RP-PCP and AHEAD-GLTFCA Conference

Management of protected areas and their peripheries in Southern Africa: has anything changed with the creation of TFCAs?

12 - 15 May 2014 - Painted Dog Conservation, Dete, Hwange (Zimbabwe)

Table of Contents

Monday, 12 May 2014

Welcome and introduction

Chief Dingane Nelukobe gave a welcoming speech to all participants, who he called "intellectuals" and hoped the gathering would shed light on some of the issues faced by his community in dealing with wildlife and conservation. He gave special thanks to the French Ambassador for his work in Zimbabwe, especially in the communal areas.

Mr. Alec Dangare, the TFCA Coordinator for Zimbabwe Parks (ZNPWMA) followed Chief Nelukobe and welcomed all participants. He expressed his gratitude for the effort by the conference coordinators to bring together various stakeholders of KAZA and GLTFCA. Mr Dangare highlighted the need to acknowledge the relevance of TFCAs – which in itself is still a relatively new concept. The conference was seen as an opportunity to take stock of the work done thus far in respect of the various initiatives impacting on socio-economic development, rural development and stewardship of natural resources. The role of academia was also acknowledged in support of the performance of sustainable utilization of shared resources. In this regard, Mr Dangare identified population growth competing with natural resources, climate change and effects of globalisation, and shrinking range of key species as the main challenges of transboundary conservation requiring innovative strategies through research. Other pertinent challenges within protected areas include poverty, unemployment, high expectations of communities and increasing sophistication of poaching. These call for further research and relevant legal policy. The CAMPFIRE programme, which has in earlier years been successful in Zimbabwe, was noted as programme that could assist in addressing a number of these challenges. However it needed to be revised and adapted to meet the prevailing socio-economic conditions in the country. More importantly, the TFCA initiative itself was endorsed as a means by which these challenges could be addressed and indeed as a driver of improved CAMPFIRE goals and rural development.

The International Coordinator of the GLTFCA, **Mr. Piet Theron** also gave a welcoming speech. With respect to the AHEAD- GLTFCA programme, he gave a brief background of the AHEAD-GLTFCA programme as the basis for the one health approach in the GLTFCA. This concept was regarded as a valuable for the GLFCA as a complex system and a long-term project. As such there continues the need to bring together practical experiences and research within specific themes. Mr Theron noted that the GLTFCA programme had changed over the years and requires a refocus on specific issues. These issues included: poaching, that is, wildlife crime (illicit wildlife trafficking, etc.), and the institutional reform process focusing on implementation, decentralization and livelihoods (that is, developing and supporting sustainable alternative livelihoods such as, among others, cross border tourism and wildlife crime). This welcoming speech was concluded by a call for funding for applied research to inform the implementation of the TFCA programme.

The French Ambassador, **Mr. Laurent Delahousse**, concluded the institutional welcoming session. In his address, the Ambassador highlighted that the work of French Government through project such as the RP-PCP (a part of RENCARE) and through CIRAD, having worked with the communities throughout the period of socio-economic hardship in Zimbabwe. These organisations have also been promoting accountability and democracy in Zimbabwe. Other efforts have been towards fighting global warming, a duty that France has taken seriously in light of its hosting of the UNFCCC CoP meeting to sign the global agreement. However, the main field of French involvement has been on research on protected areas. In this regard the RP-PCP works with researchers in Zimbabwe, from local institutions such as the University of Zimbabwe and other universities, regional stakeholders and the European Union (EU), which includes institutions such GEO SAF. The EU itself is the main financer for CIRAD in developing countries. The Ambassador concluded by acknowledging the diversity of the gathering for the one goal of protecting the environment, wildlife and diversity of cultures and backgrounds as a wonderful message of hope.

Key points and conclusions:

- The diversity of participants and attendance to the conference which included, *inter alia*, researchers, academics, practitioners of various fields, members of the local communities for the one goal of protecting the environment, wildlife and diversity of cultures and backgrounds as a wonderful message of hope.
- The conference was seen as an opportunity to take stock of the work done so far with respect to the various initiatives impacting on socio-economic development, rural development and stewardship of natural resources.
- The need to bring together practical experiences and research within specific themes for the TFCA programmes was also identified as a key issue for the conference.
- A call for funding for applied research to inform the implementation of the TFCA programme was also highlighted as crucial to the progress of TFCAs.

Prof. David H. Cumming, of the University of Cape Town, opened the introductory session, for Dr. Steve Osofsky of the Wildlife Conservation Society and founder of the Animal and Human Health for Environment and Development (AHEAD) Programme. Prof. Cumming provided a history of the programme tracing back to its inception at the 2003 World Parks Congress. The founders include Billy Karesh, Mike Kock and Steve Osofsky. In Southern Africa, there exist two working groups for TFCAs: the KAZA Working Group and the GLTFCA Working Group. The programme adopted the One Health approach from the 2004 Manhattan Meeting, which framed the One World, One Health principle. The One Health Concept not only includes health of people and animals but also of the environment. This concept has been adopted for 14 TFCAs in the SADC region.

The rest of the presentation turned to the AHEAD-GLTFCA programme. The objectives of the programme were highlighted, which predominantly centres on adopting a "One Health" approach within the socio-ecological system, as the one of

the key elements. The health aspect includes animal and human diseases and ecosystem services. However little has been done on the latter. Much of this work has been funded through Dr. Steve Osofsky, as WCS-AHEAD Programme Coordinator. Since 2011 there has been a shift from exclusive focus on animal health to interdisciplinary issues around health.
The efforts on the GLTFCA are predominantly centred on the 5 protected areas of the GLTFCA. This might be extended to Greater Mapumgubwe TFCA as Zimbabwe intents to link the two TFCAs along the Limpopo River. For this region the goal has been, from the inception of the AHEAD GLTFCA programme, to bring an integrated approach to animal and human health programmes with national planning, policy and practice. To this end, Prof. Cumming and Mike Murphree developed a concept paper in 2004, amongst others, which aimed at introducing a major modular programme into which academics, researchers and communities could slot in their contributions. While this modular programme did work, nothing much is being done currently. One of the major setbacks has been the lack of funding. Additionally, the AHEAD GLTFCA programme deals with complexities such as the interrelationship of livestock, human health and wildlife: in this respect the initial framework of the AHEAD GLTFCA programme was on diseases, livelihoods and sustainability. This was revisited in 2006 guided by pertinent questions framed for "One Health" in TFCAs. Nevertheless the biggest gap is currently the lack of baseline data[1].
The presentation was concluded by the highlights of the following publications: the book "As Fences Come Down" which addresses the fences that are scattered and result in wildlife fragmentation, a video "Beauty and the Beef" on the Foot and Mouth areas and wildlife areas and how these affect livelihoods.

Dr. Clara Bocchino, the AHEAD-GLTFCA Network Coordinator, followed with a presentation on the AHEAD-GLTFCA network and programme activities, since its regionalisation in 2013. Activities, projects and hurdles were listed and explained, while new partnerships in the region were highlighted and these included:

- The Resilience in the Limpopo River Basin Programme, funded by USAID, and comprising of a regional programme and an Olifant River Basin Programme. The AHEAD-GLTFCA network was involved in both, with an active participation in the Olifant's programme through its involvement in the initial planning phase and the creation of an two-country legal register;
- The IUCN Biodiversity and Protected Areas Management Programme, in its regional component, aimed at scoping research and education in Protected Areas Management and have used the AHEAD-GLTFCA network as an initial platform.

Dr. Bocchino also explained that fundraising was achieved by project activities and cited the Regional Standing Committee Southern African Regional Resilience Strategy as a project involving Ms. Suzi Malan, for AHEAD-GLTFCA, and the African Centre for Disaster Studies, for the development of a resilience strategy bringing together humanitarian and environmental issues. This project provided the funding for the realisation of this 2015 Conference.

[1] The revised document is available online

Dr. Michel de Garine-Wichatitsky, for CIRAD, closed the session by addressing the key question of the Conference, that is, "Management of protected areas and their peripheries in Southern Africa: has anything changed with the creation of TFCAs?". Dr. de Garine-Whitchatitsky mentioned that in response to this question the book *People living on the edge* was published, which shares the experiences of the communities living in and around TFCAs. Other related initiatives include: the RENCARE Programme which adopts a bottom up approach to defining priorities by communities and translating them into researchable questions, and the EU DREAM programme based on local interaction with stakeholders.

The discussion, which followed, turned to the following issues raised:

The boundaries of the GLTFCA: it was stated that the Treaty establishing the GLTP only defined the boundaries of the national parks although it is unclear whether these are hard edges. On the other hand, the boundaries of the GLTFCA (the buffer zone) have been left to the countries to decide and are therefore fluid and changing as indicated by the different maps on the region. More often than not these boundaries are determined without consultation with the communities on ground. In Zimbabwe the process of defining the boundary is dependent on the dynamics on the ground. For instance the Sengwe-Chipise corridor, which is gazetted, was established by a consultative process with communities. For the rest of the GLTFCA Zimbabwe side consultations are underway with partner communities in Chipinge, Mwenezi and Beitbridge. For KAZA the districts involved participated largely and the communities themselves defined the boundary in response to the call by countries in terms of its treaty.

Influence of boundaries on beef trading: the basis of trade is that deboned beef provides for trade without issues of the foot and mouth disease. The deboned beef is therefore certified as low prone to the foot and mouth disease.

The situation of transboundary conservation in other regions of Africa: In East Africa there is transboundary natural resources management governed by agreements and protocols of the transboundary natural resource management areas. This type of transboundary conservation works for East and West Africa because the areas are very large with wildlife corridors and limited land use. Whereas Southern Africa this areas comprise of various types of land uses which complicate the conservation efforts.

Key points and conclusions of presentations

- This conference is an opportunity for new collaboration on TFCA efforts in the region, and continues the networking function of the AHEAD-GLTFCA network.
- The AHEAD-GLTFCA predominantly centres on adopting a "One Health" approach with the socio-ecological system as the one of the key elements in the GLTFCA complex. The programme is moving towards an interdisciplinary approach to health issues.

- The delineation of boundaries of TFCAs, be it GLTFCA or KAZA, should include communities on the ground as active participants. Moreover, these boundaries affect issues regarding animal health and trade.
- Transboundary management in the different regions of Africa is largely influenced by the land uses in the areas.

Theme 1 "TFCAs as complex socio-ecological systems: drivers for TBNRM"

Session chairs: Prof. D. Cumming and Prof. M.W. Murphree

1. How useful is it to view TFCAs through a social-ecological systems lens?

Keynote address by Prof. D.H.M. Cumming

Transfrontier protected areas have been established on all continents and the number has grown to more than 250, since the Waterton-Glacier Park was established in 1932. Southern Africa has extended the concept to transfrontier conservation areas (TFCAs) in which protected areas are part of a larger landscape that may include a range of land uses and land tenure regimes. Southern African TFCAs vary in size from 2,000 km2 to c. 440,000 km², include parts of between two to five countries, and are situated along an ecological gradient that extends from deserts to forests. Most TFCAs comprise core protected areas (state, private, community), which are embedded in a matrix that includes a high proportion of land under traditional communal tenure, where human population densities may vary between < 5 to > 300 people/km². Each TFCA has a human and ecological history rooted in the formation of their constituent protected area boundaries and on the national boundaries, which were imposed on the region when it was colonised in the 19th Century.

TFCAs are mostly dominated by single sector, top-down approaches to the governance and management of their constituent parts that lead to continuing tensions between alternative development options and pathways. An alternative approach is to view TFCAs as complex social-ecological systems (SES) in which fostering adaptive capacity and resilience may be key to their sustainability. The usefulness of this approach is illustrated by drawing on examples of cross-scale influences and scale mismatches (from global to local) in governance and natural resource management that constrain adaptive capacity and resilience in the development of TFCAs. Illustrative examples are drawn from the management of elephants, predators, disease, fire and non-timber forest products, law enforcement, and tourism.

Comments and questions:

- Claims that CITES policies are effective in the mismatch within the ecological resource base are problematic to answer to because of poaching. By banning trades in all products and by-products, CITES has made local people complacent to poaching, particularly of destructive species, like elephants. In turn, these have become increasingly perceived as global commons, but this is not a real answer.
- Wild dogs can be used as model animal to determine the success of TFCAs. Pack size does play a role in hunting success, and should be a priority for conservation efforts;
- While world population of elephant are declining, local populations are seeing as increasing;
- CAMPFIRE has only been successful in certain areas of Zimbabwe.

2. Introduction: RP-PCP research framework and applications

Dr. M. de Garine-Wichatitsky

The Research Platform « Production and Conservation in Partnership » (RP-PCP) was officially created in 2007. This platform is a partnership between two Zimbabwean universities (UZ and NUST) and two French research institutes (CIRAD and CNRS), working in collaboration in the SADC region with government services (veterinary services, national parks...), universities, research groups and NGOs. The RP-PCP contributes to improving the understanding and management of "wild-domestic interfaces in Southern Africa", through applied research, R&D projects and support to post graduate students projects working within Transfrontier Conservation Areas (see www.rp-pcp.org).

This paper presents the integrated multidisciplinary and holistic approach developed over the years by the members of the platform. We first focused on defining clearly our object of research, identified by the partners as "socio-ecological systems in the context of wild-domestic interfaces", which is of particular interest to Zimbabwe and the Southern African region, where Transfrontier Conservation Areas initiatives are blooming. During the first phase of the existence of the RP-PCP, the emphasis was put on the development of crosscutting multidisciplinary approaches between four main thematic fields (Animal Health & Environment, Ecology, Natural Resources Governance & Institutions, and Conservation & Agriculture) to promote crosscutting research projects. We then adopted a socio-ecological system approach, and envisaged several models of interactions between the biophysical and the socio-cultural components of SES associating protected areas and theirs peripheries. We adopted a conceptual model emphasising interactions through ecosystem services/disservices, land use and management strategies, and the values and attitudes of the actors of the systems. We illustrate the applications of the proposed framework, which is still developed as an on-going process: i) assisting in the formulation of cross-cutting research question emerging through a process of co-construction; ii) situating research questions of individual projects and student proposals; iii) identifying gaps in the questions addressed globally through RP-PCP activities

Comments and questions:

- Cattle may develop immunity to some diseases without receiving immunisation shots, but this is very species specific;
- Multi species ranching may provide a solution, and in Kenya, Boron cattle sharing habitat with a full range of wildlife, but being kept in kraals at night, worked effectively by creating continuous new nutrient hotspots.

Speed presentations

3. Preliminary results of a serological survey for Rift Valley Fever in ungulate populations at various wildlife/livestock interfaces within the GLTFCA

K. Knight

Rift Valley Fever (RVF), an emerging mosquito-borne zoonotic disease, poses significant threats to human and livestock health. Although endemic in sub-Saharan Africa, its epidemiology remains unclear, in particular the role of wildlife in the maintenance of the virus and transmission to livestock. During the past decade, the creation of Transfrontier Conservation Areas in Southern Africa, such as the Great Limpopo TFCA (GLTFCA), has changed human/livestock/wildlife interfaces where pathogen spillovers may occur.

The aim of this study was to (i) evaluate RVF serological status in domestic and wild ungulates; (ii) infer the potential role of wildlife in the RVF epidemiological cycle within the GLTFCA.

Blood samples from cattle and wildlife were collected at various wild/domestic interfaces in the GLTFCA. These were analysed for RVF antibodies using I-ELISA. Cattle were sampled at four locations in 2008: Chomupani (no wildlife interaction, n=53), Gora (interactions limited by a game fence, n=59), Pesvi (n=40) and Malipati (n=30 in 2008, n=77 in 2009) (both intense interactions). Buffaloes were sampled in three locations: Malilangwe (limited interaction with cattle, n=20), Crooks' corner and Mabalauta (intense interaction, n=114 and 38 respectively). Impala (n=23) and greater kudu (n=22) were also sampled in Mabalauta.

The overall prevalence was 15.38% (n=259) and 8.14% (n=172) for cattle and buffaloes respectively. In 2008, the prevalence in cattle ranged from 13.21% for Chomupani, to 33.33% for Malipati, with Gora and Pesvi having intermediate prevalence. However, Malipati samples from 2009 showed a significantly lower prevalence (3.90%). In buffalo, the prevalence in Malilangwe (20.00%) was higher than both Crooks' corner (7.02%) and Mabalauta (5.26%). None of the kudu or impala tested positive.

These preliminary results suggest that RVF virus circulates in cattle and buffalo populations within the GLTFCA, with significant inter-annual variations, however further investigations are needed to elucidate the possible roles of wildlife-livestock interactions and mosquito diversity and abundance.

Comments and questions:

- Antibodies were measured through antigens;
- Circulation is incorrect, it could be accidental exposure - see the role of buffalo: the candidate should be careful of testing these results, go further on test validation.

4. Grazing and rangeland dynamics in semi-arid African - Savannas - implications for sustainability and management.

E. Mudongo

The effect of grazing intensity, defoliation and soil treatment on productivity and survival of perennial grasses was studied at Barnes Oasis and Legemaat ranches in Gantsi – western Botswana and Okavango Research Institute in Northwest Botswana. Random complete block design approach was used to determine differences in grass productivity at different clipping frequencies, soil treatment and timing. A fence-line contrast was used to determine differences in grass cover and biomass between the two cattle ranches with different grazing management strategies. An increase in clipping frequency resulted in severe decline and ultimate death of perennial grass species. Perennial grasses were more productive when rested during the early months of the growing season with dung inputs and trampling. Comparison of ranches revealed higher palatable perennial grass cover on the heavily stocked rotationally grazed Barnes Oasis ranch compared to higher annual grass cover in the lightly stocked and continuously grazed Legemaat ranch. Findings of this study imply that destocking will not improve rangeland condition but proper grazing management emphasizing timing and adequate rest and graze, with adjustments of stocking rates during critical periods like severe drought.

The above findings have implications for conservation in communities around protected areas where wildlife and livestock intermingle. For instance, an increase in cattle numbers from communities around Chobe national park threatens habitats for key populations of sable and roan antelopes. Despite an increasing number of livestock, a proper livestock management strategy for these communities that ensures timely and adequate grazing and resting of the rangeland is critical to the survival of populations of these species in Botswana. Based on these insights, a study will be conducted on the forest reserves around the Chobe national park (KAZA-TFCA) to examine the interactions of livestock and wild herbivores and the effects of these interactions on wild herbivore populations in the region.

Comments and questions:

- Research like this, on investigating the intermediate disturbance hypothesis, is much needed.

5. Using footprint analysis as a forensic tool in the mitigation of human-wildlife conflict: African Painted Dog and Sympatric species.

T. Nekatambe

Spoor identification by tracking is an age-old technique used in tracking and interpreting animal behaviour. These tracks provide potentially valuable data (e.g., regarding density, location, movement), which can be exploited in non-invasive and cost effective techniques for the monitoring, research and identification of reclusive carnivores. They also provide a much-needed layer of information that can be used to establish the range and distribution of problem animals in areas where domestic livestock production occurs on land adjacent to conservation areas. As such the

polarization between agriculturalists and conservationists requires the development of a forensic tool that will determine the true culprits of livestock depredation and be used in determining the demographic characteristics and ranges of such problematic animals.
The major objectives of the study are as follows:

- To develop a footprint Identification system that will contain footprint profiles for the five study species (African wild dog, spotted hyena, domestic dog and jackal species) allowing them to be distinguished.
- To further apply the footprint identification system in determining the risk of livestock loss as well as determining the range and distribution of the study species throughout the communal areas.

This study will facilitate the further development of non-invasive conservation techniques through the expansion of the database system that will incorporate more species for profiling and identification. Communities will be able to harness the power of the footprint Identification system and will have a better understanding of the location of their settlements and grazing areas relative to the areas utilized by the study species as corridors and therefore be in a position to take the right offensive action in protecting their livestock.

Comments and questions:

- The fieldwork includes the use of indigenous knowledge systems, such as old local trackers;
- The speed of movement alters the footprint so only images from walking through gates can be used and the front/hind/left/right must be identified;
- The point of looking at multiple communal areas responds to the need for gathering as much relevant information as possible, as such substrates shall be looked at too. If there is a good set, for instance where a hyena is eating a cow, and it helps risk assessment too.

6. Land use coexistence in socioecological systems: A participatory approach to cattle grazing in a protected area - communal land interface in Zimbabwe.

A. Perroton

TFCAs are complex socio-ecological systems, involving different stakeholders with different objectives, different practices and sometimes different worldviews, who interact together and with the natural environment. On the local scale, the coexistence between different stakeholders living in such systems is often complicated, and human/wildlife conflicts are often associated with, or hiding, human/human conflicts.
Within ward 15 of Hwange district (KAZA-TFCA, Zimbabwe), rural communities and forest managers share a common environment, and this is not without creating tensions between them. The lack of grazing resources in communal lands, along with the increase of droughts in the early 90s, led the communities and the Forestry Commission managers to find an agreement allowing cattle herders to legally access grazing and water for their livestock within the forestry. More than a decade later, this

right of access appears as a key element for the sustainability of the livelihoods of rural households. However, cattle owners, forest managers and lodges managers operating in the area have divergent views regarding this agreement. We present the approach and the first results of an on-going interdisciplinary work involving GPS cattle collars, stakeholders' interviews, role-playing game, and participatory mapping. The aim is to better understand the perceptions, strategies and practices of the actors, and their interactions. Ultimately, participative modelling of this complex system will allow us to anticipate its future trajectories, in order to promote coexistence of these different types of land uses within a complex TFCA socio-ecological system.

Comments and questions:

- Co-existence theory is exciting and requires support form negotiation approaches as well as scenario planning;
- This approach consider local as well as global variables, such as climate change, and political change. More study is being done on cattle, as well.
- It is crucial that communities see the results of this study, which can be a powerful tool.
- This is a valuable study, because it is crucial for communities to make relevant changes with an increasing human footprint.

7. Transboundary Conservation of Large Carnivores in the GLTFCA: Challenges and Opportunities

R. Groom

Wide-ranging large-bodied carnivores present a particular conservation challenge. Most protected areas are too small to effectively conserve viable populations of large carnivores and they can be a major conflict species when they move out of the protected areas and come into contact with humans. As a result of the problems these species cause (both real and perceived) persecution and human-inflicted mortality can be high. Because of their vast space requirements, transfrontier conservation initiatives are critical for the survival of large carnivores, but connectivity between protected areas within the TFCAs is often a problem.

The African Wildlife Conservation Fund has been working to monitor and conserve the large carnivores in and around the Gonarezhou National Park since 2009, in partnership with the Zimbabwean Parks and Wildlife Management Authority and Frankfurt Zoological Society. Although populations of all large carnivores in the park have been increasing since 2009, movement data from lion and wild dog GPS collars near the eastern boundary of the park demonstrates a concerning lack of transboundary movement. In addition, a recent genetic study indicates a lack of connectivity for African wild dogs between Gonarezhou and Kruger National Park. Although further investigation is needed, if this is indeed the case, it demonstrates a significant problem of connectivity within the Greater Limpopo Transfrontier Conservation Area (GLTFCA).

Here we discuss the movements and possible constraints to movements of large carnivores within the complex landscape of the GLTFCA, and describe our future

plans for work in the region, to further investigate and improve the functioning of the GLTFCA for large carnivores.

Key points and conclusions:

- Large carnivores have a wide range area and TFCAs need to develop tolerance. For tolerance to be sustainable more funding is needed. Animals (dogs, lions and elephants) don't cross into Mozambique although this is a protected area. The buffer zone does not work; the result is a poor genetic pool for lion population within the park.
- In terms of wild dogs, they are known to adapt easily to any area and would therefore be considered a model animal to test the functionality of these buffer zones. However a bottleneck effect is also seen in the Kruger National Park, which shows that something is not working.
- A PhD project is underway between the University of Zimbabwe and Wits. Preliminary results show low lion genetic diversity, so the goal will be to stimulate and enhance natural migration. GPS systems will be used to monitor where connectivity issues are. Artificial insemination of wild dogs with genetic material from northern Kruger may also be a possibility to improve genetic diversity.

8. Human-Elephant Conflict in local communities living adjacent to the southern border of Matusadona National Park, Zimbabwe

N. Muboko

Official reports indicate that fatal or near fatal incidences between humans and African elephants (*Loxodonta africana*) are increasing in local communities (Nyaminyami) living adjacent to the southern borders of Matusadona National Park (MNP), Zimbabwe. There are no boundary fences between the national park and the communal areas and animals and people freely interact. Efforts to manage the human-elephant conflict have met with little success. Using a questionnaire survey, key informant interviews, documentary review and direct assessment we recorded high incidences of conflicts between elephants and humans in the study area. Elephants destroyed property, raided crops, frighten and even killed humans. Interestingly, despite the high incidences of conflict over 81% (n = 79) of the residents expressed positive attitudes towards elephant conservation. However, about twenty-one per cent (n =20) of the respondents had no confidence in problem animal control management and indicated that they would take personal action against elephants if threatened. We conclude that the human-elephant problem is more pronounced in communities living close to the MNP boundary and reduces as distance increases away from the park boundary. We recommend for a multi-action approach that includes protection of residents, more involvement of residents in the management of natural resources, setting up a fund to assist and/or compensate victims of wildlife injuries or deaths, educating residents on how to co-exist and establishing game corridors to enable wildlife movements.

Key points and conclusions:

- The key driver for increasing human-elephant conflict is the increasing elephant population. One objective of the study was to see if an increase in distance from the park border does cause a decrease in conflict. This was confirmed by the data in addition to noting that in the wetter season's conflict was also higher. Although the world elephant population is decreasing, local people are experiencing an increase in elephant numbers.
- In terms of reporting incidences, most will report to the authorities and 20% will take personal action. With this being said 80% of people feel that programs like CAMPFIRE is doing well and have asked the program to continue. Most people feel positive towards HEC.

9. Demography of two populations of African wild dogs in Zimbabwe and implications for conservation

S. Tafadzwa

African wild dogs, *Lycaon pictus*, have declined in numbers over the past years. Their persistence is largely dependent on effective conservation and management strategies. In Zimbabwe, data from long term monitoring of the Hwange and Mana Pools populations is used to compare the demographic attributes of the two populations. The different demographic parameters are compared for temporal and spatial variation. Results show that there are significant differences in pack sizes between the two populations, with Mana Pools having bigger pack sizes than Hwange. In all reproductive parameters (pup production, pup survival and recruitment), the Hwange population had significantly lower values than the Mana Pools population, with no significant temporal variation across the years considered. In both populations the number of pups produced positively correlated with pack size, indicating the possibility of component the Allee effect. This shows that differences in reproduction are the major causes of the differences in pack demography and dynamics. As a consequence, packs in Hwange are at risk of local extirpation due to low pack sizes, which has implications in their ability to successfully reproduce due to Allee effects. Conservation efforts should thus be intensified in protecting the existing packs in Hwange from further loss of individuals due to road kills and snaring which have been the major causes of adult mortality in the population. There is however need for more research on the causes of reproductive failure in Hwange, the causes of pup mortality and the different ecological factors affecting pack demographics and dynamics in the two populations.

Key points and conclusions:

- Wild dogs are being persecuted because they are viewed as a pest for livestock and disease carriers of Rabies and Canine Distemper. In this study packs were not used that was only seen once in 3 years and information forms was also used and distributed to obtain data.
- Results show that pack size did not increase much in the past 7 years. Pup production varied between the two populations that were studied and both

population decreased in size with Mana Pools showing larger pack sizes in general compared to the Hwange population.

- The difference in reproduction may be due to snaring and road accidents experienced in Hwange. Pack size does play a role in hunting success and should be a priority for conservation efforts.

10. Environmental awareness and the trouble with CAMPFIRE in lessons on environmental management from a specific park in Zimbabwe

C. Tafangenyasha

Recent problems in the operations of Zimbabwe's CAMPFIRE appear to have rendered CBNRM dysfunctional around Hwange National Park. The setbacks in the dysfunctional state of CMPFIRE gave rise to unprecedented illegal extractions of natural resources and the widespread silent killing of the prized large wildlife species that include elephant. A state of emergency declared by the Zimbabwe Government elicited urgent turnaround solutions. The roles played by different actors and the approaches, roles of units, guiding principles, ethics and assessment methods in the effectiveness of CBNRM did not match the rising challenges of a spiralling poverty cycle of local communities. An effective environmental awareness and education has been suggested as a starting point in a time-bound solution to solve the unfolding livelihood crises. This paper examines the dysfunctional state of CAMPFIRE and the overlooked role of environmental awareness and education that should be used in turning around the unfolding livelihood crises in the GLTFCA and KAZA-TFCA areas.

Key points and conclusions:

- There is a lack of environmental awareness and education. There are problems with cyanide and assumptions are being made. The frame should be schools and communities. Metrics should be towards continuous graphs and records on metric types will help. Environmental education can be used as a conservation measurement. This will be measure through adaption of metrics and increase IQ scores through platforms raised.
- The question remains if domestication is a way for conservation; nevertheless humans and animals living together are better.
- The major problem with CAMPFIRE is from public concerns (Hwange) that they have not been benefitting when NGO funding was given. The result is that people have to kill animals to make ends meet.

11. The ecology of human lion conflict in North-western, Zimbabwe

B. Stapelkamp

This presentation was done on behalf of Andrew Loveridge and was a brief overview of 15 years of research with Wildlife Conservation Research Unit (WildCRU). The study reports that the lion habitat corridors in the KAZA region are 1 of 6 with over a

1000 lions in KAZA. The data has been collected by model representing least cost corridors of young lions based on dispersal and habitat data. Movement of these lions brings them into conflict with human. In particular, predation makes up 16% of cause of loss of livestock, which is highly prioritised by communities. It was found that predation actually outweighs loss of livestock from diseases. Predation in these instances is not limited to livestock raiding but also negative impacts on culture and history. 41% of communities under study were affected by predation.
As a result of predation, lions' mortality is due to anthropological causes rather than natural causes. The study showed that of 167 deaths recorded less than 20% were from natural causes. The risk of mortality depended on the distance to the closest village such that the closer a lion is to a village the higher the risk. One of the remedies identified is traditional animal husbandry, particularly the use of bomas.
The study also revealed seasonality in livestock loss to lions. High losses were recorded in wet season whereas in dry season only the cattle that moved further away from their 'homes' and became easier prey. The potential solutions identified included: fencing, traditional methods and communal bomas. Fencing was most favoured by communities in Tsholotsho although it requires high maintenance. While the traditional methods that involved the use of vhuvhuzelas (a part of the Long Shields Project) had contributed to 50% reduction of livestock loss.

12. Ecological trap in the buffer zone of a protected area: effects of indirect anthropogenic mortality on the African wild dog *Lycaon pictus*

E. Van der Meer

The African wild dog is and endangered social carnivore, that is, it lives in packs. They are found in large territories and therefore protected areas are too small for them. Consequently they encroach beyond these protected areas exposing themselves to anthropogenic mortality, also known as the "edge effect". The study area comprised of the Hwange National Park and its buffer zone (communal land, the road and other areas). The study found that the wild dogs have been declining as they move outside the Park. The linear regression analysis established that they are drifting from the Park with disastrous consequences, that is, high mortality and low natality. The main causes were anthropogenic, that is road kill, snares and shooting. This therefore meant that natural induced mortality was higher in the Park than outside. It was noted that these dogs had a higher hunting success outside the park and less interspecific competition with other predators such as lions and hyenas. Therefore with the increase of these other predators comes the decline of the dogs. There is therefore a need for sustainable conservation of lions.
It was also pointed out that in the Park, i.e. Hwange National Park, diseases from interactions between the wild dog and domesticated dogs were not a major threat. However in Malilangwe almost all the packs, except for one, were almost wiped out by rabies.

13. Development and Implementation of a KAZA TFCA Conservation Action Plan for an endangered large carnivore

R. Groom

Dr. Rosemary Groom delivered this presentation in her capacity as the Southern Africa Coordinator of Range Wide Conservation Programme for Cheetah and Wild Dogs. The Range Wide Conservation Programme for Cheetah and Wild Dogs in 2007 adopted a Regional Conservation Strategy, which led to the development of National Action Plans in all the countries of Southern Africa except Angola.
With respect to the KAZA TFCA it was reported that this TFCA is important to the African wild dog population for the following reasons: it is habitat to 24% of the world population of wild dog; it has the most divers genetic make-up of the species; it will be important for viability for future of wild dog given climate change; the wild dog species found there serve as flagship species to stimulate conservation action for other species (as umbrella species) and it increasingly attracting tourists. Therefore, future work within the KAZA TFCA on the wild dog will be guided by the 2014-2019 Conservation Strategy, drawn in 2013. Nevertheless one of the key challenges to the implementation of this strategy is pertains to policy and legislation for transboundary conservation and political commitment which although being present have made the work least achievable.

14. Transfrontier Parks and Communities: Potential Socio-economic impacts of the Great Limpopo Park (GLTP) on the Sengwe Community in Zimbabwe

S. Nyasha

Some preliminary remarks were made to the effect that the GLTP has not gone beyond its potential given that the link between Gonarezhou National Park (Zimbabwe) and the Kruger National Park (South Africa) has not yet been affected.
The study's findings were that despite the assertions by TFCA proponents that adjacent communities would benefit the following was established: the GLTP is driven by people residing outside the Chiredzi District; the communities still viewed the GLTP as a mystery; the institutional framework excludes community level structures; communities therefore benefit minimally; the CAMPFIRE programme has not benefited the Sengwe Community; and the communities have negative perceptions about the GLTP because of the Sengwe-Chipise Corridor for fears of displacement, fencing, negative impacts on livestock production and destruction of the CAMPFIRE concept; and inhibited access to non-timber forest products. There were however a few positive perceptions such as improved migration – moving to South Africa was identified as a key part of the Sengwe communities' livelihood; employment creation linked to tourist arrivals and infrastructure development. One of the recommendations by the study was the need for improvement in planning for the GLTP at national and local levels.

15. Using satellite to understand corridors and trans-boundary landscapes and integrate species management

G. Rasmussen

This presentation reflected 25 years of research on the use of satellite to understand corridors and transboundary and integrate species management. The aim of the study was to establish the importance of connectivity, and maintenance of landscapes that can be deemed "appropriate biological units". A species based landscape approach was used in terms of which field based data and GIS data of a number of dispersals of species from Zimbabwe to South Africa, Zimbabwe to Botswana and within Zimbabwe. On landscape ecology specific focus was on the KAZA where a landscape strategy was employed to study species' habitat where people are with the use of satellite data. With respect to transboundary movement in KAZA of wide ranging species most vulnerable to habitat fragmentation, the painted dog was the species under study. It was established that such species do cross the Zambezi but, when get to the other side, they die. As a means to facilitate a landscape strategy to remedy these challenges one of the methods used was the Best Habitat Model.

Key points and conclusions:

- The human lion conflict in North-western Zimbabwe has led to high mortality of lions due to anthropological causes (as a result of livestock predation) rather than natural causes.
- The wild dog *Lycaon pictus* situated in and around the Hwange National Park encroach beyond the protected area exposing them to anthropogenic mortality, also known as the "edge effect". The mortality rate in this regard is quite high outside the Park as opposed to inside.
- The development and implementation of a KAZA TFCA Conservation Action Plan for the African wild dog is dependent upon political will and legislation and policy that enable the goals to become achievable.
- The use of satellite for species management in a transboundary setting and the respective corridors has proved effective to develop strategies that can be used to protect wide ranging species that are most vulnerable such as the painted dog.

Questions and answers

Benefits of trophy hunting on lions: Trophy hunting has profound impacts on lions because it involves looking for biggest male lions. These lions being the patriarchs of the pride if hunted down leave the lioness and cubs vulnerable.
Lion canning of 4000 lions in South Africa: Zambia and Botswana have stopped and it should also be discouraged in South Africa. An option would be to target old lions that have been kicked out of their pride for trophy hunting as a sustainable alternative. However it may be difficult to implement.

Control of animal migration: is very much dependent on cooperation between the various stakeholders especially affected communities.

The implementation of KAZA TFCA Conservation Action Plan for the African wild dog: implementation should be a bottom up approach where local authorities spearhead the strategy and then work it up to Heads of States.

The Sengwe-Chipise wildlife corridor: though it was gazetted in 2009 it is usually forgotten because it is not seen in practice. It is a minefield and not really habitable for people or wildlife therefore there were few people living in there even prior to its creation. However there are a few animals that have been reported to use it as a corridor – especially the elephants – a few collared elephants were spotted. Nevertheless there have been conflicts between the government and the communities with respect to the corridor and the GLTP. Thus a co-management agreement is being formalised with the community by the government.

Theme 2: Agriculture and animal production activities within TFCAs

Session chairs: Prof. K. Giller and Dr. C. Murungweni

16. Agriculture and Nature: Trouble and Strife?

Keynote address by Prof. K. Giller

Global demand for agricultural products is expected to double in the next decades, putting tremendous pressure on agriculture to produce more. The bulk of this increase will come from developing countries, which host most biodiversity-rich areas of the planet. Whilst most biodiversity is found in production landscapes shared with people, where agriculture represents an increasing threat, international conservation organisations continue to focus on the maintenance and expansion of the network of protected areas. When conservation organisations partner with agricultural programmes, they promote low input, extensive agriculture.

Combined with the focus on protected areas, this may exacerbate rather than mitigate conflicts between biodiversity conservation and agricultural production. Two models have been proposed to increase agricultural production whilst minimizing the negative consequences for biodiversity: 'land sparing' and 'land sharing'. Although often polarized in debates, both are realistic solutions, depending on the local circumstances. We propose a number of criteria that could guide the choice towards one or the other.

We conclude that general principles to be considered in both land sparing and land sharing are: managing spill over effects, maintaining resilience and ecosystem services, accounting for landscape structure, reducing losses and wastes, improving access to agricultural products in developing countries and changing consumption patterns in developed countries, and developing supportive markets and policies.

Key points and conclusions:

- Agriculture in a developing country is functionally different since success is defined in a different way. People are successful in producing sustainable crops in an area that is classified as not suitable for crop production. They succeed because they plant with or without rain, they maximise yield by planting maximum area and they only plant maize. People share resources and when the yield is low then livestock will be sold.
- The Ecoexist project is aims in the short term to prevent elephants form raiding the crops and in the long term at determining why this is happening.
- Non-lethal (e.g. Anatolian shepherd dog) predator control is more effective then lethal methods.
- An effective veldt management technique looks at grazing a lot of animals (100 000) in an area for a few days, and then move on. Animals are kraaled at night and their dung function as plant fertilizer.

17. Shifting trends in the agricultural landscape and its practices to promote human-elephant coexistence in the eastern panhandle of the Okavango Delta – the Ecoexist Project, Okavango, Botswana.

G. McCulloch

The Ecoexist project is a five-year program aimed at reducing human-elephant conflict (HEC) in the northern Okavango Delta and surrounding regions. Our goal is to create an enabling environment for policies and on-the-ground programs to reduce HEC and foster coexistence between elephants and people. In the short term, we reduce real and perceived HEC by addressing failures and gaps in current mitigation responses. Over the longer term, we are collaborating with local, regional, and international stakeholders to address the root causes of conflict and help align policies and incentives to support human-elephant coexistence. We connect science with policy, supporting informed decision-making through our research and field based evidence, and is strengthening the existing work of government agencies, local communities, regional stakeholders, and the private sector by facilitating collaboration, intervention implementation, communication, and capacity building. Ecoexist's five impact goals address five key drivers of HEC, two of which focus on the changing landscape and resource use as a result of expanding subsistence agriculture:

Strategic Goal 1: Inform and leverage change in land use planning to consider elephant movement corridors during land use allocation in order to facilitate resource use by people and elephants. We have conducted in-depth research into elephant migration in the area and identified the key movement pathways in the eastern panhandle that are being encroached upon by agriculture. Appropriate land use planning, aimed at avoiding this and other land use conflicts, through the development and implementation of a GIS based land use conflict information strategy model (LUCIS), is currently being developed by Ngamiland's Tawana Land board using our elephant pathway data. We are also in the process of building capacity among sub-district land board technical officers to develop simple and effective processes that will facilitate the effective implementation of this planning.

Strategic goal 2: Improve farmer resilience to the effects of HEC by improving agricultural practices and techniques that improve yields and food security, and reduces the spacial and temporal imprint of agriculture on the landscape, which includes short cycle crops and conservation agriculture implementation. We are introducing alternative agricultural methods and techniques in the panhandle, e.g. short-cycle crop varieties and conservation agriculture (CA), that will bring improved yields and increased farmer resilience to HEC, as well as reducing the need to abandon farms in search of more fertile land, which will reduce unnecessary conversion of elephant habitat to agricultural land use. Through an evidence-based approach we are gathering support and incentives, through government support schemes for these alternative practices.

Key points and conclusions:

- This concept is based on work done by D. Sanghurst (2008). During the wet season both elephants and humans utilize the water at the Okavango Delta and this result in crop raiding by the elephants.
- The Ecoexist project is aimed at mitigation in this regard.

- The short-term goal will be to prevent elephants from raiding the crops and the long term is aimed at determining why this is happening.

18. Dead or alive? Comparing costs and benefits of lethal and non-lethal human-wildlife conflict mitigation on livestock farms

J. S. McManus

Livestock depredation has major conservation and agronomic issues; it drives carnivore killings and can be costly for farmers. Lethal control measures are easily available, reportedly perceived to be cheaper, and more practical and effective than non-lethal methods. However, the costs and efficacy of the two approaches have rarely been formally compared. We conducted a 3-year study on 11 South African livestock farms, examining costs and benefits of lethal and non-lethal conflict mitigation methods. Farmers used existing lethal control in the first year, switching to livestock guarding dogs *Canis familiaris*, alpacas *Lama pacos*, or livestock protection collars for the following two years. During the lethal control year, running costs averaged US$3.30/head of stock, while depredation cost US$20.11/head. In the first year of non-lethal control, implementation and running costs combined were similar to lethal control (US$3.08/head). However, depredation declined by 69.3% to US$6.52/head on average. In the second non-lethal year, running costs (US$0.43/head) were significantly lower than previous years, and depredation costs decreased further, to US$5.49/head; a difference of 72.7% and 15.8% compared to the lethal and first non-lethal years respectively. Assuming that depredation would otherwise have remained at the same level as during the lethal year, during the first non-lethal year farmers saved US$2.11 in avoided depredation for every $1 spent. During the second non-lethal year, this profit: loss ratio increased to US$5.36:US$1. Our results suggest that non-lethal methods of conflict mitigation can reduce depredation and be economically advantageous compared to lethal predator control.

Key points and conclusions:

- Results compare lethal vs. non-lethal methods to control predators. Results show non-lethal (e.g. Anatolian shepherd dog) methods being more effective especially in the second year of implementation. However with this being said there is the enjoyable social aspect that hunting brings.

19. Our work in the Hwange Communal Lands TFCAs- ACHM Talk

H. Matanga

Africa Centre for Holistic Management (ACHM) is situated on an 8000 ha property comprised of private ranch known as Dimbangombe learning site and state land (Fuller Forest and Gauchewood). The property is separated from the Hwange Communal Lands by a patch of state forestland and the Bulawayo-Victoria Falls main road that runs along the community's western edge to Victoria Falls. Dimbangombe also forms part of the properties that make up a single contiguous wildlife range

stretching from the Hwange National Park in southwest Zimbabwe to Zambezi National Park in the north, and into the surrounding wildlife reserves of Namibia, Botswana and Zambia. It is also known for its big game that includes lion, leopard, cheetah, elephant, buffalo, kudu and sable antelope, and a rich array of birds.

Holistic management was developed by Zimbabwean-born ecologist Allan Savory following a lengthy personal search for solutions to the problem of land deterioration occurring in Africa and the human impoverishment that always resulted. In the 1960s he made a significant breakthrough in understanding what was causing the desertification of the world's grassland ecosystems. Holistic management is therefore a decision making tool that addresses the triple bottom line. It ensures that decisions made in any context are socially, economically and environmentally sound.

ACHM is working in sixteen (20) communities in Hwange Communal Lands under five chiefdoms (Nelukoba, Nekatambe, Wange, Shana and Mvuthu). In these communities, ACHM is using the Holistic Land and Livestock Management (HLLM) to rehabilitate the livelihoods, land and water sources. This is critical since Hwange Communal Lands lie in the dry agro- ecological region of the country where rainfall for crop production is a limiting factor. The communities are also within the Transfrontier zones, which makes the management of their ecology and resources an invaluable need. The major Livelihood option for Hwange Communal Lands is Livestock and with the right systems in place, wildlife production. Our programs ultimately address livelihood needs of the communities in the TFCAs. Recently, ACHM also introduced market value chains in its products and services. The promotion of livestock value markets is meant to ensure that smallholder farmers also benefit financially from resuscitating their rangelands, enabling them to regain their pride and dignity.

Historically, rangelands have been managed largely for livestock production to the exclusion of many other ecosystem goods and services (biodiversity and water sources). In many areas in our region, this has seen most rangelands degrading at a fast rate, crop fields failing and eventually leading to livelihoods failure. In turn, this makes life for humans, livestock and wildlife insecure. ACHM in its programs addresses this. The management of rangelands is critical to forage production and conservation of water resources. ACHM uses a grazing planning technique that uses concentration of animals to increase grazing, trampling, dunging and urination in the rangeland and affects water infiltration, run-off, grass cover, species composition, the trees, ultimately influencing biodiversity, water resources and carrying capacity for both wildlife and livestock. Planned grazing as practised in HLLM improves rangelands, livestock health, and water cycle due to improved herbaceous vegetation cover, ground litter, cooler soil temperatures and high soil moisture content. The underlying goal is that of improving livelihoods by enhancing the land and natural water sources for now and for the future generations.

The presentation will discuss the work of ACHM to improve lives, land, livestock (health and management) and wildlife management. The thematic areas to be addressed will be agriculture, socio-ecological issues in the communities, animal health and security issues in terms of food security.

Key points and conclusions:

- The research shows that livestock can be used as a tool to see what impact climate change can have on the environment.

- In order to conserve the vegetation a technique was used where a lot of animals (100 000) graze in an area for a few days and then move on. Animals would also be kraaled at night.
- The animal dung would also function as fertilizer to increase the plant growth in the area that was grazed. This worked very well.
- However the training material had to be changed so that the community could understand the concept.
- Community based facilitators are used as veldt managers.

20. Potential ways to adapt the crop and livestock systems to effects of increasing rainfall variability in South Eastern Zimbabwe

C. Murungweni

Drought is the greatest threat to agriculture in semi-arid parts of southern Africa. We hypothesised that the effects of drought can be reduced by cleverly making use of physiognomic properties of land and ethno-veterinary knowledge on adapting livestock. We investigated the crop and livestock system of southeastern Zimbabwe in order to understand how people can adapt to increasing drought conditions. For the cropping system, we quantified the mosaic of crop growth conditions, resulting from spatial variation in rainfall, different crop varieties (five for maize, three for sorghum, one for groundnut and one for millet), landscape positions (lower lowland, upper lowland and upland) and cattle manure (yes or no) over two contrasting seasons (good and bad in terms of rainfall variability). The most important determining factor of crop yield was landscape position. Short season varieties of Maize (ZM309, ZM401 and Gopane) yielded best in the lower lowlands with manure than in uplands, whereas the three varieties of sorghum (Gangara, Chibedhlani and Chihumani) yielded best with manure in uplands than in other landscape positions. Manure had a positive effect but many farmers do not use manure because it can exacerbate heat effects on plants. This is not true when the manure is banded on the plants. Birds seriously affected Millet and groundnut grew best together with maize in lower lowlands with manure. For livestock system, farmers discovered *Neorautanenia brachypus* as a lifesaving feed for cattle. We evaluated the feed and anthelmintic value of the tuber of *Neorautanenia brachypus* by feeding trials with cattle and goats. The crude protein levels was 104 g/kgDM and Infected animals fed on N. brachypus reduced strongyloid worm infection in small ruminants ($P < 0.05$) and in large ruminants ($P < 0.01$) just as good as the conventional recommended deworming drugs.

Comments and questions:

- The results show that seed di d not much exchange, and farmers use to keep them for the next season. In drought, however, people eat the seed and then have to go across the border to find new seeds. Border politics must be handled carefully;
- The cost of producing Ilala Palm wine was not part of this research. It is known, however, that the production is exported through Sango Border Post into Mozambique;

- Commercialisation of palms is limited because grain is necessary;
- Zhombwe is not commercially farmed.

Speed presentations

21. The role of key browse species in understanding livestock-wildlife interactions at wildlife-livestock interfaces

C. Mudzengi

Extensive livestock production is an important source of livelihood to people living in semi-arid South-eastern Lowveld of Zimbabwe (SEL). However, frequent droughts and deliberate increases in cattle numbers by farmers amplify the rate of dry season deterioration of rangeland quality and quantity in the area. At the interface between Malipati Communal Land and Gonarezhou National Park (GNP), farmers respond to this grazing shortage by unofficially grazing their cattle in the park resulting in wildlife-livestock interactions. Wildlife-livestock interactions elevate the probability of disease transfer between wildlife and cattle, in addition to creating conflicts with park authorities. Competition for browse and space at the wildlife-livestock interface may also threaten conservation of ethnoveterinary plants, most of whose spatial distribution is not known. We hypothesize that browsing species can be used by farmers to manage interactions at the wildlife-livestock interface. They are a source of food, feed, and ethnoveterinary medicines. Improved Global Position System (GPS) technology will be combined with hyperspectral remote sensing in a GIS environment to develop a method for mapping the nutritive value of key browse species in these heterogeneous savannah environments. We also aim to develop a GPS based method of bio prospecting as a function of spatio-temporal movement of cattle at the wildlife-livestock interface. Quantitative and qualitative techniques will also be used to determine the type and extent in use of browse species by ruminant animals and people. The anthelmintic effect of different concentrations of the key browse species identified will be evaluated as a source of ethnoveterinary medicine. Understanding and improving feed situation outside the park has potential to increase cattle production, improve people-park relations, and inform policy on sustainable biodiversity management.

Key points and conclusions:

- The research focuses on semi arid areas where a rangeland system, specific sites are Gonarezhou, Malipati and the Grassland Research Institute.
- Preliminary findings show that increased livestock numbers have negative effects, and when grazing is reduced livestock is driven into the National Park;
- The objectives of the research are:
    - To develop methods to determine spatial distribution and nutritional value of KBS heterogeneous savannah areas.
    - To develop a GPS based method of bio prospecting as a function of spatial temporal movement. Determine type and extent in use of KBS by ruminant animals and people.

Comments and questions:

- The specific species object of the research are: Acacia, Mopani and Zhombwe;
- Livestock does eat Mopani tree leaves, and Motopas Research Station has conducted research on the use of Mopani in cattle feed;
- Palatability (tannin production) may be a response to over grazing.

22. Impacts of hydro-connectivity and contrasting land use patterns on the limnochemistry and nutrient stoichiometry of ephemeral pans in Hwange National Park and its periphery

M. Shumba

Ephemeral water pans are characterised by wide seasonal water level fluctuations, which have a profound impact on hydroconnectivity and consequently their ecology. Limnochemical aspects of selected ephemeral water pans were investigated in Hwange National Park and the surrounding forestry and communal areas. The aims of the study were: 1. to investigate influence of seasonality on hydroconnectivity and water stoichiometry in ephemeral pans and 2. to determine the influence of land use patterns on the limnochemistry of water pans. Water samples were collected in the wet (November, December, February, March), and dry (April, July and September) seasons in selected water pans and analysed for pH, turbidity, conductivity, temperature, dissolved oxygen, total dissolved solids, salinity, phycocyanin, chlorophyll a, total hardness, nitrates, total organic carbon, ammonia, total nitrogen, total phosphorous and reactive phosphorous. Stoichiometry of the carbon, nitrogen and phosphorus concentrations was evaluated and showed that phosphorus is the limiting nutrient for pans in Hwange National Park and its peripheries. Significant seasonality and spatial differences in limnochemical parameters in the pans investigated show the variable influence of land use patterns and hydroconnectivity.

Key points and conclusions:

- Limnochemistry is related to seasonal water level fluctuations, which also influences water quality and nutrients ratios;
- Land use also impact limnochemistry, as show by wet and dry sampling;
- The results show that all areas are within accepted ranges, but with significant differences occurring between seasons in pans;
- There is a strong relationship between land use patterns and water quality.

Comments and questions:

- Both pumped and ephemeral pans were object of the study, but they have not been split, which was deemed a useful suggestion;
- Analysis on land focussed on uses and did not include geology or other factors;
- A suggestion was made to concentrate on phosphor as a fertilizer, not nitrogen.

23. Diversity of ectomycorrhizae in fallow lands in the mid-Zambezi area, Zimbabwe

J.Tsamba

Ectomycorrhizal fungi (ECM) are symbionts of plants that facilitate nutrient mobilization and fixation in ecosystems. They indicate community changes at much finer scale and at earlier stages of community succession than plants. Vascular plant species composition changes with age of fallowing (Tambara *et al.*, 2012). We hypothesize that fungal species composition changes with age of fallowing in response to changes in host species composition (Visser, 2006). The present study was conducted in the Angwa area of Dande, mid-Zambezi valley, and it focused on ectomycorrhizae of agricultural fallow lands.

Thirteen woody tree species were recorded in the studied fallow lands, with *Acacia tortilis* subspecies *spirocarpa* being the dominant tree species. Root samples from soil cores randomly collected within the vicinity of common tree species of fallow ages 1 to 10 years were examined for mycorrhizae and extent of mycorrhizal colonization. Eleven ectomycorrhizal species were recorded. Seven of them have been recorded elsewhere, and four could not be readily identified. Eight tree species formed associations with ectomycorrhizal fungi. Five had no ectomycorrhizal associations. The highest number of ectomycorrhizal associations (3) were linked to *Lonchocarpus capassa.* No ectomycorhizal associations were recorded on *Diospyros quiloensis*, *Faidherbia albida*, *Dicrostachys cinerea*, *Grewia flavescens* and *Combretum eleagniodes.* Whether the dominance of *A. tortilis* subsp. *spirocarpa* in fallow lands can be linked to mycorrhizal association is a subject still to be verified. We are yet to establish whether the unidentified ectomycorrhiza specimens represent new records to the Miombo biome or new species.

Key points and conclusions:

- The research was conducted at about 400m altitude, in deciduous dry savannah, with a mix of Mopani and Miombo woodlands;
- EMC was taken from roots and observed to be family specific, yet common and generalist;
- *Boletus spp* found in *Lonchocarpus capassa* produces edible bodies;
- The low degree of hosts specificity is in contrast with expectations.

Comments and questions:

- No specific investigation was done on the role of fires, but they would definitely have an impact, specifically on spores;
- Other species found have a great ecological importance, but only the Bolatus have livelihood significance.

Session questions and answers:

- The international market of meat production is clearly divided between feedlots and free range, yet large areas are used for maize cropping (reference was made to sheep farms in America), and it is expensive to feed animals when there is no food for human consumption. Feedlot meat is less healthy than free range meat;
- Policies are a major stumbling block, and more support is needed to review such policies. CAMPFIRE, for instance, is a controversial issue because of its shortcomings, but could be improved. Policy harmonisation can also help in situation such as we see in Beitbridge where buffaloes are on communal land;
- On buffalo, one must remember the role played by trade sensitive diseases, specifically FMD, which will continue to spread as long as buffaloes are valued animals. There are pushes for OIE to accept the revised standards, but currently the onus is on the exporter to show evidence of no risk of disease and the responsibility on veterinarians is huge. A cultural change is needed, specifically to transform the mind-set of farmers. Evidence shows, however, that prepared meat is risk free[2];
- KAZA and AHEAD should continue to promote alternative approaches, towards non-geographic methods. Farmers are a difficult audience, though, and part of the solution is the legal movement of cattle, requiring a multi-sectoral engagement;
- On the use of Zhombwe for feeding, 12-20 kg of the tuber is needed to feed a cow (the tuber may reach up to 45kg). Animals eat it three times per week as a survival strategy, and it is believed to have medicinal properties. The plant should be able to survive because it is used only when needed, and each pod contains 5/6 seed, which can be used for propagation in March/April;
- More clarity should be sought on whether improvements are due to the nutritional or medicinal properties, but there is evidence that a lactating cow taking the tuber has less sour milk;
- Conservation agriculture relies on GMOs and chemicals, let us break the organic myth, because this term includes a variety of practices using zero tillage. Good agriculture is different, and there is evidence of 90% dis-adoption rate in the first year;
- The community representatives aske how can they work with institutions to resolve the KAZA-CAMPFIRE issues regarding elephants. The answer begged to acknowledge the difference between a bad system and bad implementation (50% of CAMPFIRE benefits may end up in the Rural District Council not with people). Progress on CAMPFIRE seems to be stuck here where authority is down to the village, but benefits are not, unlike in Namibia where all benefits go to the conservancy community.

[2] On this subject please refer to the Phakalane Meeting minutes and declaration, and to the documentary *Beauty and the beef*.

Supporting Decision Making for Protected Areas and Biodiversity - assessing user needs in the region

IUCN Biodiversity and Protected Areas Management Programme workshop

Organised by Christine Mentzel and Gregoire Dubois

This workshop is aimed at the representatives of implementing agencies and will concern the management of Protected Areas, as well as Access and Benefit Sharing.

The Vision

The Biodiversity and Protected Areas Management (BIOPAMA) Programme was created to address global, regional and local threats to biodiversity conservation in Africa, Caribbean and Pacific (ACP) Countries, by enhancing the work of existing institutions and networks, while building capacity to implement policies.

The Aim

BIOPAMA aims at creating a global reference information system while building capacity to improve biodiversity conservation and protected areas management, in ACP countries. This was based on a needs assessment revealing (1) communication, and (2) data and tools, as critical issues.

The resulting Digital Observatory for Protected Areas (DOPA) will allow for the assessment, monitoring and forecasting for biodiversity at a global scale. This is base on three needs:

1. To assess Protected Areas;
2. To monitor and validate Assessments; and
3. To predict and forecast changes in Protected Areas.

The DOPA is funded on Regional Reference Information Systems (RRIS).

The workshop

The objectives of this workshop, which is bringing together implementing agencies from the Eastern and Southern African regions, are:

1. Introduce BIOPAMA.
2. Understand how and what kind of information is exchanged from PA's to authorities (National, Regional and Global.)
3. Understand if and how agencies dealing with PA's are engaging with other sectors (agriculture and fisheries, extractive industries, infrastructure developments etc.)
4. Understand what tools are used and might be useful for defining conservation priorities.

When using Satellite Imagery, it is important to attach information on national and regional level, to support information-based planning. Currently, BIOPAMA is interesting in knowing what are the avenues of communication between implementing agencies, and who engages with whom, using what tools.

The following points were made by participants and discussed:

- The Southern African Development Community - Transfrontier Conservation Areas Network links together TFCA units across the region. Currently, the TFCA Portal is being established to provide a platform for information exchange, with the purpose of overcoming common chanllnges such as joint learning.
- The AHEAD-GLTFCA network is a very volatile group of people, and different tools have been experimented on to enhance communication with, from and between members, but this has not worked across generations. The use of web-based tools has not proven useful, people prefer face to face meetings, like this, which are not always possible.
- The use of web-based tools for map creation and sharing requires working partnerships, and dedicated people/institutions. However, to simply set up a huge repository of information is not useful, unless it responds to relevant questions, and identifies its users. Currently, even the WCMC website is outdated and not useful.
- It is necessary to understand existing communication flows to see how can BIOPAMA work from the regional to the national level to Protected Areas management and for mainstreaming biodiversity conservation. For instance, how does the donor community get informed, informs and shares information that is relevant? Is there a map for human-wildlife conflict, or poaching? Is it needed?
- A suggestion would be to use Universities to identify the specific questions in need of answering, and reinforce existing communication networks. This would allow a combine national/TFCA approach. There is definietly a need for a regional biodiversity system.
- Information may come from protected sources, so this is a complex process. The DOPA, however, could be a Wiki for regional biodiversity and Protected Areas

needs. This process may help in identifying existing knowledge sources (and their protection status) and put in a place that is accessible to all. On the field, though, we need GPS systems to make the mapping connection.

- Existing documentation, particularly coming from implementing agencies, is not standardised across sectors and nations, and this is a problem even for TFCA management. This project could support existing networks and tools by creating a land-use system database, that brings together these separate processes.

Country information flows

Zimbabwe: the ZNPWM is an authority within a ministry, under the Biodiversity Office, and our sister agencies include Forestry. Everyone feeds information to the Ministry, but we cannot share information without designated Focal Points. The ZNPWM has information collected by rangers for law enforcement on carcasses, sightings, poisoning, etc. However, we cannot share this information unless the Director General clears the request. He also delegates relevant officials to compile Biodiversity Reports.
Wilderness Safaris issues monthly reports to the Ecologist in Hwange National Park. Highlighted issues are escalated up from there.

Swaziland: There is a very similar structure, whereby rangers collect information and the Park Manager compiles the reports, which are sent to the National Director. Some data is protected. As for TFCAs, we have task groups on the ground, but the departments of Tourism and Agriculture compile their own information and use different channels to reach their National Directors. The Tri-later commission then takes decisions. There are Research Groups at Park level, who create and share reports in an integrated information flow. These have a link to the Ministry via the office responsible for wildlife.

> Information is expected but no one seems to take charge of the costs involved in data collection and processing. Access to information is a challenge, especially at regional level.

Tanzania: There is not a National Biodiversity Information System, so information gathering and sharing is a challenge. The Tanzania Wildlife Research Institute (TAWIRI) has information and so does the government under the Ministry of Natural Resources and Tourism, which vets the information published by the Research Institute. TAWIRI also does the reporting for Multilateral Environmental Agreements.

Mozambique: Conservation areas are under the Ministry of Tourism, and information flows two ways from the park to the reservoirs. Each Protected Areas has an administrator (warden) with a discreet level of autonomy in daily procedures and decision-making. Ranchers report to the administrators. Administrators report to the National Agency for Conservation Areas (ANAC) every 3 months. ANCA collates all

the information and reports to the Minister every 6 months. Two are the critical issues for reporting: poaching and human-wildlife conflict. On the latters, the reports go to the Ministry of Agriculture.

All information collected on wildlife concerns incidents.

General discussion on data collection and information flows

It was noted that overall data collection and processed is not always reliable because there are discrepancies between information received, the raw data is situational and the processing does not always make it through the bureaucratic channels.

When TFCAs are concerned the management structure meets quarterly to present and share information across countries, it then goes up to the Joint Management Board (JMB) and the Council of Seniors. The Mapumgubwe TFCA reports to the permanent secretary and the ministry in Zimbabwe, but this also differs with projects. The higher the information goes, the more it becomes politically driven and used, and the Coordinating Units may not even get the chance to verify reports before they escalate. Zimbabwe has one shared CITES database for reporting purposes: the information escalated from the database is again discretional and political, potentially leading to biased decision-making even at CITES level.

When Mozambican officers attend conference they have to report back to the Director General and, via him/her, to the Minister. They are also required to share the information with other Protected Areas managers.

It was generally agreed that when collecting information on a Protected Area, managers look outside the PA's boundaries too, this requires reporting to different Departments/Ministries, but that kind of mapping capacity is indeed lacking: there is no tool that helps multisectoral reporting, for wildlife, human densities, livestock densities, etc.

For TFCAs, the Integrate Development Plans (IDPs) should provide such mapping, at least for KAZA and GLTFCA. Even at national level, KAZA has a cross-sectoral committee in most countries.

Regionally, maps exist through the effort of PPF, but overlays are lacking for specific issues, particularly relating to conflict situation.

Overall, the mapping need is for a tool that integrates information into a single platform.

General discussion on tools and information priorities

Country representatives confirmed that paper is used overall for data collection, although countries like Swaziland are hoping to use GPS soon. The use of mobile phones has been tried but the geographic location of parks makes network access very difficult and unreliable. External funding has been used in Mozambique to get GPS and radio systems, in Gorongosa and Limpopo National Park. The problem in relying on external funding is that the donor decides what the funds will be used for.

If governments were able to decided on to spend funds based on a Needs Assessment, the situation may be very different, but in any case no such assessment exists for Mozambique. In Zimbabwe, it was noted, the Protected Areas with Rhinoceros population have been allocated GPS units, others do not receive much support so they rely on paper because mobile phones are unreliable and they are not issued by government.

Table 1: Information priorities

Country Issues	Swaziland	Tanzania	Zimbabwe	TFCAs
	Spread of invasive alien species	Natural water points in PAs; Spatial views.	Fires; Human/livestock information (settlements); Elephant/rhinos.	Conflict hotspots; Mosaic of land use types; Corridors.

The collection of information relies heavily on research, which needs to go up to management, but what is there is a mismatch between information and decision-making? This mapping tool may help to simplify research data for practical application, specifically if is it based on high resolution, real time, satellite imaging. Of course, a question was raised on capacity building to use the tool at Park's level, and it was noted that training would be provided through E-stations.

Swaziland suggested that this forum should be used as a stepping-stone for future iterations.

"When someone has no idea of how they will benefit, they won't help with introducing the technology, for example people need to know what they are missing" P. Gandiwa (GMTFCA)

Resilience in the Limpopo River Basin (RESILIM) programme

Organised by Steve Collins

Introduction to the RESILIM Programme

The Limpopo River Basin is a closed basin hosting about 14 million people across 4 countries with high level of pollution in the water deriving from a patchwork of land uses. The Climate Change models applied to the basin show a warming rate twice as high as that predicted by the United Nations International Platform for Climate Change. Currently, the only available date is temperature and precipitation, which still helps to forecast on drought, shifting rainfall seasonality and rainfall reduction, although more data is needed. It is also forecast that the basin will experience more extreme event in the near and far future.

RESILIM is a 5-year Programme also referred to as "The Nexus", because it aims at linking climate change, livelihoods and biodiversity. It is currently left with three and half years since its inception. The strategy of this regional programme is to engage with and support the Limpopo River Basin Commission (LIMCOM), to support the need for scientific evidence and to help people in the basin deal with change. On the latter, the programme focuses on, among others, legal and cross border issues that impact on resilience. There is therefore a need to identify projects to help communities build resilience in the Limpopo River Basin (LRB).

The ultimate goal of RESILIM is to fulfil the One World concept by addressing the impacts on climate change. The focus is on to two TFCAs, namely the GLTFCA and GMTFCA, and building resilience in the areas within the Limpopo Basin. The programme is aimed at offering grants and support to protected areas agencies, communities and scientists. Therefore a call for proposals will be made in due course to get work on climate change, particularly on issues that enable adaptation. With regards to the improved livelihoods element of the project, RESILIM deals with market realities with regard to sectors such as tourism, non-timber, and others.

Belynda Petrie: Risk, Vulnerability and Resilience

This part of the RESILIM project addresses "water-ecosystems-climate change" as its nexus. It therefore adopts a system-based approach to understanding vulnerability through a climate change lens beyond a mere development perspective.

The programme adopts two models: a scenario-based approach which involves scenario planning approaches, and a "No-to-low regrets approach" to investment,

which basically pushes for action instead of waiting for information, since climate change is happening regardless. Vulnerability is understood by looking at the potential impacts of climate change first, and then working backwards to people, that is from end point to start point. To this end, sensitivity layers have been used which include, *inter alia*, GIS mapping, data sets, and current data sets. The programme also looks into the adaptive capacity of the Basin as building structural change and not just coping strategies. The programme develops adaptive capacity layers and tools, such as exposure maps on current and future projections, sensitivity maps, hot spot maps, and spatial mapping.

Some of the results of resilience and vulnerability mapping undertaken so far in the Shashe-Limpopo Confluence and the Pafuri area indicate that water scarcity is a feature of the LRB and will continue to be exacerbated by climate change. However, the adaptive capacity is influenced by the socio-economic and political climates and geographic landscapes of the four countries involved (South Africa, Mozambique, Botswana and Zimbabwe), which are not on the same level. For instance, while South Africa has good adaptive capacity because of its political and socio-economic stability coupled with functional institutions, this is not necessarily true of the other countries involved. Other significant challenges on adaptive capacity have to do with limited human capacity in the varying landscapes of the four countries. Mozambique for instance, because it has no high-ground areas, is completely dependent on what happens in the other 3 countries.

The workshop was concluded by an exercise was done by workshop participants on how climate change impacts the GLTFCA and KAZA.

Colleen Howell: Building inclusive adaptive capacity and resilience to climate change

One of the agendas of the RESILIM programme is to target those groups, who are most vulnerable to climate change based on the Nairobi Declaration signed by African Ministers, with a focus on addressing vulnerability through the lens of the disability.

Disability is usually neglected despite statistics showing that about 15% of people in the world are disabled, and live in low and middle-income counties. In Africa, disability, poverty and economic marginalisation are intertwined, and yet disabled people tend to be excluded from mainstream economic activities, such as education and employment. Thus vulnerability is not just about poverty, but also the way in which disability is understood and responded to.

However, Southern Africa, especially Zimbabwe, have been proactive in pushing for rights of people with disabilities while South Africa has strong legal policy. The programme therefore proposes an inclusive approach, which addresses heightened vulnerability. In this regard, the focus is on issues such as prevalence (quantitative methodology), barriers, and resilience approaches (such as human rights and developmental issues). Most importantly, this approach acknowledges the disabled

people themselves as thought leaders, that is: people with the knowledge to address their issues. This therefore translates to building resilience from the inner core of vulnerable groups (bottom-up) instead of top-down.

One of the key goals of RESILIM is to address climate change challenges in the LRB. There are different approaches within the bigger RESILIM project such as: the climate change, livelihoods and biodiversity nexus; the water-ecosystems-climate change; and inclusive adaptive capacity which focuses on vulnerability. All of these approaches advocate for bottom up approaches to dealing with climate change within the Basin.

Panel discussion on RESILIM

The key elements of climate related planning for a TFCA, as identified by participants are:

- The strengthening of stakeholders engagement and partnerships e.g. relationships between park managers and communities
- The establishment of dynamic and non-static TFCA boundaries
- Health related planning, i.e. consolidating services that deal with human and animal health strategy, with a focus on Public Health Care
- Research – identifying new research areas/priorities
- Increased cooperation – at political level
- Conflict management and dispute resolution
- Trade-offs e.g. in Limpopo River Basin
- The role of national governments
- The need for harmonisation of law and policy by TFCA country participants

The group identified the following strategies, decisions and actions important for a TFCA climate change approach:

- Protection of areas providing ecosystems services where TFCA boundaries are not static; and
- Emergency preparedness.

It was concluded that there are huge challenges involved in the resilience LRB and there is a need to develop capacity to deal with them. Protected areas need to be able to think on their feet. This means that people are important for making trade-offs, working together and all other efforts, and governments should consider changes in protected areas' landscapes.

Theme 3: Animal and Human Health in the management of TFCAs

Session chairs: Prof. L. Blumberg and Prof. G. Matope

24. Frontiers in the management of wildlife/livestock diseases

Keynote address by Prof. L. Blumberg and Prof. G. Matope

The creation of transfrontier conservation areas (TFCAs) has been deemed to play a key role in the development of eco-tourism and biodiversity conservation in Southern Africa. However, human and animal health managers, and researchers are facing a number of challenges related to their creation. These include increased transboundary movements of wildlife, livestock, and people; increased wildlife-livestock contacts; and challenges for disease surveillance. More importantly, the possibility of inter-species transmission of pathogens cannot be over-emphasized. An example of this was a study on zoonoses as a cause of acute febrile illness (AFI) in the Mnisi area of Bushbuckridge, Mpumalanga, South Africa. The area is bordered by the Kruger National Park and contacts between wildlife, livestock and humans are frequent. While the area is endemic for malaria, successful control has resulted in a major decrease in malaria as a cause of AFI. Consenting malaria-negative adult human patients with AFI were enrolled and convalescent blood samples taken. Laboratory testing was done for brucellosis, Bartonella, leptospirosis, Q fever, tick bite fever (TBF), and West Nile, Sindbis, Rift Valley and Chikungunya virus infections. Results indicated high background exposure to TBF, Q fever and leptospirosis. A surprising finding was the number of Bartonella infections, not previously described in this population. There is need to revisit AFI treatment algorithms in clinic settings, and to educate the population about reducing tick and surface water contacts. Similarly, diseases of economic importance such as foot and mouth disease, and re-emerging zoonoses; bovine tuberculosis, brucellosis, anthrax and rabies have been detected in livestock and wildlife in the frontiers of TFCAs, but the drivers for their emergence, intra- and inter-species transmission have not been explored. Thus, a holistic approach for research, surveillance and management by implementing the "One Health" concept is required to reduce the impact of infectious diseases in the TFCAs.

Prof. Matope identified several emerging issues and concerned as per Table 2.

In discussing animal health at the interface, Prof. Madope highlighted the amount of information gaps that needs addressing and the lack of baseline data to apply a theory of change and develop scenarios. The following areas have been identified as critical for current research:

1) Mobility and contracts between wildlife and domestic animals:
   - Does the interface promote inter species sharing of pathogens – amplification/dilution- role overstated?
   - Tend to use associations.
2) Disease emergence/re-emergence
   - Interface area conditions?
3) Patterns/drivers – animal infections and diseases:
   - Epidemiology
   - Ecological drivers/determinants.
4) Socio economic impact of diseases:
   - Impact
   - Public health threat
5) Disease management control
   - Pathogen/disease detection
   - Epidemiological surveillance.

Table 2: Emerging health concerns and drivers at the interface

Emerging concerns related to TFCAs	Emergent infectious diseases	Drivers for emergence of infectious diseases	Domestic animal/wildlife – shared diseases at the interface:
Increased movement	New infection – evolution/change- OIE terrestrial health code	Genetic change	Trans boundary diseases- OIE list A RVF etc.
Competition for space		Globalisation	Endemic diseases – OIE list B. e.g. anthrax/rabies.
Pathogen transmission	Known infection – new geographical area	Change host range, host susceptibility	Zoonotic diseases reported at interface recorded by OIE: rabies, anthrax, BTB, brucellosis, RVF, bovine and porcine cyst.
Emergence – infectious diseases	Previously unrecognised infections/diseases	Climate change e.g. ticks re heart water	
		Anthropogenic factors	

In order to move forward, the region needs to use a One Health medicine approach and implement One Health management of diseases, which can and should be owned by communities, in its operationalization.

Mentioned article: *One health surveillance and control of brucellosis in developing countries: moving away from improvisation.*

Prof. Blumberg continued the presentation by using Ebola as a clear example of a zoonotic disease requiring a One Health approach. The huge outbreak in West Africa, hit 236 people in Guinea with 158 deaths thus far.

The zoonotic aspect derives from the human/animal and human/human contamination, so the only preventative intervention in Guinea was to ban bush meat, which is near impossible. The major intervention was to stop human exposure.

At the interface of contagion, one should note that the disease is under diagnosed, because it carries non-specific symptoms. Passive surveillance is further complicated by the failure of practitioners to ask about histories of animal exposure, their limited access to laboratory diagnostics and the existing high prevalence of TB, HIV/AIDS, malaria and other respiratory diseases.

The correct treatment would entail centrality of animal disease prevention and control.

The risk assessment conducted shows that exposure to small animals is the biggest problem, that activities such as slaughter, cleaning faeces, etc., increase exposure and risk, as does attendance to dip tanks. Results show that:

- Tick bite fever – common- over all mild.
- Q fever
- Leptospirosis – rodent urine.
- Bartonellosis – fleas – acute.
- Brucellosis (1), RVF (0), arbo viruses (3%).

The research outcomes and/or limitations may de summarised as follows:

- Improved tick control?
- Modify antibiotic treatment
- Reduce surface and rodent contact
- Surveillance in animals – e.g. Q fever.
- Establish long term surveillance in clinics.

There are still many knowledge gaps, but a One Health approach with good communication should have better impact on policy.

25. Trans boundary disease management in Southern Africa: Implications of a one health approach for Trans frontier conservation, agriculture and economic development

S. Atkinson

The Kavango Zambezi Transfrontier Conservation Area (KAZA TFCA) is on the verge of becoming perhaps the world's largest conservation-oriented landscape. While nature-based tourism is expected to contribute significantly to economic growth opportunities and poverty alleviation in southern African TFCAs like KAZA, livestock-based activities remain an essential component of achieving this goal. However, current internationally accepted approaches to managing livestock diseases

of economic importance (e.g. foot and mouth disease - FMD) in the region, which rely on veterinary cordon fencing, appear to be increasingly ineffective and are not compatible with the TFCA concept which promotes landscape connectivity and free-movement of wildlife. This intersectoral conflict represents one of the key threats to the ecological connectivity required for genuine conservation success, and thus to risk-diversification of land-use options and livelihood opportunities.

Working with regional partners, the Wildlife Conservation Society's AHEAD (Animal & Human Health for the Environment And Development) programme is focused on developing practical solutions to equitably resolve this fundamental land-use conflict. This can 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, by identifying mechanisms for managing transboundary animal diseases (TADs) like FMD without complete reliance on current fencing approaches, and by informing and influencing cross-sectoral and transboundary policy responses that support both TFCAs and control of TADs.

Key points and conclusions:

Approach in KAZA:

- Identify different non geographical approaches for FMD. E.g. Commodity based trade.
- Enabling environment for co-operation.
- Information policy decision making supporting TFCA's and effective disease management.

Alternative non-geographic approaches investigated:

- Integrated management of food safety and animal disease risk along value chain- WTO and OIE.
- Locality of production not required to be FMD free.
- Layout of SPS committee:
    - HACCP
    - CCP's
- Proposing to incorporate Commodity based trade and HACCP though CCP's.
- Integrated approaches to disease risk management.
    - Entire value chain – farm to fork.
    - Integrated value chain system – out weighs other options.
- Facilitating access
    - OIE recognise non geographical approaches as a strategy.
    - Regional, some flexibility.
    - SADC- lives stock technical committee.
    - Phakalane agreement – non geographical approach to manage FMD.
    - OIE- new draft FMD chapter next year.
    - National
        - Namibia support CBT market access and Zimbabwe.
- Opportunities to remove veterinary control fences.

26. Animal Health in the Great Limpopo Trans frontier Conservation Area

E. Lane

In this presentation the results of the first 5 years of necropsy examination and histopathological disease diagnosis, involving over 270 cases and over 30 species of animals and birds in the Great Limpopo Transfrontier Conservation Area, will be discussed. Cases will be used to illustrate the realised and potential value of disease diagnosis in the management of TFCA's. Examples include establishing baseline disease information such as normal tissue anatomy in road traffic accident cases; establishing common and newly described conditions (such as specific parasites) which are useful to facilitate the correct diagnosis should new diseases such as Peste de Petits Ruminants emerge; flagging of relevant prospective research projects, for example steatitis in Nile crocodiles, and haemoparasites in Red-billed Hornbills; collection of banked samples to support retrospective research such as molecular diagnostics for Canine Distemper virus; health assessment in "problem animals" which represent one aspect of the interface between humans and wild animals, and domestic animal parasites in free-ranging wildlife, which represent another; and diagnosis of conditions such as blue green algae toxicity which can inform management decisions. Species differences in the reaction to M. bovis disease presentation as well as cases in African wild dog, spotted hyena and giraffe and their possible implications for conservation of these species will be discussed.

Key points and conclusions

- Species whose health is compromised are: African Buffalos, Elephants, Banded mongoose, Wilde bees, Kudu, Impala, and Lion
- The most recurrent traumatic injuries are: bone fractures, soft tissue, radial nerve, inter/intra species conflict, Post Traumatic Stress Disorder and Road traffic accident for large animals.
- Parasites were found to be both internal and external.
- Problem animals carry BTB, infectious diseases and other disease such as large tumours in carnivores.
- In the period between 2007 and 2014 most animals were found to be healthy and reaping the benefits of Disease Risk Assessments, Test Validation, Baseline Disease Information and Research.

27. Buffalo movements at the wildlife/livestock interface along the Limpopo River and consequences for Pathogen transmission: preliminary results from the BUCATIN project 2010-2014

A. Caron

Wildlife/livestock interfaces are known to be hotpots of pathogen transmission. In southern Africa, Transfrontier Conservation Area initiatives will include and sometimes create wildlife/livestock interfaces and the risk for pathogen transmission to livestock and to wildlife has already been demonstrated. There is therefore a need

to understand wildlife and livestock interactions at the interfaces to mitigate the sanitary risk and promote TFCAs.

The BUCATIN project started in 2010 to explore buffalo and cattle interactions along the Limpopo River, in the section separating Kruger National Park in South Africa and the Sengwe communal land in Zimbabwe. Telemetry and epidemiological studies have been carried out 3 times in 2010, 2011 and 2013. Here, we present some preliminary results on buffalo movements along the Limpopo River and discuss the implications for pathogen transmission at the buffalo/cattle interface.

Initially focusing on adult females only, the telemetry study was extended to young females (from 18 months to 3.5 years). We present results on home range size and variability according to seasons. First, home ranges of these buffalos span across the South African/Zimbabwean border indicating a potential for transboundary disease transmission. We also observed the relatively good stability of home range size for adult females compared to some young females that can experience large home range variation in only a few months. These observations are linked to the diseases detected in these populations (notably zoonosis such as brucellosis, rift valley fever and bovine tuberculosis). We conclude by exploring options for disease surveillance and management in buffalo and cattle at this interface in order to mitigate the disease risk.

Key points and conclusions

- The starting point for the research was the spread of BTb in the GLTFCA, from Kruger National Park.
- The research aimed at understanding and mapping pathogen transmission, including its relation to human/wildlife conflict; the contact between hosts, including its relation to the management of the interface.
- The methodology included the use of satellite collars, with regular blood sampling for cattle and opportunistic sampling for buffalo.
- The research showed that Buffalo does not use the Sengwe corridor, hence there are few cattle/buffalo interactions, which are seasonal and depend on boundaries. There is suspicion of wildlife-cattle transmission, but no information on cattle-wildlife transmission of pathogens.
- The maps derived are: (1) disease survey map; (2) pathogen transmission map; (3) adult female buffalo map at the Crooks Corner and Limpopo River interface.
- The new Protocol 2013 showed the following preliminary results mapped out:
    - Adult female – localised HR
    - Adult male – two tries – two fails
    - Young female – 19 between 2.5 years old and 4.5 years old.
- The conclusion call for a combine research approach, able to look at the whildlife/livestock/human interface, under a Eco Health and One Health paradigm.

28. Epidemiology and the role of multiplicative factors linked to emergent bovine tuberculosis at the wildlife/livestock interface areas in Zambia

M. Munyeme

Bovine tuberculosis (BTb), caused by *Mycobacterium bovis* has insidiously and mutely continued to devastate livestock and wildlife of the Kafue Basin in Zambia. However, the multiplicative factors and drivers responsible for its emergency, transmission and sustenance have poorly been understood. Consequently, this current study was conducted to identify drivers of its occurrence. To this effect, a range of factors were carefully studied. These ranged from biologically plausible determinants of disease occurrence, ecosystem factors, to social interaction patterns, direct determinants such as well as proxy factors such as exposure patterns among independent populations. Further, the overlap, as well as the sharing of common pool resources such as grazing pasture and watering points at the wildlife-livestock interface areas, has been recognized as "hot" spots for disease occurrence as well as major drivers for bovine tuberculosis (bTB) occurrence in the Kafue flats. To investigate this particular phenomenon Geographical Positioning System (GPS) coordinates representing of such identified areas were captured alongside biological and risk factor data. Multiple logistic regression analysis indicated that BTb occurrence was independently associated with social interaction patterns such as grazing systems with the livestock/wildlife interface being deterministic. It was further observed that cattle BTb prevalence oscillated between 0.6% (in Non-interface areas) to 7.4% (in livestock/wildlife interface areas) whilst it averaged 27% in Kafue lechwe antelopes (wildlife). Further, this study postulated a bi-modal route of transmission at the livestock/wildlife interface with direct empirical evidence elucidating the actual circulating *Mycobacterium bovis* strains in Zambia. Cattle were found to be the major source of *Mycobacterium bovis* strains given the comparatively higher variety of strains compared to wildlife, with possible "spill-back" from wildlife (lechwe antelopes) to cattle and possibly other wild animals (Baboons?). The study has further established the epidemiological link between cattle and wildlife BTb in Zambia.

Key points and conclusions

- In the Kafue flats, epidemiology and multiplicative factors show that BTb is not homogeneously distributed and there is extensive overlap where cattle and wildlife are grazing.
- The objectives of the research were to (1) critically analyse epidemiology of the disease, and (2) map the study area.
- Sampling was biological and geo-referenced, it was analysed in laboratory and a statistical and risk analysis was conducted.
- Using complex discrimination and finger-printing, the lungs of cattle and lechwe were studies with the result that BTb was less severe in cattle.
- The main strains discovered for cattle were SB120 (is the main concern and is found in the Kafue basin), SB948 (related to 120 and found in the Northern part), and SB131 (outside of the Kafue basin, found in the Eastern part).
- BTb is an imported disease in Zambia and was transmitted from cattle (VNTB is higher in cattle) to wildlife.

- Multiplicative factors are flooding, host factors, population, agent pathogeny, epidemiological patterns and agro-ecologica emerging opportunities. There exist a possible spillover effect.

29. Hidden disease threats at the wildlife/livestock/human interface

A. L. Michel

The presentation went beyond TFCAs to include the interface between humans and captive wildlife found in zoos. In developing countries the threat of diseases on wildlife is mostly from the visiting public with TB as the highest cause of death. However, in TFCAs much of the contact between humans and wildlife is with those working there and wildlife. The disease transmission interface is such that disease circulates where wildlife is a source to human infection and domestic animal infection. The biggest threat in Eastern and Southern Africa is the MCF. Another disease is the Bovine Tuberculosis (BTB), which goes freely as multi host pathogens at the wildlife/ livestock/ human interface. These diseases, especially BTB and Brucellosis thrive and do not reflect clinical signs quickly and yet are chronic. Studies were undertaken in Gonarezhou National Park, Zimbabwe and Madikwe Game Reserve, South Africa, on the transmission of BTB at the interface. The first study, in Gonarezhou, was a cross-sectional study of 10% of the cattle population in the area. It was established that endemically infected wildlife area threat to cattle; and the contact between wildlife and cattle occurs with or without the fence. A BTB control scheme of communal cattle were tested and showed that the disease can hide and escape detection unless efforts made to find it. Thus BTB escaped into communities without the fence. In other countries without fences and BTB control schemes the extent of spillback had to be investigated. The second study, in the Madikwe Game Reserve, though not a TFCA was undertaken because of the border between South Africa and Botswana. The game reserve has 800 buffaloes and undertakes regular TB testing because these animals are sold. The methodology used for the study involved microbacterial culture, spolio-typing and VNTR typing. The results of the study showed that before 2012 there had been no TB infections however it was not sure how buffalo had become infected after 2012. It is assumed that the infections were as a result of fame introductions from other areas. In conclusion the study revealed that the interface shows a man-made interface of a new nature, that is, wildlife/wildlife interface. Moreover, the human wildlife interface is good where frequent screening tests are done especially of cattle, as they are easily accessible for such tests, and on translocated wildlife.

30. Pheroid technology: applications in therapeutics against *Staphylococcus aureus* and the potential it holds for the animal health sector

D. Wilken

This study was based on challenges associated with transmissible zoonotic diseases between domestic animals and wildlife. Research shows that these diseases have high infections in humans necessitating the importance for one health initiative. In

particular the study focused on veterinary medicine, specifically, Pheroid technology and its use to fight *Staphylococcus aureus*. While this particular disease is not typical in TFCAs when it does infect animals it causes multiple antibiotic resistance and ultimately impacts on food security and economic factors. The goal of the study was therefore to use Pheroid based antibiotics instead of free drugs to fight the disease. The results of the study indicated that where the Pheroid formulation was improved 6-fold above its reference formulation the growth of *Staphylococcus aureus* could be inhibited. The study concluded that the use of Pheroid technology could inhibit *Staphylococcus aureus*.

31. The epidemiology and ecology of *Bacillus anthracis* infections (anthrax) in wildlife/livestock interface areas in Zimbabwe

K. Mukarati

The project is aimed at studying the incidence and pattern of anthrax outbreaks in wild and domestic animals at the interface and establishing the possible role of each animal species in disease propagation. The research is based on the understanding that people consume anthrax-infected meat knowingly or unknowingly. Anthrax is under reported for both wildlife and domestic animals. However it is mostly prevalent in herbivores. While, carnivores are relatively resistant and produce antibodies but do suffer mortality from it depending on the dose consumed from infected animals they feed on. Samples will be collected from known past anthrax carcass burial sites to isolate and identify the bacterial strains and elucidate the relationships of the various isolates by molecular techniques (molecular epidemiological study). Similarly, samples will also be collected from fresh cases as may occur during this project. Both wild and domestic carnivores will be studied through serology for their potential as sentinels for anthrax in the range. The project has three study sites namely, Great Limpopo Transfrontier Conservation Area (GLTFCA), KAZA TFCA and Mana Pools each with three interface types denoting intensity of animal species interaction - porous, semi-porous and amorphous. These interface types alongside environmental and meteorological factors will be taken into account in this study for the better understanding and control of anthrax at the interface.

32. Ecological Risk Assessment and Mapping of High Risk Areas for Anthrax in the Upper Zambezi Basin with Sioma-Ngwezi as Case Study

H. K. Kamboyi

Anthrax is a multi-species zoonotic disease with spore-forming bacteria, Bacillus anthracis, which is able to multiply in the host and infected animals in adverse environmental conditions. It is prevalent in herbivores with symptoms such as oozing of blood and bloating. In carnivores it is evidenced by swelling due to toxins Research also shows that anthrax is also found in humans with symptoms in the intestines and can become deadly. The literature review shows that anthrax is prevalent in Zambia in the Upper Zambezi Basin, the Lower Zambezi Basin and the Luangwa Valley as serious ecological disease in livestock and wildlife. The effects have been devastating on ecotourism and the socio-economic viability of the wildlife sanctuaries in the

Zambezi Basin and Luangwa Valley. The study is prompted by an increase in the frequency of anthrax and as an emerging disease in a number of species. The lack of investigations at ecosystem level and prevailing anthropological activities, have largely contributed to the speculative nature of what deterministic and risk factors at play in this area. The expected outcomes are to be able to predict the ecological drivers of anthrax recurrence and its epidemiological linkage to the anthropological activities in the Upper Zambezi floodplain. More importantly there is a need for a "One Health" approach, that is, an integrative, multi-disciplinary approach to addressing the disease at the wildlife/livestock interface. The methodology will involve cross-sectional through active environmental sampling of carcasses, the soil near the carcasses and watering points as well s pre-tested structured questionnaires; the use of a retrospective cohort component based on metadata analysis and correlating anthrax outbreaks from veterinary, medical, wildlife and meteorological authorities for past 20 years.

33. Assessing the Circulation of Bovine Tuberculosis in Cattle Herds at the Interface from Chobe National Park, Botswana

M. Tladi

The presentation is based on a follow up study in 2011 on the circulation of Bovine TB (BTB) in Chobe, Botswana, which is part of the KAZA TFCA. This follow up study established that BTB has been detected in cattle outside the Chobe National Park and therefore there is a need to activate emergency plans to prevent it from spreading to other livestock and wildlife. Thus a further study is aimed at assessing the circulation of BTB at the livestock-wildlife interface in 2 phases of 2 years each. The methodology will entail identity and pre-incubate samples. Ultimately the study should be able to raise awareness about the possible environmental and public health implications of this disease among local and national authorities in order to establish control measures that prevent its further spread to other livestock and wildlife populations.

Key points and conclusions of presentations

- Improved Pheroid formulation could be used to inhibit the growth of *Staphylococcus aureus* and therefore important in a One Health approach to curb disease at the human/animal interface.
- Anthrax is prevalent in Zambia in the Upper Zambezi Basin, the Lower Zambezi Basin and the Luangwa Valley as serious ecological disease in livestock and wildlife. A "One Health" approach, that is, an integrative, multi-disciplinary approach to addressing the disease at the wildlife/livestock interface in these regions of Zambia.
- BTB has been detected in cattle outside the Chobe National Park and therefore there is a need to activate emergency plans to prevent it from spreading to other livestock and wildlife.

Theme 4: Policy, Law and other legal instruments for the governance of TFCAs

Session chairs: Prof. E. Du Plessis and Prof. T. Murombo

34. Re-thinking property for conservation

Keynote address by Prof. E. Du Plessis

A modern view of property sees property from a rights perspective, instead of a duty perspective. Property is often described as a bundle of rights, which rights may be restricted or regulated (in some instances even taken away) by the state. The duties of holders of property rights are often neglected or left only for discussions on neighbour law, where the rights of the neighbouring owners clash. Other than that, we regard the law of property as the area of law that sets out what an owner's rights are to her property, the boundaries of ownership and the remedies an owner has in case her rights are infringed upon. A definition or understanding of property as individual entitlement is problematic from an ecological perspective, since the interconnectedness between land and the ecosystem, or the ecological whole, cannot prosper on individual notions of ownership. Instead, holders of property rights need to understand how they fit into the ecological whole and realise their collective responsibilities. This raises the problem of how property laws must be developed or understood to, on the one hand protect property rights, but on the other hand to not do so at the cost of ecological integrity. This paper looks the impact of more eco-friendly ways of understanding property rights.

35. Rethinking law for transboundary ('global') natural resources conservation ('sustainable use')

Keynote address by Prof. T. Murombo

While the fundamental objectives behind transfrontier conservation areas, as an approach to conservation, are not entirely new; legal obstacles are hamstringing the modern concept. The integration that is assumed in the conception of transfrontier conservation areas, while a demonstration of naivety of political boundaries and the oneness of the ecosystem (ecosystem approach), forgets that law is not like the ecosystem. The fragmentation of law – at the *international, regional* and *domestic* level has meant that partner/range countries often have quite divergent legal and policy frameworks that govern the use and conservation of the same resource. Ideally, regional integration bodies such as SADC, ECOWAS should take the lead in developing high-level regional frameworks for collaboration and legal harmonisation. Unfortunately, for the GLTFCAs and KAZA, the SADC does not have sufficiently harmonising frameworks and what exists lacks clear guidance for countries to effectively partner in transfrontier conservation. This lack of harmonisation permeates natural resources regulation in each country's domestic natural resources laws and policies. The domestic result – ineffective implementation and inadequate

enforcement thus also affects the regional conservation initiatives. A fundamental oversight however is that prior to modern conservation law and governance structures – indigenous/customary communities were able to share natural resources with few to no conflicts and unsustainable use.
There are fundamental underpinning legal systems and concepts that sustained the customary collaboration and integration between communities and nature. Addressing issues regarding harmonisation, implementation and coordination of transboundary conservation and the challenges being faced in transfrontier conservation areas requires not just laws but certain kind of law: grounded in the indigenous and customary practices of local communities and situated within the socio-economic realities of the partner countries.

Comments and questions:

- The question of property of wildife and livestock is critical for the resolution of conflicts between communities and conservation agencies;
- In acknowledging wildlife as state property only when communities hunt (or kill for protection) and not when wildlife damages individual property is at the core of such conflict;
- Current legal systems are unable and/or unwilling to resolve the vacuum, due to the cost implications in responding to wildlife damages to individuals.

36. A legal framework for transfrontier biodiversity conservation in SADC

N. Lubbe

Biodiversity is central to human survival because it provides the natural capital essential for maintaining ecological integrity and sustaining life. Africa has rich, biodiversity resources, particularly in the Southern African Development Community (SADC) region, which contains five of the eight biodiversity hotspots in Africa. It is unfortunately alarming to note that each of the 34 hotspots worldwide has already lost 70% of its original vegetation. Their decay emphasizes the importance of biodiversity conservation and it is in this context that Transfrontier Conservation Areas (TFCAs) are important. The main purpose of TFCAs is to conserve biodiversity, and in essence, they constitute an evolved or modern manifestation of traditional Protected Areas (PAs). TFCAs allows for more holistic conservation approaches in line with key conservation concepts such as connectivity, bioregionalism and ecological integrity, as well as the integration factor and what is required to promote sustainable development. It is crucial to note that the mere existence and/or establishment of TFCAs will not necessarily lead to better biodiversity conservation. In fact, evidence suggests that although the coverage of the PAs (including TFCAs) has risen tremendously during the past decades, biodiversity is still lost at an alarming rate. For TFCAs to effectively contribute to biodiversity conservation, the successful governance thereof in terms of the SADC legal framework, as in other regions of the world, becomes crucially important. The purpose of this paper is to analyze the SADC legal framework to establish if it could contribute to the governance of biodiversity in TFCAs. In doing so, the paper first distils, from a legal theoretical

point of view, various principles of biodiversity conservation relevant to the TFCA context. It then proceeds to analyze the SADC regulatory framework with a view to determining if the framework provides for the regulation of these principles of biodiversity conservation in TFCAs.

Key points and conclusions of presentation:

- An increasing human population remains problematic, therefore TFCAs are important;
- Different law definitions create confusion in the joint management and implementation of TFCAs;
- Article 24 (AU) needs to be revised;
- SADC only provides goals for TFCA, but guidelines are needed.

37. Sanitary and Phytosanitary measures in the SADC region: a South African perspective

B. Joubert

Sanitary and Phytosanitary (SPS) measures are measures aimed at the protection of human, animal and plant life and health within specified territories from the risks associated with the introduction and spread of pests and diseases into such territories through trade. "SPS measures" is a very broad term covering food safety (Codex Alimentarius International food Standards i.e. Codex), animal health (World Organization for Animal Health known as OIE) and plant health (International Plant Protection Convention known as IPPC).

South Africa is a member of the South African Development Community known as SADC. In SADC SPS measures are provided for in the SADC Sanitary and Phytosanitary Annexure to the Protocol on Trade of 1996 (SADC-SPS). The SADC-SPS and SPS measures are measures, as in the case of the WTO, aimed at the protection of human, animal and plant life. In terms of the aforementioned annexure, the protection afforded by these measures include protection against the risks which may arise through the entry and spread of pests, diseases, disease carrying organisms or disease causing organisms into a territory (Article 1(16)(a) of SADC-SPS – Terms and definitions). SPS measures may be applied further in the protection of human and animal life form additives, contaminants, toxins or disease causing organisms in food, beverages or foodstuffs. Human life and health is protected by SPS measures applied as a means of protection from diseases carried by animals and plants or from the entry establishment or spread of pests (Article 1(16)(b) and (c) of SADC-SPS – Terms and definitions). Limitation or prevention of damage within a territory caused by the entry, establishment or spread of pests is also achieved through the application of SPS measures (Article 1(16) (d) of SADC-SPS – Terms and definitions). The SADC-SPS annexure to the trade protocol applies to all SPS measure whether they directly or indirectly affect trade between member states or not (Article 3 of SADC-SPS - Scope and Coverage).

SPS standards and measures should not create a non-tariff barrier (NTB) to trade through rigid and unnecessary or unreasonable standards. SPS measures are not intended to be used capriciously as a means to provide protection for domestic

industries. Resultantly standard setting organizations such as Codex, OIE and IPPC are specifically recognized in the WTO-SPS agreement as part of the framework used in establishing territory specific SPS measures. The SADC Protocol on Trade (1996) stipulates that policies and measures are to be implemented by members to eliminate existing forms of NTBs in relation to intra-SADC trade and members are not permitted to enforce new ones [Article 6 of SADC Protocol on Trade 1996 - Non-Tariff Barriers). Members are also required to promote competition and prohibit unfair business practices within the community (Article 25 of SADC Protocol on Trade 1996 – Competition Policy).
The purpose of this study is to establish to what extent the South African legal framework complies with its obligations in terms of the SADC SPS Annexure to the Protocol on Trade as well as to determine whether the SPS measures are being used as NTBs.

Key points and conclusions of presentation:

- The SPS measures relate to trade, and this can possible make trade difficult which can result in goods being traded elsewhere.
- This was never the purpose of the SPS measures.
- Amendments to NTO-SPS and SADC-SPS (2008) act are old, which is problematic.

38. Transfrontier conservation decision making in Southern Africa: some practical applications and recommendations

S. Malan

This study in transboundary conservation focused on the decision-making processes as found in two southern African case studies, the Greater Limpopo TFCA, and the Greater Mapumgubwe TFCA. The overall objective of the research project had been to consult with all layers of stakeholders and policy makers involved to: synthesize the current state of knowledge; identify the range of potential land management options and adaptation actions at various scales; identify the range of potential effects of major disturbance types on natural and human systems, including incremental effects of management responses on natural and human systems; and determine the range of values that drive decision-making processes.. The methodology involved: investigating the socio-economic issues through analyses of semi-structured interviews with community members, park officials and managers at various levels; conducting semi-structured interviews with local government officials, national policymakers and NGOs involved in the TFCAs; and an in-depth scrutiny of relevant policies and treaty documents. A value system framework was developed as a result, and each of the ecosystem, socio-economic and governance dimensions received a cumulative score for the two case study areas. The gist of these findings as well as recommendations that could enhance decision-making processes for the two TFCAs will be presented along with practical applications.

Key points and conclusions of presentation:

- Differences in value systems were a key aspect that came up during the study;

- There is a lot of flow on the system, because of pressure and the system sometimes struggle to cope;
- According to policymakers there is implementation, but this was not noted by the interviews.

39. The potential role of the law in fostering sustainable tourism development in southern Africa's TFCAs

A. Mugadza

It is common because that tourism is regarded as the main driver of economic development and poverty alleviation in the TFCAs of Southern Africa. In fact one of the main arguments put forward for the establishment of TFCAs in the region is that because of the richness of the biodiversity in southern Africa TFCAs should able to pay for themselves, for the local communities involved, for national economies and for the region at large, through the development of tourism. However in order to reconcile these goals with the other key objectives of TFCAs, namely, biodiversity conservation, and regional integration and peace, a sustainable tourism development approach is proposed. Inherent in this approach is the recognition that tourism should meet the following criteria: the protection of the environment and its resources; improved quality of life and economic benefits for local communities; and a quality experience for visitors. Notwithstanding, this requires a multi-disciplinary approach to sustainable tourism: it is proposed that for these criteria to become a reality in TFCAs the role of the law cannot be underestimated. In general the role of the law as an enabler, a regulator and an inhibitor is important to ensure that sustainable tourism development in the TFCAs is advanced. As a case study this paper will focus on the role of the law in the realisation of an improved quality of life and economic benefits for local communities on the Zimbabwean side of the GLTFCA is examined. In particular, the paper will examine the role of law in ensuring that there is devolution of authority to local communities from local government in order for them to continue with the CAMPFIRE programme as the main driver of hunting tourism.

Key points and conclusions of presentation:

- The CAMPFIRE concept is a top down approach, which is not ideal. This is because the goal was for communities to see what their resources are and how this could support them.
- The two laws that originate from this project also have gaps, which result in unpredictability. This has to be corrected so that the law is seen as a regulator by the people for the people.
- We should be revising the 2013 amendments to ensure that CAMPFIRE is used correctly.

40. Benefit sharing arrangements and local perceptions of CAMPFIRE in Zimbabwe: Lessons for the Transfrontier Conservation Initiatives in Southern Africa

T. Petros

The CAMPFIRE program is the community-based natural resources management (CBNRM) strategy designed to deal with Natural Resources Management at grassroots level. The program aims to empower rural communities through the Rural District Councils to manage their natural resources sustainably, for their local development. Little is understood about how local institutional arrangements, cultural and historical backgrounds influence aspects such as local perceptions on CAMPFIRE, benefit sharing outcomes and Human Wildlife Conflicts. Learning different institutional arrangements in two contrasting areas will help the respective authorities in designing of stronger institutional and benefit sharing arrangements in the management of wildlife in view of the impending Transfrontier Conservation Areas. The research analyzes benefit sharing arrangements and local perceptions by exploring into: community participation in decision making in CAMPFIRE, different benefits accruing from the CAMPFIRE program, benefit sharing and institutional arrangements, local perceptions on the current CAMPFIRE implementation and institutional models as well as determine alternative models for improving benefit sharing in relation to the proposed TFCAs (KAZA and GLTFCA).

Key points and conclusions of presentation:

- We need to move towards a place where communities are experiencing more benefits;
- There are five research questions that will be looked at;
- It is planned that 200 KAZA and 200 GLFTCA households will be interviewed.

Theme 5: Human Security in TFCAs: approaches and models

Session chair: MR. M.J. Murphree

41. Reflecting on TFCAs and their role for sustainability

Keynote address by Prof. M.W. Murphree

The Invisible Peoples

The invitation to make a presentation at the meeting has provided the opportunity to carefully re-read the book **TRANSFRONTIER CONSERVATION AREAS: PEOPLE LIVING ON THE EDGE** (Andersson, J A et al. Earthscan/Routledge, London 2013). With multiple editors, several of who are at this meeting: this is in my view by far the best socio-ecological book that we yet have on the TFCAs. It should be read by all involved in TFCAs, from scholars with species-specific foci to managers and planners with macro-specific programme interests (rural development, disaster aversion, etc.) to scholarship with a broad global perspectives in this planet's biophysical future. In its introductory comment, the book gives a clue as to its theme, which is that "...the peoples most affected by TFCA formation tend to disappear from view." (Frontspiece) This concern is duplicated in this paper.

In my view the most important chapter in the book is Chapter 4 by Prof. Giller and associates, entitled "Populations and Livelihoods on the Edge." Against the background of exponential national human population growth in eastern and southern Africa, the authors examine "drivers" leading to population growth or decline in and around TFCAs. Their most important finding is as follows: "... the most important driver is indirect - the (lack of) alternative opportunities away from the edge. Rapid population growth at national level, combined with poor economic growth (and even economic contraction and de-industrialization in Zimbabwe) led to people seeking places to settle. The remoteness and relatively poor agro-ecological potential of the conservation areas and environs means that, while they may be the ancestral home for some, they are not the first choice for in migration and settlement." (p. 83)

This scenario is not a novel picture on the global stage. If we project for eastern and southern Africa an historical course similar to that which has occurred elsewhere we can expect the following:

- A growing human population, hopefully stabilizing around the middle in the Century;
- Some of this growth will be absorbed in human population expansion in the productive agricultural areas of Region Three, but there will be an overall shift in population numbers from rural to urban;

- Those shifting from rural to urban habitats will join a growing urban lumpenproletariat, the nature of which will depend on politico-economic factors;
- Rural populations in Regions Four and Five, the heartland of the new TFCAs, will remain relatively stable in size. Communities will persist as socio-cultural anchors for many whose lives are lived out in urban areas.

Far from consigning TFCAs to residual status this projection underlines the importance of the areas they occupy. They contain populations particularly vulnerable to political, economic and ecological upheaval. To a large degree they are custodians of the cultural heritage of the areas in which they are located. And, critically, they are major providers of the ecological goods and services upon which their countries depend.

The Core Function of TFCAs

The considerations set out above implies that the fundamental function of the TFCAs should be:

To provide incentives for those who by choice or circumstance live in them to be good stewards of the natural resources over which they preside.
TFCAs *should act as incentives for investment in the future.*

What they must not do is provoke a stasis created by mutual vetoes. **Remember, these people (the rural small-scale farmers in the TFCAs) have a veto over anything that you propose.** This veto can be exercised in a number of ways: through inaction and withdrawal, through covert non-compliance, through political subversion or, in extreme cases, through confrontation and violence. The "authorities" of the day also have, of course, their vetoes: the regulation and the law, the withdrawal of funds and contextual support, the coercion of the bulldozer and perhaps even the bullet. If both parties exercise their vetoes in some form the result is stalemate. Nothing happens. Too often stasis is a condition to be found in rural Africa.
TFCAs can become a forum and a context in which stasis is changed into experiment. Ignorance is tempered by potential, fear by conditionality and self interest by mutual benefit. These transformations are not easy. They are the result of negotiations between equal status parties and require the time needed to generate trust. They are, however, transformations, which must take place if TFCAs are to be more than rhetoric.

The Unit of Proprietorship

With whom do we (the planners, the managers, the analysts, the "authorities") negotiate with if the course above is followed? One could of course produce a long list of relevant actors. We recognize however that it is "the people" who are by far the most important, people that we usually aggregate into "communities". This is a vague and imprecise term...and we like it that way! We can talk about "community participation" and "community benefits" and, if pressed, we can produce almost any

definition that suits our programme. I prefer the adjective to the noun, and like to refer to "communal regimes of property management". There are both sociological and topographical reasons for this, which will not be discussed here, and further we need to remember that localized institutional requirements vary according to context. Whatever we call these primary collective regime units we need to remember that they require a defined membership, a defined jurisdiction and defined rights and responsibilities. Among the required rights are the following:

- The right to determine use
- The right to determine the mode of use
- The right to be in receipt of the full value of use (which, as with any income, may be taxed.)
- The right to determine the disposal of value received

This is not "benefit sharing", it is collective "ownership" similar to the "ownership" that the individual farmer holds over his individual assets and produce. Bear in mind that "ownership" is never completely unfettered and can be subject to exceptional circumstances. But if ownership is to be significant it must be "strong ownership", i.e. the exceptions must be exceptional. If we take this view of a communal regime two critically important conjunctions are made: responsibility and authority are joined and input and benefit are linked.

During the meeting the status of Zimbabwe's CAMPFIRE Programme received considerable attention. It was noted that in many instances CAMPFIRE had "failed," and it was suggested that the lack of conjunction between the components mentioned above was the main reason. There were of course other reasons why the initiation of CAMPFIRE led to failure. CAMPFIRE assumes a viable ratio between available resources and demand and was not projected for many sites. CAMPFIRE also assumes a minimally effective core of social and human capital in a projected natural resource, a condition, which was sometimes found not to be present. Thus CAMPFIRE was imposed by several district councils on sites, which did not have the conditions necessary for its inception. This having been noted, the links between authority and responsibility, input and benefit, remain fundamental. Without them, CAMPFIRE will never achieve its potential.

I suggest that the same is true of TFCAs. I am not talking here of Transfrontier Protected Areas: contiguous trans-boundary national parks such as Kgalagadi. Their functional integration is largely a matter for national park authorities and staff to work out. I am talking here of Transfrontier Conservation Areas, usually much larger transborder entities which often contain national parks but which are separated from each other not only by national borders but by large tracts of private and communal land. In Zimbabwe typically in Regions IV and V, these are areas where rain fed agriculture is marginal or non-viable. Livestock grazing predominates and human populations depend largely on wage labour remittances for household economies. Not surprisingly, these are the areas where wildlife tends to be more abundant. It is also not surprising that, with some exceptions, the TFCAs replicate the areas, which were the main focus of CAMPFIRE 25 years ago. The success of negotiated

arrangements leading to progress in the TFCAs will depend on the activities of the people who live there. This, in turn, will depend on a robust set of first order local managerial and proprietorial regimes spread across the CA, which hold its base in place. A notional projection of a successful CAMPFIRE landscape and that of a successful TFCA would look little different: a mosaic of land use types with irrigation, mining and small scale industry where feasible, some subsistence agriculture emphasizing drought resistant varieties and clustered around communities, some "black spots" where development has been impeded, an expanse of semi-arid savannah supporting a judicious mix of wildlife and livestock, and a few commercial/educational/health centres linked by a road and tourist network. Aside from the transfrontier element, with its important tourism and trade implications, the scenarios are similar. The same can be said of the institutional requirements needed,

Institutional and Biological Resilience

In an effort to rescue this presentation from a southern African myopia confined largely to social science perspectives on the components needed for the development of protected areas, I have turned to Simon Levin's insightful **Fragile Dominion: Complexity and the Commons.** (Cambridge, Massachusetts: Helix Books, 1999) Levin, Professor of Biology at Princeton University, examines the pathways of global biological evolution and seeks to draw lessons for our current management of biodiversity. The application of his findings shows the remarkable relevance of biological history for our current tasks in environmental protection, this in both in goal and means. One core statement in the book could be equally placed in this presentation: "Making the payoffs for behaviour in the common good nearer and clearer increases the chance of success. Sound and responsible environmental management demands equitable and sustainable stewardship of common resources." (p. 198)

In the last chapter of his book Levin attempts to apply his findings to current policy in a listing of "Eight Commandments of Environmental Management." I will not repeat all of these here, but mention a few of particular relevance to current TFCA initiatives:

"Reduce uncertainties." A call for research and knowledge generation.

"Expect surprise". This is really a call for adaptive management, the maintaining of flexibility in management structures and the adjustment of procedures on the basis of monitoring and new data.

"Maintain heterogeneity." Levin states that "Natural systems are dynamic arenas in which variability and change at local levels maintain diversity at broader ones." (p. 202) The same applies the institutional systems that we seek to create.

"Sustain modularity." In modular structures, Levin finds, " there is buffering against cascades of disaster." (p.202) Increasing trends towards globalization have however made the world a smaller place and weaken modularization. This could be a tendency in the development of TFCAs, and management should recognize

the importance of modularity and heterogeneity, even when it appears administratively "messy."

This is just a sampling of Levin's eight "commandments", and I urge my audience to read the much fuller exposition of both these rules and the lengthy exposition that proceeds them in the book itself. Here I remark more fully only on the first, the exhortation to reduce uncertainty through greater knowledge generation and use. In southern Africa, after over twenty-five years of research on the management of our environment and its use, the gap is perhaps not so much in knowledge generation as it is in the interchange and integration of this knowledge. Our scholarship is fragmented by nationality, language, discipline and diverse international reference points in academia. The kind of forum that we are currently engaged in here at Hwange is critical to breaking down these barriers. In the past, this type of interchange has been supported mainly by IUCN, USAID and NORAD. This support has, for various reasons, been shrinking in recent years. The supporters of this current meeting: CIRAD, the Wageningen programme, the French Embassy, the AHEAD/GLTFCA Programme, the European Union and others have moved into the breach and have supplied splendid support. For interdisciplinary, development oriented research in southern Africa this has been vital, and we are extremely grateful.

The TFCAs in 2014: A Personal View

I conclude with a personal assessment of TFCAs at this point in time, in terms of their value to our regional conservation and development needs.

I have said enough, I trust, to make it clear that I am not hostile to the concept TFCAs can in certain circumstances provide the right platform for significant ecological and economic improvements in areas long marginalized by the boundaries erected by colonialism. At the same time we have cause to be sceptical about certain aspects of their creation and status.

Primarily initiated by the perspectives of contemporary international conservationism they show that the spirit of Berlin 1886 is even now alive and well as yet more lines are drawn across the face of Africa by planners far removed from those whose lives are bisected thereby. A dangerous confusion exists as to the distinction between Transfrontier Conservation Areas and Transfrontier National Parks, with the hint suggested by some statements I have heard in this meeting that the former will in time be transformed into the latter. Given the demographics of human population grown in Africa mentioned earlier in this presentation this would be a people-to-state appropriation, which could not be accepted.

And then there is the issue of where the TFCA boundaries are. We have seen a number of projections on the screen, and indeed some of the boundaries appear to have shifted during this conference!

For me the central criterion for evaluating the TFCAs should be demonstrated **functionality**, the TFCAs then being located on a spectrum from those which exist primarily as a forum for information transfer and consultative debate to, at the other

end, those which are integrated in management. What should be avoided at all costs is the ossification of TFCAs into additional layers of bureaucracy, which further retard positive levels of dispute resolution and environmental stewardship "on the ground." We have had too much of that at national and sub-national levels already, without going transfrontier with yet another disease!

Comments and questions:

- It is important to look at our role as scholars in order to improve communication with communities. We need to see ourselves not as primary designers or implementers, but as resources or facilitators to local people. We can communicate ideas, not impose them;
- Our own sphere of intellect and activities is only a small part of our work and, inevitably, we have to compromise in the understanding that not every situation will be a win-win result. However, in helping resolving the questions of the value attached to killed wildlife, to the costs born by communities and to the need of improving livelihoods, we need to work together to reinforce the awareness of others over what happens here.

42. Human-wildlife conflicts in the Greater Mapumgubwe Transfrontier Conservation Area: a case study of Maramani Communal area, Zimbabwe

P. Zisadza-Gandiwa

Official reports indicate that fatal or near fatal incidences between humans and African elephants (*Loxodonta africana*) are increasing in local communities (Nyaminyami) living adjacent to the southern borders of Matusadona National Park (MNP), Zimbabwe. There are no boundary fences between the national park and the communal areas and animals and people freely interact. Efforts to manage the human-elephant conflict have met with little success. Using a questionnaire survey, key informant interviews, documentary review and direct assessment we recorded high incidences of conflicts between elephants and humans in the study area. Elephants destroyed property, raided crops, frighten and even killed humans. Interestingly, despite the high incidences of conflict over 81% (n = 79) of the residents expressed positive attitudes towards elephant conservation. However, about twenty-one per cent (n =20) of the respondents had no confidence in problem animal control management and indicated that they would take personal action against elephants if threatened. We conclude that the human-elephant problem is more pronounced in communities living close to the MNP boundary and reduces as distance increases away from the park boundary. We recommend for a multi-action approach that includes protection of residents, more involvement of residents in the management of natural resources, setting up a fund to assist and/or compensate victims of wildlife injuries or deaths, educating residents on how to co-exist and establishing game corridors to enable wildlife movements.

Key points and conclusions of presentations

- First research: The original results were published in 2013 in an article on CAMPFIRE and Human Wildlife Conflict in local communities bordering the Gonarezhou National Park (Zimbabwe);
- Second research: The original results were also published in 2013 in an article on Human wild life conflicts in greater mapungubwe TFCA: Case study Maramani communal lands;
- This research used qualitative data collection methods, and analysis, with Chi-square and regression;
- Of the exisitng 11 wildlife species, elephants and hyenas are most problematic;
- The animals are raiders and/or predators causing fear, injury or loss of human life, infrastructural damage and disease (zoonosis);
- In Maramani, people use fences as well as other methods for scaring animals (whips and fires).
- The conflict with wildlife influences people's perception of the TFCA.
- Kraals could be a solution but we should really resolve the underlying land use conflict.
- Recommendations are for (1) research-based priority interventions; (2) standardise protocol for the management of TFCAs; (3) relevant TFCA initiatives.

43. Positioning wildlife crimes in regional conservation- a development matter

C. Bocchino

Wildlife crimes are a growing regional concern for both government and conservation implementing agencies. The critical problem in the current debates, however, is the amount of feeling involved in lobbying and decision-making as opposed to scientific knowledge and management experience. Whereas it is recognised that solutions of problems originating from a local level cannot be standardised, it is important to have an overarching vision and programme on how to negotiate the conflict and come to a resolution. This is because the actual killing or maiming of an animal is just the tip of the iceberg, which is the crime. Wildlife crimes include issues pertaining to the existence and functioning of global criminal gangs, as much as it revolves around unresolved issues of subsistence hunting and human-wildlife conflict. Can there be a common ground? In the presenter's opinion, there is only if we do not shy away from the root causes, that is the current conservation conundrum: conservation, the ever present fortress conservation, is more concerned with preserving species, than preserving ecosystems. As such there will always be a marginalisation of people living with wildlife, which only prompts more conflict and more "crime". Whereas the role of law enforcement is critical, especially in resolving the syndicate sphere, a company of trade should inform longer term localised solutions that only TFCAs can offer as multi land-use approaches to conservation.

Comments and questions

- Humans may change their cultural and value systems, but it has to be an owned choice, and not imposed by another set of value systems. In any case it takes a long time, think of the cultural changes in Europe from Roman times, through the Middle Ages, until now: what do we do while we wait for cultures to change?
- The ivory ban did not really work, it may have for some countries but definitely not for South Africa, Mozambique, Zimbabwe, Namibia and others in the region. This is because each country has a different situation in terms of population numbers, stockpile, legislative systems, and socio-economic needs. Whatever happened in the past, we must understand what are the drivers now and deal with them in the present;
- There is a feeling, and it is justified, that we are sitting on the fence, while decision are made elsewhere and they do not work, but no one looks at the fence where we are and listens;
- In proposing benefit sharing with communities, it is perhaps time to realise that subsistence poaching should not be considered illegal, it may need to be regimented, but the bannign on subsistence hunting only exacerbates human conservation conflict;
- There is a study in Gonarezhou National Park on what communities know on cross-border wildlife crime.

44. Reducing the risk for disasters in and for conservation

M. J. Murphree

The biggest problem we face is disasters caused by humans that have an environmental element (e.g. climate change). To address this problem, we look at disaster management, which aims to reduce vulnerability while increasing resilience. This coincides with the One Health concept. Being very complex, government plays a vital role and six root causes should be addressed: ecology, disease, economics, infrastructure and development, social and political issues and institutional silo's. Programs like AHEAD bring people together from different disciplines and by everyone contributing each realised that the conservation that you are doing has a bigger impact. I have realised that conservation puts itself in a corner, because of the issues being so big. However unless conservation forms part of the world it will not have a future.

45. Education for conservation: Children in the Wilderness

S. Goatley

Children in the Wilderness is a programme of Wilderness Safari, and is implemented with the communities surrounding tourism sites of the company. It is currently in its second year and in 2015 the final data will be generated, thus allowing a review of the programme and a quantification of its success. The programme uses lodge staff and parents from the communities to provide school children with a unique experience in the bush, where a mixture of education and playing activities are used to promote

conservation concepts. The programme is to be extended to adults, especially the parents of children.

Closing feedbacks from the audience

- This meeting should be annual
- A session has to be allocated specifically for environmental educators
- "I enjoyed this week and learned a lot. I think we should move away from this quick fix notion, this is complex and when small differences add up we get a bigger effect"
- We must learn to communicate across fields to address challenges together.
- "I think that it is good that agriculture is part of AHEAD. How can we get policies into government?"
- "We need to build relationships, we need to build trust with the government, we need to communicate. Then it will be easier to get an MOU, an action plan and so concepts will become a reality."
- "I believe there is trust, so what it the way forward?".
- Chief Dingani Nelukoba: "I would like to see action in my community. How talking about these issues will translate into action plans"
- "The next AHEAD meeting needs a session on how research has translated into policies."
- "There is a perceived idea that law is complex, but law education by the community is required"
- "I would like to see how information that is gathered here will have a difference."
- "Please give ideas on how to reach markets in terms of Foot and Mount Disease. Then policy guidelines can be drawn on how to manage this."
- "I would like to hear from the community directly and more practically success stories to take away that can help me with my human-wildlife conflict issues"
- "I would like to see how we as scientists can get policies to let cows and buffaloes graze together"

Closing of the Conference

The French Ambassador, **Mr. Laurent Delahousse**, began by commenting on how important it is to have conservation and communities together even in conferences so that discussion can be initiated and progress made. As Chief Nelukobe has reminded us historical values are important in this process and a holistic approach indispensable to resolve what seem to be impasses. Everyone should work together to address these are other regional questions; such as the bad reputation Zimbabwe has internationally. He said he is proud of being the ambassador of France in Zimbabwe and of being Zimbabwe's ambassador in France.

Dr. De Garine-Wichatitsky introduces the Zimbabwe Permanent Secretary for Higher and Tertiary Education.

The Permanent Secretary noted that this conference has been a fascinating experience, especially because of its venue The Painted Dog Conservation. It was also a rich learning experience. He acknowledge the role of the Ambassador of France, the representation of the European Union, the Chairman of the Research Platform, the representatives of Bindura University of Technology, Chief Nelukobe and thanked all the participants, the researchers, who have contributed to the Conference. In particular, he mentioned Prof. M.W. Murphree, whom he called a top academic, a mentor, a pastor and a citizen: a man of Zimbabwean heart. He mentioned Matthew Boulgarel and Michel de Garine-Wichatitsky, and all the organisers, as well as Peter from the Painted Dog Conservation. Finally, he gave a special tribute to all presenters. Of course, this could not have been possible without funding. He mentioned the French government and the EU, who have assisted over the years and expressed appreciation on behalf of Ministry of Education. He hoped that with continued research, new knowledge shall be produced. He quoted Powell and said that the tragedy with African countries is that stories not documented. Now, however, we are blessed in the sense that God has created ways for us to communicate. Knowledge must be shared/communicated/documented/translated into policies and programs, such as the Man And Biosphere, and other UNESCO programmes for education, with the goal of creating harmony between man and nature. In Harare, ignorance has destroyed wetlands and polluted water. This forum has given the opportunity to reflect on some policies and highlighted the need to revisit some ideas, for the sustainability of humanity, which should be all embracing. Everything starts from education. In Proverbs 24 v 3&4, it is stated that:

Through wisdom a house is built,
And by understanding it is established;
By knowledge the rooms are filled
With all precious and pleasant riches (NKJV).

This mobilization of wisdom tells me that we should reintroduce conservation into the school curriculum in Zimbabwe. As Mandela said: "the tragedy with my people is

that they don't know themselves and their environment". The same story is told from Brazil, "my mother is in the world but she is not part of the world": we need to include people into system. This is what ethno based writers tell us. And perhaps more significantly, we need to consolidate co-operation for more research to be conducted and then translated into policy. He expressed gratitude for those contributing to the SADC protocol on education and training, which is to be seen as a move towards borderless education systems. The most significant issue that we should never forget is capacity building, and the need to find a formula for translating research outputs into policy dimension, to create a legacy. He concluded by thanking everybody and stated that after amendment 20 the lives of people should improve.

PLEASE NOTE THAT ALL PRESENTATIONS ARE AVAILABLE ON THE DEDICATED AHEAD DROPBOX FOLDER, IF YOU ARE NOT ABLE TO ACCESS IT, PLEASE CONTACT: CLARA.BOCCHINO@GMAIL.COM