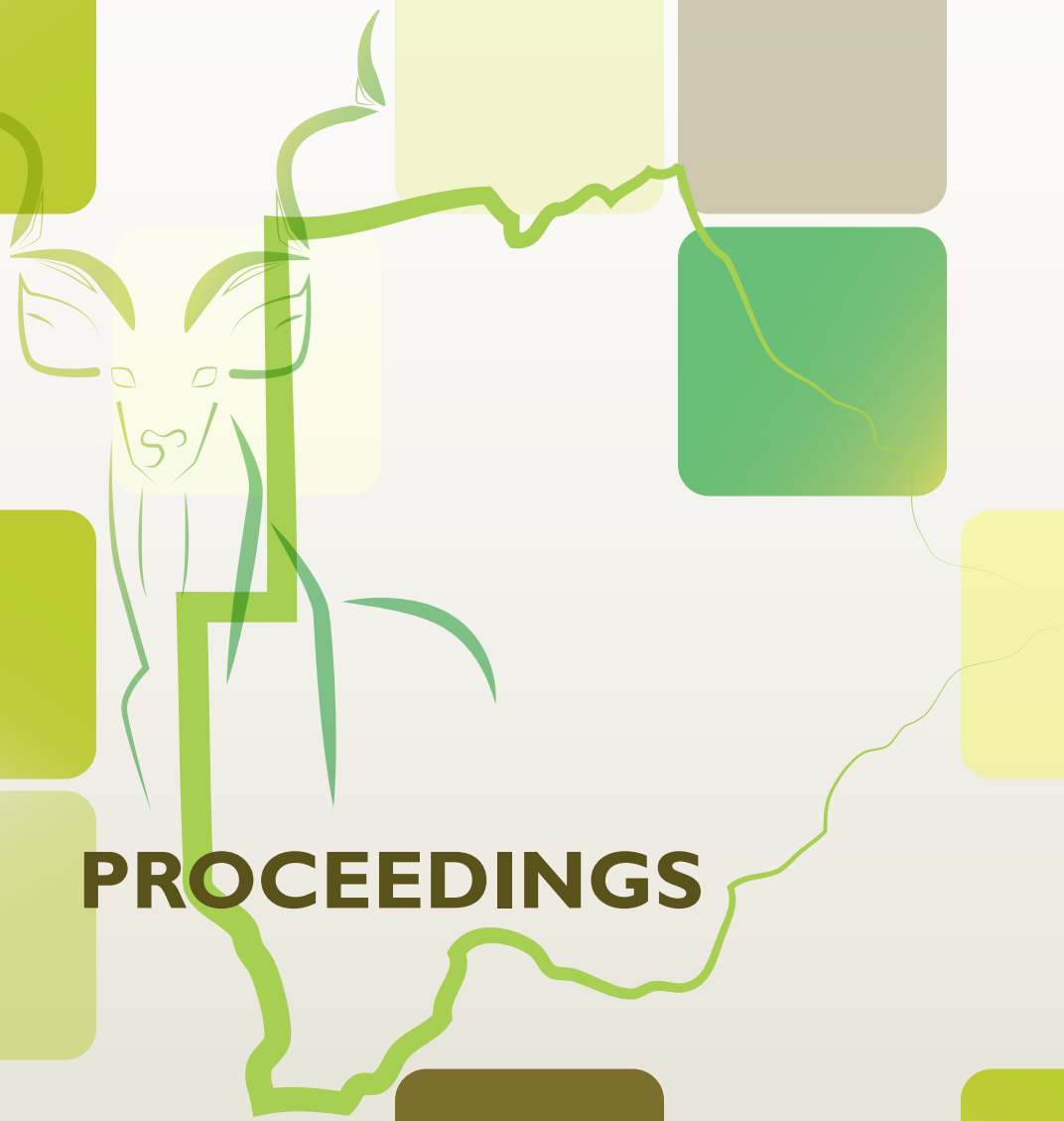
# BOTSWANA WILDLIFE RESEARCH SYMPOSIUM

*"Bridging the Gap between Conservation Science and Management"*

Botswana Wildlife Training Institute, Maun, Botswana

4-6 February 2014



# PROCEEDINGS

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## Abbreviations

| | |
|---|---|
| AHEAD | Animal & Human Health for the Environment And Development |
| BOCOBONET | Botswana Community Based Organisation Network |
| BOTA | Botswana Training Authority |
| BPCT | Botswana Predator Conservation Trust |
| BPM | Bird Population Monitoring |
| BTB | Bovine Tuberculosis |
| BWTI | Botswana Wildlife Training Institute |
| CARACAL | Centre for African Resource: Animals, Communities and Land Use |
| CBD | Convention on Biological Diversity |
| CBNRM | Community Based Natural Resource Management |
| CBO | Community Based Organisation |
| CBT | Commodity Based Trade |
| CCB | Cheetah Conservation Botswana |
| CKGR | Central Kalahari Game Reserve |
| CNP | Chobe National Park |
| DWNP | Department of Wildlife and National Parks |
| FMD | Foot and Mouth Disease |
| GoB | Government of Botswana |
| GIS | Geographic Information Systems |
| GMTFCA | Greater Mapungubwe TFCA |
| HEC | Human-Elephant Conflict |
| HWC | Human-Wildlife Conflict |
| KAZA | Kavango Zambezi |
| KCS | Kalahari Conservation Society |
| KTP | Kgalagadi Transfrontier Park |
| KWS | Kenya Wildlife Service |
| LEC | Leopard Ecology and Conservation |
| LSGD | Livestock Guarding Dog |
| LUCIS | Land Use Conflict Identification Strategy |
| MEWT | Ministry of Environment, Wildlife and Tourism |
| MOMS | Management Oriented Monitoring System |
| NGO | Non Governmental Organisation |
| NP | National Park |
| OKACOM | Permanent Okavango River Basin Water Commission |
| ORI | Okavango Research Institute |
| PA | Protected Area |
| PS | Permanent Secretary |
| RVF | Rift Valley Fever |
| SADC | Southern African Development Community |
| SANParks | South African National Parks |
| SAREP | Southern African Regional Environmental Programme |
| SASSCAL | Southern African Science Service Centre for Climate Change and Adaptive Land Use |
| SSF | Small-Scale Fisheries |
| TAD | Transboundary Animal Disease |
| TFCA | Transfrontier Conservation Area |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| USAID | United States Agency for International Development |
| WB | World Bank |

WCS Wildlife Conservation Society
WITS Witwatersrand
WMA Wildlife Management Area
WWF World Wildlife Fund

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# 1. Introduction & Background

The Ministry of Environment, Wildlife and Tourism (MEWT) through the Department of Wildlife and National Parks (DWNP) is mandated to conserve and manage the country's wildlife resources. An important aspect of fulfilling this function is for DWNP to support decision making processes by enabling, conducting and coordinating scientific research which leads to effective management and conservation of Botswana's wildlife and its habitats. Without research, there is no objective way to detect conservation challenges, evaluate the success of management actions or determine if management objectives are being achieved. The department acknowledges that given its limited financial and human resources, the role of independent researchers is of vital importance to its overall agenda while the internal Research Division focuses on monitoring and applied research. It also acknowledges through the organization of this Symposium and other similar fora in the past, that it is important to create opportunities for conservationists, conservation area managers and researchers alike to meet, share information and ideas, and collaboratively seek solutions to existing challenges.

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It is in this context that MEWT through DWNP organised the **Botswana Wildlife Research Symposium** hosted at the **Botswana Wildlife Training Institute** (BWTI) in Maun from **4-6 February 2014.** DWNP hopes to make this symposium an annual event – one that provides an opportunity for conservationists, managers and researchers to collectively reflect on the state of information, gaps, challenges and debate possible solutions, hence the running theme, "bridging the gap between conservation science and management". BWRS 2014 was supported through funds and in-kind contributions provided by the World Bank (WB), United Nations Development Programme (UNDP) of Botswana, United States Agency for International Development (USAID), Wildlife Conservation Society's (WCS) Animal & Human Health for the Environment And Development (AHEAD) Programme, Wilderness Safaris, Okavango Research Institute (ORI) and Tlhare Segolo Foundation.

The three day Symposium allowed an overview of the research currently being conducted in Botswana under the following themes:

i. Wildlife Monitoring
ii. Community Based Natural Resource Management (CBNRM)
iii. Human-Wildlife Conflict
iv. Human-Livestock-Wildlife Interface Issues
v. Transboundary Conservation
vi. Critical Management Issues

A concluding workshop session offered insight into current conservation priorities, research and monitoring needs, and climate change implications for (i) biodiversity conservation, (ii) CBNRM and tourism, and (iii) Human-Wildlife Conflict. These Proceedings provide an overview of the various sessions and are in no way meant to be an exhaustive account of the research presented and ensuing discussions.

## 2. Opening Session

Permanent Secretary (PS) of the Ministry of Environment, Wildlife and Tourism (MEWT), Mr Neil Fitt officially opened the Symposium. In his speech he affirmed the Ministry's commitment towards informed decision making and stakeholder engagement through platforms such as the Symposium. He emphasised the need for accurate and reliable baseline data to be collected from conservation areas and be made available to MEWT so as to adequately inform policies and decisions emanating from the Ministry. PS Fitt explained that the recently introduced prohibition on commercial hunting in all open areas was based on information presented to the government indicating that many wildlife species are in decline across the country. Other management strategies such as the provision of artificial watering points within and outside Protected Areas (PAs), the translocation of problem animals especially predators, and the promotion of non-consumptive use of wildlife resources, are also informed by data collected in the field.

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PS Fitt acknowledged the importance of recognising that many natural resources extend across international borders, thus necessitating the need for transboundary collaboration and management of those resources. In this respect, he acknowledged the participation of the Southern African Regional Environmental Programme (SAREP), Wildlife Conservation Society's Animal & Human Health for the Environment And Development Programme (WCS-AHEAD), the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA) and the Greater Mapungubwe Transfrontier Conservation Area (GMTFCA) at the Symposium.

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Ms Shirley Atkinson, speaking on behalf of the WCS-AHEAD Programme, emphasised the role of strong partnerships amongst those working on the frontlines of wildlife conservation and between the wildlife and livestock sectors. She highlighted how conventional geographic zonation-based approaches (fences) to managing the transmission of transboundary animal diseases (TADs) such as foot and mouth disease (FMD) have been seen to negatively impact not only access of the livestock sector to international markets, thus having catastrophic affects for local livelihoods, but also wildlife by preventing migration due to the presence of fences. Therefore, partnerships and dialogue between traditionally competing sectors such as livestock and wildlife are vital to re-evaluate the means to manage such risks in ways that are positive for both the livestock and wildlife sectors, especially since both sectors are important contributors to the country's Gross Domestic Product.

Dr Lare Sisay from UNDP reiterated the critical role of scientific research in decision making. In supporting Botswana's implementation of its Multilateral Environmental Agreements such as the UN Convention on Biological Diversity (CBD), UNDP recently committed over US$ 300,000 to the review and update of the National Biodiversity Strategy and Action Plan to integrate the Aichi Targets in line with the CBD Strategic Plan for 2011-2020. A sum of US$ 2 million is also committed to support the Government of Botswana (GoB) in the implementation of CBD goals, and a further US$ 1.8 million towards the co-management of the Chobe National Park and Forest Reserves in the Chobe area. Dr Sisay indicated that co-management of such areas with non-governmental entities such as communities, civil society and the private sector is promoted as a more effective means of managing PAs and to expand the benefits of conservation.

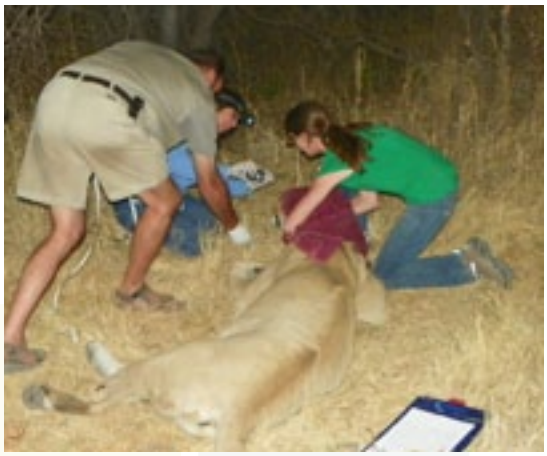
Mr Kai Collins of Wilderness Safaris explained how the company spent over P6.7 million on conservation in the past financial year, over half of which was spent in Botswana. He highlighted that the company is working hard to increase its conservation footprint which currently covers 3.1 million hectares touching nine biomes stretching across nine African countries including five centres of endemism. The Wilderness Wildlife Trust (an independent entity established in the late 1980s supported by the Wilderness Group) has supported over 30 research and conservation projects in Botswana.

Dr Oduetse Koboto, Director of DWNP, wrapped up the opening session by thanking all partner organisations with whose support the Symposium was planned, funded and implemented.

## 3. Wildlife Monitoring

The wildlife monitoring session was chaired by Mr Boat Modukanele of the UNDP-UNEP Poverty Environment Initiative. The session began with a presentation by Mr Edwin Mudongo from DWNP who noted that the Kgalagadi is of significant conservation importance given its network of adjoining Wildlife Management Areas (WMAs), providing key functional habitat heterogeneity that the Kgalagadi Transfontier Park (KTP) alone cannot provide. Historically, large populations of migratory species moved between the KTP, the Central Kalahari Game Reserve (CKGR) and the Makgadikgadi. This migration was severed by the erection of cordon fences such as Kuke and the loss of wildlife habitat to other land uses such as livestock agriculture. An increase in livestock agriculture in the Kgalagadi area, compounded by an increase in the number of boreholes to allow for this land use, was put forward by Mr Mudongo as one reason for the decline in wildlife populations in the area. Plenary discussions highlighted the intense pressure that currently exists to convert land in the Kgalagadi to uses other than conservation and wildlife. Furthermore, the contributing role of improper land use planning in exacerbating Human-Wildlife Conflict (HWC) was mentioned, as often the ecological and resource needs of wildlife are not considered when land use is being planned. DWNP informed that they are aware of these challenges and are working closely with relevant authorities such as Ministry of Lands and Housing and local land boards to improve integrated land use planning.

The presentation by Dr Krystyna Golabek of Botswana Predator Conservation Trust (BPCT) highlighted the importance of predator monitoring as predators are known ecosystem regulators, indicators of ecosystem perturbation and important contributors to HWC. They also contribute significantly to the nation's tourism product. Using focal studies of sample populations, Dr Golabek reported that wild dog data recorded since 1989 in the Moremi area and surrounding WMAs demonstrated healthy fluctuations in the number of dogs in packs between 1991 and 2012. She presented a model developed to consider predictors of recruitment success which indicated parental age and total rainfall to be positively related to the proportion of pups surviving to one year, while denning temperature and wet season duration were negatively related.



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A large carnivore study presented by Dr Glyn Maude of Kalahari Research and Conservation found that the number of lions in the KTP has increased over time. The presentation by Mr Christaan Winterbach of Tau Consultants depicted a decline in lion prey between 1997 and 2007 in NG29 and NG30 of the Okavango Delta. This could be related to vegetation changes where grassland has given way to sedges which are not favoured by herbivores. He explained that these vegetation changes are likely to have been induced by floods and changes in the floodplain.

Climate change impacts for the region predict an up to 3°C increase in temperature in southern Africa including Botswana, with up to an extra 120 days per year that can be classified as very hot (i.e. over 35°C), an increase in the number of extreme events and general

increase in aridity of the region. These factors are likely to impact wildlife as well, constraining the way in which they move. In his presentation, Dr Barend Erasmus of the University of the Witwatersrand (WITS) pointed out that the choices an animal makes, affects its internal state (body temperature) which in turn affects where it can move. A study is currently underway by WITS University tagging gemsbok in the CKGR and gemsbok and wildebeest in the Schwelle area in the Kgalagadi with internal movement and temperature loggers to understand how herbivores adapt their movement patterns in response to climate change.

A point was made in plenary that currently, most wildlife research is carried out by radio collaring or tagging wild animals and that there is a need for greater accountability in this process to avoid abuse. One way to do so, would be to develop a database linking collared animals to research groups/individuals and their respective projects.

Dr Kabelo Senyatso of BirdLife Botswana presented that Botswana has close to 600 bird species, of which 30 are globally threatened. The country is amongst the world's 50 most bird diverse states. Dr Senyatso noted that BirdLife Botswana's Bird Population Monitoring (BPM) scheme currently covers the country with at least 400 transects, allowing bird data to be collected annually, recording species trends, including common species which are often overlooked. BPM offers scientifically credible data which may have multiple uses for often unforeseen purposes. However, effectiveness of the programme has thus far been constrained by relatively few volunteers, inadequate species identification skills, low public awareness, funding, and uneven coverage of the different districts.

## 4. Community Based Natural Resource Management (CBNRM)

The CBNRM session was chaired by Mr Monametsi Sokwe of the Ngamiland Council of NGOs. Mr Felix Monggae of Kalahari Conservation Society (KCS) first provided an overview of CBNRM in Botswana. His presentation revealed that as of 2009, 105 Community Based Organisations (CBOs) were registered country-wide comprising 150 villages in 10 districts and representing more than 135,000 people. Of these CBOs however, only 39% could be considered to be operating actively. Mr Monggae argued that while the CBNRM programme has over the years contributed positively to local livelihoods, it is hindered by a number of constraints (Box 1). This was supported by the presentation made by Dr Naomi Moswete of University of Botswana on community involvement in CBNRM-based tourism and support for the KTP. She found that in the Kgalagadi region, only a few CBO members actually take part in decision making; management of finances; and tourism which results in disparate benefit distribution within communities.

**BOX 1: Constraints to CBNRM in Botswana include (Monggae):**

- Misappropriation of funds
- Discouraged practitioners
- Elite capture
- Succession crises
- Lack of understanding/shifting communities
- Dishonest brokers
- Lack/poor facilitation
- Disjointed advice
- Lack of accountability
- Lack-lustre interest
- Monopolisation of benefits
- Focus on consumptive use for over 20 years
- Prohibitive to broad stakeholder participation
- Top down approach resulting in a lack of consultation and transparency

Despite the positive contribution of CBNRM to local livelihoods, Mr Monggae cautioned that if the following aspects of the programme were not strengthened on a priority basis, further negative gains could result from the programme:

- Capacity and governance
- Policy and legislation
- Institutional framework
- Generating and managing benefits

He went on to state that while the CBNRM Policy of 2007 advocates for community empowerment this has not taken place in practice as evidenced by the increasingly centralised control of the programme by the GoB. Furthermore, policies are only statements of intent and are not legally binding. As such, Mr Monggae urged that the existing CBNRM policy needs to be reviewed, clarifying the roles of different stakeholders including NGOs, and limiting the role of government to regulation and creation of an

enabling environment. The policy also needs to be legally backed through an Act of Parliament. He further highlighted that the lack of an institution dedicated solely to the advancement of the CBNRM programme, as is found in other countries, is a serious hindrance, especially since the Botswana Community Based Organisation Network (BOCOBONET) is currently a defunct body. Mr Monggae also recommended outsourcing training in business development to address the capacity deficiency in this regard which would also maintain and enhance the interest of the private sector.

**BOX 2: Private sector contribution in CBNRM and tourism initiatives (Snyman):**

- Investment in conservation initiatives
- Technological advancements e.g. solar projects
- Environmental education – e.g. Children in the Wilderness programme
- HWC mitigation education
- Encourage investment in local infrastructure
- Establish mentorships, internships & scholarship programmes
- Socio-economic & other financial benefits through wages, lease fees, taxes, etc.

The presentation by Dr Susan Snyman of Wilderness Safaris demonstrated that private sector investments (in this case Wilderness Safaris) into local communities can impact positively (Box 2) on socio-economic development, helping to reduce poverty levels; increase expenditure on education; increase the amount of money committed to dependents and savings; and reduce expenditure on loans.

© S.Snyman

Dr Joseph Mbaiwa of ORI presented on the importance of wetlands to local livelihoods noting that they provide resource rich areas in the otherwise dry lands of Africa. Ngamiland District is home to the Okavango Delta, which has over 122,000 inhabitants and is recognised as a Wetland of International Importance, a Ramsar site and a renowned tourism destination. However, the area is also characterised by high levels of poverty (50-60% in Western Okavango) and conflict among different land users. Land use activities in the Delta include livestock agriculture; subsistence crop farming; subsistence gatherers; subsistence, commercial and sport fishing; tourism development; wildlife management and CBNRM; wildlife disease control; and water abstraction. Dr Mbaiwa argued that tourism in the Delta has not benefited local communities in any significant way and benefits from CBNRM are also declining, resulting in negative attitudes towards tourism development and wildlife and conservation as a land use. This is likely to increase conflict. The sense of frustration and lack of ownership has been enhanced by the inability of local communities to participate in decision making processes, which could also lead to poaching. Dr Mbaiwa argued that trophy hunting in the Okavango Delta was limited to peripheral areas which are not viable for photographic tourism. However, the prohibition on hunting is now driving communities in these previously non-viable areas to convert to photographic tourism. Given that many CBOs' benefits have in the past been skewed towards consumptive use, the impact of the hunting prohibition on the programme is a cause for concern. This sentiment was shared and expressed repeatedly by participants through the course of the Symposium.

Ms Malebogo Sentsho of DWNP presented on MOMS or the Management Oriented Monitoring System which was originally developed in Namibia for use by conservancies as a logical means of implementing adaptive management and enabling communities to become actively involved in natural resource monitoring. Its key facet is that it allows information to be collected in a user-friendly, simple and practical

manner at the local level. Ms Sentsho explained that MOMS was introduced by DWNP in Botswana in 2004 and is currently used in all game reserves, national parks and other DWNP stations. Several CBOs in the country including Khwai, Sankuyo and Mababe use MOMS and with support from the Southern African Science Service Centre for Climate Change and Adaptive Land Use (SASSCAL) and the WB. This is being rolled out to other CBOs. A MOMS training module has also been developed for BWTI through BirdLife Botswana. She noted that World Wildlife Fund (WWF) funds have been used to develop a MOMS database, while SAREP is funding the development of a website for all concessionaires. Ms Sentsho reported on the challenges to MOMS, including a high turnover of trained facilitators at DWNP, lack of transport, insufficient patrols and maintenance of community motivation by involving them in decision making.

## 5. Human-Wildlife Conflict

The session on Human-Wildlife Conflict (HWC) was chaired by Dr Kate Evans of Elephants for Africa. Presentations in this session emphasised the complexity of HWC which, in order to be addressed at all levels, requires both its symptoms and underlying causes to be understood. Mitigation of HWC requires a "tool-box" of measures to draw upon, utilising a combination of approaches that are cost effective, multi-disciplinary, have a minimal negative impact on the environment, are effective in the long term and are able to selectively target problem animals. However, different potential solutions often have associated obstacles to their utilisation, which may relate to local perceptions, resource limitations and unexpected behaviour. Presentations made in this session, and in fact throughout the Symposium, reiterated the need to collect accurate data on HWC and avoid discrepancies between DWNP data and that collected by independent researchers.

### Human-Predator Conflict

The presentation by Mr Phale Phale Kgotla and Ms Jane Horgan from Cheetah Conservation Botswana (CCB) reported that while kraaling livestock at night offers one mitigation method against predation-related conflict, challenges to implementing this include a lack of financial resources to build appropriate kraals; lack of staff to round up the livestock; traditional beliefs that kraaling results in loss of livestock condition; and a preference that livestock graze at night rather than during the day. Their Livestock Guarding Dog (LSGD) study interestingly revealed that Tswana dogs are more effective at guarding livestock than traditionally preferred Anatolian Shepherd dogs; small dogs are as effective as large ones; and even non-effective guard dogs improve tolerance towards predators and reduce the level of lethal control used by farmers.

© Cheetah Conservation Botswana

Dr Stephen Henley and Dr Monika Schiess-Meier from Leopard Ecology and Conservation (LEC) presented research indicating that fencing was not an effective mitigation method in reducing livestock predation by leopards or lions in the Khutse Game Reserve, possibly due to other drivers. However, culling did reduce livestock predation by lions in the same area. The prohibition on hunting recently instituted, is likely to have an impact on human-predator conflict response.

Translocation of problem animals is often used as a management strategy to mitigate HWC. The strategy aims to reduce the threat to livestock or humans posed by the wild animal while still keeping the animal alive. It simultaneously aims to reduce the potentially lethal threat to the wild animal which it would otherwise face by continuing to raid crops or livestock and thus be in danger of being killed by the affected human population. Several presentations showed data, albeit some of it preliminary, that depicted the limited efficacy of this strategy. Dr Maude presented preliminary data from collaring and translocating a number of lions which later moved out of the PA to which they were relocated and continued to prey on livestock.

Mr Kgotla and Ms Horgan recounted that translocation of cheetah had borne little success with 20 out of 23 translocated cheetah dying within a few months of the operation. Dr Henley and Dr Schiess-Meier's results demonstrated that translocated leopards often continue to move outside of the PA to which they are translocated and raid livestock. Plenary discussions raised the point that the criteria for translocation exercises needs to be considered and reviewed in more detail, which could be achieved through collaboration between DWNP and independent researchers.

### Human-Elephant Conflict (HEC)

Mr Malvern Karidozo of Elephant Pepper Development Trust highlighted in his presentation that HEC mitigation often bears limited results due to the ability of elephants to habituate quickly to the measures, learning to avoid or ignore them. Additionally, methods may be expensive, dangerous or complicated, requiring expert staff or specialised equipment. They may be labour intensive, raising maintenance concerns or highly disruptive to the social dynamics of the species. In order for HEC to be managed successfully in the long term, support is required from all levels of government with supportive policy and legal frameworks in place and a strong element of local participation.

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Mr Karidozo went on to report that capsicum-based elephant deterrents such as chilli fences and chilli bricks are yielding positive results if administered effectively. He dispelled the common fallacy that HEC can be totally eliminated, that there can be a "one size fits all" counter measure; that the intensity of HEC is directly proportional to the size of the population; or that elephants are the most serious pest species. For her part, Dr Lucy King from Save the Elephants presented work on trials being conducted with beehive fences to protect farms in Botswana, Mozambique, Tanzania and Uganda. These trials exploit the behavioural reactions of the species to the sound and presence of bees, resulting from the fact that an elephant's ears, eyes and trunks are sensitive to bee stings. Beehive fences are used on fields furthest away from a village as a first line of defence. Besides protecting fields from crop damage, this technique allows local communities to produce products such as honey and wax candles for household use or sale. The trials, although quite small-scale at the moment, are also engaging more women at the household level.

The Okavango Panhandle has approximately equal populations of humans and elephants, numbering around 15,000 each. Research conducted by Dr Anna Songhurst of EcoExist has found that this elephant population is increasing at a rate higher than the expected maximum rate of increase lending the need for a better understanding of the drivers for the migration of elephants into this area. Elephant movements are seen to be strongly influenced by human habitat modifications which has implications for micro-level land use planning. Hence the data collected by Dr Songhurst and EcoExist is currently being fed into a GIS mapping model adopted by SAREP and the Tawana Land Board with the aim of preventing further conflict instigated by inadequate land use planning. Certain fields were found to be more vulnerable to crop-raiding than others, implying that mitigation measures should target these high risk fields.

## 6. Human-Livestock-Wildlife Interface

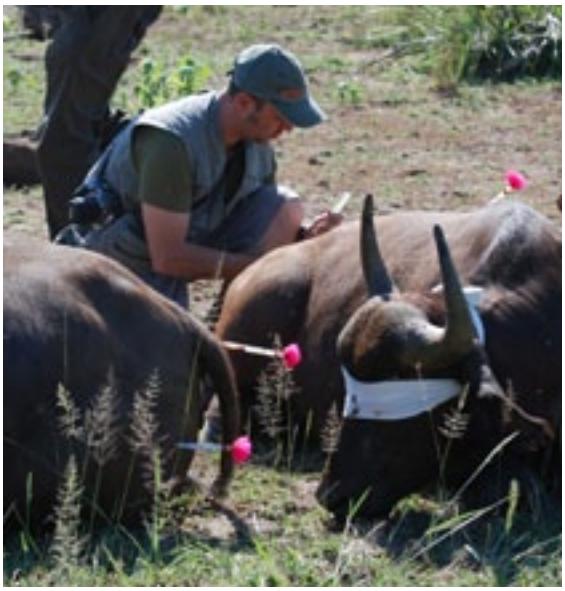
This session was chaired by Dr Mokganedi Mokopasetso of the WCS-AHEAD programme. The interface between anthropogenic activities, domestic livestock and wildlife is a critical one for health and livelihood issues. Dr Kathleen Alexander from CARACAL highlighted in her presentation that disease transmission at this interface is driven by a variety of interdependent drivers that vary across space and time influencing and influenced by the host, the pathogen and environmental characteristics. Due to this complexity, a better understanding of the issues at the interface requires a multi-disciplinary approach and inter-sectoral dialogue.

Studies presented by Dr Alexander exemplified the impact of anthropogenic activities on behaviour and health at the interface. She showed that banded mongoose troops found utilising human waste display higher rates of aggression and an increased incidence of tuberculosis. She also reported that humans prefer buffalo as a source of bushmeat but that traditional practises of processing its meat could change patterns of exposure and infection risk to communicable diseases such as Brucellosis. Dr Alexander further noted that climate change is likely to worsen the public health threat of diarrheal disease in Botswana given that diarrhoea prevalence is greater in the dry season by 20%.

Dr Mmadi Reuben of DWNP argued that there are only a few wildlife species that make any significant epidemiological contribution to domestic animal diseases despite the common misconception amongst farmers that disease is always transmitted from wildlife to livestock and then to humans. He stated that disease management needs to be socially, scientifically, politically, and economically viable and acceptable. For this, a One-Health approach is relevant and necessary. He also described several challenges related to the management of transboundary animal diseases (TADs) including:

- Lack of sound epidemiological data
- Difficulty in harvesting good wildlife diagnostic samples
- Lack of local and regional diagnostic facilities
- Lack of a national wildlife disease surveillance plan
- Expense of wildlife disease surveillance

Dr Ferran Jori from CIRAD presented preliminary baseline data and confirmed evidence that three zoonotic diseases (Bovine Tuberculosis [BTB], Brucellosis and Rift Valley Fever [RVF]) do occur in wildlife and/or cattle at the interface in Botswana's component of the KAZA TFCA (Okavango Delta and Chobe National Park [CNP]). As a serious emerging disease, RVF requires further investigation. Similarly, given the absence of fences around CNP, the circulation of BTB in cattle has the potential to spill-over into the wildlife population as it has in other parts of the region, and thus requires further study and action.



© F.Jori

There was recognition during plenary that endemic diseases are a critical part of biodiversity and therefore careful consideration must be given by managers as to whether they are seeking to eliminate or control these diseases and what the knock-on effects from such management strategies could be.

Dr Mokopasetso's presentation highlighted that transfrontier conservation areas (TFCAs) are sites that epitomise the challenges that lie at the interface. SADC Member States have invested millions of hectares to TFCA development with the principal aims of conserving biodiversity whilst enhancing opportunities for socio-economic development and promoting a culture of peace and cooperation. While wildlife, through nature-based tourism, offers the region a comparative global advantage, livestock bears considerable cultural and traditional significance, contributing to local economies. The conundrum policy makers face is that the TFCA concept promotes the free movement of wildlife over large geographic areas, whereas the conventional approach to animal disease control in southern Africa is based on the separation of wildlife and domestic livestock populations (to protect livestock from diseases maintained and spread by wildlife). Successfully integrating these two competing land uses, both of which carry measurable economic value in the region, will be essential if rural development and large scale conservation initiatives are to succeed in the long term.

Dr Mokopasetso stressed that it is in this context that the management of animal diseases at the interface has become a policy issue with implications for livestock production, associated access to export markets and other sectors in the region, including public health. Foot and mouth disease (FMD) is of particular importance in the sub-region bearing incredible economic impact. Dr Reuben's presentation informed that buffalo serve as reservoir hosts for certain FMD serotypes with high risk areas being just south of the buffalo fence and along the Botswana/Zimbabwe border. Conditions in Botswana are considered good for FMD outbreaks with regards to the presence of the host, the agent and a conducive environment.

Dr Mokopasetso reminded participants that current FMD management centres on a geographic or zonal approach i.e. in order for livestock farmers to gain access to regional or international trade markets, their livestock and livestock products must originate from geographic areas or zones that are proven to be disease free. Based on this approach, Botswana is divided into several risk zones with those zones in close proximity to buffalo populations, ineligible to enter the international market because the area itself cannot be shown to be disease-free and not because the livestock is unhealthy or infected with FMD per se. For many years, these disease control zones have been established through the construction of permanent veterinary cordon fences – the current network of which covers more than 10,000km in length and spanning three countries. However, this single resource decision has had multiple resource consequences, impacting local livelihoods and animals more than the disease itself. Implications include restricting wildlife movement, jeopardising connectivity across landscapes and thereby the success of TFCAs. Dr Mokopasetso went on to explain that veterinary fencing currently excludes much of the Okavango Panhandle and NG13 from the rest of the KAZA TFCA, impeding the movement, dispersal and migration of wildlife.

A video entitled "Beauty and the Beef: Achieving Compatibility between Wildlife Conservation and Livestock Production" (click on link at www.wcs-ahead.org) was shown which introduced alternative non-geographic approaches to FMD management such as value-chain-based disease risk management and commodity-based trade (CBT). Such non-geographic, commodity-based approaches focus on the safety of the process by which products are produced rather than on their regional origin and in doing so, offer the potential for developing countries to export meat products that can be shown scientifically to be safe for importing countries while also precluding the need for some of the fencing that currently constrains the vision for regional transboundary conservation. Both Namibia and Zimbabwe are already exploring these options. Because the EU demands standards that exceed the international standard set by the OIE, markets other than the EU, including regional markets need to be explored.

The presentation by Dr Jeremy Perkins of University of Botswana described how the GoB has spent millions in fence erection for the purposes of disease control, HWC mitigation and separating competing land uses. Once erected, these fences must then be maintained, the cost of which can further escalate when affected by environmental characteristics such as encroaching sand dunes, as exemplified in the KTP. Dr Perkins went on to explain that besides fundamentally disrupting wildlife/ungulate migration routes and thereby reducing or altering the resources wild animals are able to access, which is of particular importance during lean seasons, fences are also often the site of considerable wildlife mortality as animals get caught in them trying to cross to the other side. For instance, 56 eland were found dead along or near the 40km stretch of fence studied in the KTP. The efficacy of fences in mitigating HWC is further brought into question as not only do certain species such as hyenas and jackals successfully traverse them by digging underneath, but in the absence of the use of other mitigation measures such as kraaling and continued traditional preferences such as night time grazing, depredation in adjoining farms continues.

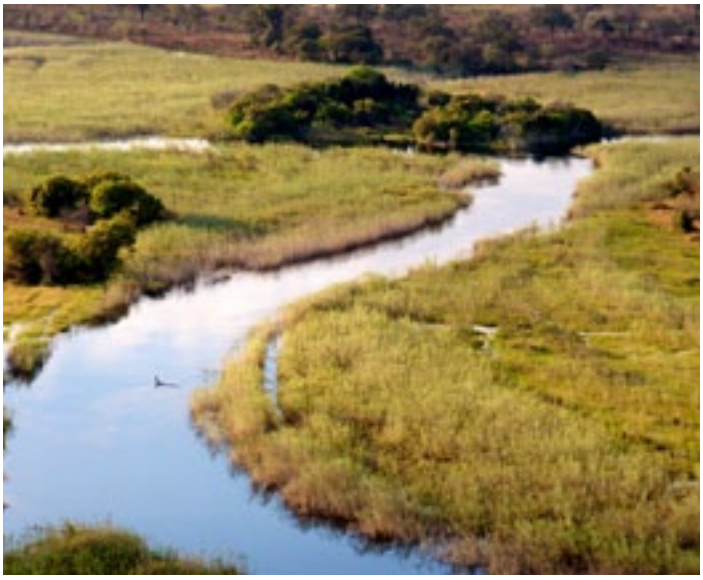
© J. Perkins

Work presented during this session and others frequently brought to the forefront the need for cross-sectoral cooperation and increased complementarity between land use planning decisions. Dr Perkins highlighted for instance, that KTP was established with particular conservation and economic objectives in mind. However, other well intentioned policies instituted by GoB are inadvertently intensifying the probability of conflict by promoting livestock farming in the Kalahari despite the low suitability of the area for this land use and providing loans for the same in areas adjoining KTP. This despite the understanding that other land uses may be better suited to the area such as CBNRM tourism/wildlife based activities.

## 7. Transboundary Conservation

This session was chaired by Mr Sedia Modise of Peace Parks Foundation and saw the presentation of work conducted on several transboundary resources and programmes including two TFCAs –GMTFCA and KAZA TFCA. The presentation by Dr Patience Zisadsa-Gandiwa of the GMTFCA on HWC in Greater Mapungubwe highlighted the need for research based, priority interventions to manage HWC and the need for TFCAs to be seen to be responsive towards HWC as the latter has the potential to negatively influence TFCA development. Mr Frederick Dipotso of the KAZA TFCA provided an overview of KAZA, highlighting some of the progress made and challenges faced in achieving its objectives.

The presentation by Dr Chris Brooks of SAREP informed that a focus area for SAREP is transboundary collaboration on fisheries in the OKACOM geographical area in order to sustainably manage this shared resource. There are 71 species of fish within the Okavango River below the Popa Rapids and 96 in the whole basin with no endemic species found in the lower section of the river. Research indicates that for around 40% of households in the Panhandle, fishing contributes around 30% of household income.
Dr Brooks noted that a transboundary fisheries management plan was approved in August 2013 by Angola, Botswana and Namibia. Key outputs of the plan are policy harmonisation; joint patrols; fish protection areas; joint monitoring surveys; and a data sharing protocol. Transboundary collaboration allows the development of standardised systems for survey methodology and harmonisation of policies and legislation for the same resource shared by several states. Without this collaborative approach, differences increase the likelihood of conflict amongst fishers at the local level and are ultimately detrimental to the conservation and utilisation of the resource.



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Mr Keta Mosepele of ORI presented work on small scale fisheries (SSFs) in the Okavango Delta, explaining that while large scale fisheries may catch more fish on a global scale, SSFs, which tend to be labour intensive and artisanal in nature, produce more for human consumption but are poorly understood, under-valued, and under-reported. Because the value chain for SSFs lies within the informal sector, they are often excluded from national accounts but yet contribute significantly to subsistence income and the risk-spreading strategies of poor, rural households. Classical approaches to the management of floodplain fisheries depend on technical measures such as gear limitations, input controls such as licensing and output controls such as quotas. Mr Mosepele argued that these approaches are inadequate and need to be up-scaled across borders for which an ecosystem management approach is more relevant. Such an approach would allow for multi-stakeholder participation; an appreciation for the socio-political and economic dimensions of management; an understanding of the multiple drivers that impact inland fisheries; adaptive learning acknowledging the complexity and variability of the ecosystem and its associated social and institutional environments; and allow planning and management to sustain fish productivity. He asserted that fish stocks

in the Okavango Delta are healthy and do not require excessive regulation as small scale fishermen do not fish intensively. The high level of heterogeneity within the Okavango Delta creates pockets of many inaccessible refugia for fish, which later recolonize other lagoons with low fish populations. The functional link among the matrix of source and sink lagoons provides for more stable fish populations within the Delta. However, there may be a need to identify the source and sink lagoons to broaden the understanding of the ecological interactions that are taking place, as well as monitor changes in species diversity. The presentation highlighted the irrelevance of a closed season in fishing, especially for non-commercial fishermen who are using hook and line to catch fish for their own needs. Since fish breed at different times in the year, the closed fishing season may favour some but not all fish.

Still on the Okavango Delta, Dr Mangaliso Gondwe from ORI showed how wetlands are an important natural source of methane ($CH_4$). He advised that being a net sink and not emitter of greenhouse gases the Okavango Delta must be maintained, especially in the context of impending climate change effects.

© P.Hancock

Vultures were considered as another example of a transboundary resource. A presentation by Mr Pete Hancock of Raptors Botswana highlighted that continent wide, vulture species are in decline with six of the seven species found in Botswana being globally threatened. He went on to report that tracking of vultures has shown some species such as lappet-faced vultures, traverse large distances crossing into Namibia and South Africa thereby being afforded only limited protection by the PAs within Botswana. This movement has important implications for poisoning incidents as these can happen anywhere, whether deliberate or incidental. Furthermore, in Botswana, there are increasing reports of large populations of vultures being decimated by deliberate poisoning or careless handling/disposal of toxic chemical substances. In order to prevent extirpation of the few remaining local populations, Mr Hancock highlighted the need to investigate the source of poison which subsequently needs to be cut off and the need to better understand how far ranging species such as the lappet-faced vulture, are being affected by poisoning.

## 8. Critical Management Issues

The presentations in this session focused on topics of critical management concern to DWNP. Two speakers, Dr Izak Smit from South African National Parks (SANParks) and Mr Julius Cheptei from Kenya Wildlife Service (KWS), were especially invited to provide perspectives from their countries on artificial water provision and high levels of tourism in PAs respectively. The session was chaired by Dr Cyril Taolo of DWNP.

### PA functionality, corridors and land use planning

In his presentation, exploring whether Botswana's PAs are working or functional, Dr Richard Fynn of ORI defined a functional PA as a region where herbivores have the ability to forage adaptively in a manner that enables them to meet their high resource demands over the period of foetus development and lactation; minimise loss of body stores over the dry season, especially in drought years; and minimise levels of predation. Hence, herbivores are healthier if they are able to move between short and tall grasslands during the wet and dry seasons respectively. Fragmentation of an ecosystem due to land use change and fence erection such that herbivores are unable to access the various resource types is problematic especially during the late dry season and drought years. Based on this premise, Dr Fynn argued that Botswana's northern conservation areas are highly functional, offering a mix of wet and dry season habitats and corridors for migration as confirmed by herbivore species migration. These seasonal movements favour both rare herbivore and carnivore species by preventing high lion densities. Conversely, he argued that the

Kgalagadi system is dysfunctional as a result of ecosystem fragmentation brought about by the presence of veterinary fences and loss of access to critical drought-refuge habitats on the Boteti River, Okavango Delta and Orange River, which has led to the collapse of many ungulate species including wildebeest, hartebeest, zebra and springbok.

Dr Fynn noted that the prohibition on hunting has had the effect of removing the only economically viable land use (i.e. safari hunting) for the corridor zones of the northern areas and as a consequence, water is now being artificially provided as a means of increasing the appeal of some areas towards photographic tourism. Without this, there is a fear that cattle will move into these areas. He went on to argue that providing artificial water in the northern conservation areas would have disastrous consequences by disrupting natural movement patterns causing degradation and overgrazing of wet-season ranges and removing functional heterogeneity. In response, DWNP acknowledged that wildlife should be allowed to thrive in these areas so as to increase their photographic tourism value while not causing long term ecological harm. Dr Fynn suggested that artificial water provision in the southern system is necessary and feasible as rare antelope species such as roan and sable have already been lost from there. Careful consideration would however, still be needed before providing water as it could increase competition between wildlife and livestock in the region.

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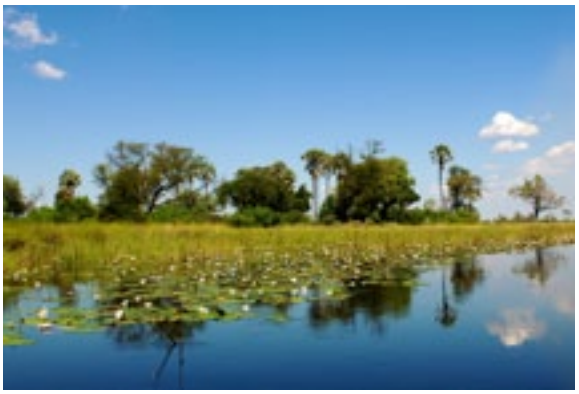
In his presentation, Dr Smit acknowledged the diversity of often competing objectives and reasons for artificial water provision such as tourist expectations; herbivore and rare antelope management; climate change and human impact; relationships with neighbouring communities; etc. Initially, in the 1960s, SANParks made a deliberate management decision to provide artificial water in Kruger NP to counter the effects of fence erection and droughts. However, this effectively created an unnatural situation, changing herbaceous composition, affecting herbivore distribution and turning waterholes into nutrient hotspots. It ultimately became considered as a causal reason for the decline in rare antelope species. Research has shown that the other effects of artificial water provision include overlapping of seasonal home ranges; decreasing home range size; reducing mortality of weaned calves; increasing predator risk close to waterholes; etc. Following a philosophical shift in KNP from a "nature-in-balance" to a "nature-evolving" approach in the late 1990's, fluctuations in the system were considered acceptable and stemmed from an appreciation of the importance of creating heterogeneous conditions which allowed for a utilisation gradient. Based on this paradigm shift, a large number of boreholes were closed post 1997. Since then, there is some evidence of change in the herbaceous species composition and biomass but no reduction in mammal densities has been recorded or any indication of negative impact on tourism. SANParks' current approach, a systems ecology based approach rather than an issue based approach, allows for spatial and temporal variability in surface water availability (i.e. it won't be available everywhere all the time), but it does allow for tweaking at a small scale or localised level to address pressing management issues. The approach is based on three principles:

i. Water should not be provided in areas that are naturally dry
ii. Water should not be provided too evenly across the landscape
iii. Artificial water should only be provided or condoned if human-induced constraints affect the availability of drinking water (e.g. deteriorating quality and quantity of rivers flowing in the NP).

Dr Smit emphasised the need for PA managers to be open-minded, reflective and adaptable and that while keeping interference to a minimum can make the most sense ecologically, financially and logistically, where

there is a need to interfere with an ecological system, it is important to be honest as to why it is being done. Thereafter, the outcomes of the management actions should be monitored with an awareness of unforeseen and unintended impacts as well as slow and cascading variables. He cautioned against a single species approach and the implications it could have on the entire system, unless the species in question is a driver or keystone species. He also appreciated the importance of local context. Understanding that most management actions (active or passive) will likely be met by some opposition, he reiterated the importance of being inclusive in the decision making process, encouraging constant dialogue between scientists and PA managers, and being pre-emptive in the communication strategy.

Wildlife corridors have a functional importance in mitigating the negative impacts of habitat fragmentation as they enable ecosystem connectivity which improves wildlife resilience to climatic perturbations and variations. In his presentation, Dr Brooks described key fences which constrain the movement of wildlife in the KAZA TFCA, essentially contributing to habitat fragmentation and rendering the landscape unsuitable for wildlife. He also argued that the Zambezi Region is a core area in KAZA and is under stress but is also critical for functionality of the landscape. He argued that a number of key corridors being used by elephants and other species must be conserved in order to ensure that Botswana's elephant population is able to expand its range, thereby reducing pressure from HEC in the country. This requires collaborative effort between different stakeholders including NGOs, researchers, land authorities and regional partners to identify all known functional corridors in the region, conserve them and restrict land allocations close to them. He explained that in some cases, existing fences may need to be realigned which would allow a natural reestablishment of old corridors. At the local level, livelihood issues need to be addressed, offering viable options for local communities, incentives to settle or move away from corridor edges and mitigation measures for existing HEC such as cluster fields and the use of chilli pepper.



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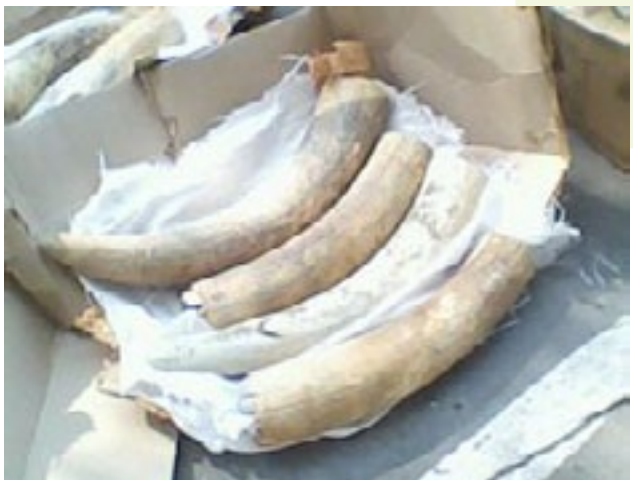
Dr Brooks made another presentation on a case study on work implemented at Seronga Sub-Land Board by the Tawana Land Board and supported by SAREP and the Department of Environmental Affairs using a goal driven GIS model - the Land Use Conflict Identification Strategy (LUCIS) - that produces a spatial representation of probable patterns of future land use. The tool first requires existing conservation, agricultural and developed land to be mapped, then in collaboration with stakeholders, optimal areas for future conservation, agriculture and development are mapped. Finally, using a layering approach, these are brought together to identify possible areas of conflict. In order to identify the criteria for suitability for a particular land use type, goals and objectives for the land use must be clearly stipulated. The pilot study has integrated relevant sectoral policy requirements and demonstrated that some policy driven requirements can potentially cause conflict with other land uses. Dr Brooks presented the strength of LUCIS as a decision support tool to develop alternative land use futures with stakeholders themselves deciding on criteria for land use planning. In this particular case study, information from Dr Songhurst's research data on elephant pathways was also integrated into the model. The pilot study is now allowing Tawana Land Board to allocate land away from high conflict zones in the hope of promoting coexistence. Notably, it does not affect existing allocations. Other key features of LUCIS are that it facilitates planning at appropriate scales, identifies policy conflict requiring stakeholder negotiation and allows analysis and visualisation of future land use.

## Illegal hunting

In his presentation, Dr Tico McNutt of BPCT highlighted that although illegal hunting is considered to be a factor in the decline of populations of several species of wildlife in northern Botswana, it has been difficult to quantify its impact, largely due to the fact that it is illegal in nature and that it is perceived to be a characteristic of "subsistence hunting" and therefore assumed to be insignificant.

Mr Tim Blackbeard of DWNP presented records based on people caught with animals, arguing that there is a large range of animal species illegally hunted in the south of the country but elephants are a key target species in the north. Predator smuggling is also considered to be of growing concern particularly in the KTP. Discrepancies between independent researcher data and that of DWNP was once again highlighted in that the latter found a higher incidence of illegal hunting or poaching in the south of the country compared to the north, and did not consider buffalo to be a targeted species in the north. Dr McNutt however, presented 122 recorded incidences of illegally killed animals in NG26 between 2009-2012, with the most common being lechwe and buffalo.



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Dr McNutt went on to describe both the direct and indirect implications that illegal hunting carries with it. In 2009, 42 dead vultures were recorded close to a poisoned giraffe carcass and in 2013, an additional 326 vultures were found dead at a poisoned elephant carcass in NG14. Hunters are also known to set bush fires in order to clear the undergrowth and increase visibility, stimulate green growth to encourage grazers to feed in the open, and to cover their tracks. Dug-out canoes (mekoro), horses and donkeys have all been recorded as vehicles for transporting dried meat. Dr McNutt argued that there are numerous drivers of illegal hunting including that it is a lucrative commercial trade as game meat receives a premium above local beef; it has low prosecution rates; local people perceive wildlife as an unlimited resource; and the sense of a cultural right to hunt for meat. He described a model developed by BPCT to determine the impact of illegal hunting on sustainable wildlife populations and concluded that illegal hunting or bushmeat hunting can significantly impact Botswana's wildlife population. Dr McNutt suggested several solutions to tackle this challenge, including fostering a greater sense of ownership and derived benefits from wildlife as a resource; improving legislation and enforcement of existing legislation to illustrate the consequences for participating in the trade; and managing fences. He also highlighted the need for proper investigations into the bushmeat trade to gain a deeper understanding into how it is structured and operates. Anecdotal evidence offered during plenary indicated that many local butcheries and local brewery outlets supply bushmeat. Plenary discussions also considered the impact that the prohibition on hunting would have for local livelihoods and what the long term ramifications would be for illegal hunting levels as the prohibition further restricted access of local communities to the resources they reside with. DWNP responded to these concerns explaining that they are working closely with communities to replace the opportunities lost as a result of the prohibition and understand that these cannot be replaced overnight.

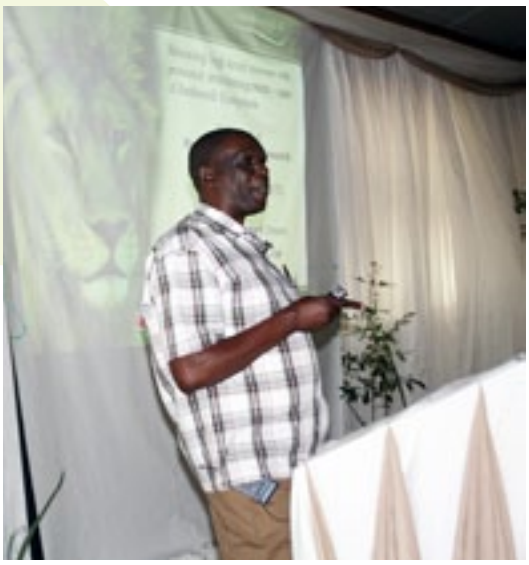
## Fire

Mr Charles Mpofu of DWNP presented fire data from the Department of Forestry and Range Resources from between 2006 and 2010 which showed CKGR and CNP to be highly affected by wildland fires while KTP and Moremi Game Reserve have experienced little or no recurring fires. The majority of fires were found to originate outside of PAs with August-October being peak months. While causal agents for wildland fires cannot be confirmed, grass cutters, neglected cooking fires and cattle herders are some of them. Mr Mpofu argued that deploying Quick Fire Response Teams to fire prone areas before the fire season and ensuring that the expertise and skills of these teams are periodically refreshed are important methods in preventing excessive fire-related damage. Concurrently, awareness campaigns within local communities on the detrimental impacts of fire on the environment need to take place.

## Increasing tourism in PAs

DWNP is contending with considerable pressure from tourism on the CNP riverfront especially inside the NP where the number of vehicles entering the area on a daily basis is steadily increasing. Other than

causing high levels of congestion and affecting the individual tourist's overall experience, DWNP is also concerned about the impact this could have on the ecosystem. It is in this context that Mr Cheptei, the second invited speaker, spoke about the Amboseli ecosystem and efforts of the KWS to balance high level tourism with PA management. The 392km$^2$ Amboseli NP lies within the greater Amboseli ecosystem covering 8,900km$^2$ and stretches into neighbouring Tanzania. Challenges facing the PA include a rising human population, poor urban planning and uncoordinated government projects as well as rampant development of hotels and lodges, all with serious implications for biodiversity and the level of HWC. Human development is blocking wildlife corridors, anthropogenic activities are causing water diversion and reducing pasture productivity, while rising poverty levels are increasing dependency on charcoal burning and bushmeat. Pressures from neighbouring countries such as Somalia and Sudan are also enabling a proliferation of small arms into the country and enhancing poaching pressures. KWS is attempting to address these challenges, in part through development of the Amboseli Ecosystem Management Plan which proposes zonation to mitigate land use conflicts while providing a conducive environment for investment in other land use options that are socially and economically acceptable to land users. The plan includes a tourism management component which promotes the establishment of a stakeholder forum for tourism in the ecosystem, regulates infrastructure development and provides incentives to tourism investors to facilitate the establishment of private wildlife conservation areas in the land bordering the park. High use, exclusive use and low use zones are defined within the ecosystem for visitor use and access. Within these zones, the types of tourism infrastructure are further categorised:



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- High Use: Tourism infrastructure is highly developed with high densities of viewing roads and tourist beds.
- Low Use: Retains the current level of infrastructure development with no further tourism development allowed. This zone can be used to support special tourist niches such as cultural tourism.
- Exclusive Use: Ensures that land located within community lands is reserved for exclusive wildlife-tourism use, which ensures that viable corridors and wildlife dispersal areas are maintained.

Accompanying this approach, the management plan includes a strong community partnership and education programme, which includes addressing issues of livestock production and marketing.

## Financial sustainability of PAs

Another key challenge facing DWNP is the financial sustainability of PAs. Dr Senyatso's presentation highlighted that co-management of PAs has the potential to enhance financial and management effectiveness but that this must be complemented by the development and implementation of business plans and financial scorecards for each PA. To further improve PA financial sustainability, PA staff should be well versed with budgetary skills; periodic reviews and adjustment of park fees to cover operational costs should take place; the marketing and advertising components of the parks should be enhanced; investment in development and maintenance of basic infrastructure such as roads is required: and a policy change which enables parks to retain a portion of the revenue to cover operational costs is necessary.

## The role of BWTI in conservation area management

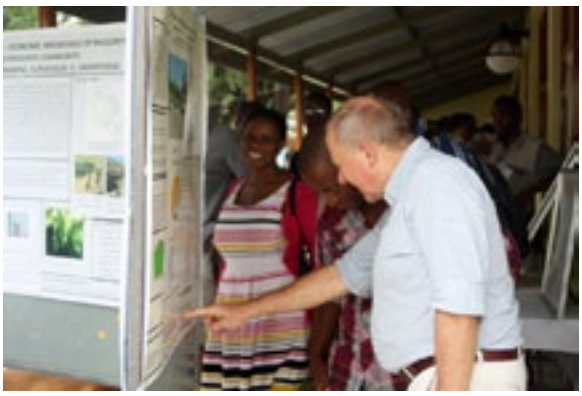
At the time of its establishment in 1980, the mandate of BWTI was to provide training for pre-service and in-service DWNP staff and to be an operational base for information dissemination on wildlife conservation

issues. In his presentation, Mr Moemi Batshabang of BWTI described how over the years, the campus facilities and infrastructure have expanded, the institute has received Botswana Training Authority (BOTA) accreditation for its various long and short courses and it draws trainees not only from DWNP but also from CBOs, private sector and the general public, particularly for its certificate course in Professional Tour Guiding. He noted that at least 2,500 candidates have graduated from the various courses, 25% of these being women and up to 80% being enrolled for short courses. However, despite its accomplishments, Botswana is expected to face a deficit of skills required to manage the country's natural resources and provide related services for the tourism industry. Most skills-based, wildlife training institutes on the continent are national institutes and most African universities focus on knowledge-based training. Given that there is a market need for more skills-based training, BWTI aspires to occupy a niche which reaches out regionally and internationally, and transforms its existing modular curricula to respond to the training needs of the wildlife and tourism sectors. This would require investment to improve and enhance the programmes on offer, its staff complement, facilities, trainee intake and business model.

## 9. Symposium Wrap-Up

The following section provides a summary of topics that were the source of considerable and recurring discussion during the Symposium.

Botswana's CBNRM Policy of 2007 defines CBNRM as a "development approach that incorporates natural resources conservation". It is based on the premise that those living closest to natural resources bear the costs associated with the conservation of those resources and in order for them to actively and effectively engage in conservation, the benefits from those resources should outweigh their conservation costs. Presentations made at the Symposium highlighted the gains made in this regard but more importantly, they emphasised existing challenges which threaten the future of the programme. Key among them are increased centralised control of the programme and the fact that only a small proportion of community members are engaged in decision making or benefit from the programme. This is resulting in a growing sense of disempowerment among local communities living in and around conservation areas. Urgent review and an innovative and progressive approach is therefore required to resolve the root causes for the deterioration of the programme in order to avoid negating the good work effected over the years. There are lessons which should be drawn upon from neighbouring countries in this process.



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The decline in wildlife populations was alluded to as a decisive factor leading to the prohibition of hunting in Controlled Hunting Areas. Research presented at the Symposium demonstrated a number of factors which have over the years contributed to the decline, with illegal hunting as one of them. Factors such as intermittent floods, drought and more broadly climate change as well as anthropogenic activities such as ecosystem fragmentation due to the erection of fences and land use change have also been strong contributors. The potential impact of the recent decision to prohibit hunting was a recurring and resounding theme throughout all three days of the Symposium. Concern was expressed that such a decision would further disempower local communities with regards to both access to, and management of, the natural resources by which they are most strongly affected and on which they heavily rely. Safari hunting has been an especially lucrative source of income for CBOs in the CBNRM programme. With safari hunting no longer a possible land use, efforts are being made to replace the opportunities lost to local communities by making these areas more appealing for photographic tourism, for instance, by providing artificial watering points. This could however, potentially have further knock-on effects by disturbing the long term functionality of the ecosystem. Examples from elsewhere in the region have shown this management intervention to have severe and detrimental long term consequences and thus require context specific application and close monitoring, if applied. The effect

of the prohibition of hunting on human-predator conflict response was also questioned.
HWC remains a grave threat in and around conservation areas as wild animals continue to raid crop fields and livestock affecting local livelihoods. Several presentations emphasised the need to use a "tool-box" approach for the mitigation of HWC as no single technique can effectively ease conflict. Interventions reported in HEC mitigation that are yielding positive results include the use of chilli pepper and beehives to protect fields. Tswana breed dogs were shown to be better protectors of livestock compared to the previously preferred Anatolian Shepherd dogs. Translocation is often employed as a mitigation strategy by DWNP to ease human-predator conflict; however, several presentations indicated that this might have limited efficacy as translocated predators continue to raid livestock outside of the PA to which they were relocated. It was clear, however, that more intensive research is required in this regard. With limited opportunities available to DWNP to manage human-predator conflict, this research would be valuable in determining the cost-benefit ratio of such interventions.

Fragmentation of wildlife habitats brought on by land use change, contradictory government policies and other anthropogenic activities continue to compromise PA functionality. In this context, the utility and necessity of identifying and securing major wildlife migration corridors is critical to maintain functional habitat heterogeneity and access to key seasonal resources for wildlife. The Symposium underscored the effect of fences, which have been used to separate competing land uses and control animal diseases, in severing wildlife migration routes and ecosystem connectivity. Non-geographic (non-fence-based) approaches to the control of FMD were presented as carrying the potential to improve management at the livestock/wildlife interface in Botswana while simultaneously allowing local livestock producers in zones not free of FMD the ability to sell safe beef products. This would need to be combined with an active pursuit of alternative markets, both regionally and internationally. All these discussions stressed the need for an ecosystem based approach to conservation given that wildlife and other natural resources are not restricted by artificial boundaries, be they park or national ones. For an effective ecosystem approach to be implemented, inter-sectoral dialogue and integrated land use planning are clearly necessary. The use of the LUCIS model by Tawana Land Board was an interesting case study and demonstrated the use of research data on elephant pathways in the allocation of land so as to minimise future conflict.

## Workshop session

During the final afternoon of the Symposium, ORI facilitated a workshop session with three key areas forming the basis of the breakaway working groups as follows:

i. Human-wildlife conflict
ii. CBNRM and tourism
iii. Biodiversity and conservation

Each group identified, agreed and presented key (i) conservation issues, (ii) research priorities, (iii) monitoring strategies, and (iv) climate change implications pertaining to their respective theme. Results from the working group sessions can be found in Annex 3 and will be used to inform a national wildlife conservation research strategy.

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## Closing

Dr Taolo, Deputy Director of DWNP, closed the Symposium after thanking the presenters and attendees for their active engagement, BWTI for hosting the Symposium, partner organisations for sponsoring the event and the organising committee for planning and executing the event.

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# Annex 1: BWRS 2014 - Programme.

| Day One – Tuesday 4th February 2014 | | |
|---|---|---|
| **BOTSWANA WILDLIFE RESEARCH SYMPOSIUM**<br>**BOTSWANA WILDLIFE TRAINING INSTITUTE, MAUN, BOTSWANA** | | |
| **EST. TIME** | **SESSION/PRESENTATION TITLE** | **PRESENTER & AFFILIATION** |
| 07:30 | REGISTRATION | |
| **Opening Ceremony [Director of Ceremony – Molothanyi Bolt Otlhomile, RWO – Ngamiland]** | | |
| 08:30 | Opening remarks | Director of Ceremony |
| 08:33 | Prayer | Volunteer |
| 08:36 | Introduction of Guests | District Commissioner |
| 08:40 | Keynote Address | Hon. Minister, MEWT |
| 09:00 | Remarks by Symposium Partner | WCS/AHEAD Representative |
| 09:10 | Remarks by Symposium Partner | UNDP Representative |
| 09:20 | Remarks by Symposium Partner | ORI Representative |
| 09:30 | Remarks by Symposium Partner | Wilderness Safaris |
| 09:40 | Vote of thanks | Director, DWNP |
| 09:50 | GROUP PHOTO | All |
| 10:30 | TEA BREAK | |
| **Session I: Wildlife Monitoring [Session Chair – Boat Modukanele, UNDP-UNEP Poverty Environment Initiative]** | | |
| 11:00 | Wildlife population dynamics outside protected areas of Botswana – a case of the Kgalagadi District | Edwin Mudongo<br>*DWNP* |
| 11:15 | Wildlife population monitoring in the arid regions of Botswana | Glyn Maude<br>*Kalahari Research & Conservation Botswana* |
| 11:30 | Dung beetle research in Botswana: progress, challenges and opportunities | Power Tshikae<br>*University of Pretoria; National Institute of Communicable Disease* |
| 11:45 | Predator population monitoring using focal studies of sample populations | Krys Jordan<br>*Botswana Predator Conservation Trust* |
| 12:00 | DISCUSSION | |
| 12:25 | Bird population monitoring: engaging Batswana in biodiversity monitoring and testing the extent to which Botswana's 'common' birds do indicate the status of co-occurring biodiversity | Kabelo Senyatso<br>*Birdlife Botswana* |
| 12:40 | Ecological monitoring in the Okavango Delta | Christaan Winterbach<br>*Tau Consultants* |
| 12:55 | The ecology of herbivore movements: coping with climatic variability | Barend Erasmus<br>*University of the Witwatersrand* |
| 13:10 | DISCUSSION | |
| 13:30 | LUNCH | |
| **Session II: CBNRM [Session Chair – Monametsi Sokwe, Ngamiland Council of NGOs]** | | |
| 14:30 | Facing the inadequacies of CBNRM in Botswana | Felix Monggae<br>*Kalahari Conservation Society* |
| 14:45 | Management Oriented Monitoring System in Community Based Organisations | Malebogo Sentsho<br>*DWNP* |
| 15:00 | Natural resource utilization, land use conflicts and sustainability: the case of Ngamiland District, Botswana | Joseph Mbaiwa<br>*Okavango Research Institute* |
| 15:15 | DISCUSSION | |
| 15:35 | TEA BREAK | |
| 16:05 | Community involvement in CBNRM-based tourism and support for the Kgalagadi Transfrontier Park in southwestern Botswana | Naomi Moswete<br>*University of Botswana* |
| 16:20 | The impact of private sector ecotourism on local socio-economic development in Botswana | Susan Snyman<br>*Wilderness Safaris* |

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|---|---|---|
| 16:35 | DISCUSSION | |
| 17:00 | ADJOURN | |
| 18:30 | RECEPTION BRAAI | |

## Day Two – Wednesday 5th February 2014

# Botswana Wildlife Research Symposium

### Botswana Wildlife Training Institute, Maun, Botswana

| EST. TIME | SESSION/PRESENTATION TITLE | PRESENTER & AFFILIATION |
|---|---|---|
| **Session III: Human-Wildlife Conflict [Session Chair – Kate Evans, Elephants for Africa]** | | |
| 08:30 | Human-wildlife conflict: an obstacle to agro-ecological systems | Phale Phale Kgotla<br>*Cheetah Conservation Botswana* |
| 08:45 | Problem predator paradigms: a brief review of human-predator conflict management strategies as applied to leopards and lions in the Khutse area | Stephen Henley<br>*Leopard Ecology & Conservation* |
| 09:00 | Reducing human-elephant conflict and fostering coexistence between people and elephants | Anna Songhurst<br>*ECO-EXIST* |
| 09:15 | The mitigation of conflict between elephants and people in Botswana with reference to *Capsicum*-based deterrents | Loki Osborn<br>*DWNP HWC Project* |
| 09:30 | Using bees as a natural deterrent for crop-raiding elephants | Lucy King<br>*DWNP HWC Project* |
| 09:45 | DISCUSSION | |
| 10:15 | TEA BREAK | |
| **Session IV: Human-Livestock-Wildlife Interface [Session Chair – Mokganedi Mokopasetso, WCS-AHEAD]** | | |
| 10:45 | Important diseases at the livestock-wildlife interface in Botswana | Ruben Mmadi<br>*DWNP* |
| 11:00 | Depredation and wildlife conservation in the southern Kalahari: looking for a way forward | Jeremy Perkins<br>*University of Botswana* |
| 11:15 | Beauty & the Beef | Video |
| 11:35 | Transboundary disease management In southern Africa: implications for transfrontier conservation, agriculture and economic development | Mokopasetso Mokganedi<br>*WCS-AHEAD* |
| 11:50 | DISCUSSION | |
| 12:15 | Disease burdens at the wildlife-livestock interface in two protected areas of northern Botswana: the Okavango Delta and Chobe National Park | Ferran Jori<br>*CIRAD* |
| 12:30 | Identifying and managing the coupling points influencing community livelihoods and ecosystem health | Kathy Alexander<br>*CARACAL* |
| 12:45 | DISCUSSION | |
| 13:05 | LUNCH | |
| **Session V: Transboundary Conservation [Session Chair – Sedia Modise, Peace Parks Foundation]** | | |
| 14:00 | Preliminary assessment of human-wildlife conflicts in the Greater Mapungubwe Transfrontier Conservation Area: a case study of Maramani Communal Area, Zimbabwe | Patience Zisadza-Gandiwa<br>*Greater Mapungubwe TFCA* |
| 14:15 | Classical fisheries management and transboundary fisheries management, a panacea for sustainable fish utilization? The case of the Okavango Delta | Keta Mosepele<br>*Okavango Research Institute* |
| 14:30 | Monitoring vulture movements | Pete Hancock<br>*Raptors Botswana* |
| 14:45 | DISCUSSION | |
| 15:05 | Okavango Delta's contribution to climate change through diffusive methane fluxes | Mangaliso Gondwe<br>*Okavango Research Institute* |
| 15:20 | Transboundary collaboration | Chris Brooks<br>*Southern Africa Regional Environmental Programme* |
| 15:35 | Aim and goal of the development of the KAZA TFCA | Frederick Dipotso<br>*Kavango Zambezi TFCA Secretariat* |

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|---|---|---|
| 15:50 | DISCUSSION | |
| 16:10 | TEA BREAK | |
| **Poster Presentations** | | |
| 17:45 | ADJOURN | |

## Day Three – Thursday 6th February 2014

# Botswana Wildlife Research Symposium

### Botswana Wildlife Training Institute, Maun, Botswana

| EST. TIME | SESSION/PRESENTATION TITLE | PRESENTER & AFFILIATION |
|---|---|---|
| **Session VI: Critical Management Issues [Session Chair – Cyril Taolo, DWNP]** | | |
| 08:30 | Are protected areas in Botswana working? | Richard Fynn<br>*Okavango Research Institute* |
| 08:45 | Towards a systems approach for artificial water provision in the Kruger National Park | Izak Smit<br>*SANParks* |
| 09:10 | The pattern and increase of poaching in Botswana | Tim Blackbeard<br>*DWNP* |
| 09:25 | DISCUSSION | |
| 09:45 | An assessment of fire occurrences in some protected areas within Botswana from 2008 to 2011 | Charles Mpofu<br>*DWNP* |
| 10:00 | Illegal bushmeat hunting in Botswana | Tico McNutt<br>*Botswana Predator Conservation Trust* |
| 10:15 | Land use planning and wildlife management: the case of Ngamiland District Integrated Land Use Plan | Sekgowa Motsumi<br>*DEA* |
| 10:30 | Role and contribution of BWTI in wildlife management: successes, challenges and opportunities | Moemi Batshabang<br>*BWTI* |
| 10:45 | DISCUSSION | |
| 11:10 | TEA BREAK | |
| 11:40 | Transboundary wildlife corridors | Chris Brooks - *SAREP*<br>Mike Chase -*EWB* |
| 11:55 | Balancing high-level tourism with protected area management, case of Amboseli National Park | Julius Cheptai<br>*Kenya Wildlife Service – Amboseli National Park* |
| 12:20 | Optimizing financial and operational sustainability of Botswana's protected areas: key findings from the "Strategic Partnerships to Improve the Financial and Operational Sustainability of Protected Areas" project | Kabelo Senyatso<br>*Birdlife Botswana* |
| 12:35 | DISCUSSION | |
| 13:00 | LUNCH | |
| **Session VII: Workshop – [Session Chair – Okavango Research Institute]** | | |
| 14:00 | Conservation issues wrap up (from the 3 days) | *Okavango Research Institute* |
| 14:15 | Breakaway groups to discuss the issues raised in "Conservation Issues Wrap Up" | Groups |
| 15:45 | TEA BREAK | |
| 16:15 | Report back: recommendations, revised research agenda, way forward | Groups |
| 16:45 | Official closing | Permanent Secretary, MEWT |
| 17:00 | ADJOURN | |

# Annex 2: Abstract Pack

## Wildlife Population Dynamics Outside Protected Areas in Botswana – A Case of the Kgalagadi District

Edwin I. Mudongo & O A. Keitsile, *Department of Wildlife and National Parks, Botswana*

Botswana is one of the few countries that still has vast areas of land set aside for wildlife conservation in the form of national parks and game reserves. However, most migratory species of animals tend to utilize some prime areas that offer better quality forage at different seasons outside these protected areas. We focused on the wildlife management areas (WMA) surrounding the Kgalagadi Transfrontier Park (KTP). Despite the large populations of some migratory herbivores like eland and wildebeest and other ungulates such as springbok, hartebeest and gemsbok in the Kgalagadi, very little research has been done in this part of the country. Data from aerial censuses dating back to 1996 was examined to determine trends and contrast with protected area populations. Long-term ground transect data collected in the WMAs was used to complement aerial census data. Results showed higher wildebeest, hartebeest and springbok populations in surrounding WMAs and communal areas than the KTP. Highest densities of springbok populations were found around KD2/1. Hartebeest also concentrate in these areas with smaller populations around KD15 and KD27. Eland populations were higher inside the park during all surveys except the 2001 survey where a larger population was found in KD1 area. Gemsbok populations were exclusively higher in the park than surrounding areas during all surveys but large populations still exist outside the park. Wildebeest populations fluctuated between the park and surrounding areas over the years. Trends show populations of springbok declining since 1996 and starting to increase in 2012 whereas that of gemsbok decreased from 1996 and started increasing from 2002 onwards. Eland and hartebeest populations have generally increased since 1996. Cattle numbers have also increased in especially KD1 and KD2 since 1996. The Kgalagadi WMAs, especially those forming the Schwelle area, appear to be providing key resources supporting species such as springbok that has been declining over the years. Thus, these areas provide key functional habitat heterogeneity that the KTP alone cannot provide despite its large area. However, the effect of increasing livestock numbers, climate change and other human activities in this prime wildlife habitat in the long-term is discussed.

## Wildlife Population Monitoring in the Arid Regions of Botswana

Glyn Maude, *Kalahari Research and Conservation, Botswana*

The Kalahari Research and Conservation (KRC) team has been conducting research activities in the arid regions of Botswana since 2009. The regions include Makgadikgadi, Central Kalahari Game Reserve (CKGR) and Kgalagadi Transfrontier Park (KTP). At present, the KRC team works directly with lion, wild dog, wildebeest, lappet-faced, white-backed and white-headed vultures. Some wildlife populations resident within the arid regions of Botswana are believed to be in decline, but the reasons for this are much debated and this presentation will show relevant data that will shed light on the issue within the Kalahari regions. The findings of our research and their implications for arid area and wildlife conservation within Botswana will be discussed. Population estimates for large carnivore species resident within the KTP, CKGR and the Makgadikgadi areas will also be presented. In addition, preliminary research findings on the monitoring of six satellite collared trans-located lions will be presented and discussed; as well as specific findings and implications from studies on collared wildebeest. Furthermore, key results from research that is relevant to wildlife conservation such as water provision; barriers to wildlife movement; and human wildlife conflict will be presented briefly.

### Predator Population Monitoring Using Focal Studies of Sample Populations

Krystyna A. Golabek, *Botswana Predator Conservation Trust, Botswana*

There are numerous methods to monitor wild populations and all involve some type of sampling. The Botswana Predator Conservation Trust has studied large carnivores by focusing on sample subpopulations of known individuals. Long-term continuous records of sub-populations of African wild dogs date back to1990, while lion, leopard, cheetah and spotted hyenas date back to 2007. The long term monitoring of sample sub-populations of known individuals allows us to identify trends but additionally and importantly provides a deeper understanding of the demographic and environmental drivers underlying those trends. Some examples from recorded observations of large carnivores are presented.

### Bird Population Monitoring: Engaging Batswana in Biodiversity Monitoring and Testing the Extent to which Botswana's 'Common' Birds do Indicate the Status of Co-occurring Biodiversity

Kabelo J. Senyatso and Keddy Moleofi, *BirdLife Botswana, Botswana*

Bird populations are always shifting and changing and so monitoring them is a useful tool to track and know about these changes in our areas, and infer as to what drives those changes. Monitoring also helps both volunteer-counters and researchers to increase their knowledge and understanding of the scientific process, gain deeper understanding of natural phenomena and issues of local importance, strengthen attitudes toward the natural environment, and participate in making science-based recommendations. The BirdLife Botswana-led Bird Population Monitoring (BPM) Programme is expected to provide both the country and the volunteer-counters with ample benefits, particularly relating to meeting the Convention on Biological Diversity (CBD) targets, including the Aichi 2020 Biodiversity targets. The country-wide BPM programme has been running since 2010 and now has more than 350 participants who systematically monitor common birds along more than 250 randomly selected 2km transects. This presentation summarizes trends for some of the common birds, and shares lessons for other wildlife monitoring programmes. To date, the BPM has provided scientists with an opportunity to increase public awareness of birds across local and global scales, as well as a useful dataset that can be used to answer research questions that require observations over time or space.

### Ecological Monitoring in the Okavango Delta

Christiaan Winterbach and Hanlie Winterbach, *Tau Consultants, Botswana*

To understand the Okavango ecosystem better we should look at key regulatory factors that might be driving ecological fluctuations and changes as well as human imposed limitations and impacts. It is critical to distinguish between ecological fluctuations and changes as opposed to human induced changes or limitations. The latter requires management intervention. Monitoring not only provides baseline data for adaptive management but also generates questions that should be addressed.

Our long term monitoring in NG/29 and NG/30 in the south-western part of the Okavango Delta provides some insight on a local level. From 1996 to 2012 the herbivore populations declined. We found a significant correlation ($R^2 = 0.8883$) between prey density and number of lions in our study prides. As prey density decreased, lion numbers decreased.

Prolonged periods of flooding post 1999 resulted in grasslands on the seasonal floodplains being converted to sedges, resulting in habitat loss for grazers in NG/29 and NG/30. The loss of grassland habitat was between 50 and 60% in the Piajo area of Chief's Island. This is probably not indicative of system-wide changes but demonstrates the potential negative impact on local herbivore populations.

The DWNP aerial surveys showed that lion prey declined in the Okavango Delta from 1996 to 2007. The decline in lion prey did not occur uniformly across the Delta and even increased to the west of the Sandveld Tongue. Illegal hunting and/or bushmeat trade is a huge concern in this area.

### The Ecology of Herbivore Movements: Coping with Climatic Variability

Barend Erasmus, Norman Owen-Smith, Robyn Hetem and Francesca Parrini, *University of the Witwatersrand, Johannesburg, South Africa*

There is mounting concern about the declining populations of large mammals apparent in protected areas across Africa, including both locally rare species and formerly abundant migratory populations. Several possible causes have been hypothesised, but the basic problem seems to be human population expansion pressing against or even into protected areas, restricting the capacity of large herbivore populations to cope with the climatic variability that is being amplified by global warming. Amplified climatic variation in rainfall is likely to be stronger in regions with lower rainfall where the annual coefficient of variation in rainfall is correspondingly greater. The central and south-western Kalahari regions are predicted to experience up to a 100% increase in the number of days per year where the daily maximum temperature is above $35^0$C. Furthermore, a vast area is still available over which large herbivores could potentially roam, albeit with little perennial surface water. The Central Kalahari Game Reserve alone covers over 50,000 $km^2$, and there are no barriers to animal movements south-west towards the Kgalagadi Transfrontier Park extending into South Africa. This provides considerable scope for animals to exploit spatial heterogeneity in vegetation and in the localization of rainfall events. Hence, this study region can provide a benchmark for comparison with other areas where the scope for movement has become compressed by human settlements. Moreover, this area has a relatively homogenous geological substrate, is without elephants and has very few people living within it, simplifying the factors to be disentangled influencing the movements of the focal herbivores.

Under the changing climatic conditions anticipated, large herbivores will exhibit changes in their movement patterns to exploit heterogeneous resources. If these behavioural responses revealed by animal movement tracking are inadequate to maintain homeothermy, we expect to observe abnormalities in an animal's body temperature. Body temperature provides a sensitive indicator of physiological stress in terms of infection, dehydration, loss of body condition and nutritive stress. By measuring body temperature and animal movement, we will link changes in the stress physiology of the animal to known changes in the environment, and use this relationship to explore the limits of movement as an adaptation to extreme conditions. The links between real-time logging of body temperature (bio-logging) and animal movement analysis is key link between fine-scale processes and observed broad-scale patterns.

Our focal herbivore species are (1) wildebeest, formerly present in a mobile population exceeding 200,000 animals, which collapsed to a minute fraction of this total following the construction of veterinary cordon fences that blocked their access to surface water to the north-east, essential in a severe drought year; and (2) gemsbok, an arid-adapted grazer dependent on very similar food resources that has continued to thrive despite the lack of access to perennial surface water.

The overall project hopes to inform the management of large unfenced protected areas to remain effective in the conservation of mobile large herbivore populations under global change conditions. Here we present preliminary findings on the spatiotemporal variability of foraging resources, and the associated movement patterns of gemsbok and wildebeest to access these resources.

### Facing the Inadequacies of CBNRM in Botswana

Felix Monggae, *Kalahari Conservation Society, Botswana*

Concerted efforts to implement Community Based Natural Resources Management (CBNRM) programmes by stakeholders in Botswana has been riddled with challenges, which brought to the fore the realisation that having good policies and legislation in place does not guarantee good CBNRM results on the ground.

The core aims of CBNRM are to create the right incentives for groups of resource users within defined jurisdictions to use natural resources sustainably. These incentives include enabling resource users to realise tangible economic benefits from resource use and providing strong proprietorship over the resource. The importance of tenure and property rights or "proprietorship" for sustainable natural resource management has been long recognised. Murphree (1994) defines proprietorship as "sanctioned use rights, including the right to determine the mode and extent of management and use, rights of access and inclusion, and the right to benefit fully from use and management." "Collective proprietorship" is where a group of people is jointly given sanctioned user rights over land and/or resources, which they are then able to manage according to their own rules and strategies. This implies the development of some form of local institutional arrangement that governs decision-making and in Botswana's case these are Community Based Organisations or Trusts. CBNRM also aims to support the development and capacitation of these institutions and institutional arrangements for groups of resource users to control resource use.

While recognising that CBNRM is not a stand-alone solution to the problems of poverty eradication and conservation management, it has to be appreciated that it is a developmental process with its own unique strengths and weaknesses. It is apparent, however, that there has been lack of agreement on the best approaches to unravel CBNRM challenges in Botswana. It is critical for stakeholders to take measures to maximise and leverage the successes of the past and address the inadequacies of the current programme, which have been adequately identified by various interest groups, researchers and CBNRM practitioners. This would enable scaled and appropriate development through natural resource exploitation where the interest of all stakeholders, including the state would be recognised.

The management authority devolved to lower levels is not absolute and the state often plays a major role in decision-making regarding the use of natural resources. It is with this background that this presentation discusses the inadequacies of the CBNRM programme in Botswana and calls upon all stakeholders to cooperate and re-launch a transparent and sustainable programme for the county. The following are some areas that are discussed as implementation bottlenecks:

- Conflicting interests: social, legal, technical and political;
- Inadequate implementation capacity: human capital and financial resources;
- Mismatch in policy provisions and resource availability;
- Disparities in priorities; and,
- Policy provisions which are not legally binding.

### Management Oriented Monitoring System in Community Based Organizations

Malebogo Sentsho, *Department of Wildlife and National Parks, Botswana*

Management Oriented Monitoring System (MOMS) was first introduced to the Department of Wildlife and National Parks (DWNP) in 2004 and adopted the same year. It was piloted in a few Community Based Organizations (CBOs) in Ngamiland. The system was later rolled out to other CBOs in Ngamiland, as well as Chobe and Central Districts. All

the communities involved consider MOMS to be providing useful information that can be used for local level adaptive management. The system is now routinely used to generate information for presentation during community meetings and reporting to DWNP on problem animals, wildlife sightings and mortalities. The purpose of this presentation is to highlight the process followed to develop MOMS modules for communities, data capture and analysis, as well as formats for reporting at various levels of management. Results from audits conducted in 2010 and 2012 are briefly outlined, including achievements, challenges and recommendations for improving MOMS implementation by CBOs.

### Natural Resource Utilization, Land Use Conflicts and Sustainability: The Case of Ngamiland District, Botswana

Joseph E. Mbaiwa, *Okavango Research Institute, University of Botswana, Botswana*

Conflicts are situations of competition and potential disagreement between two or more stakeholder groups over the use of one or more scarce resource. Resource utilization and conflicts over land, water, wildlife, and forests are common, especially in Africa, including Botswana. This presentation uses the concepts of sustainable development and the sustainable use of environmental resources in addressing issues of resource competition and conflicts in Ngamiland District. A stakeholder approach was used to identify interest groups or stakeholders involved in resource competition and conflicts in the area. Findings showed that stakeholders could conveniently be categorized into two main groups, the traditional and emerging stakeholders. Traditional stakeholders included agro-pastoralist, hunting and gathering communities that have lived in Ngamiland District for centuries. Emerging stakeholders were modern land users such as the tourism, modern livestock and wildlife management sectors that were recently introduced in the area. Resource competition and conflicts was minimal amongst traditional stakeholders, but more pronounced between traditional stakeholders and emerging stakeholders as well as between the various emerging stakeholders. This presentation points out that resource competition and conflicts pose a threat to the sustainable use of Ngamiland District and the Okavango Delta as a natural resource. The sustainable use of natural resources in Ngamiland District requires the participation of all the stakeholders in land use policy formulation, implementation and monitoring. Particular attention needs to be paid to traditional groups because they live in the Ngamiland District and could be economically motivated to effectively manage and monitor natural resources in the district.

### Community Involvement in CBNRM-Based Tourism and Support for the Kgalagadi Transfrontier Park in South-Western Botswana

Naomi Moswete, *Department of Environmental Science, University of Botswana, Botswana*

The concept of Community Based Natural Resources Management (CBNRM) was used to examine involvement and participation of local people, as well as benefits from CBNRM- based tourism in and around the Kgalagadi Transfrontier Park (KTP) in western Botswana. The study also assessed community support for the KTP as a transboundary protected area with dual management and ownership between Botswana and South Africa. In Botswana, CBNRM is a combination of rural development and natural resources conservation and it is based on the notion that local people must have the power to decide over their natural resources (wildlife, veldt products) in order to promote sustainability. Above all, the CBNRM policy of 2007 aims to alleviate rural poverty and advance conservation by strengthening rural economies and empowering communities to manage resources for their long-term social, economic and ecological benefits. Hence, rural communities especially those adjacent to protected areas, are encouraged to participate in natural resource conservation and community-based ecotourism in order to benefit. The role of CBNRM programmes is also recognized as a vital strategy in improving livelihoods and in ensuring good governance, transparency, accountability and participation within

rural communities. Data were collected by means of questionnaires, which were administered in 746 households living adjacent to KTP from October 2008 to January 2009. Results revealed that only a small proportion of the community residents benefited from CBNRM-based tourism and park-based recreation. Constraints to participation, in addition to the strains of desert environments, included lack of transportation, weak buying power and incidents of poverty within local communities. A few CBO-based ecotourism enterprises and projects only benefited a handful of villagers. Some individuals were involved in the CBO tourism activities, while the majority of the villagers were not actively involved particularly in management and decision making of the communally owned tourism enterprises. Despite these findings, the local communities in and around the park were supportive of KTP as a transboundary protected conservation area in the greater Kalahari region of Botswana.

### Partnership between a Private Sector Ecotourism Operator and a Local Community in the Okavango Delta, Botswana: the Case of the Okavango Community Trust and Wilderness Safaris

Susan Snyman, *Wilderness Safaris, South Africa*

The majority of Africa is characterised by high levels of poverty, high population densities and limited economic development. Botswana is, however, different in having the highest Gross Domestic Product per capita in Africa, relatively low population densities and high levels of socio-economic development. Inequality however remains high. A Community-based Natural Resource Management programme was introduced in 1989 to ensure that local communities benefit from the country's abundant natural resources, with the hope that they will then protect them. Partnerships between the private sector and local communities evolved from this. Okavango Wilderness Safaris, a private sector ecotourism operator, has relationships with three community trusts: Okavango Community Trust (OCT), Sankuyo Community Development Trust and the Khwai Development Trust. This presentation looks specifically at the partnership with the OCT. Based on ecotourism staff and non-staff interview results, an analysis of this relationship reveals that there are socio-economic benefits to be received, but the distribution of these is limited. Socio-economic benefits to individual community households can be substantial, but overall community benefit distribution needs to be re-assessed. Overall socio-economic impacts of the partnership are examined and suggestions for enhancing private sector/community relationships are put forward, based on the interview results and personal observations.

### Human Wildlife Conflict: An Obstacle to Agro-Ecological Systems

Phale Phale Kgotla and Jane Horgan, *Cheetah Conservation Botswana, Botswana*

The level of human-wildlife conflict (HWC) in the country has been rising steadily despite efforts to curb and reduce it. These efforts have been tested, researched and proven to work, but some level of conflict still prevails. This may be because some problem animals have learnt to work around such efforts, the methods are not correctly applied or the time invested in them to actually reap the benefits is not enough. Every animal exhibits its behavior based on the conditions of its environment, and it is human actions that ultimately affect the responsiveness of these animals to mitigation methods.

Cheetah Conservation Botswana (CCB) promotes the use of livestock guarding dogs (LSGDs) to reduce HWC. This is a mitigation method that has been used for centuries around the world including elsewhere in Africa. CCB provides the placement and monitoring of LSGDs throughout Botswana and has established an LSGD network through which farmers who use LSGDs are supported and trained. Data collected from LSGD owners has revealed that local Tswana dogs are more effective livestock guardians than other pure breeds like Anatolian Shepherds and also cheaper to obtain and maintain. The superior results may be due to Tswana dogs' environmental acclimatization, better resistance to local diseases and general hardiness which leads to better overall performance. A LSGD is, however, limited in its effectiveness by the amount of time invested by its owners. LSGDs can develop problems that can compromise their ability to guard

livestock if they are not monitored regularly for behavioral and health issues. Although one of the cheapest and easiest methods of mitigating farmer-predator conflict, LSGDs still require a commitment from their owners to be successful. A small commitment to keeping the dog healthy and well-behaved will result in significant reductions in livestock depredation over the course of the dog's life.

CCB promotes the use of LSGDs for small stock (goat and sheep) farmers that farm alongside predator populations. We are continuing to investigate the use of LSGDs with projects testing their effectiveness at guarding cattle herds and the use of other mitigation methods such as kraaling. Further encouragement for LSGDs could be instigated by including the use of LSGDs as part of eligibility criteria for farmers who receive compensation for livestock depredation. The PAC data collection form could also be modified to have a section on HWC mitigation measures employed by farmers in order to document such practices and facilitate data analysis.

One thing that is often overlooked but needs to be considered when implementing any mitigation method are the cultural considerations for the area in which you are working. These must be addressed when implementing mitigation measures and failure to do so can result in further conflict rather than the reduction of it.

### Problem Predator Paradigms: A Brief Review of Human-Predator Conflict Management Strategies as Applied to Leopards and Lions in the Khutse Area

Steve Henley and Monika Schiess-Meier, *Leopard Ecology & Conservation, Botswana*

Historical and current conservation management strategies have contributed towards the desirable situation where today we still have populations of large predators both within and outside Botswana's protected areas. However, exponential growth in the human population and change in the future climate regime strongly suggest that human-predator conflict will intensify. This Symposium is an opportune forum to begin reviewing and revising existing management strategies in anticipation of an escalating conflict.

The prevailing human-predator conflict management strategies focus on isolation (fencing) and reactionary control (problem animal translocation and culling). In this presentation we consider the efficacy of these as conservation strategies when applied in and around Khutse Game Reserve, in light of 13 years of research on leopards (*Panthera pardus*) and lions (*P. leo*). We review predator movement and demographic patterns before and after the erection of the Khutse Game Reserve fence and concurrent livestock predation records. We evaluate release site fidelity and survival of translocated problem animals. We review leopard and lion demographic trends in response to translocation and shooting, as well as change in livestock predation patterns. We conclude by introducing for discussion, concepts for future research based on the insights gained and conservation biology theory. We consider the merits of a conservation management strategy that emphasizes the co-existence of humans and predators as opposed to one that promotes the separation of these populations.

### Ecoexist Project: Reducing Human-Elephant Conflict and Fostering Coexistence between People and Elephants

Dr Anna Songhurst, *Ecoexist, Botswana*

People and elephants are in competition for access to water, food and space throughout the elephant range in Africa and Asia. In Botswana, as in many other countries, interactions between people and elephants are becoming more frequent and Human-Elephant Conflict (HEC) incidents are increasing as more land is converted to arable farming and the elephant range expands. Consequently, HEC is one of the most challenging wildlife management and conservation issues in the country. The general objective of the presenter's Ph.D. study between 2008 and 2012 was to gain a greater understanding

of the complexities of the competition between people and elephants in the eastern Okavango Delta panhandle, focusing on elements that can be investigated in the short term and could aid in devising effective mitigation and management strategies. Specifically, the aims were to, a) determine the current elephant population numbers and growth rate in the study area and investigate how reliable aerial survey estimates are; b) monitor the extent of HEC incidents and compare community based monitoring techniques to a government approach; c) determine key drivers of elephant crop-raiding and explore how spatial autocorrelation affects such data; d) investigate how elephant movements are affected by human habitat modifications, and; e) investigate rural farmers' attitudes towards elephants and compare perceived human-elephant conflict to actual measurable levels of elephant crop damage. Findings showed that combinations of social and ecological factors were involved in shaping competition between people and elephants. A multi-disciplinary approach to investigations was therefore needed to fully understand such competition and resulting conflicts. Contributory factors to HEC identified in this study included: actual and perceived conflict levels; farmer vulnerability to risk and available coping strategies; susceptibility of crops to elephant foraging, which affects both actual and perceived conflict levels; methods used to measure damage; natural and modified behaviour of people and elephants affecting resource and spatial use as well as how each species reacts to living in close proximity to each other; and, human feelings and perception towards elephants and the situation, which are influenced by an array of socio-economic factors. To be successful, effective conflict resolution and management strategies would, therefore, require consideration of short and long term dynamics, as well as a combination of mitigation approaches that consider all elements affecting conflict extent. Finding sustainable solutions to HEC also requires understanding current policies and incentives related to wildlife management, agriculture, and rural development, and then facilitating cooperation between government, private sector, and local communities to align goals. The Ecoexist Project was established to build on the findings from this PhD study and endeavours to create an enabling environment for policies and on-the-ground programmes to reduce HEC and foster coexistence between elephants and people. Moving from conflict to coexistence requires a portfolio of management tools and strategies that provide short and long-term solutions. Ecoexist focuses on applied research, land use planning, crop-raiding mitigation, agricultural experiment and innovation, and tourism development. In the short term, the project aims to reduce real and perceived HEC by addressing failures and gaps in current mitigation responses. Over the longer term, Ecoexist will collaborate with local, regional, and international stakeholders to address the root causes of conflict and help align policies and incentives to support human-elephant coexistence. The two time horizons will ensure farmers› immediate concerns of HEC are being addressed while we work to create an enabling environment for institutions and policy to support broader goals of coexistence and sustainable futures for people and elephants.

### The Mitigation of Conflict between Elephants and People in Botswana with Reference to *Capsicum*-Based Deterrents

Loki Osborn and Malvern Karidozo, *Connected Conservation, Zimbabwe*

Elephants (*Loxodonta africana*) destroy subsistence crops and threaten the livelihoods of rural farmers across Africa. In an effort to formulate a nonlethal repellent and methods of application as well as assessing the effectiveness of *Capsicum* based elephant deterrents, tests were conducted with high and low-tech *Capsicum* based repellents in the communal lands of Zimbabwe and Zambia respectively. In the high-tech repellent experiment, the time taken to repel elephants from fields by farmers using methods currently available such as community guarding, use of fire, guard dogs and noise making were compared to a *Capsicum* oleoresin repellent spray. In the low-tech repellent trials, *Capsicum* based deterrent methods namely the chilli fence and chilli briquettes were evaluated in protecting maize (*Zea mays*) crops. We monitored conflict incidences in the chilli fence protected plots and those in unprotected (control/reference) plots. We also monitored human-elephant conflict incidences in the plots protected by chilli briquettes against those in the control plots in order to assess the effectiveness of the mitigation measures. Elephants were repelled from fields significantly faster by the *Capsicum*

oleoresin spray than by traditional methods. In all the trials we noted that *Capsicum* based methods repelled elephants and provided protection for the crops as they experienced significantly less damage. We argue that *Capsicum* based deterrents assessed in these trials are effective in repelling elephants and do add significant deterrent value in mitigating human elephant conflict.

### The Elephants and Bees Project: Using Bees as a Natural Deterrent for Crop-Raiding Elephants

Lucy E. King, *Save the Elephants, Kenya*

Elephants in Kenya are not confined to national parks and reserves, hence interactions between farmers and crop-raiding elephants can pose serious social, political, economic and conservation problems. Dr Lucy King's research in Kenya has proved that African elephants are aware about and will actively avoid the threat of African honeybees. She demonstrated that not only do elephants run away from disturbed bee sounds but would also emit a unique low frequency (infrasonic) rumble that warns other elephants in the area to retreat. These behavioural discoveries were groundbreaking, and encouraged her to develop and test a unique application for this behaviour through the use of protective Beehive Fences around farmers' fields with the aim of reducing human-elephant conflict (HEC). The beehive fences are not only reducing damaging crop-raids by elephants, but the bees are also helping to pollinate the fields and farmers are now harvesting valuable "Elephant-Friendly Honey" as an additional product from their land. Since starting her research in 2006, the Beehive Fence HEC mitigation concept has spread rapidly and Beehive Fences are presently up and running in test sites in Kenya, Mozambique, Tanzania, Uganda, Botswana and India. Her research won her the UNEP/CMS Thesis Award 2011, the Future for Nature Award and the St Andrews Prize for the Environment in 2013. The Elephants and Bees Project (www.elephantsandbees.com) is led by Dr Lucy King under the umbrella of the research charity Save the Elephants in partnership with the University of Oxford and Disney's Animal Kingdom."

### Important Diseases at the Livestock-Wildlife Interface in Botswana

Mmadi M. B. Reuben, *Department of Wildlife and National Parks, Botswana*

The livestock–wildlife interface in Botswana continues to grow as more land is acquired for agricultural purposes. Land use policy continues to shape the dynamics of domestic livestock–wildlife interaction at the interface. These interactions, mostly relating to conflicts and interspecies fights, facilitate disease transmission in carnivore species especially canine distemper and rabies. Although prevalent in Botswana, both diseases have not received detailed epidemiological studies. Previous molecular studies done to determine the pattern of rabies circulation showed two distinct patterns of viral circulation: the domestic dog – black backed jackal – bat eared fox cycle representing the domestic cycle; and the mongoose cycle referred to as the wild cycle. A high number of rabies cases in the country have been recorded in Ngamiland and Okavango districts over the last two years, while Canine Distemper Virus (CDV) continues to pose a significant risk to endangered species like the African wild dog. The domestic dog population is an important reservoir of CDV locally and has been observed to transmit the disease to wild carnivores.

Herbivore diseases within the interface are influenced by the species involved, ecological conditions and resource availability within a locality. Availability of surface water is a major factor determining the grazing range of water-dependent wildlife species during the dry season and the intensity of wild animals' interactions with livestock. Foot and Mouth Disease (FMD) is a disease of international trade importance that has significantly affected the country in the past. Botswana has a significant population of the African buffalo that is a known reservoir host for specific strains of the FMD virus (SAT types). The buffalo population occurs in the northern ecosystem where infrastructure has been put in place to restrict species movement within that area as a way of viral containment. Different zones, coupled with control in movement of cloven-

hoofed animals and their by-products throughout the country, have been established as control measures for FMD. The arrangement is unique to southern Africa where free ranging FMD infected buffalos exist and continues to stimulate new approaches to transboundary animal disease control strategies. Malignant Catarrhal Fever is a prevalent disease associated with blue wildebeests in Botswana. Although the disease is distributed throughout the country, it is more evident in the eastern and south-western parts of the country where surface water is scarce during the dry season. Keeping of blue wildebeests in cattle ranches and game ranches adjacent to cattle ranches pose the same disease risks.

Effective disease control strategies for diseases at the livestock–wildlife interface should be based on epidemiological studies. Comprehensive cost-benefit analysis of disease control strategies should encompass all sectors of the economy relating to the affected communities using the One Health approach. Although Botswana lacks technical capacity to undertake comprehensive wildlife disease surveillance and investigation, some basic passive surveillance methods do exist. More effective control strategies would, however, also require efficient animal disease legislation to be put in place. It is necessary to infuse various disease control measures into existing management activities for different stakeholders for effective implementation.

### Depredation and Wildlife Conservation in the Southern Kalahari: Looking for a Way Forward

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Wildlife management and livestock utilisation in southern Kalahari rangelands has reached a crossroads whereby the promotion of livestock-keeping adjacent to Kgalagadi Transfrontier Park (KTP) is negatively impacting upon wildlife populations and creating unprecedented levels of depredation. Assessment of the condition of a portion of the 100km long fence that runs along the KTP boundary from Two Rivers to west of Khawa in October 2013, along with spoor counts of the animals that were found along it are presented, together with an assessment of herding and kraaling strategies on neighbouring cattle-posts. Fifty-six eland carcasses were found in or next to the fence over a 40km section between Hartbeesloop Gate and TshaneTshane, and were believed to be from a broader movement of eland out of the TKP in the winter of 2012. The importance of measures that promote rather than restrict the mobility of Kalahari ungulates is emphasised, along with the preference to fence the farms rather than the TKP boundary. The fence was found to be a largely ineffective barrier to predators with jackals and hyenas digging under it, enabling lions to access the areas to the east, particularly where movement of the sand dunes it crosses had created gaps within the fence. While livestock kraals varied in their design and 'predator proofness', the general absence of herding and the tendency for cattle to remain out at night so as to benefit from the early morning dew, meant that cattle were particularly vulnerable to depredation. The need to diversify livelihoods through the development of wildlife/based tourism economies within a CBNRM framework that fully embraces the benefits of multi-species animal production systems is emphasised.

**Transboundary Disease Management in Southern Africa: Implications for Transfrontier Conservation, Agriculture and Economic Development**

Mark W. Atkinson, Mokganedi Mokopasetso, Shirley J. Atkinson and Steven A. Osofsky, *Wildlife Conservation Society, Animal & Human Health for the Environment And Development (AHEAD), USA*

Southern Africa has a disproportionately high fraction of global biodiversity, found across a range of arid and semi-arid ecosystems. Fourteen potential and existing terrestrial Transfrontier Conservation Areas (TFCAs) have been identified in this region, many encompassing national parks, game reserves, hunting areas, and conservancies embedded within a matrix of land under traditional communal tenure. The existing and proposed TFCAs cover more than 750,000 km$^2$ and include within their borders many of sub-Saharan Africa's highest priority biodiversity conservation areas.

*AHEAD* (Animal & Human Health for the Environment And Development), a programme of the Wildlife Conservation Society (WCS) and partners, is focused on problems facing biodiversity conservation and development in large, transboundary landscapes; from the critically important perspective of the linkages among wildlife health, domestic animal health, and human health and livelihoods. One current area of focus is the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA), arguably the world's largest conservation-oriented landscape. The development of TFCAs to further the conservation of biodiversity and sustainable development through the harmonization of transboundary natural resource management is a priority for Southern African Development Community (SADC) and the five countries that encompass KAZA, which are: Angola, Botswana, Namibia, Zambia and Zimbabwe. KAZA spans 440,000 km² and encompasses more than 35 national parks, game reserves, community conservancies and game management areas. The area contains the largest contiguous population of elephants (>250,000) on the continent and includes, for example, the Okavango Delta (the largest Ramsar site in the world), Chobe National Park and Victoria Falls (a World Heritage Site).

The primary economic driver behind the creation of TFCAs like KAZA is nature-based tourism that seeks to maximize returns from marginal lands in a sector where southern Africa enjoys a global comparative advantage. In fact, nature-based tourism may now contribute as much to the gross domestic product in SADC countries as agriculture, forestry, and fisheries combined. Consequently, a key strategy for biodiversity conservation in southern African TFCAs is securing biological connectivity across larger landscapes in which the region's core protected areas are increasingly facing the threat of becoming isolated ecological islands in agricultural landscapes, with the loss of connectivity so important to maintaining genetic diversity and the viability of globally endangered wildlife populations. Enhanced connectivity across large landscapes such as the KAZA TFCA is also considered to be a crucial factor in biological adaptation to climate change in the region.

Loss of important habitat corridors through land-use restrictions, primarily driven by livestock disease control requirements, contributes to ongoing habitat fragmentation and the loss of traditional migratory and dispersal routes in the region. Present animal disease controls depend in large part on thousands of kilometers of game-proof fences and strict regulation of local and export markets for animal products. Disease control fences and the physical and land-use barriers they create pose one of the greatest threats to transboundary connectivity and the vision of vast conservation landscapes that seeks to foster both conservation and livelihood benefits in largely semi-arid lands that may be considered marginal for agriculture.

The management of wildlife and livestock diseases (including zoonoses) within KAZA remains unresolved and an emerging policy issue of major concern to livestock production, associated access to export markets, and other sectors, including public health. The TFCA concept promotes free movement of wildlife over large geographic areas, whereas the present approach to the control of transboundary animal diseases (TADs) is to prevent movement of susceptible animals between areas where TADs occur and areas where they do not, and to similarly restrict trade in commodities derived from animals on the same basis. The TFCA concept and current internationally accepted approaches to the management of TADs are therefore largely incompatible – a key threat to transboundary conservation success and risk-diversification of land-use options and livelihood opportunities in the region.

The *AHEAD* programme, launched in 2003, aims to help resolve these issues and contribute to the conservation of biodiversity and the enhancement of livelihoods of the rural poor in KAZA. This would be accomplished by helping to create an enabling environment for enhanced cooperation among conservation, agriculture and human health experts and authorities within and between member countries, identifying mechanisms for controlling TADs without complete reliance on current fencing approaches, and informing and influencing cross-sectoral and transboundary policy responses that support both TFCAs and control of TADs.

### Disease Burdens at the Wildlife-Livestock Interface in Two Protected Areas of Northern Botswana: the Okavango Delta and Chobe National Park

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Animals living in Transfrontier Conservation Areas (TFCAs) are particularly exposed to the introduction of pathogens from neighboring countries and to increased opportunities of transmission between wildlife, livestock and human populations. These pathogens can have serious impacts on the health of livestock, wildlife or people if they come across susceptible or naive populations in which they can amplify. Therefore, monitoring the circulation of pathogens at the interface of TFCAs appears particularly relevant from a sanitary, conservation and public health perspective. The goal of this work was to produce baseline reference data on the circulation of selected zoonotic or production limiting diseases at the wildlife-livestock interface of two main protected areas of northern Botswana, belonging to the KAZA TFCA. In this context, 500 cattle were sampled along the western boundary of the Okavango Delta (OD), while 450 cattle were sampled in the eastern and western borders of the Chobe National Park (CNP) in April 2010 and 2011 respectively. Cattle sampling in both areas was accompanied by the implementation of semi-structured questionnaire on cattle farming practices and potential contacts with wildlife. In addition, 85 buffalo were initially sampled in CNP and another 85 individuals in December 2010. Buffalo and cattle samples were screened for the presence of antibodies against brucellosis, bovine tuberculosis and Rift Valley fever (RVF). In addition, samples of buffalo were screened for various tick-borne diseases such as *Theileria, Anaplasma, Ehrlichia and Babesia* species. Brucellosis antibodies were detected in buffalo in both study areas, but very low levels were found in cattle from both areas. Antibodies against RVF virus were found at similar prevalence levels in buffalo and cattle, although no clinical disease has ever been reported for cattle in northern Botswana. Buffalo and cattle seroprevalence against RVF were significantly higher in Ngamiland than in the Chobe area ($p>0.001$). Antibodies against *Mycobacterium bovis* were detected in a small proportion of livestock at the interface of CNP, but insignificant levels of antibodies were found in buffalo from both areas and in cattle at the interface of the OD. Significant levels of tick borne parasites being able to affect livestock production were identified in buffalo populations from OD and CNP. These findings provide baseline data on the circulation of diseases at the wildlife-livestock interface with possible environmental and public health implications. The baseline data was collected during the first year after the signature of the KAZA TFCA Treaty and the results obtained justify further comprehensive studies in future to monitor the dynamics.

**Identifying and Managing the Coupling Points Influencing Community Livelihoods and Ecosystem Health**

Kathleen A. Alexander and Mark E. Van de Walle, *Department of Fisheries and Wildlife Conservation, Virginia Tech, Blacksburg VA, USA; CARACAL, Kasane, Botswana*

With nearly 50% of the Earth's surface characterized as 'dryland', the linked issue of water quality, health and water scarcity is identified as an urgent global problem but particularly in dryland countries such as Botswana. Our work on climate-health interactions in the Chobe River region of northern Botswana identifies important linkages between human and wildlife health, landscape change, and degradation in ecosystem services related to water quality and sanitation deficiencies. We identify important coupling points where changes in components of the system may arise from and be influenced by changes in human and animal health and ecosystem function. These linkages and coupling points increase human population vulnerability to forecasted climate change. Our work also identifies human presence and landscape transformation as an important contributor to the spread of antibiotic resistance and microorganism transmission potential at the human-wildlife interface. Evidence of high levels of antimicrobial resistance among various wildlife species, even within protected areas, identifies an emerging health threat and also highlights the need for improved waste management in these systems. As humans encroach into natural areas, contact between humans and wildlife escalates. Our zoonotic disease research programme identifies interactions between biodiversity, land use, poverty, cultural practices in bush meat utilization, and potential increased risk of exposure to important zoonotic diseases such as leptospirosis and brucellosis. Identification of a novel emerging pathogen closely related to human tuberculosis in banded mongoose, *Mycobacterium mungi*, underlines the threat of emerging disease at the human-wildlife interface and the manner in which human landscape use can increase disease transmission. Humans, wildlife, and the environment are inextricably linked. Understanding and managing these linkages will be key to the sustainable management of these systems and the health of dependent populations.

**Preliminary Assessment of Human-Wildlife Conflicts in the Greater Mapungubwe Transfrontier Conservation Area: A Case Study of Maramani Communal Area, Zimbabwe**

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Human-wildlife conflict (HWC) is a common phenomenon especially in tropical countries where local people mostly depend on natural resources occurring adjacent and/or inside protected areas. The implementation of transboundary conservation initiatives has been perceived to result in an increase in HWC, especially in rural communities lying within conservation areas as a result of an expanded range of wild animal habitats, increasing human population associated with expanding human settlements, livestock populations and crop production. Here we report on the preliminary assessment of HWC in Maramani Communal area, Zimbabwe, a part of the Greater Mapungubwe Transfrontier Conservation Area. The objectives of the assessment were threefold: (i) to determine the nature and extent of HWC, (ii) to establish problem wild animals, and (iii) to determine methods used to manage the HWC in Maramani Communal area. Data were collected from five villages within the Maramani Communal area using (i) key informant interviews with 10 community members, that is, two representatives from each of the five study villages, (ii) interviews with 50 randomly selected households (ten households per village), and (iii) field observations covering the HWC hotspots between September and October 2013. During this period, crop-raiding conflicts are usually at their lowest whereas livestock predation is at peak levels. Our results showed that a total of 11 wildlife species were reported as problem animals in the study area. Elephants were reported to invade fields and destroy crops in the cropping season (November to March); and also damage veterinary

fences and other infrastructure within the study area. However, livestock predation peak periods were reported to occur in the hot-dry (August–November) and cool-dry (April–July) seasons. Predation was mostly from spotted hyena, lion and jackals. Fencing, vegetable gardens, scaring animals by beating drums, setting fires in the crop fields at night and kraaling livestock were the common methods employed by the local people to minimise or manage HWC within the study area. Moreover, the responsible authorities, being Beitbridge Rural District Council and Zimbabwe Parks and Wildlife Management Authority staff from Tuli Safari Area, assisted in managing problem animals through various control methods as well as conducting conservation awareness and education programmes. Overall, local people in Maramani Communal area rated the impact of HWC as medium to low. We recommend that there is need for the refining of integrated conservation and development projects in the study area taking into cognisance ways of reducing existing HWC, and also enhancing conservation benefits to local people.

**Classical Fisheries Management and Transboundary Fisheries Management, A Panacea for Sustainable Fish Utilization? The Case of the Okavango Delta**

Keta Mosepele, *Okavango Research Institute, University of Botswana, Botswana*

Article 63 (1) of the 1982 United Nations Convention provides the legal framework, at a global scale, for the development of transboundary fisheries management initiatives among and between states. The Southern African Development Community (SADC) protocol (Article 4.1) on fisheries defines transboundary fisheries management among and between SADC Member States. These international tools have defined the general parameters regulating the management of fish resources that straddle international boundaries. The instruments are, however, silent on the nature and form of the resultant transboundary management regime that should be implemented to manage fish resources. It is on this basis that the main philosophical construct of "The Tragedy of the Commons" underpins both classical and contemporary approaches to fisheries management, where effort regulation is the main management objective to ensure sustainable fish utilization. Generally, this management philosophy is driven by international and regional Non-Governmental Organizations (NGOs). There are, however, a plethora of fisheries management issues at both national and transnational levels that need to be addressed by a management plan. A *truly* holistic approach needs to be taken to identify these management issues, and a *genuinely* participatory exercise needs to be undertaken to find a solution to these management concerns. Ultimately, the success of these management interventions (at all scales) depends primarily on the driver (e.g. national governments, transnational organizations, international NGOs, etc.) of these at the operational level. Essentially, the products of management interventions in (transboundary) fisheries management are donor driven processes that sometimes do not have any basis on pertinent concerns. This presentation argues for a holistic approach to fisheries management interventions where the issues and solutions should be from within. It analyses a transboundary fisheries management plan for the Okavango River Basin fisheries that was predominantly donor driven and not developed from within. This prevailing scenario, where donors identify the issues and propose solutions, creates an environment where the beneficiaries of the proposed interventions do not have ownership. Lack of ownership makes the management plan unsustainable in the long term. Because the prevailing management philosophy is based on the commons theory, interventions are invariably related to technical measures (e.g. mesh restrictions, gear restrictions, closed seasons, closed areas), input controls (e.g. licenses, state regulated access, ownership), and output controls (e.g. quotas, size limits). The fundamental question then is whether these interventions are appropriate to manage dynamic, floodplain fisheries. Current research has shown that access, user rights and conflicts are the predominant fisheries management concerns bedevilling floodplain fisheries. Upstream developments (e.g. agricultural, infrastructural developments like dams, etc.) present urgent and clear threats to fish habitats (hence fish production) that need to be addressed by transboundary management plans. These issues are, however, not addressed by classical management approaches. This presentation highlights these concerns and proposes a conceptual framework for the development of a more holistic plan for the development of transboundary management plans for floodplain fisheries, using the Okavango Delta as a case study.

## Monitoring Vulture Movements

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Botswana's vultures are all globally threatened but little information exists on their numbers, distribution and movements. Herremans and Herremans-Tonnoeyr (2000) showed that raptors were generally more abundant in protected areas in Botswana than outside. In addition, Mundy *et al.* (1992) stated that some species such as the Lappet-faced Vulture had relatively small home ranges. A project was therefore set up to test the hypothesis that Botswana's large protected areas could support viable vulture populations. The project is a collaboration between BirdLife Botswana, Denver Zoological Foundation and Kalahari Research and Conservation, facilitated by the Department of Wildlife and National Parks.

Eight Lappet-faced and two White-headed Vultures were fitted with satellite transmitters in various protected areas throughout the country and their movements regularly monitored. Over 200 White-backed Vultures, which were caught incidentally, were fitted with rings and patagial tags.

Most Lappet-faced Vultures maintained small home ranges during the breeding season but thereafter made long range forays outside of protected areas and beyond Botswana's borders into Namibia and South Africa. These long range forays were of short duration and the birds returned to their core home ranges. The White-headed Vultures ranged widely but mostly within the Central Kalahari and Khutse Game Reserves. Re-sightings of tagged White-backed Vultures have been from various localities outside protected areas but mostly within Botswana – no clear pattern is detectable from the small sample.

The implications of these findings for vulture conservation are discussed, particularly in the light of mass poisoning events, which have occurred throughout southern Africa in recent years. Recommendations are made for regional vulture conservation activities.

## Okavango Delta's Contribution to Climate Change through High Diffusive Methane Fluxes

Mangaliso J. Gondwe and Wellington R. Masamba, *Okavango Research Institute, University of Botswana, Botswana*

Global warming is associated with the continued increase in the atmospheric concentrations of greenhouse gases (GHGs); carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$). Wetlands constitute the largest single natural source of atmospheric $CH_4$ in the world, contributing between 100 and 231 Tg $yr^{-1}$ to the total budget of 503–610 Tg $yr^{-1}$, approximately 60% of which is emitted from tropical wetlands. We conducted diffusive $CH_4$ emission measurements to evaluate the contribution of the Okavango Delta to the atmospheric $CH_4$ budget. Diffusive $CH_4$ fluxes varied between 0.24 and 293 mg $CH_4$ $m^{-2}$ $h^{-1}$, with a mean (±SE) emission of 23.2±2.2 mg $CH_4$ $m^{-2}$ $h^{-1}$. These emission rates lie within the range reported for other tropical wetlands. The emission rates were significantly higher ($P$<0.007) in permanent than in seasonal swamps. River channels in permanent and seasonal swamps exhibited the highest average fluxes at 31.3±5.4 mg $CH_4$ $m^{-2}$ $h^{-1}$ compared to floodplains (20.4±2.5 mg $CH_4$ $m^{-2}$ $h^{-1}$) and lagoons (16.9±2.6 mg $CH_4$ $m^{-2}$ $h^{-1}$). Diffusive $CH_4$ fluxes in the Delta were probably regulated by temperature since emissions were highest (20-300 mg $CH_4$ $m^{-2}$ $h^{-1}$) and lowest (0.2-3.0 mg $m^{-2}$ $h^{-1}$) during the warmer-rainy and cooler winter seasons respectively. Assuming mean inundation of 9,000 $km^2$, the Delta's annual diffusive emission was estimated at 1.8±0.2 Tg, accounting for 2.8±0.3% of the total $CH_4$ emission from global tropical wetlands. But what does this mean for future conservation in southern Africa in general?

## Transboundary Collaboration

Dr Chris Brooks, *Southern Africa Regional Environmental Programme, Botswana*

Over the past two years the Southern Africa Regional Environmental Programme (SAREP) has been working with the respective fisheries officers from Angola (National Institute of Fish Research), Botswana (Department of Wildlife and National Parks) and Namibia (Ministry of Fisheries and Marine Resources) to develop and implement a transboundary fisheries management plan for the Okavango River Basin. The management plan was completed in August 2013 and has since been approved by the relevant Ministries in the three countries. The aim of the plan is to establish a joint management system to ensure the conservation and sustainable use of the shared fish resources of the Okavango River for the benefit of local communities. The management plan will also provide a foundation for the responsible co-management of shared fish stocks between Angola, Namibia and Botswana in the Okavango River basin. In order to achieve this aim, information on the yield and harvesting patterns used by the subsistence and commercial fisheries, biodiversity data of the fish populations and institutional linkages between scientists in Angola, Namibia and Botswana must be obtained and shared.

The first stage of the collaborative implementation began in April 2014, with a joint biological survey of the system, using a standardised monitoring protocol. All three countries have accepted that even with joint law enforcement patrols and ultimately harmonised fisheries regulations, there is a need to enhance and also facilitate the greater participation of fishing communities in the management of the resources upon which they largely depend for food security and income generation. As part of this management strategy, a series of community focused Fish Protection Areas will be identified and established during 2014 and 2015.

Fish stocks within certain sections of the river have been detrimentally affected through intensified fishing activities and the use of more effective fishing gears. Some researchers have already demonstrated the negative impact of fishing within the Namibian stretch of the river between 1992 and 1999, finding that experimental catch rates within Muhango National Park were approximately five times higher than in heavily-exploited areas upstream. Similar concerns for over fishing are however not expressed for the Okavango Delta, with its complex mosaic of habitats and areas of relative inaccessibility. Recent surveys into the upper catchment have discovered species that are new to science and highlighted the need for improved conservation.

This project is just one component of increasingly integrated fisheries research and management activities throughout the region. The Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA) is increasingly becoming a major partner in managing fisheries along with other transboundary natural resources. The management plan highlighted here can further act as a catalyst for improving cooperation in management and development of the river with other riparian states that share the resources of the Okavango/Zambezi system, including, Zambia and Zimbabwe.

## Aim and Goal of the Development of the KAZA TFCA

Mbiganyi Frederick Dipotso, *KAZA TFCA Secretariat, Kasane, Botswana*

The Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA), as stated in the KAZA Treaty signed on the 18th August 2011, exists primarily for the purpose of harmonizing policies, strategies and practices for managing shared natural resources that straddle international borders of the five partner countries. It also provides opportunities for deriving equitable socioeconomic benefits through the sustainable use and development of the share natural and cultural heritage resources. The KAZA TFCA partner countries are Angola, Botswana, Namibia, Zambia, and Zimbabwe. The KAZA TFCA covers a total area of about 444, 000 $km^2$ with 36 proclaimed protected areas including Okavango Delta (Ramsar Site), and

Victoria Falls (World Heritage Site). The TFCA is richly endowed with biodiversity and cultural wealth, whose sustainability and potential benefits depend on the ability to conserve these unique resources through transboundary collaboration and local integration of policies, strategies, and practices.

**The vision** of the KAZA TFCA is to "*establish a world-class transfrontier conservation and tourism destination area in the Okavango and Zambezi River basins, supporting sustainable development in this region by 2030",* while its **mission** is to *"sustainably manage the Kavango Zambezi ecosystem, and its heritage and cultural resources based on best conservation and tourism models for the socio-economic wellbeing of the communities and other stakeholders in and around the KAZA region through harmonization of policies, strategies and practices*." It is the desire of the KAZA partner countries to manage the TFCA based on principles of good corporate governance and strong business ethics that will create value to the constituent stakeholders such as local communities, private sector and government agencies, including the central treasuries of the five countries.

The KAZA TFCA was set up taking into consideration its environmental, tourism and socio-economic significance, recognizing that the TFCA is endowed with multiple conservation and business opportunities with a great potential to contribute to the socio-economic development of the communities living in and along the TFCA, as well as to larger economies of the partner countries. Hence, rural development and poverty eradication through increased community benefits derived from natural resources and cultural resources are some of the key outcomes envisaged for the KAZA TFCA.

## Are Protected Areas in Botswana Working?

Richard Fynn, *Okavango Research Institute, University of Botswana, Botswana*

The northern conservation area of Botswana is one of the largest and most functionally intact protected areas network remaining in Africa. It contains key dry season habitats in the form of floodplains and swamps of the Okavango Delta, Selinda Spillway, Linyanti Swamps, Savuti Channel, Savuti Marsh and the Chobe River Front, as well as the Chobe Enclave dambo grasslands that provide reliable grazing and greenery over the dry season. The woodland systems adjacent to these floodplains also provide alternate dry season grazing options within easy reach of drinking water. Functional wet season grazing for short to medium-grass grazers such as wildebeest and zebra are provided by nutrient-rich saline grasslands on the Mababe Depression, Nxai Pan and Makgadikgadi pans, while a mix of Sandveld and Mopane woodlands provides important wet season habitat heterogeneity for medium-grass grazers such as buffalo and tall-grass grazers such as roan and sable. This regional-scale distribution of functional seasonal habitats results in three different long-range migrations of zebra as well as medium-range seasonal movements of buffalo. These medium and long-range seasonal movements act to maintain good rangeland condition and minimize densities of lions, enabling non-migratory rare antelope such as sable and roan to select low-predation-risk habitat – a key factor for their survival and for the maintenance of large-herbivore biodiversity in the region.

In contrast to the northern conservation area, the Cental Kalahari Game Reserve and Kgalagadi Transfrontier Park (KTP) have much poorer, dry season grazing options and poor water security for herbivores. The vast distances required for movement to water during drought years by Kgalagadi ungulates (500-600 km) renders it impossible for a protected area network to conserve what once represented Africa's third largest population of ungulates (wildebeest, hartebeest and springbok). This situation can possibly be ameliorated to some degree by a well-planned system of water supply during the dry season in the KTP/Schwelle region so as to enable the wildebeest population to recover to much-higher numbers than present.

### Towards a Systems Approach for Artificial Water Provision in the Kruger National Park

Izak P.J Smit, *South African National Parks, Kruger National Park, South Africa*

There was concerted effort, especially between the 1960s and 1990s, to increase the distribution of surface water in Kruger National Park (KNP), South Africa. By 1995 there were more than 350 boreholes and 50 earth dams providing water for animals. As a consequence, most of the park was within easy walking distance of a permanent water source for large, mobile herbivores during the peak of the water-for-game programme with less than 20% of the park further than 5km from permanent water during a drought. This situation was unnatural and led to various unintended ecological effects in KNP and in surrounding protected areas. In reaction to this and in response to a changing conservation and management paradigm from a largely "nature-in-balance" approach towards a more "nature-evolving" approach, the water provision policy was revised in 1997. This new policy takes a "system" rather than an "issue-based" view, aiming to recreate and mimic a more natural mosaic of spatio-temporal variability in surface water availability instead of focusing on using waterholes to symptomatically address specific issues or concerns. Since the policy change, about two-thirds of the boreholes have been strategically closed and many catchment dams have been breached (or not repaired after floods) in a process ongoing to this day. KNP managers hope that the change in water provision will induce spatial and temporal variation in how large mammals utilize landscapes, and as a result induce a more natural and heterogeneous utilization gradient ranging from water-rich to water-remote areas, with cascading effects on other aspects of biodiversity as well. However, through the adaptive management approach we also recognize that water management will remain a continuous learning process, and one should be prepared to adapt due to unpredictable surprises and unintended consequences typical to complex systems. In my presentation I will briefly outline the "dilemma" of water provision in KNP, the approach we follow and the basic principles that underline our current water provision policy.

### The Pattern and Increase of Poaching in Botswana

Tim Blackbeard, *Department of Wildlife and National Parks, Botswana*

The pattern of poaching over the last 10 years or so has changed drastically. No longer is hunting done for just subsistence means but it has turned into commercial poaching. Previously, the odd animal killed used to be in the central parts of the country where cattle posts and wildlife mixed, with a few cases along the northern borders. Every now and then, a few predators would be killed in retaliation for raiding domestic stock.

But since the turn of the century, illegal hunting has taken a turn for the worse to become commercial poaching with sophisticated syndicates moving into ivory and rhino horn hunting, with products being destined primarily for south east Asia as the predominant end user market. This has also brought in drugs in exchange for the ivory and rhino horns, particularly in the northern parts of the country. The eastern part of Botswana, the Tuli Block, has a healthy population of elephants and poaching remains relatively low. A new trend of poaching is that people are targeting predators, mainly lion, leopard and cheetah. The parents are killed or separated from their cubs, which are then taken alive and sold across the border in South Africa for large sums, ranging from BWP50,000 to BWP75,000 per cub. This is taking place along the southern border from the Kgalagadi Transfrontier Park to Werda.

The rhino population in the country has increased, but has come at a high cost. The poaching of these animals in South Africa has been extremely high and may top 1,000 this year alone. Once the South African wildlife authorities tighten up security of their rhino population and poaching is made more difficult, attention will turn to Botswana. This in turn, will put a strain on Botswana's law enforcement and resources to protect her rhinos. Botswana has employed all its security forces, from the prisons department to the military and the wildlife department. Up to now, the rhinos are steadily increasing with the odd rhino being shot.

## An Assessment of Fire Occurrences in Some Protected Areas in Botswana from 2006 to 2010

Charles Mpofu, *Department of Wildlife and National Parks, Botswana*

Wildland fires affect millions of hectares of forest and other vegetation in the world annually. In some ecosystems, fire plays an ecologically significant role in maintaining biogeochemical cycles and disturbance dynamics. In other ecosystems, fire may lead to the destruction of forests or long-term degradation. In most areas of the world, wildfires burning under extreme weather conditions would have detrimental impacts on economies, human health and safety, with consequences that are of significance and severity comparable to other major natural hazards. In Sub Saharan Africa, more wildland fires burn in higher frequencies than in any other continent of the world. Approximately 175 million hectares burn every year, accounting for 37% of dry matter burnt globally.

Botswana is also affected by wildland fires. The outbreaks of these fires especially in the Chobe and Ngamiland districts are large scale due to heavy loads of fuel from the past wet seasons. These fire outbreaks are often contained after several weeks with major efforts from various stakeholders. The majority of big fires have affected protected areas such as Central Kalahari Game Reserve, Chobe National Park and Moremi Game Reserve, but the severity of damage and long term impacts of these recurring fires have not yet been adequately assessed.

This presentation, therefore, provides insight into fire occurrences in some protected areas in Botswana over a period of five years including Chobe National Park, Moremi Game Reserve, Makgadikgadi/Nxai Pans National Park, Central Kalahari Game Reserve, Khutse Game Reserve and Kgalagadi Transfrontier Park. Trends from 2006 to 2010 are presented and areas prone to fires within each protected area identified. The Department of Wildlife and National Parks (DWNP) formulated a fire management strategy in 2011 to improve response time in case of fire outbreaks and it is expected that the strategy will be reviewed in 2016 to identify gaps, highlight current constraints of the system and incorporate improved fire management strategies based on lessons-learnt. Some of the strategies include development of a quick fire response team at district level. There are also yearly meetings convened by DWNP's district fire coordinators to review the previous fire season and assess effectiveness of the fire management strategies put in place.

## Illegal Bushmeat Hunting in Botswana

JW McNutt, *Botswana Predator Conservation Trust, Botswana*

The illegal hunting of wildlife for human consumption (called "bushmeat") has driven the near complete collapse of wildlife populations in some parts of Africa and in particular, West Africa. Reports of illegal hunting of wildlife for meat in Botswana are frequently reported to law enforcement authorities (Botswana Police, DWNP Anti-poaching Unit (APU), and Botswana Defence Force APU), but the actual frequency of this illegal activity and its impact on Botswana's wildlife populations remains unknown. Results from recent comprehensive wildlife surveys of northern Botswana showed significant declines in many wildlife species (Chase, 2011; DWNP, 2012) compared to previous government aerial surveys. Explanations to account for these declines vary widely and are speculative. Listed among possible explanations is "illegal hunting", but in the absence of information about the frequency of this activity, its impacts remain unknown. Here we present results of a case study of a leasehold Wildlife Management Area in the western Okavango Delta to model the potential impacts of varying levels of offtake. We apply a simple single species population growth model and vary frequencies of offtake to investigate the potential impacts of illegal hunting on the viability of these wildlife populations. We parameterize the model using population data from aerial surveys and apply known large predator population densities and predation rates derived from our focal study populations elsewhere in the Okavango Delta. Results from this investigation demonstrate that: (i) this area in 2010 was already unable to sustain large predator populations at densities present elsewhere in the Okavango and (ii) even low levels of additional offtake is unsustainable. We conclude that illegal hunting may be a significant factor in reported wildlife population declines in northern Botswana.

## Land Use Planning and Wildlife Management: The Case of Ngamiland District Integrated Land Use Plan

Sekgowa Motsumi[1], Kent Burger[2] and Dr Chris Brooks[3]

*[1] Department of Environmental Affairs, Botswana; [2] Natural Resources and People; [3] Southern Africa Regional Environmental Programme, Botswana*

Ngamiland District was one of the districts that developed a district-specific Integrated Land Use Plan (ILUP) as required by the land related legislations and National Land Policy. The main thrust behind this initiative was to ensure optimal land use dispositions in the district with minimal resource use conflicts. The ILUP was prepared in phases with the first phase being highly consultative, only covering a portion of the district and focusing on the Okavango Delta Ramsar Site; while the next phase was a consolidation of existing plans and expanding the integrated land use planning to the entire district. The latter phase was less consultative, primarily driven by Department of Lands based in Gaborone. All the plans incorporated wildlife management as a major component of land use planning and cornerstone of the district economy. However, implementation of the ILUP has faced a number of challenges, including resource and capacity constraints by implementing agencies; mismatch in scale at which land zonation was done; and implementation level. A key lesson was that planning should be done at the right scale and appropriate management unit. To deal with these the land authority, in collaboration with District Land Use Planning Unit initiated a process to pilot a spatial and temporal scale based land use planning tool called Land Use Conflict Identification Strategy (LUCIS). The tool deliberately identified conservation as a land use that is competing with other uses and thereby contributing to conflict. The participatory nature of the LUCIS model and its futuristic approach has created a useful platform for dialogue amongst planners and communities. One of the key successes was the visualisation of areas with potential for land use conflict and link between formal scientific knowledge and indigenous knowledge. The tool has demonstrated that there is need for land use planning to consider temporal aspects of resource use versus fixed term spatial use. Wildlife habitat requirements such as corridors and landscape connectivity are also critical in land use planning.

## Role and Contribution of BWTI in Wildlife Management: Successes, Challenges and Opportunities

Moemi Batshabang and Mpiga J. Mangubuli, *Botswana Wildlife Training Institute, Botswana*

This presentation discusses the role and contribution of Botswana Wildlife Training Institute (BWTI) to wildlife management in Botswana. It also discusses challenges and explores opportunities for growth in order to contribute more meaningfully to the development of skills for management of the national renewable natural resource base and the resultant tourism industry.

BWTI was established in 1980 to provide pre-service and in-service training for all categories of staff at Department of Wildlife and National Parks (DWNP); operational base for dissemination of information on wildlife conservation; and training facilities for government authorities and the general public. Gradual development of the physical infrastructure and the capacity of the institute enhanced the upgrading and broadening of curricula to cope with the growing needs for technical training for personnel in DWNP and the private sectors in wildlife and tourism industries. Training efforts undertaken by the institute to-date have focused on empowering wildlife officers and private individuals with knowledge and skills that can enable them to operate in any relevant organisation with minimum supervision and to adapt to emerging challenges of wildlife conservation and tourism in the country.

The projected annual increase of visitors by 10% above the 1997 level to the year 2020 would create a serious deficit in human resource capacity to manage the country's natural resources and provide related skills for the tourism industry. This opens opportunities for training services at BWTI to meet the demand for skilled people to sustain utilisation of natural resources and growth of the tourism industry.

The institute has already developed modular curricula for certificate and diploma in wildlife management and conservation,

as well as basic certificate in professional tour guiding. There is, however, need for transformation of BWTI to strategically respond to the training needs of the wildlife and tourism sectors in Botswana and the SADC region by developing and maintaining effective high quality, market-focused, needs-driven and success-oriented training curricula. Production of competent and flexible workforce and entrepreneurs who will perform and adapt to changing technological and socio-economic demands of the wildlife and tourism industries is more critical now than ever before. Apart from training for the public service, a potential market exists from private candidates within the country and abroad, private sector, Community Based Organizations and Non-Governmental Organizations.

### Transboundary Wildlife Corridors

Chris Brooks[1] and Mike Chase[2]

*[1] Southern Africa Regional Environmental Programme, Botswana; [2] Elephants Without Borders, Botswana*

Securing the conservation of the remaining wildlife corridors within the Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA), as well as opening up new (or previously blocked) corridors, is one of the most important management strategies required to ensure the viability of the region's large and medium-to-large sized wildlife populations. Habitat fragmentation, driven by human activity and development, is threatening to cut off the small number of remaining functional corridors in the region, whilst the alignment of existing fences continues to restrict and confine wildlife movement between the protected areas within the KAZA boundary. Research by Elephants Without Borders (EWB) has identified a number of critical corridors for the movement of elephants across the borders of the 5 countries within the KAZA TFCA. The linchpin that ties these movements together and the focal area for conserving existing wildlife corridors within the KAZA TFCA is the Zambezi Region of Namibia. Work undertaken by the Southern Africa Regional Environmental Programme (SAREP), Integrated Rural Development and Nature Conservation (IRDNC) and World Wide Fund for Nature (WWF) has shown that these elephant corridors are also important for the movement of a range of ungulate wildlife species, including buffalo and zebra. This presentation highlights some results from the work done by EWB, SAREP, IRDNC, WWF and also the Namibian Ministry of Environment and Tourism (MET) in identifying these corridors and the work that is being done to help secure them and to open up corridors currently blocked by fences.

### Balancing High-Level Tourism with Protected Area Management: The Case of Amboseli National Park

Julius K. Cheptei, *Kenya Wildlife Serivice, Kenya*

Kenya is one of the world's mega-biodiversity countries due to its abundance of species and variety of ecosystems. The large wildlife populations in the expansive rangelands of Maasai Mara and Amboseli have long been recognized as a world heritage. The country's biodiversity consists of an estimated 35,000 known species of plants and animals including approximately 21,575 insects, 1,133 birds, 314 mammals, 191 reptiles, 180 freshwater fish, 692 marine and brackish fish and 88 amphibians. The country has a significant number of endemic species in various Important Biodiversity Areas (IBAs) around the country. About 8% of the Kenya's land mass is protected for wildlife conservation. Protected areas in Kenya are important assets for tourism generation as well. The tourism sector is heavily dependent on the vast beauty of the Kenyan environment, which includes landscapes, wildlife, ecosystems and the rich diversity of cultural, historical and archeological resources in the country especially within the protected areas. These valuable resources have become a major attraction for the establishment of a wide range of community-based ecotourism initiatives around the country including Amboseli National Park.

The Amboseli ecosystem covers an area of approximately 9,000km$^2$ stretching between Mt. Kilimanjaro, Chyulu Hills, Tsavo West National Park and the Kenya/Tanzania Border. It is a fragile ecosystem that is internationally recognized as a United

Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve because of its significance as an example of an area that fulfills conservation, research and development functions. The Amboseli ecosystem has, however, been under siege from rising human population, prolonged droughts, and haphazard developments such as unplanned tourism facilities, drilling of boreholes, construction of airstrips, farming, settlement, as well as land subdivision along wildlife corridors. This has resulted in diminishing wildlife, migratory routes and dispersal areas. While the park continues to experience the above, it has remained rich with resource values such as swamps (which include the Kimana and Namelok); wildlife comprising of elephants, lions, zebras, wildebeest and giraffes; Mt. Kilimanjaro; diverse landscapes; authentic Maasai culture; cultural sites of local importance; and traditional pastoralism. There is, therefore need for protection and proper management of the Greater Amboseli ecosystem in order to ensure its sustainability. It was on that basis that park management, in collaboration with stakeholders, developed a management plan that is divided into sections on: plan foundations, AE zonation scheme, five management programmes, and planned monitoring to address the critical issues in balancing high level tourism in the ecosystem.

### Optimizing Financial and Operational Sustainability of Botswana's Protected Areas: Key Findings from the *Strategic Partnerships to Improve the Financial and Operational Sustainability of Protected Areas* Project

Motshereganyi Kootsositse and Kabelo J. Senyatso, *BirdLife Botswana*

Botswana's protected area (PA) management system is currently government-controlled with minimal input from stakeholders. This management system is associated with various problems such as increasing pressure on the protected areas from other land uses, under-budgeting, inadequate manpower allocated to their management and increasing conflicts between wildlife and communities in the PA proximity. To explore opportunities and options for optimization of financial and operational management effectiveness of the PAs in the country, three PAs were selected (Chobe National Park, Khutse Game Reserve and Kgalagadi Transfrontier Park), at which sites some financial variables were measured and this paper reports some of the main findings. Firstly, financial analysis of the three PAs revealed that personnel costs accounted for approximately 60% of the total operational costs. Secondly, with the exception of Chobe National Park, the other PAs under investigation made financial losses during the past 5 years. Thirdly, all park managers and personnel tasked with handling of cash were conversant with National Financial Instructions and Procedures (FIAP), particularly from cash collection to banking of cash. Fourthly, willingness-to-pay (WTP) and willingness-to-accept (WTA) analysis showed that both local and international visitors were willing to pay more for utilization of the selected PAs. An interesting finding was that both local and international WTP were more than their WTA, which is contrary to economic theory which postulates that WTA will always be greater than WTP as it is un-constrained. Fifthly, in order to optimize the financial and operational effectiveness of the PAs, three management models were assessed (private, government and co-management), and based on cost-benefit analysis and multi criteria decision analysis, co-management was deemed the best management option that would optimize financial and operational management effectiveness of the PAs. Lastly, it is important that business planning for the PAs be developed and implemented to enhance their management and financial effectiveness. The business plan must entail a sound financing strategy indicating financing options and target on contribution of each financing option. Under the proposed co-management system, financial sustainability of PAs is emphasized.

# Annex 3: Workshop Session Outputs

## Biodiversity Conservation

| Conservation Issues | Research Needs |
|---|---|
| 1. Authorities must 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, needs limited management interventions. It is vital to keep the system open and natural (that is, adopting a laissez-faire approach instead of an interventionist approach).<br><br>2. Using a systems-approach which considers the whole system when making management decisions is considered vital. Management plans for individual concessions should be developed taking cognisance of 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 entire ecosystem. As noted above, management of individual concessions should be kept to a minimum.<br><br>3. In order to facilitate a systems-approach to conservation, there needs to be explicit harmonization of policies between the Ministry of Agriculture, especially those policies dealing with veterinary issues, and the Ministry of Environment, Wildlife and Tourism. Greater dialogue also needs to take place between these Ministries. 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 as certain parts of the northern plains are key wet-season ranges for Chobe riverfront's 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 riverfront wildlife numbers (Botswana's flagship wildlife area) and compromise movements within the KAZA region.<br><br>4. In order to further facilitate a systems-approach of conservation, wildlife management should be promoted as a primary land-use across regional landscapes 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. Similarly, much of Chobe riverfront's zebra and buffalo populations rely on floodplains in Namibia | 1. Identification of key biodiversity indicators for Botswana and their application in the conservation of wildlife.<br><br>2. More knowledge on which wildlife species have declined the most and the mechanisms contributing to the declines.<br><br>3. Collaborative research with neighbouring countries (e.g. within TFCA framework) to meet conservation objectives.<br><br>4. Utilization of expert opinion and knowledge in gaining a greater understanding of the functioning and structure of whole ecosystems and how to conserve and manage them.<br><br>5. Innovative thinking and problem solving at the wildlife/livestock/human health and livelihoods interface to effect policy change.<br><br>6. An investigation of key issues to develop a wildlife disease framework/policy for Botswana.<br><br>7. More research 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?<br><br>8. Research on vegetation, birds, amphibians, and fish to understand their functional importance in biodiversity conservation. |



| Monitoring Needs | Climate Change Targeted Studies |
|---|---|
| 1. Long-term monitoring of population demography and dynamics; carried out by concessionaires and by DWNP staff, especially within National Parks and Game Reserves.<br><br>2. A fully integrated and comprehensive approach to disease surveillance and management.<br><br>3. Better data on diseases of conservation, agro- economic and public health significance.<br><br>4. While the current aerial census method is needed and provides useful information, it carries with it 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, 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, 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.<br><br>5. Another supplement for the aerial census could be to fly certain blocks in greater detail.<br><br>6. 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.<br><br>7. Important to monitor the effects of artificial waterholes on wildlife populations such as sable and roan. | 1. An investigation of factors to be considered to ensure functional connectivity across landscapes; in order to enable wildlife to adapt to predicted rainfall variability and patchiness under climate change. TFCA's are key to maintaining 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. |

between the Chobe River and the Zambezi River over the dry season. 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.

5. A systems-approach to conservation requires improved transboundary animal disease management from the perspective of biodiversity conservation (ones that don't rely entirely on geographic zonation through veterinary cordon fencing). Concerted 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 considerably positive impact on large-scale conservation management and the success of TFCAs as well as greatly improve the viability of the beef industry.

6. It is necessary to address existing and predicted constraints to wildlife movements across landscapes (strategies include but are not limited to land-use planning & designation, disease management and fencing realignment)

7. The KAZA partner countries must urgently create a policy framework at the national level that recognizes the critical role of TFCAs and demonstrates the importance of TFCAs for conservation. For example, Botswana's new wildlife policy now recognizes the role of TFCAs and Namibia has only just developed policies which even make mention of TFCAs specifically.

8. Clear-cut conservation goals do matter which can subsequently efficiently direct research. As envisaged in the National Biodiversity Strategy and Action Plan (NBSAP) Botswana should develop a core set of biodiversity indicators as part of a Clearing House Mechanism (CHM).

9. Guidelines for conservation translocations are required, with special reference to where a particular wildlife species is released because the genetics of introduced species may corrupt and weaken the genes of the local population. For example, there is a case where some wildebeests were 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.

10. An anti-poaching strategy must adequately involve communities. It is, however, important to monitor the effect of poaching including the wildlife species targeted and the people involved.

11. Development of productive game farms to provide game meat would reduce the demand for bushmeat and go a long way towards curbing illegal hunting.

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| 12. There is acknowledgment that not all fences are bad. It is necessary to understand when fencing is helpful to wildlife and conservation goals. For example, the Boteti fence benefits wildlife by reducing 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. | |

## CBNRM and Tourism

| Conservation Issues | Research Needs |
|---|---|
| 1. There is a need to better understand how much communities are utilizing natural resources.<br><br>2. The contribution of CBNRM to natural resource management needs further exploration.<br><br>3. The effect of tourism on conservation is unclear.<br><br>4. The reason for denying communities access to some areas such as the Delta should be clarified and solutions found to rectify this situation.<br><br>5. Only a few communities that are within wildlife areas benefit from wildlife under CBNRM (Khwai, Sankoyo, Mababe, Kachikau, 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, bear the costs of living next to wildlife areas (crop raiding by elephant, livestock depredation). 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. | 1. Documentation of spinoffs from tourism: people working in lodges have a trickling effect as they always have to share their income with other family members.<br><br>2. Determining who benefits from tourism.<br><br>3. Validation of the perception that people don't want to work in the bush as follow up to the research that was done 10 years ago.<br><br>4. An investigation of different strategies and models for community beneficiation.<br><br>5. Comparative research on CBNRM, extended to other parts of the country (not only northern parts).<br><br>6. An investigation of the effects of the current hunting ban on CBNRM.<br><br>7. A comparative study on benefits derived from hunting versus photographic safaris.<br><br>8. Research on possible benefits to communities from photographic tourism.<br><br>9. An assessment of funding opportunities for CBNRM research? |



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| | |

| Monitoring Needs | Climate Change Targeted Studies |
|---|---|
| 1. Continued involvement of communities in monitoring of natural resources, through MOMS and other systems.<br><br>2. Formulation of criteria used for moving people out of resource rich areas.<br><br>3. Monitoring and evaluation of policies and legislation to ensure that enactment of laws is not targeted to the disadvantage property owners. | 1. What will happen to communities when the Delta dries up?<br><br>2. Targeted communities should be asked what they want done if environment changes due to climate change.<br><br>3. Need for formal / informal education on climate change as related to tourism e.g. photographic safaris.<br><br>4. Study on impact of what communities have seen in terms of climate change influences e.g. rainfall patterns, agriculture, etc. |

## Human-Wildlife Conflict

| Conservation Issues | Research Needs |
|---|---|
| 1. Problem Animal Control (PAC) is reactionary; more resources need to go into prevention of conflict.<br><br>2. Important wildlife corridors are blocked by infrastructure development and human encroachment, while the prevailing management policies do not always favour wildlife conservation.<br><br>3. Inadequate collaboration between stakeholders is a constraint to resolving and planning 'land- use' (see above).<br><br>4. Communities are often excluded when polices are developed.<br><br>5. Areas outside Protected Areas seem to be a 'sink' for predators since many are leaving PAs and not coming back – presumably being killed whilst outside.<br><br>6. It is apparent that more predators and herbivores are being killed by man due to HWC.<br><br>7. Current legislation allows people to kill problem predators as well as receive compensation – this needs to be reconsidered.<br><br>8. It is helpful to accept that the prohibition on hunting cannot be changed in the short term; and monitor it to understand its impact. | 1. Collaboration of data on different species for corridor protection.<br><br>2. An investigation on the sustainability of agricultural policies (e.g. government decision to increase Botswana's cattle herd by 1million).<br><br>3. Management-oriented (applied) research.<br><br>4. Understanding of habitat use, patterns & strategies for livestock.<br><br>5. Government departments to review research priorities and communicate to stakeholders.<br><br>6. Collection of better and consistent data on animal numbers, so we do not have to 'make do'.<br><br>7. Participatory research, involving scientists and communities, to investigate effective solutions for HWC. |



| Monitoring Needs | Climate Change Targeted Studies |
|---|---|
| 1. Long term monitoring of indicator and keystone species.<br><br>2. Participatory monitoring to include the standardized monitoring system that has been developed by SAREP.<br>The system needs to be successfully communicated and implemented by:<br>a. Communities<br>b. DWNP<br>c. Researchers<br>d. Tourism sector<br><br>3. Monitoring of the current Problem Animal Control programme to understand the drivers and factors that influence decisions to resort to lethal control.<br><br>4. Methodology development to enhance effectiveness of monitoring. | 1. Focus more on human-livestock side. Include other experts such as social biologists and anthropologists.<br><br>2. Collaboration and co- ordination between researchers and government (DWNP, MEWT & Ministry of Agriculture).<br><br>3. Better & more consistent data on animal numbers and dynamics.<br><br>4. More research focused on movement policy/implementation of our research findings.<br><br>5. Research on the effectiveness of HWC mitigation techniques here in Botswana. |

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| Blackie, F | Botswana Wildlife Training Institute | | Socio economic benefits of harvesting thatching grass by Nata residents |
| [1]Fynn, R., [2]Chase, M. & [3]Roeder, A. | [1]Okavango Research Institute, University of Botswana, [2]Elephants Without Borders and Institute for Conservation Research, [3]University of Trier, Department of Environmental Remote Sensing and Geoinformatics, Trier, Germany | | Functional habitat heterogeneity and large herbivore seasonal habitat selection in northern Botswana |
| [1]Gadimang, P. & [2]Masunga, G.S. | [1] Research Division, Department of Wildlife & National Parks, [2] Okavango Research Institute, University of Botswana | | Population demography of red lechwe in two floodplain habitats of the Chobe-Linyanti ecosystem, northern Botswana |
| Kenny, D., Reading, R., Maude, G., Hancock, P. & Garbett, R. | Kalahari Research and Conservation | | Elevated blood lead levels in avian scavengers from Botswana, Africa |
| [1,2]Kesch, M. K., [2]Bauer, D.T. & [2]Loveridge, A. J. | [1]Department of Animal Ecology and Conservation, University of Hamburg, Germany. [2]Wildlife Conservation Research Unit, Department of Zoology, University of Oxford, UK. | | Fence line transgressions at Botswana game fences |
| Koolopile, O | Botswana Wildlife Training Institute | | An analysis of elephant poaching trends in Chobe NP from 2005 – 2011 |
| Magola, K | Botswana Wildlife Training Institute | | Analysis of Lake Ngami fisheries |
| Mapitse, G | Botswana Wildlife Training Institute | | Investigating possible dietary benefits of geophagous soils, Nxai pans |
| Masake, M. & Rutina, L. | Okavango Research Institute, University of Botswana | | Benefit of wildlife based tourism to conservation: a case of Khwai and Sankuyo villages |
| [1]Mogwera, K., [1]Rutina, L. & [2]Seonyatseng, E | [1]Okavango Research Institute, University of Botswana, [2] Department of Wildlife & National Parks | | Farmers' responses to human carnivore conflict mitigation strategies |
| Motswasele, K | Botswana Wildlife Training Institute | | Perceptions of local residents towards Maun Wildlife Educational park |
| [1]Ngaka, K., [1]Rutina, L. & [2]Maude, G. | [1]Okavango Research Institute, University of Botswana, [2]Makgadikgadi and CKGR Research | | Cascading effects of the Okavango floods on human-carnivore conflict along the Boteti River |
| Ntswaneng, R | Botswana Wildlife Training Institute | | Socio Economic importance of Mogonye Gorge to Mogonye community |
| [1]Rutina, L.,[1] Mogwera, K., [2]Seonyatseng, E. & [2]Mpofu, C. | [1]Okavango Research Institute, University of Botswana, [2] Department of Wildlife & National Parks | | Herders' ecological knowledge and human-carnivore conflict investigations |
| [1]Rutina, L., [2]Seonyatseng, E., [2]Mpofu, C. & [1]Mogwera, K | [1]Okavango Research Institute, University of Botswana, [2] Department of Wildlife & National Parks | | Potential for interspecific completions among large carnivores in agro-ecosystems |
| Shaks, V., Smith, A.C., Rose, N.L. & Mackay A.W. | University College London; Okavango Crocodile Monitoring Programme | | Mercury in Nile crocodiles (*Crocodylus niloticus*) in the Okavango Delta: A baseline for the assessment of future threats |
| Sianga, K., Fynn, R. & Bonyongo, C. | Okavango Research Institute, University of Botswana | | Zebra and buffalo habitat use in northern Botswana |
| Sianga, K., Fynn, R. & Bonyongo, C. | Okavango Research Institute, University of Botswana | | Transboundary movements of buffalo during the late dry season in northern Botswana: Importance of the KAZA TFCA to enable access to critical key-resource habitats |
| Tseme, M | Botswana Wildlife Training Institute | | Effectiveness of the Chobe River Front decongestion strategy in the Chobe NP, in northern Botswana |
| Tshimologo, B. | Okavango Research Institute, University of Botswana | | Demographic scent marking characteristics of African wild dogs (*Lycaon pictus*) in northern Botswana |
| Tshotlane, K | Botswana Wildlife Training Institute | | A survey on the underutilization of Morama beans (*Tylosemia esculentum*) by Tsetseng Community |

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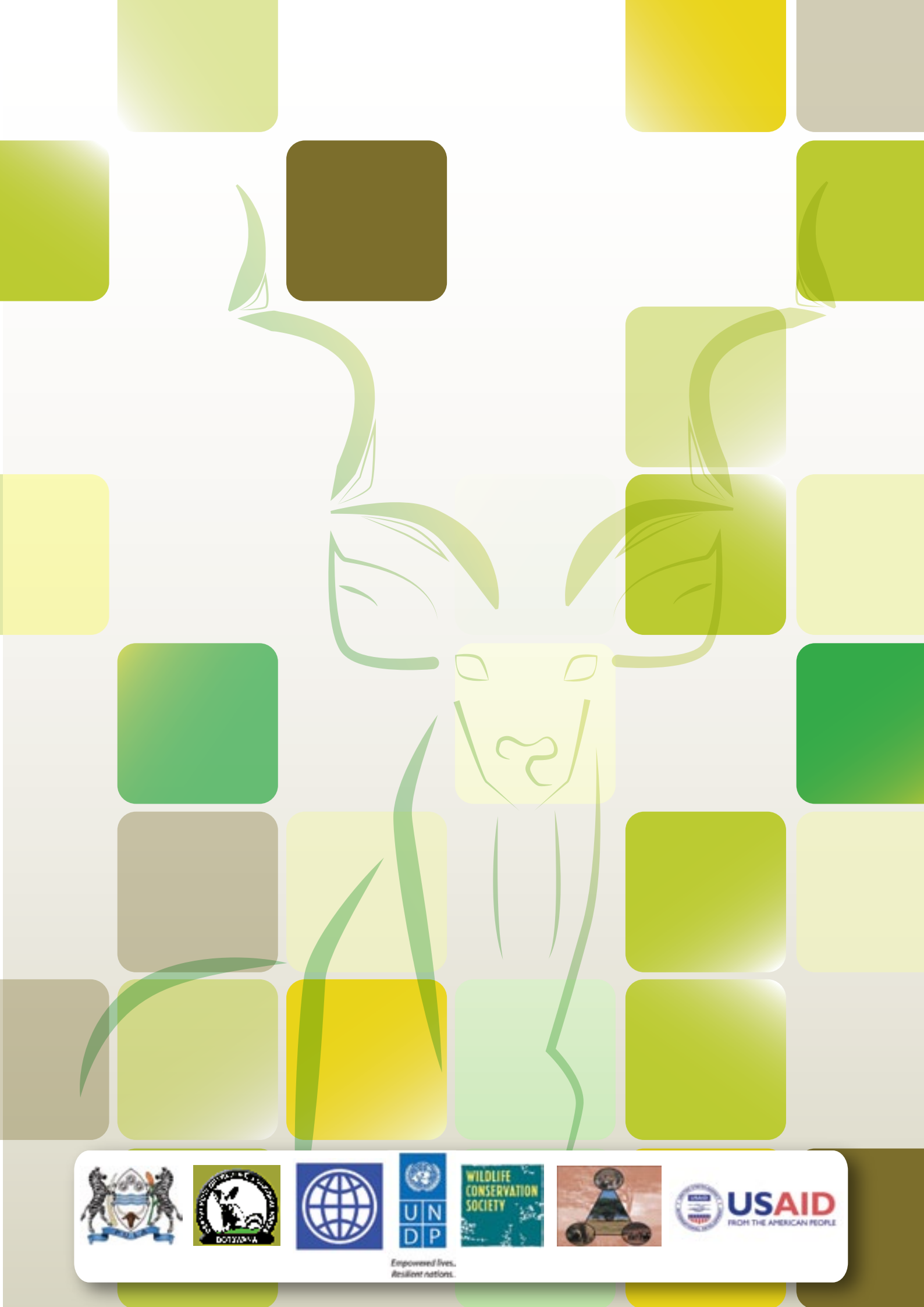
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