research obligations established

Illustrative examples of activities for each theme/output are shown below.

Examples of activities under each Theme/Output

Output #1	Output #2	Output #3	Output #4	Output #5	Output #6
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 systematic conservation assessments, e.g. - Problem definition - Objectives - Spatial databases (GIS) - Alternative land use scenarios - Land management model - Spatial and biodiversity 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 habitats 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 4. Develop Key Performance Indicators for the conservation activities and species involved	**Activities**: 1. Conduct resilience analyses of protected areas. Conservancies and CAMPFIRE areas involving key stakeholders and explore alternative plausible futures for the protected areas and their neighbouring areas 2. Explore the potential for developing adaptive co-management arrangements for each area (**Note:** this theme, and output and activities, address provisions in the Constitution, EMA and PWL Act, NBSAP, and policy directives on CBNRM and community involvement in protected areas, and SADC protocols on TFCAs, and the CBD)	**Activities**: 1. Identify significant areas and ecosystems and species populations outside the Parks & Wildlife Estate that require research inputs to support their conservation and sustainable management. 2. Monitor status and distribution of selected species jointly with land occupiers and neighbouring countries. 3. Conduct joint censuses of shared populations across internal and national boundaries of important species (e.g., elephants). 4. Identify and assess status of stopover refuges for migratory bird species	**Activities:** 1. Identify areas/regions of land and natural resource use conflicts that are impacting on biodiversity 2. Conduct EIAs / SEAs and related analyses of trade-offs to inform land and natural resource use decisions 3. Monitor impacts of land and natural resource use, and conservation decisions on biodiversity and socio- economics of associated landowners, households, and communities 4. Conduct integrated research (ecological, economic, social) on human-wildlife conflicts at the wildlife-livestock interface, and on options for mitigating conflict 5. Identify and assess major threats impacting biodiversity	**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, International 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 scenario planning, 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

1. INTRODUCTION AND BACKGROUND 1

2. LEGAL AND POLICY MANDATE FOR WILDLIFE RESEARCH 2

3. PAST AND CURRENT RESEARCH PROGRAMMES 4

4. MAJOR WILDLIFE CONSERVATION ISSUES 7

5. STAKEHOLDERS' VIEWS ON WILDLIFE RESEARCH PRIORITIES 7

6. STRATEGIC DIRECTIONS, OPTIONS AND PROPOSED RESEARCH THEMES 7

7. LITERATURE CITED 15

ANNEX 1: GLOSSARY 16

ANNEX 2. ADDITIONAL REFERENCES 17

ANNEX 3: CONVENTION ON BIOLOGICAL DIVERSITY: ECOSYSTEM APPROACH PRINCIPLES 18

ANNEX 4: OBJECTIVES TREE 20

LIST OF FIGURES

Figure 1. Number of conservation publications relating to national parks and protected areas in Zimbabwe during the 1980s through to the current decade.

Figure 2. Proportion of publications by staff and non-staff during the period 1980 to 2017

Figure 3. Distribution of published papers between 1980 and 2017 in relation to research topic or subject (Sample of 502 records from Google Scholar searches for each decade)

Figure 4. Distribution of the approximate number of research permits currently issued to non-staff (external) researchers.

Figure 5. Changing views of nature and conservation**.** (Source: Mace 2014)

Figure 6. Summary of conservation planning processes that are required to deliver effective conservation action (Source: Knight, Cowling and Campbell 2006)

Figure 7. An operational model for conservation planning

Figure 8. An outline of the resilience analysis process.

Figure 9. A wider range of interacting and competing human wildlife conflict issues. interests and claims.

ACKNOWLEDGMENTS

The generous support of the Conservation Force in the development of this strategy and in the holding of a consultative workshop in Harare on the 9-10 of August 2017 is gratefully acknowledged. Thanks, are also due to those who responded to a questionnaire on wildlife research priorities and the workshop participants for their valuable contributions to the development of this strategy.

1. INTRODUCTION AND BACKGROUND

The first large game reserves, later national parks, were established in Zimbabwe in 1928. It took another 30 years for Government to appreciate that research was necessary to better manage the country's wildlife resources. It began 1959 with the appointment of a Fish Research Officer and a Wild Life Ecologist in the then Department of Game. In his 1959 Annual Report the Director of the Game Department noted "Probably the most important development was the acceptance, by Government, of the need for scientific research into the management of the fauna, including fish, and the provision made for three professional officers on the establishment of the Department. This very important step forward should enable management and control to be done scientifically and systematically." The separate Department of National Parks did not employ scientists and research on the country's fauna and flora, which had been left to museums, universities, and herbaria.

In 1960 the Game Department was renamed the Department of Wild Life Conservation and an additional research post of Quelea Control Officer was established. In November 1963 the two departments (wildlife and national parks) were merged to form the Department of National Parks and Wild Life Management (DNPWLM) with a Research Branch headed by an Assistant Director (Research) covering both wildlife and fisheries. The research establishment by the end of 1964 was three Wildlife Research Officers, a Fish Research Officer, a Senior Technical Officer and four Technical Officers. Wildlife research was focused on supporting the budding game ranching industry, eland as a potential domesticated animal, and issues relating to game elimination in the control of tsetse fly. By 1967 research was divided between the Fisheries Research Branch and the Wildlife Research Branch, each headed by a Chief Research Officer. During the 1980s these designations were changed to branches of Aquatic Ecology and Terrestrial Ecology to reflect their research responsibilities and directions more clearly.

Additional resources were injected into the DNPWLM after independence and by the mid-1980s the Branch of Aquatic Ecology had an establishment of 15 Ecologists, 5 Technicians and Research Assistants (Game Scouts). The Branch of Terrestrial Ecology had an establishment of 20 Ecologists, 3 Graduate Technicians, 2 Technicians, and 60 Research Assistants. Each officer had a vehicle and an operational budget to carry out approved research projects. With the establishment of an Authority investment in research declined and the current research establishment in Scientific Services is twenty-six ecologists. Furthermore, research officers based in the field do not have transport available for their work and no clear budgetary allocations. As a result, research capacity within the ZPWMA is presently severely constrained.

Protected areas, both terrestrial and aquatic, throughout southern Africa are facing renewed pressures in the face of growing human populations, resource scarcities, climate change, and resistance to the sustainable use of natural resources. Zimbabwe is no exception, and a social media informed public and scientific community is increasingly demanding evidence-based wildlife management (Dubois et al 2017). The core business of the ZPWMA is the conservation and protection of the country's fauna and flora through planned interventions based on sound empirical research. An effective and focused research capability is clearly necessary. Law and policy support the mandate for this research strategy. The following definitions are from the Parks and Wild Life Act Chapter 20:14

"**Wildlife**" in this report refers to all indigenous plants and animals (vertebrates and invertebrates) and "**habitats**" includes both aquatic and terrestrial habitats and wetlands. This definition of wildlife differs from definition of "wild life" in the Parks And Wild Life Act, which excludes fish and does not include plants. The respective definitions in the Act are as follows:

> "**wild life**" means all forms of animal life, vertebrate and invertebrate, which are indigenous to

Zimbabwe, and the eggs or young thereof *other than fish*.

"**fish**" includes vertebrate fish, and aquatic molluscs and crustaceans, both indigenous and non-indigenous, but does not include the bilharzia snail (*Biomphalaria pfeifferi* and *Bulinus physopsis globusus*) and the liver fluke snail (*Lymnea natalensis*);

2. LEGAL AND POLICY MANDATE FOR WILDLIFE RESEARCH

The constitution of Zimbabwe provides for environmental rights in Section 73 as follows:

(1) Every person has the right –
- (a) to an environment that is not harmful to their health or well-being; and
- (b) to have the environment protected for the benefit of present and future generations, through responsible legislative and other measures that –
  - (i) prevent pollution and environmental degradation;
  - (ii) promote conservation; and
  - (iii) secure ecologically sustainable development and use of natural resources while promoting economic and social development
- (c) The state must take reasonable legislative and other measures, within the limits of the resources available to it, to achieve the progressive realisation of the rights set out in this section

The functions and mandate of the Parks and Wild Life Management Authority are provided for in Part II, Section 4, of the Parks and Wild Life Amendment Act, 2001 as follows:

"4 Functions of Parks and Wild Life Management Authority

(1) Subject to this Act, the functions of the Authority shall be;

(a) to control, manage and maintain national parks, botanical reserves and botanical gardens, sanctuaries, safari areas and recreational parks for the purposes set out in subsection (1) of section twenty-one, subsection (1) of section twenty-five, subsection (1) of section thirty, subsection (1) of section thirty-five and subsection (1) of section forty, respectively, and, so far as is reasonable, practicable and compatible with such purposes, to provide facilities for visitors thereto;

(b) to examine and report to the Minister from time to time upon;
- (i) the policy which should be adopted to give effect to the objects and purposes of this Act; and
- (ii) the conservation and utilisation of the wild life resource of Zimbabwe;
- (iii) the conservation and utilisation of the fish resource of Zimbabwe; and
- (iv) the preservation and protection of natural landscapes, wild life and plants and the natural ecological stability of wild life and plant communities in national parks; and
- (v) the preservation and protection of rare or endangered plant communities growing naturally in the wild in botanical reserves; and
- (vi) the propagation and cultivation of exotic and indigenous plants in botanical gardens; and
- (vii) the protection of animals or particular species of animals in sanctuaries; and
- (viii) the preservation and protection of the natural habitat and wild life in safari areas and the facilities and opportunities given to the public for camping, hunting, fishing, photography, viewing of animals, bird watching and such other pursuits that may be permitted therein in terms of this Act; and
- (ix) the preservation and protection of the natural features of recreational parks; and
- (x) plans for the development of national parks, botanical reserves, botanical gardens, sanctuaries, safari areas and recreational parks; taking into account in particular the geography and geology of each area reported upon, research and management therein, the enjoyment, education, inspiration, benefit and recreation afforded to the public thereby, progress in implementation of land use in surrounding areas;

ANCILLARY POWERS OF AUTHORITY

20. To do anything for the purpose of improving the skill, knowledge or usefulness of its employees, and in that connection to provide or assist other persons in providing facilities for training, education **and research** and **to pay for** the aforesaid, where necessary." (bold font added)

The purposes of the various categories of protected areas as set out in the Parks & Wild Life Act are:

NATIONAL PARKS

21 Purposes of national parks and duties of Minister in relation thereto (1) The purposes for which national parks are or may be constituted under this Act shall be:

(a) to preserve and protect the natural landscape and scenery therein; and

(b) to preserve and protect wild life and plants and the natural ecological stability of wild life and plant communities therein; for the enjoyment, education and inspiration of the public.

BOTANICAL RESERVES AND BOTANICAL GARDENS

25 Purposes of botanical reserves and botanical gardens and powers and duties of Minister in relation thereto (1) The purposes for which botanical reserves are or may be constituted in terms of this Act shall be to preserve and protect rare or endangered indigenous plants or representative plant communities growing naturally in the wild for the enjoyment, education and benefit of the public. (2) The purposes for which botanical gardens are or may be constituted in terms of this Act shall be to propagate and cultivate exotic and indigenous plants for the enjoyment, education and benefit of the public.

SANCTUARIES

30 Purposes of sanctuaries and duties of Minister in relation thereto (1) The purposes for which sanctuaries are or may be constituted under this Act shall be to afford special protection to all animals or particular species of animals in the sanctuary concerned for the enjoyment and benefit of the public.

SAFARI AREAS

35 Purposes of safari areas and powers and duties of Minister in relation thereto (1) The purposes for which safari areas are or may be constituted under this Act shall be to preserve and protect the natural habitat and the wild life therein in order that facilities and opportunities may be afforded to the public for camping, hunting, fishing, photography, viewing of animals, bird-watching or such other pursuits that may be permitted therein in terms of this Act.

RECREATIONAL PARKS

40 Purposes of recreational parks and powers and duties of Minister in relation

thereto (1) The purposes for which recreational parks are or may be constituted under this Act shall be to preserve and protect the natural features therein for the enjoyment, benefit and recreation of the public.

Legal Implications. The above components of the Constitution and Parks and Wild Life Act place clear responsibilities on ZPWMA for conserving species, habitats, and ecosystem processes within the areas for which they are responsible and more generally for the country at large. The Parks and Wild Life Act also requires reporting to the minister on a wide range of wildlife and ecological matters that require effective and responsible monitoring of key indicators. Although responsibility for research is not explicitly stated in Section 4, meeting the reporting requirements to the minister and the public, for whom these resources are held in trust, the agency is unable do so without a strong monitoring and research capacity. ZPWMA's core business is conservation and without knowledge of the status and trends in the species, ecosystems and landscapes for which it is responsible it cannot meet its conservation and reporting responsibilities. ***Effective monitoring and associated adaptive management are central to the conservation and resource management enterprise***.

The 2014 National Biodiversity Strategic Action Plan (NBSAP-2) includes a wide range of monitoring, research and biodiversity evaluation targets that require input from ZPWMA and should be consulted by researchers seeking to contribute to the implementation of both the national biodiversity strategy and this wildlife research strategy.

3. PAST AND CURRENT RESEARCH PROGRAMMES

During the 1970s and 1980s research activities were focused on

> **Monitoring** (e.g. aerial censuses of large mammals, hunting offtakes and trophy quality, vegetation change, fires and their impacts)
>
> **Resource inventories** (e.g. plant and animal check lists for each protected area, vegetation mapping, species distributions and status)
>
> **Park Planning** (developing management and zonation plans for each protected area)
>
> **Applied research** (e.g. elephant impacts on habitats, fire management, species studies, population dynamics, ageing criteria, game tsetse relationships, home range studies, initiation of CAMPFIRE)

In 1992 a comprehensive Research Plan (86 pages), cross-referenced to the 1992 Policy for Wildlife, was developed. The plan listed five research programmes for Aquatic Ecology and 32 research programmes for Terrestrial Ecology, of which 13 were considered high priority, 12 medium priority and seven of low priority. The high priority terrestrial programmes listed 40 present projects and a further 52 required projects. Altogether 178 projects were listed in the terrestrial ecology research plan and 42 in the aquatic ecology research plan. This plan was carried forward to 2001/2002 with minor alterations but without budget entries. It was still in use, with minor edits to the Aquatic Ecology component, in April 2017.

The four research programmes identified under aquatic ecology[1] were:

1. The kapenta fishery
2. Inshore fisheries
3. Aquaculture
4. Sport fishing
5. Limnology, aquatic weed and water pollution

The high priority programmes for terrestrial ecology were:

1. Rhino research
2. Park planning
3. CAMPFIRE
4. Land use economics
5. Habitat monitoring
6. Monitoring large mammal populations
7. Monitoring law enforcement effort and illegal activity
8. Elephant
9. Wild dog
10. Ecosystem processes
11. Environmental impact assessment

[1]/Note that the conservation of aquatic fauna and flora and their habitats (rivers and wetlands) was not included within the research brief of the branch.

12. Monitoring of the tourism industry
13. Game ranching

The output of published research has increased since the 1980s (**Fig. 1**), however, non-agency research workers have provided an increasing proportion of published work (**Fig. 2**). The overall distribution of output in relation to a range of topics has been dominated by work on elephants and rhinos, other large herbivores and predators (Fig.3). Apart from the aerial census programme focused on elephants and continuing monitoring of rhinos, long-term rigorous monitoring data on trends in key species, habitats, wildlife utilisation, and wildlife industry performance, are generally lacking.

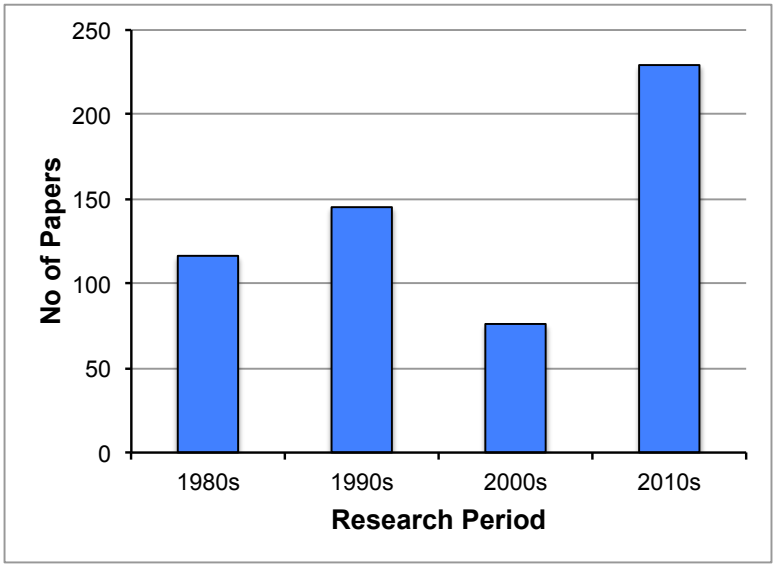


Figure 1. Number of conservation related publications relating to national parks and protected areas in Zimbabwe during the 1980s through to the current decade up to mid-2017[1].

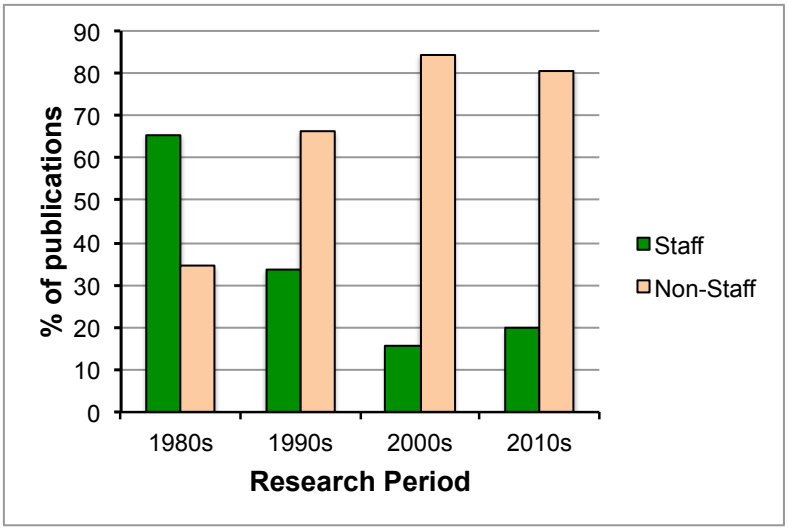


Figure 2. Proportion of publications by staff and non-staff during the period 1980 to 2017.

1/ These results (Figures 1 to 3) are based on google scholar searches for papers that included reference to the Department of National Parks and Wild Life Management and the Zimbabwe Parks and Wildlife Management Authority. The total, but incomplete, sample was 502 papers over the four decades.

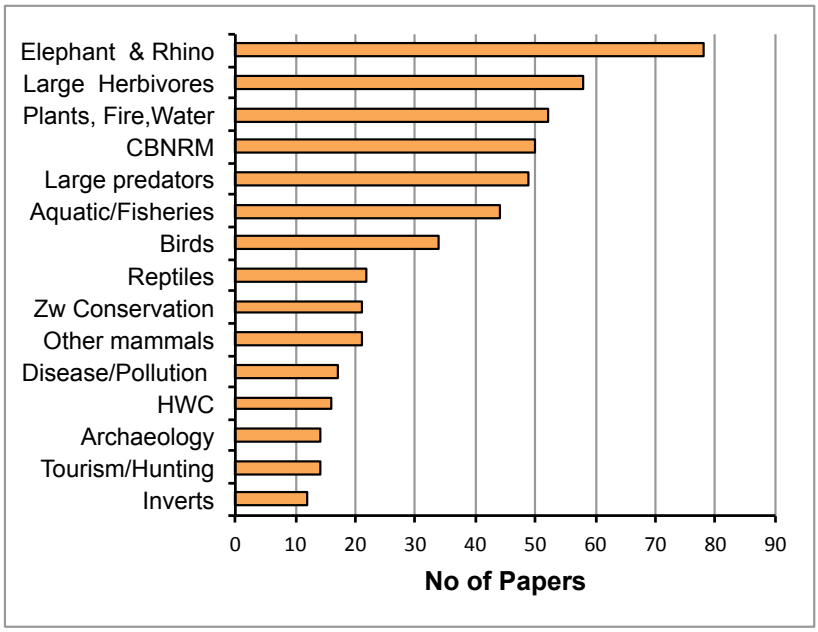


Figure 3. Distribution of published papers between 1980 and 2017 in relation to research topic or subject (Sample of 502 records from Google Scholar searches for each decade, CBNRM – Community based natural resource management, HWC – Human-wildife-Conflict)

The distribution of recent and current research permits to non-staff research projects covers a wide range of topics with an emphasis on predator research (**Fig. 4**)

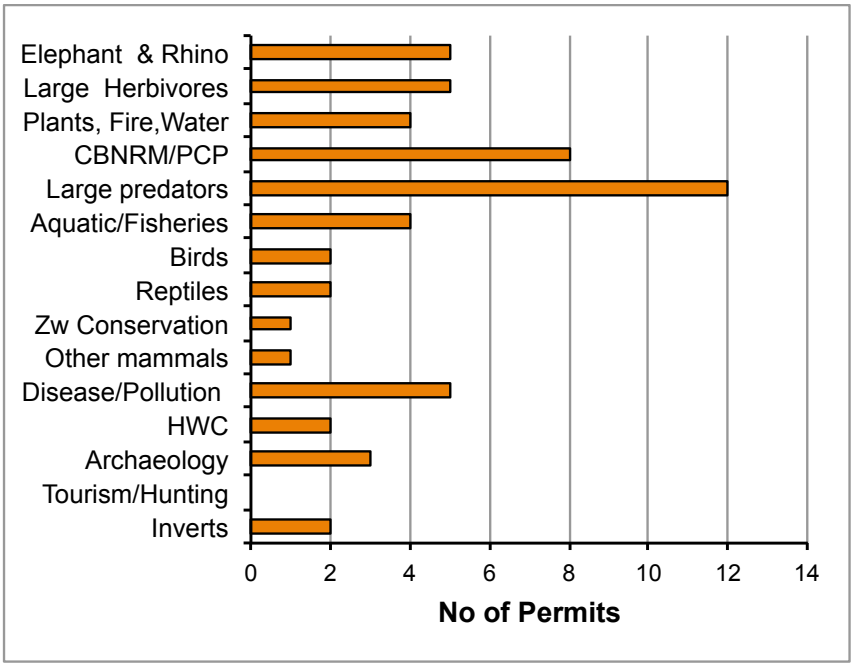


Figure 4. Distribution of the approximate number of research permits currently issued to non-staff (external) researchers. (PCP – Public Community Partnerships)

4. MAJOR WILDLIFE CONSERVATION ISSUES

Workshop participants ranked human population growth and the resulting pressures on land and natural resources as a major factor influencing the conservation of wildlife and natural resources. Combined with this was a shortage of resources, particularly funding, to tackle conservation problems. Ranked third were issues relating governance, legislation, and policy with relevance to engaging communities, landowners and the public in wildlife conservation. The importance of monitoring trends in time and space, coupled with adaptive management was also ranked as a priority requirement for effective wildlife conservation and management.

Nearly all the conservation issues identified by respondents and workshop participants reflect a need to adopt a social-ecological systems approach to research and management of protected areas and wildlife. Conservation is not just an ecological issue but is intimately bound up with peoples' values, and with the social and economic factors that influence their needs, behaviour, and approaches to conservation. The research themes developed below reflect the concerns and issues raised at the consultative workshop held at Mandel Training Centre on the 9-10 August 2017.

5. STAKEHOLDERS' VIEWS ON WILDLIFE RESEARCH PRIORITIES

In July a letter was circulated to 80+ people involved in wildlife research and conservation in Zimbabwe with a request to briefly list what they considered to be three priority topics for wildlife research in Zimbabwe and to list research in which they were involved. Responses were received from ZPWMA Ecologists and eighteen scientists in the Private/NGO sector. The responses are included in Annex 4 of the workshop proceedings.

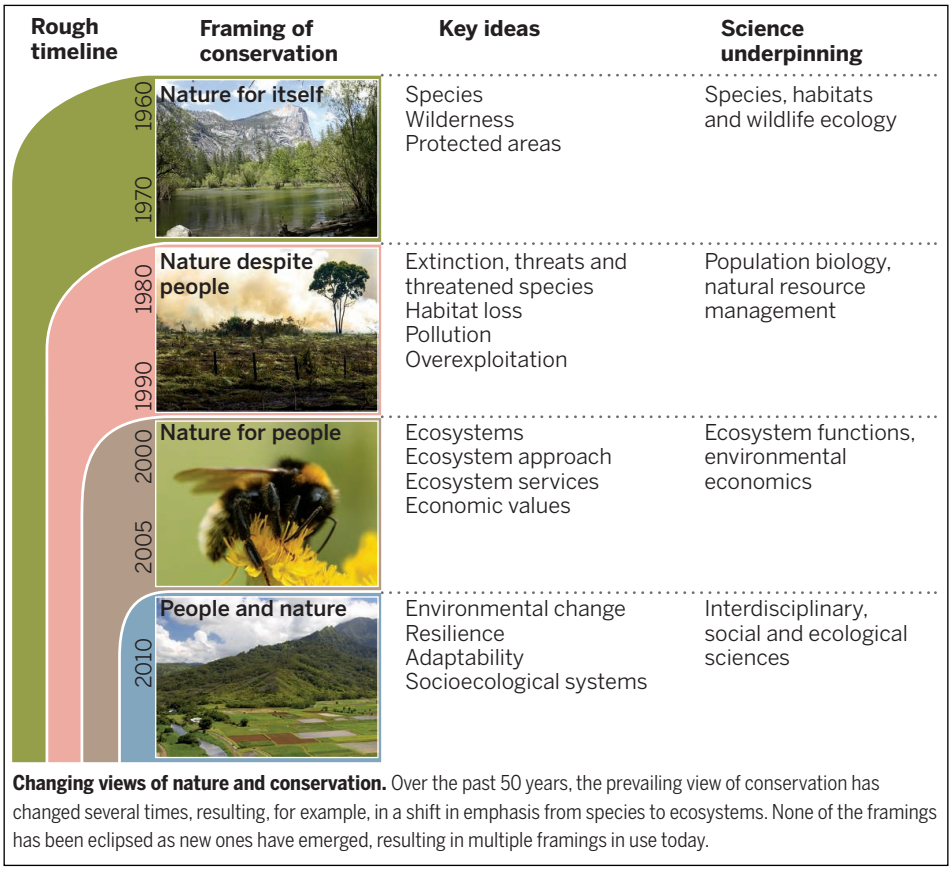
There was a strong emphasis on developing and implementing monitoring systems that covered key species, habitats, landscapes, ecological processes, and the social and economic components that are a major part of wildlife management and conservation. Monitoring was not seen as an end but as an essential component of effective adaptive management and policy formulation.

Research that recognised protected areas as components of larger landscapes and as social-ecological systems was emphasised by several respondents. The importance of research into the ecology and economics of wildlife as land use was also noted with references to CAMPFIRE, sustainable use of wildlife, and the involvement of communities that neighbour protected areas.

For the most part the research priorities proposed by respondents are accommodated within the research themes outlined below.

6. STRATEGIC DIRECTIONS, OPTIONS AND PROPOSED RESEARCH THEMES

Views of nature and approaches to conservation continue to change. Accompanying these changes are shifts 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 in a paper by Georgina Mace in the 24th Sept. 2014 issue of Science (**Figure 5**). The current focus on environmental change, adaptability, resilience and social ecological systems, and interdisciplinary / transdisciplinary approaches (Max-Neef 2005) provides a sound guide to the direction in which wildlife research in Zimbabwe and the region should move. Mace's (2014) brief paper is well supported by a very large body of research and, increasingly, of practice.



Changing views of nature and conservation. Over the past 50 years, the prevailing view of conservation has changed several times, resulting, for example, in a shift in emphasis from species to ecosystems. None of the framings has been eclipsed as new ones have emerged, resulting in multiple framings in use today.

Figure 5. Changing views of nature and conservation**.** (Source: Mace 2014)

It is increasingly being recognised that we are entering, if not within, a new geological era in which human activities and impacts are dominating the functioning of our planet. Protected areas and the biodiversity they conserve are increasingly being threatened. The following abstract from a recent paper[1] provides a succinct summary.

> "People's dominance of ecosystems is changing conservation. Issues of revenue, food security, human wellbeing, and equity dominate political decisions. Protected areas are increasingly expected to justify their existence by demonstrating that they both conserve biodiversity and provide benefits that can compete with those offered by alternative land uses. In navigating the Anthropocene, four themes are particularly important: (1) protected areas are complex social-ecological systems and must be treated as such; (2) parks are under particular pressure in the most biodiverse parts of the world, and their value and effectiveness must be rigorously demonstrated to retain political support; (3) most protected areas are not isolated landscape elements, but rather members of networks that contribute to current and future human wellbeing at a wide variety of scales; and (4) if protected areas are to offer a sustainable strategy for the future of biodiversity through the Anthropocene, we will need to periodically re-evaluate, re-negotiate, and re-envision their social and their ecological roles to ensure that they remain relevant. Enhancing protected area resilience will require recognizing and managing the spatial connections between protected areas and their surroundings; resolving the challenge of managing for biodiversity in situations of conflict and poor governance; understanding and providing for the reliance of the poor on ecosystem goods and services in times of crisis; and making people aware of the importance of protected areas for their own wellbeing."

[1]/ Cumming, G. S. (2017) The relevance and resilience of protected areas in the Anthropocene. *Anthropocene,* **13**, 45-56.

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

Long term/Overall Goal:
To contribute to the conservation of biodiversity and sustainable use of wildlife in Zimbabwe 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 Environmental Management Act, the Parks and Wild Life Act, the National Biodiversity Strategic Action Plan, and other relevant provisions;

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

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

To meet these goals and to effectively contribute to national policy objectives, the following six themes are proposed as the primary focus of a research strategy for the ZPWMA's Scientific Services Division. These themes represent broad areas of research to which partners and private researchers should be encouraged to contribute.

1. *Transparent, participatory, and inclusive conservation planning and implementation, the core of which involves systematic conservation planning at local, eco-regional and national levels.*
2. *Monitoring of, and conservation research on, threatened and keystone species, habitats, and ecological processes.*
3. *Research to enable protected areas, conservancies, and CAMPFIRE areas to function as sustainable, resilient, and integrated components of larger landscapes.*
4. *Research to support the conservation and management of wildlife on agricultural and communal lands and in transboundary ecosystems.*
5. *Natural resource use policies and decisions based on sound, science-based, information.*
6. *Build research capacity in ZPWMA and partners to meet the demands of national conservation policy*.

These strategic 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 and summarised in a two-page Objectives Tree (See **Summary and Annex 4**)

Theme 1: *Transparent, participatory, and inclusive conservation planning and implementation, the core of which involves systematic conservation planning, at local, eco-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 6 and 7** 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 trade-offs between alternative conservation options and land uses.

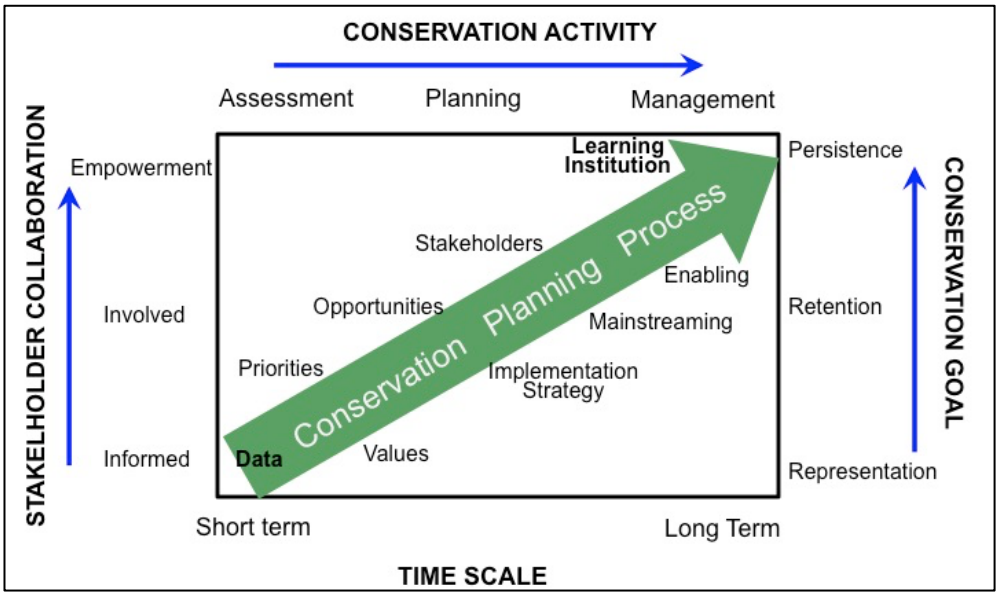


Figure 6. Summary of conservation planning processes (conservation activities, stakeholder collaboration, conservation goals) that are required at differing times and scales to deliver effective conservation action (Source: Knight, Cowling and Campbell 2006)

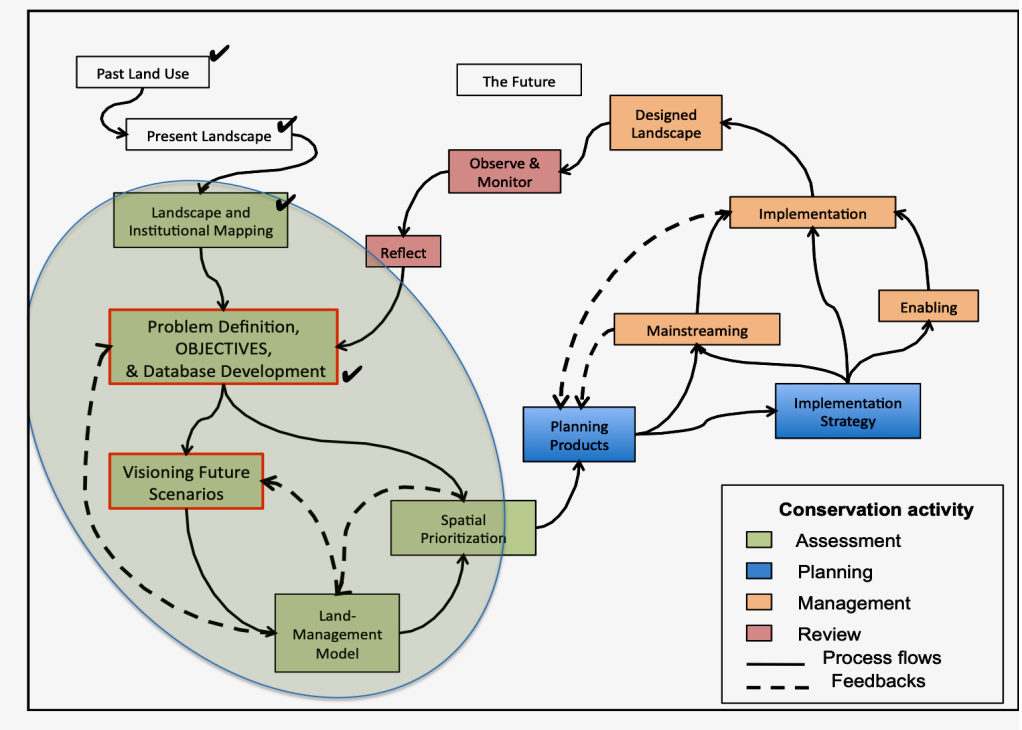


Figure 7. An operational model for conservation planning that illustrates the links between major phases of conservation planning, namely, conservation assessment, planning, management, and review of progress. Feedbacks (dashed lines) are required between stages to ensure the effectiveness of conservation 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 and monitoring of species and habitats in ecoregions that is required under the Zimbabwe NBSAP-2. (e.g. Sections 4.7.4 and 4.7.7, that deal with mainstreaming biodiversity planning and baseline information for implementation, monitoring, evaluation and reporting in NBSAP-2.)

Output #1: Activities

1. Conduct baseline species and habitat inventories for each planning area (e.g. a protected area and its neighbouring components such as in northwest Matabeleland).
2. Conduct land use and institutional mapping of target planning areas and rates of change in key land use 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[1]
4. Provide technical support to planning authorities and stakeholders on systematic conservation planning.

[1] / The Marxan programme, software for systematic conseration planning, can be used in this context. The LUCIS software introduced by SAREP in Botswana to assist in land use planning could also be used.

Indicative specific projects under this theme would include completing bird, mammal, reptile, and tree species checklist and atlases for planning areas and the country, identifying biodiversity hotspots and key ecological processes (e.g., migrations, seasonal dispersal areas, migratory bird sites) within Zimbabwe. 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, all of which would provide important information for effective conservation planning and also feed directly into Theme #2.

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

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

Risk analysis in this context can involve either the risk of losing a species because of existing conditions and likely future conditions, such as habitat loss and climate change, 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 by 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, habitats and landscapes.
2. Conduct risk analyses on vulnerable species and identify key drivers of change.
3. Surveillance and monitoring of critical wildlife diseases that could impact on species survival and monitoring wildlife health and welfare
4. Establish appropriate monitoring and response protocols (thresholds of potential concern / thresholds of acceptable change) 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 the Parks and Wild Life Act, developing thresholds of potential concern for selected priority species and habitats, risk analyses of transboundary animal diseases in transfrontier conservation areas in relation to threatened, keystone and economically important species. Trends in land use change and loss of connectivity between protected areas or of seasonal dispersal areas may also be important.

Theme #3: Research to enable protected areas, conservancies, and CAMPFIRE areas to function as sustainable, resilient, and integrated components of larger landscapes.

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

Analysing protected areas through a SES lens will help to address the legal provisions of the Zimbabwe Constitution, the Environmental Management Act and policy, and the Parks and Wildlife Act that call for decentralisation and co-management of wildlife resources. The analysis may also include resilience analysis and scenario planning (**Figure 8**) to involve a full range of stakeholders in park planning and management.

(See Walker et al 2002, Walker and Salt 2006, and 2012 on resilience analysis and Peterson et al 2003 on scenario planning in conservation).

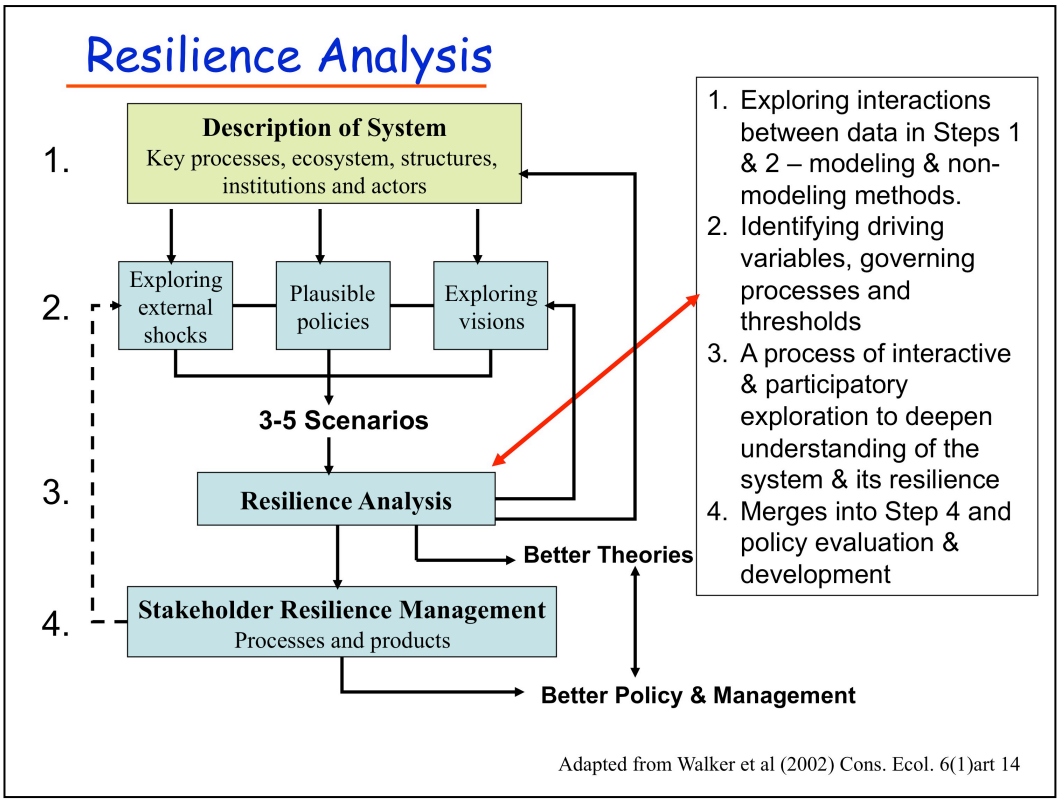


Figure 8. An outline of the resilience analysis process.

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 protected areas, conservancies, and CAMPFIRE areas.

Figure 5 indicates several specific activities involved in carrying out a resilience analysis, such as those involved in initially describing the system. Further guidance on resilience analysis can be found in Walker and Salt (2012) and in the Resilience Alliance workbooks for practitioners that are available online at http://www.resalliance.org/index.php/resilience_assessment.

Note: This theme, and output and activities, address the legal and policy directives on CBNRM and community involvement in protected areas and the provisions of CITES and CBD concerning sustainable use (See **Annex 3**).

Theme #4: *Research to support conservation and management of wildlife on agricultural land, communal land, and in transboundary ecosystems and TFCAs*

Output #4: Ecosystems and flora and fauna of importance outside the Parks and Wildlife Estate, identified and researched

Zimbabwe, by virtue of its geographical position southern Africa is bounded by Botswana, Namibia, South Africa, Zambia and Mozambique and many species of fauna and flora move across these boundaries. The country also participates in the development and management of six transfrontier conservation areas (TFCAs). Within the country there are several large conservancies and more than half the districts in the country participate in CAMPFIRE. Effective conservation and management of

these shared resources on national boundaries, and on internal land use boundaries, will benefit from coordinated and joint research and monitoring activities. In some cases, important shared resources may be problem animals, transboundary diseases, or invasive alien species. Conservation concerns may also extend to continental and intercontinental migratory species that require specific habitats or stop over refuges within Zimbabwe and require action under the provisions of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

Output #4: Activities:

1. Identify significant transboundary ecosystems (both internal and national) and species that require research inputs to support conservation and management.
2. Identify critical inter-sector conflicts constraining conservation across internal and national boundaries.
3. Conduct research into potential ways in which maintaining connectivity between protected areas may contribute to climate change adaptation, greater resiliency, and effective animal disease management across internal and transboundary landscapes.
4. Monitor status and distribution of selected species jointly with neighbouring countries and conduct joint censuses of shared populations of important species (e.g., elephants).
5. Identify and assess status of any stopover refuges for migratory bird species

Note: This theme, output and activities addresses several of the policies and objectives of the 2014 NBSAP, e.g. "Target 9: By 2020, at least 28% of Zimbabwe's terrestrial and inland water under protection, is maintained and conserved, and **protected area connectivity enhanced** through integrated resource management" (Bold added)

Theme #5: Natural resource use policies and decisions based on sound, science-based, information and valuation of ecosystem services.

Output #5: Ecological, economic, and social trade-offs 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 and provide support to wildlife-based tourism industry – both consumptive and non-consumptive.

Output #5: 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 socioeconomics of associated households and communities and businesses.

4. Conduct integrated research (ecological, economic, and social) on human-wildlife-livestock conflicts and alternative options for mitigating conflict.
5. Identify and assess major threats impacting biodiversity

Regarding human-wildlife conflict it will be important to move beyond research and analysis of direct animal-human conflict and examine and understand the wider sources of conflict (**Fig. 9**)

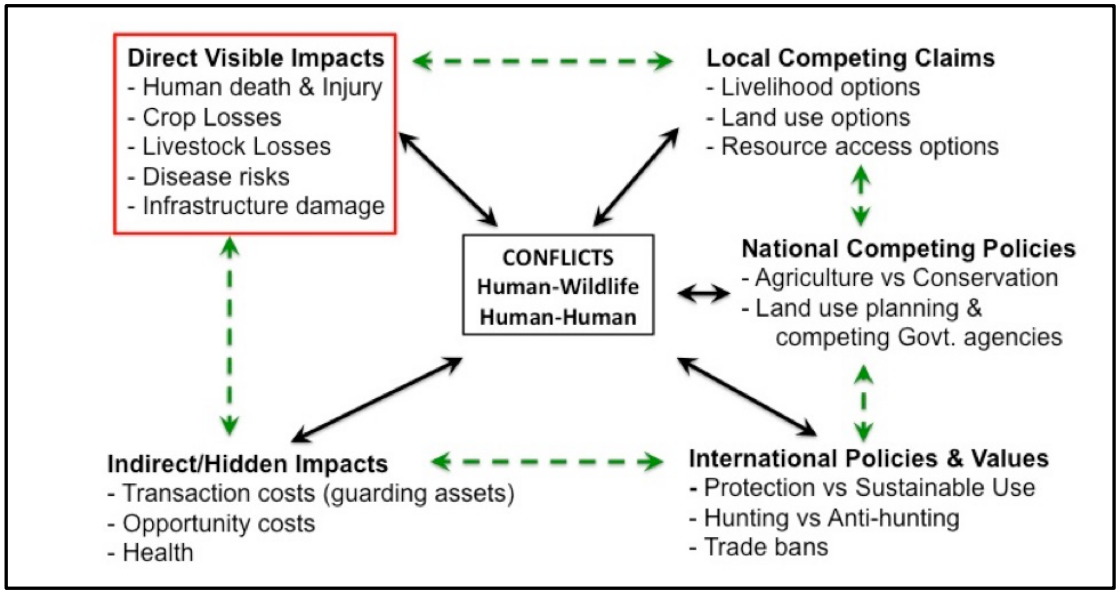


Figure 9. A wider range of interacting and competing human-wildlife conflicts issues, interests and claims.

Theme # 6: Build research capacity in ZPWMA and partners to meet the demands of national conservation policy.

Output #6 Capacity of ZPWMA's Scientific Services Division and partners to meet national research obligations established.

Three parallel developments are required.

1. To build capacity within ZPWMA to carry out research and design and implement effective monitoring programs.
2. To involve qualified and experienced staff within the department who can effectively absorb, interpret, and use the research carried out by others in the country, and elsewhere in the world, to guide conservation, natural resource management, and policy.
3. To develop a culture of treating all management activities as experiments in conservation in which actions taken and resulting impacts are recorded and monitored to establish a learning culture involving all staff within the Authority. Research and learning by doing is a responsibility across all division with the Authority and should not be limited to the Scientific Services Unit.

Output #6: 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 (local and international) and the private sector.
3. Develop incentives and guidelines that will attract private / visiting researchers to contribute meaningfully to the country's research agenda.

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ANNEX 1: GLOSSARY

Adaptive management: Adaptive management entails treating management actions and activities as experiments, monitoring the outcome and learning from the resulting impacts of those actions on the system being managed. Adaptive management can be passive or active. Active adaptive management can involve major interventions in order to learn more about system behaviour (e.g. removing fences, changing flood regimes) (Gunderson et al 2008).

Complex adaptive systems: Are typically characterised by dispersed interaction, the absence of a global controller, cross-cutting hierarchical organization, continual adaptation, perpetual novelty, and far-from-equilibrium dynamics (Arthur et al 1997, Levin 1998).

Ecoregion: In the context of Zimbabwe and this strategic plan "Ecoregion" refers to the global ecoregions defined by Olson et al (2001) and as mapped by WWF (1999) for Africa. Seven of these ecoregions occur in These are Kalahari Acacia-Baikiaea savanna, Kalahari xeric savanna, Zambezian and Mopane woodlands, Zambezian Baikiaea woodlands, Zambezian flooded grasslands, Zambezian halophytics.

Ecosystem Approach: See Annex 2.

Ecosystem services: "The conditions and processes through which natural ecosystems and the species that make them up sustain and fulfil human life" (Daily 1997), and include provisioning services (e.g. clean water, food, fibre, fuel wood, medicinal plants), regulating services (e.g. flood mitigation, water purification), supporting services (primary production, pollination), and cultural services (e.g. amenity / recreation, biodiversity, landscapes and vistas).

Resilience: The amount of change a system can undergo (its capacity to absorb disturbance) and remain in the same regime - essentially retaining the same function, structure and feedbacks (Walker and Salt 2006), and, as the ability of a system to maintain its identity in the face of internal change and external perturbations (Cumming 2011).

Social-ecological system: A fully integrated system of people and nature that includes the capacity for adaptation, learning and self-organisation.

Wildlife: As used in this strategy "Wildlife" means all indigenous animals (vertebrates and invertebrates) and plants in Zimbabwe

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ANNEX 3: 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, considering, 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 4. OBJECTIVES TREE

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

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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 provisions of Environmental Management Act, the Parks and Wild Life Act, and the 2015 National Biodiversity Action Plan and other relevant provisions

(b) Focus and coordinate wildlife research and monitoring in Zimbabwe on key wildlife conservation and management issues, and

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

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Theme 1 *Transparent, participatory, and inclusive systematic conservation planning and implementation at local, ecoregional and national levels*	***Theme 2*** *Monitoring of, and conservation research on, threatened and keystone species, habitats, landscapes, and processes*	***Theme 3*** *Research to enable protected areas, conservancies and CAMPFIRE areas to function as sustainable, resilient and integrated components of larger landscapes*	***Theme 4*** *Research to support conservation and management of wildlife on agricultural land, communal land and in transboundary conservation areas*	***Theme 5*** Natural resource use policies and decisions are based on sound scientific information and evidence	***Theme 6*** *Build research capacity in ZPWMA and partners to meet demands of national conservation policy*
Output #1 Systematic conservation planning processes at national, regional and local levels facilitated	**Output #2** Monitoring, research and risk analyses for endangered, endemic, and keystone species and habitats conducted	**Output #3** Resilience and sustainability of protected areas as social-ecological systems (SES) investigated and assessed	**Output #5** Ecosystems and flora and fauna of importance outside the Parks & Wildlife Estate identified and researched to achieve sustainable use	Output #5 Ecological, economic, and social tradeoffs between alternative land and natural resource uses fully researched	**Output #5** Capacity of ZPWMA Scientific Services UNit to meet national research obligations established

Illustrative examples of activities for each theme/output are shown below.

Examples of activities under each Theme/Output

Output #1	Output #2	Output #3	Output #4	Output #5	Output #6
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 systematic conservation assessments, e.g. - Problem definition - Objectives - Spatial databases (GIS) - Alternative land use scenarios - Land management model - Spatial and biodiversity 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 habitats 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 4. Develop Key Performance Indicators for the conservation activities and species involved	**Activities**: 1. Conduct resilience analyses of protected areas. Conservancies and CAMPFIRE areas involving key stakeholders and explore alternative plausible futures for the protected areas and their neighbouring areas 2. Explore the potential for developing adaptive co-management arrangements for each area (**Note:** this theme, and output and activities, address provisions in the Constitution, EMA and PWL Act, NBSAP, and policy directives on CBNRM and community involvement in protected areas, and SADC protocols on TFCAs, and the CBD)	**Activities**: 1. Identify significant areas and ecosystems and species populations outside the Parks & Wildlife Estate that require research inputs to support their conservation and sustainable management. 2. Monitor status and distribution of selected species jointly with land occupiers and neighbouring countries. 3. Conduct joint censuses of shared populations across internal and national boundaries of important species (e.g., elephants). 4. Identify and assess status of stopover refuges for migratory bird species	**Activities:** 1. Identify areas/regions of land and natural resource use conflicts that are impacting on biodiversity 2. Conduct EIAs / SEAs and related analyses of tradeoffs to inform land and natural resource use decisions 3. Monitor impacts of land and natural resource use, and conservation decisions on biodiversity and socio-economics of associated landowners, households, and communities 4. Conduct integrated research (ecological, economic, social) on human-wildlife conflicts at the wildlife-livestock interface, and on options for mitigating conflict 5. Identify and assess major threats impacting biodiversity	**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, International 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 scenario planning, 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