

Paper Abstracts

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Keynote address: The changing face of protected areas

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The last several decades have seen substantial global investment in the establishment of new protected areas and in the expansion of existing ones. These areas clearly remain a cornerstone of biodiversity conservation. Over the same period perceptions of the roles that protected areas play have also expanded, as have the demands placed on them. The threats and pressures that protected areas face have intensified, concomitant with general trends in environmental change. Within this context it becomes ever more important that the expectations and objectives of protected areas are clearly and unambiguously framed and communicated, and that the evidence base for their management is robust and comprehensive. This changing face of protected areas has significant implications for not only how we think about them, but importantly for how they are managed and how their performance is measured.

Theme 1: Sustainable resource use (commercial and traditional) and economics

Making non-detriment findings. Ensuring sustainable utilization of species in international trade

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The international trade in wildlife is regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), an international agreement to which South Africa is a party and which is implemented in South Africa in terms of the CITES Regulations published last year. Species are listed in three appendices, Appendix I species being all species threatened with extinction which are or may be affected by trade, Appendix II species being those that may become threatened with extinction unless trade is subject to strict regulation and Appendix III species which are voluntarily listed by the countries of origin.

Trade in Appendix I species for commercial purposes is prohibited, while the export and import of Appendix II specimens, which includes artificially propagated or captive bred specimens of Appendix I species, requires the prior grant and presentation of an export permit both in the countries of export and import. An export permit may only be granted if a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species. The making of such non-detriment findings forms part of the mandate of the recently constituted Scientific Authority of South Africa. Two non-detriment findings completed by the Scientific Authority in accordance with the CITES checklist on making non-detriment findings will be presented, one for *Hippopotamus amphibius* and another for *Encephalartos heenanii* a Critically Endangered cycad from Mpumalanga.

The non-detriment finding for the Hippopotamus demonstrates that international trade poses a low risk to this species in South Africa, whereas the Scientific Authority was unable to make a positive finding for *E. heenanii* and found that the species is at a very high risk of unsustainable use. Key areas of weakness in the management, conservation and protection of this latter species were identified.

An application of the integral projection model for exploited ungulate populations

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Continued human population expansion and resource use threaten already undermined wildlife populations, particularly where these are harvested for bushmeat or trophies. Matrix models have been used to explore demographic outcomes of exploitation and habitat loss but these typically fail to account for shifts in species' phenotypic traits like horn length or body weight.

We show that the response of a population to environmental change depends on how associations between the trait and (a) survival, (b) fertility, (c) ontogenetic development and (d) inheritance are altered. We apply an integral projection model, incorporating phenotype-demographic relationships for a generalised ungulate population. We then parameterise the model for select African ungulate species; to show how identical harvesting strategies can generate a wide range of responses across species with contrasting life histories and mating systems. Our approach has the potential to provide useful guidance for wildlife management programmes.

The role that professional hunting plays in the South African economy and conservation efforts

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It is mandatory for any foreign hunting client to arrange his/her hunt through a hunting outfitter and to be accompanied by a professional hunter. Professional hunting is a career and professional hunters must be suitably qualified and duly registered in order to operate. Details regarding other aspects of the professional hunting industry, for example the most frequently hunted species, income per province, multiplier effect, etc., will be covered in the presentation.

The professional hunting industry contributes significantly towards the economic viability of game ranching. 6292 Foreign hunting clients visited South Africa during 2009 (latest figures available), which generated a total income (regarding only species fees and daily rates) of R650 129 718.

Clients are mostly trophy hunters and income derived from their hunting activities, positively impacts on the future existence of South Africa's commercial game industry. The professional hunting industry is an excellent example of how sustainable utilisation contributes towards conservation as seen by the increase of game numbers since mid 1900's, driven by the commercial game sector.

Over and above the economic contribution made towards conservation, the professional hunting industry also supports many other conservation activities.

Five years and over R6.7-million rand later, 676 wildlife rangers, field guides and protected area managers from across the SADC region have benefitted from the funds raised by the professional hunting industry.

Other projects included the funding of research projects, rhino anti-poaching and other conservation projects, the development and production of educational media, etc.

Travel motives of South African biltong hunters

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Wildlife tourism is one of the corner stones of the South African tourism industry and can be defined as tourism that is based on encounters with non-domesticated animals, such as springbok, elephants and lions. Occurrence can take place either in the animals' natural environment, such as reserves, game farms or national parks, or when in captivity, such as zoos. These activities can be classified into two main groups, namely non-consumptive (viewing and photographing of wild animals) or consumptive (such as hunting and fishing). The literature study indicated numerous studies regarding the travel motives of tourists to wildlife destinations such as national parks, marine areas, forests and other conservation areas; however, little research has been done on the travel motives of hunters, specifically biltong hunters. Therefore, the aim of this paper is to determine the travel motives of biltong hunters in South Africa.

A web-based survey was conducted on SA Hunters' website, where respondents had the opportunity to complete the questionnaires and send it back electronically. A total of 344 (n) completed questionnaires were received back. A factor analysis was conducted and revealed seven factors, namely educational purposes (Factor 1); culture and heritage (Factor 2); family togetherness (Factor 3); nature experience (Factor 4); adventure (Factor 5); wildlife meat products (Factor 6); and spiritual (Factor 7).

These travel motives can assist game farm owners in product development as well as with the marketing of game farms, as owners now know the motives why biltong hunters hunt.

Man and wildlife: game conservation or game farming?

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The wildlife ranching industry has now reached a maturity in the sense that the rapid increase in game farms in most Provinces (with maybe the exception of the Western Cape) has now come to an end. Game farmers are now competing against each other for three main markets; tourism, trophy hunting and biltong hunters. Within this industry, a new group has emerged; the so called "stud breeders". Some of these have formed themselves into Associations and tend to breed and sell the more expensive crown species such as, sable and roan antelope, nyala, buffalo, etc. A phenomenon that has also appeared between these stud breeders, but not limited to them alone, is the breeding and selling of colour variants. A number of years ago, the first of these colour variants occurred and were mainly kept for their oddity value. However, as more and more game farmers entered the industry, an urge to have something "different" developed and these colour variants suddenly had a huge financial value.

Colour variation in the coats of animals is not a new phenomenon but in wildlife, most of these animals did not survive as they were readily predated on. As very few game farms have predators, these now survive. Most of the genes for colour variants are recessive. With the fencing of game farms, the natural movement of game animals between different populations has become curtailed and when farmers keep the populations closed, inbreeding occurs rapidly. One of the outcomes of inbreeding is an increase in the presence of recessive genes. These have now been maintained by the farmers who apply typical animal breeding principles to select and

maintain these in their population as these colour variants fetch very high prices: for example a normal impala typically sells for ≈ R900 whilst a black impala sells for ≈ R41 000. Similarly a blue wildebeest sells for ≈ R 1 900 and a gold gnu for R620 000. The question is who is buying these animals and for which market?

We argue that the breeding and selling of these colour morphs is in fact a closed circle with breeders selling to other breeders and that the market is close to saturation and on the verge of imploding.

What is the value to the stocking of extralimital species to ecotourism?

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Many Private Protected Areas (PPAs) stock an abundance of charismatic species with the aim of increasing species diversity for ecotourism. Many species, which historically did not occur on the reserves, known as extralimital species have thus been introduced into these Protected Areas. In this study we investigated the value of stocking these species in terms of ecotourism. Shamwari Private Game Reserve in the Eastern Cape, South Africa was used as a case study where we conducted research into the behaviour of tourists on game drives. A mixed-method approach was used, where quantitative as well as qualitative data were collected. It was found that the largest percentage of time was spent viewing elephants (*Loxodonta Africana*) and lions (*Panthera leo*).

Based on the proportion of viewing time and the availability of species, the extralimital white rhino (*Ceratotherium simum*) was ranked as the most important species. In the questionnaires majority of the tourists indicated they would choose to visit another PPA if their preferred species was not stocked at Shamwari. The study concludes that there is value in stocking extralimital species, based on ecotourism. However, only certain species serve as a tourist attraction and the numbers should be managed accordingly. PPAs should not compromise their conservation status and all costs and benefits of social, economic and ecological factors should be taken into consideration.

An economic evaluation of typical wildlife production systems in the Western Cape Province of South Africa

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The wildlife industry in the Western Cape Province is growing, but there is a lack of economic research on the industry. An evaluation done on the economic viability of two typical wildlife production systems in the Western Cape Province revealed that although the contribution made towards conservation is important to wildlife producers, income also needs to be generated from wildlife production in order to make the system financially viable and, ultimately, worthwhile for the wildlife producer.

The typical biltong hunting system in the Beaufort West region, housing sheep as well as wildlife to the equivalent of 349 large stock units on 10 000 hectares, has a favourable solvency position and has proven to be profitable. Profits realised are not large, however. Although this system has a net farm income of R197 781, the amount of overhead costs takes its toll on the total farm gross margin of R636 749. The system is successful by virtue of the fact that wildlife producers perceive the wildlife enterprise as additional income to livestock production, almost without any additional costs. Wildlife, in this typical system, is seen and utilised as a bonus to livestock production.

The typical trophy hunting system in the Southern Cape region, housing wildlife to the equivalent of 22 large stock units on 300 hectares, shows a healthy solvency position, but is not profitable and runs at a loss. The overhead costs of this system exceed the total farm gross margin of R190 700, which explains the negative net farm income of –R14 917. Although the gross margin per large stock unit is high, too few animals are marketed to generate an acceptable net farm income, or even to cover the overhead costs. Wildlife producers, in this typical system, manage their system on a part-time basis and fund it from other income sources.

Although the main objectives of government conservation authorities and wildlife producers might differ, the contribution of both towards conservation serves as common ground. It is therefore suggested that a joint approach is followed to further develop the wildlife industry.

The value of multiple bottom line accountability in privately managed conservation areas

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Puristic conservationists are inclined to dismiss the private sector's contribution towards conservation management due to the inevitable requirement for private reserves to deliver a return on investment. These concerns are in many respects valid as the short-term impacts associated with economic land-use activities are frequently in conflict with longer-term conservation ideals. However, we live in a world that is neither pure nor ecologically intact. Hence, compromise is inevitable if we are to justify the protection of large tracts of land for the benefit of wildlife.

Increasingly, public sector protected areas are finding it necessary to embrace commercialization in an attempt to merely survive. The problem is that very few have the skills or experience to do this effectively. Hence, there is a very real threat that, with dwindling Government subsidization and limited commercial prowess, numerous public protected areas are on an inexorable slide towards decline. Conversely, the private sector has long been grappling with the issue of compromise and the simultaneous pursuit of apparently conflicting objectives. Mistakes have undoubtedly been made but so has a lot of progress. This accumulated expertise can be applied to assist the widely embattled public conservation sector but perhaps even more significantly, it can be used to assist a badly shaken global corporate world that is still reeling from the consequences of the single-minded pursuit of profit at all costs.

Multiple bottom line accountability has for some time been touted as a more responsible business management model but as global commodity stocks soared prior to December 2007; few ostensibly paid more than lip-service to this notion. As the world slowly recovers from the worst recession since the Great Depression, one hopes however that there is a move towards a new and better way.

Multiple bottom line accountability demands compromise and the ability to balance complex and conflicting objectives. Private sector protected areas have been doing this for years and can perhaps offer a decision making framework that can advance more responsible management practice.

Developing system dynamic tools for African policy makers based on the interrelationship between natural and agriculture resources

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“Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”¹. Sustaining food security is a growing problem as the world’s population escalates and is a challenge for the developed and developing nations of the world. However, these challenges are greater for developing nations such as in Africa because of the size and severity of the problems. An important aspect of this is poor agricultural productivity^a.

Global warming scenarios have highlighted the fragile nature of our global environment. Without nature the planet cannot survive. Environmental management is crucially affected by agriculture and the interdependence is obvious. However, how best to manage natural and agricultural resources together, is not always well understood. This fact is particularly true as the need for increased food yields conflict with preserving the environment.

We are in the early phase of developing computational technologies to increase food productivity and the transfer of these technologies to farmers and policy makers. Emphasis is placed on primary African food crops and livestock. The technologies produced will have a direct impact and should add value to agricultural production. However, the overall system, including the natural environment, is being considered. The ideas behind this project and the progress to-date will be discussed.

a. FAO, (2008). State of Food Insecurity in the World 2008, FAO

Horns of Gold: Identifying factors enabling rhino poaching and developing new tools to combat them

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Rhino poaching has been a conservation calamity for many decades, but since 2008 a drastic escalation occurred that has failed to be controlled to date. International laws have attempted to control this demand in rhino horn by banning the trade, but the poaching death toll in South Africa reached 173 as June 2011 commenced.

This study aims to identify the potential causes for this heightened interest in rhino horn in order to most effectively design and implement solutions to the problem. Currently conservation responses are based on reactive crisis management, which is reliant upon indefinite funding for security and protection services or a hope that the demand will suddenly dissipate. Attempting to eliminate cultural traditions that are centuries old will never succeed, so the only alternative is to improve the management and security of rhinos in protected areas by understanding the processes promoting poaching. By assessing the risk-of-decline factor in time and space, utilising GIS tools, the impact of various physical and social influences (and their interactions with each other) on the fluctuating rates of rhino poaching across Africa can be analysed.

The application and expected outcome is to identify conservation priorities for sustainable species recovery, subsequently enabling managers to anticipate and therefore minimise these risks. It will allow managers to better allocate their resources to the areas of greatest risk, and consequently invest more in conservation education,

community-based resource management, security and monitoring. Carried out efficiently, this will prove to be a successfully proactive approach.

The use of genetics as a tool to aid law enforcement and enhance prosecution success is to be investigated as a means to increase the risks the poacher commits to. The aim is to markedly reduce the benefits of poaching, as part of this proposed future rhino management strategy.

Theme 2: Ecological challenges and conservation strategies

Carnivores, humans and parks – an assortment of challenges?

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Species management plans typically focus on the conservation species deemed threatened or that have specific value. Conservation focus, however, evolved to recognize complexity of socio-economic-ecological systems captured in the matrix of land uses in which protected areas are embedded.

Carnivores are common foci for conservationists, tour operators and hunters alike. They may provide revenue opportunities and could be keystone species that influence biological diversity. They often degrade livelihoods of people when coming into conflict with livestock land-uses. This provides an assortment of challenges.

In response, management plans at various spatial scales typically address these as issues influencing the conservation status of carnivores and respond reactively. Given the modern context of conservation, such species-focused management plans may be socially incorrect and unlikely to find political support.

I propose an approach that defines carnivores as key drivers of various socio-economic-ecological values within different land uses. I use lions as a case study as it captures challenges commonly faced by managers of small areas. Achieving objectives focusing on lions contributing to human livelihoods in a specific area are best achieved by considering each as a social unit and manage several areas as several social units interacting as a single population. Managers of such small areas then mimic social dynamics such as coalition tenure, density dependent changes in litter size, age at first birth and birth intervals as well as sub-adult dispersal.

At least three spatial scenarios are available, each of which make different population and genetic predictions, as well as carry different cost and logistical risks and benefits. Even so, I conclude that socio-political cognisant National Species Management Plans may carry much higher political value than traditional approaches and deal with an assortment of challenges in a systemic way.

Factors influencing potential dispersal routes of African wild dogs, *Lycaon pictus*, in northern KwaZulu-Natal

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The number of African wild dogs *Lycaon pictus* in northern KwaZulu-Natal has increased substantially over the last six years. This is largely due to a managed metapopulation approach of introductions onto protected areas and private game reserves since 1998. Because of the increasing wild dog population, the likelihood of rural

communities surrounding protected areas encountering dispersing wild dogs in northern KwaZulu-Natal has also increased.

Resident wild dog populations currently occur in Hluhluwe-iMfolozi Park (HiP), Mkhuze Game Reserve (MGR) of Isimangaliso Wetland Park, Thanda Private Game Reserve (TPGR), Hlambanyathi Private Game Reserve (HPGR) and Tembe Elephant Park (TEP) all of which are bordered by a matrix of natural habitats and human settlements. Thus, land outside these protected areas could be utilized to expand wild dog distribution and provide connectivity between existing resident populations of wild dogs within KwaZulu-Natal.

To investigate the viability of such an approach, Maximum Entropy Modelling (Maxent) was used to characterize habitat niche selection of dispersing wild dogs, and to identify potential dispersal linkages between current wild dog metapopulation reserves. The model was calibrated using 132 location points collected from 2006 until 2009.

A habitat suitability model with seven predictor variables had an AUC of 0.96 (SD = 0.02) and indicated four variables which best predicted probability of presence for dispersing wild dogs: elevation, road density, land cover and human density.

The results suggest that elevation and land cover may be of greater influence for dispersing wild dogs than human density or activity. Elevation was the single most effective variable indicating a higher probability of presence for dispersing wild dogs in lower lying locations; peaking at approximately 200 – 300m a.s.l. Wild dogs also showed a preference for Woodland and Bushland habitats which in KwaZulu-Natal tend to be found on lower lying topography. A preference for areas of lower human density and a highest probability of presence at road densities of approximately 0.7km/km² or less would suggest that while wild dogs may show a tendency to avoid areas of high human activity, they can coexist in close proximity to humans.

Fair Game: Activism in Conservation

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Conservation activism is generally unpopular with academics, agricultural production bodies and government entities. Most ecologists and academics tend to avoid advocacy actions. Government entities avoid and often try to undermine advocacy initiatives, and struggle to deal with the use of the media in these efforts.

Others have regarded it as both a useful and effective tool in the transfer of ecological information to assist in developing conservation policy and legislation, conservation and land management practices, public education and development of market mechanisms in support of conservation.

In the face of the overwhelming odds against conservation and the almost unstoppable slide to environmental degradation, it may yet prove to be the best tool to stem this slide.

Activism can provide for:

- 1) Developing a community with common goals,
- 2) Use of social media and press resources to develop a network for action through information dissemination,
- 3) Developing and influencing production, development, policy and market mechanisms.

These goals are usually achieved through publicising marketplace inequalities (e.g. unethical corporate, government or production actions), informing members and supporters about the rewards of association and participation, and constructing new collective identity and actions. The style of advocacy is varied.

Activism in conservation may be one of the best options available to conservationists to achieve success in environmental initiatives. FairGame™ uses vociferous advocacy in an initiative which gives the consumer the choice of produce that is ethical in terms certified environmental, social and animal welfare standards. These standards are audited, verified and accredited through independent structures. Such action uses advocacy as a key component in the development of market forces to effect positive conservation outcomes.

Impact of head fires vs. back burns: some observations

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The impact of head fires and back burns has been investigated before and we know that the implementation of these two different fire types in a fire management plan can have very different implications over the long term. It is therefore important to understand the effects of these different fire types on the structure of the vegetation community. A back- and head fire was applied in the same area under same conditions within a week from each other.

The results were monitored at the end of the growing season and the results from the two fires were very different. With the head fire, 71% of woody individuals were either dead or had all their aboveground parts killed, compared to only 22% of woody individuals with a back fire. With the back burn, 48% of individuals had more than three-quarters of their aboveground material still alive, compared to only 6% that was observed with the head fire. As to be expected from these results, the reaction of the plants were therefore very different, with 64% of woody individuals coppicing from the base only, with sprouting from the stem, primary and secondary branches making up the difference after the head fire. With the back burn it was seen that the majority of sprouting was from the primary and secondary branches with 33%, while coppicing from the base only were only seen in 23% of individuals.

Height of the plants played a very definite role in the how trees survived. With the head fire, 100% of trees smaller than 1m and 94% of trees smaller than 2m had all their aboveground parts killed, while none was completely killed and all coppiced from the base. Deaths only occurred in trees larger than 2m, with the majority of deaths in the 4-5m height class. With the back burn, the only deaths were in the 0-1m size class, even though only 59% of trees in this size class had all their aboveground parts killed. More than 90% in each of the 3-4m, 4-5m and 5m+ size classes had more than 75% of their aboveground parts still alive. The effect of the different fire types and how it will affect the structure of the vegetation community is very clear, and depending on the objectives, must be considered when controlled fires are implemented.

Can a mine mitigate its' impact and contribute to conservation?

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Every industry has both good and bad operators, and more particularly bad if the environmental effects are considered. This is apparently allegedly typical of the majority of mining activities.

Northam Platinum's Booyendal mine is striving to be a pioneering exceptional example to the contrary.

It is believed to be a model concept in South Africa, regarding the extent of land dedicated to biodiversity conservation by a mining operation. Northam Platinum Limited has invested heavily in land acquisition as well as specialist surveys, reports and baseline studies, associated with environmental impact investigations relating to

the land of which the company has custody. No formal protected area exists within the Sekhukhune Centre of Endemism. Approximately half of the plant taxa within Mpumalanga occur in the Sekhukhune region.

This area is considered irreplaceable as a natural environment and landscape, Northam Platinum Limited respects this, and is striving at great cost to maintain the environmental integrity *status quo* regarding rangeland management on the area under its custodianship.

The Booyendal mine lies in the upper Groot Dwars River valley to the North West of Lydenburg and to the South East of Roosenekal. The area which constitutes the mine property is 6 500 hectares in extent, of which 500 hectares will be impacted to a greater or lesser degree by the mine footprint. The actual mine site is limited to a mere 19 hectares in extent.

An area of 6 000 hectares has been set aside to be managed as a protected area, this is termed “the offset area”.

Re-colonisation of the Robberg Peninsula by Cape fur seals and their prey preference

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The Cape fur seal *Arctocephalus pusillus pusillus* colony at Robberg Peninsula, Plettenberg Bay, was driven to extinction by indiscriminate harvesting by the late 1800's and seals only began to re-colonise this site in the 1990s. This study describes the re-colonisation process from 2000 to 2009 on the basis of census data. Seal numbers increased during the study period from <300 to >3 100 animals.

Generalised linear models indicated the importance of year and month in explaining variability in seal numbers, whereas sea condition, time of day and lunar phase had minimal explanatory power. Within-year variation in seal counts decreased during the study period, which may be related to an increasing proportion of resident (as opposed to transient) seals in the colony. The colony is currently still in a transition phase with relatively few non-breeding animals and few pups (currently <100 per year) born on the colony. The influx of seals to the Robberg area may be associated with shifts in prey availability at the ecosystem level.

Scat analysis showed that the seals' most important prey species are anchovy, sardine, horse mackerel, sand tongue-fish and shallow water hake (in decreasing order of importance). The proportion of anchovy in the diet increased during the study period, while sardine decreased. Little evidence was found of direct competition between seals and fisheries at Plettenberg Bay, both in terms of prey species composition and quantities consumed and this is largely due to the fact that neither sardine nor anchovy is targeted by fisheries in the area. Partial protection afforded by the Nature Reserve status of the Robberg Peninsula and the existence of a Marine Protected Area adjacent to it likely contributes to the growth of this colony. However, human interference associated with fishing and ecotourism on the peninsula may prevent the colony from expanding into suitable breeding habitat and from becoming a breeding colony.

Potential interventions for the conservation and management of this colony are discussed. Scat sampling in Cape fur seals holds promise as a method to track long-term changes in prey species abundance.

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Key note address: Pioneering sustainable solutions to human-baboon conflict

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The Baboon Research Unit at UCT has endeavoured to provide sustainable solutions to human conflict on the Cape Peninsula by studying the entire population and comparing troops that are wild and free ranging with those that are commensal, herded by baboon monitors and in daily conflict with people living in rural and residential areas.

We have completed studies on the population dynamics, spatial ecology, genetics, pathogens and foraging ecology of the Peninsula baboon population to understand the causes and consequences of the variable levels of conflict that affect the 475 baboons and their 3 million human neighbours.

Our data reveal that competition for low lying productive land is the primary driver of conflict on the Peninsula and that the introduction of exotic plant species in conjunction with access to high quality food in residential areas has positively affected the growth rate of troops and altered their activity budgets and diet. Population level increases in numbers are offset by high levels of human induced mortality while geographical isolation through urban sprawl has promoted inbreeding and the subsequent loss of genetic diversity. High levels of conflict in addition to the recent discovery of human parasites and viruses within the population call for a reduction in the spatial overlap of baboons and humans.

Achieving this is not however as simple as designing barriers and aversive techniques but requires navigating biodiversity and welfare legislation in addition to equipping conservation authorities with the data required to answer the polarised demands of activists and irate residents alike.

Theme 3: Human-Wildlife conflict – both sides of the coin

**FAO/BIO-HUB Human-Wildlife Conflict Mitigation Toolkit –
helping people to prevent and mitigate conflict with wild animals**

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Human-wildlife conflict is a growing global problem. It is not restricted to a particular geographical region or climate condition, but is common to all areas where wildlife and human populations coexist and share limited resources. Human-wildlife conflict is a problem for farmers, and ultimately it must be tackled by the farmers themselves.

However, although numerous research articles, reports, recommendations, guidelines and training manuals have been produced in recent years to address the problem, most have been aimed at technical support agencies, government wildlife departments, and conservation and/or development oriented non-governmental

organizations. Few tools have been developed for and adopted by rural farmers and communities to help them to address human wildlife conflicts at grassroots level. In Southern Africa, FAO and Bio-Hub have teamed up to develop a handy toolkit designed for use by extension workers offering to local communities a range of simple and practical solutions that can have great success when used in combination. It is designed not only to help protect people, their livestock and their crops from wild animals but, just as important, to safeguard wild animals from people. Two types of toolkit, an electronic and a hard version, are available in three languages: English, Portuguese and French. The hard version is a rubber canvas bag containing a series of water proof booklets, helping users to define which kind of conflict they are facing.

Solutions vary according to whether the need is to protect people, villages, livestock, water or crops and are classified in five colour-coded categories: awareness raising in blue, access prevention in green, translocation in brown, driving animals away in yellow and as a last resort lethal control in red. A system of index identifies solutions in each of the five colour categories according to what it is the user needs to protect. In total, more than one thousand toolkits were distributed during the workshops for field tests with local communities in Botswana, Gabon, Malawi, Mozambique, South Africa, Zambia and Zimbabwe. The toolkit is designed in a way that more information can be added or slotted in and this exercise is an ongoing one, meaning for the next years to come, funding permitting, the toolkit will be reviewed and added with more information.

Promoting SMS to manage Human-Wildlife Conflicts, a first tentative to improve the control and understanding of such a problem in Southern Africa

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Human Wildlife Conflict (HWC) can be considered inevitable in all communities where human and wildlife share the same habitat. In Africa, HWC is not restricted to a particular geographical region or climatic condition but is common in all areas where wildlife and human populations coexist and have limited resources.

Two recent studies conducted in Mozambique and Zimbabwe revealed that this problem is increasing while little is being done on prevention measures and often inadequate reactions. To improve the situation, we are promoting a new approach based on strategies developed in response to the threat of emerging zoonotic diseases. We suggest a coping strategy based on the improvement of HWC data management as this is the backbone of any attempts to control and prevent HWC incidents. This approach, called PACL is based on a system combining Prevention measures, early Alert mechanisms, application of Control solutions with the objective of Learning from past experiences. In practice the records of HWC, characterized by 30 explanatory variables, are facilitated by using a series of cards and a unique one page form.

With SMS being more and more utilized as a communication means, transmitting of information is done using a network of cell phones connected to a server with FrontlineSMS. An automatic system of forwarding messages alerts decision makers, thereby allowing a quick and adequate reaction to control dangerous animals. By providing a complete set of explanatory variables, the flow of information is feeding an HWC database. The analysis of it will help to improve the understanding of HWC incidents and improve their mitigation by targeted prevention campaigns.

The implementation of this approach is currently being done in Mozambique and Zimbabwe. Details of the 3 steps required to build a local SMS network are given in the paper to train informants how to use it and to develop HWC databases. With a better control of problem animal and understanding of the deep roots of HWC, the PACL approach combined with the utilization of FrontlineSMS will contribute to improving the capacity of communities to cope with their wildlife resource.

Human-Wildlife conflict takes flight; ecological scrutiny of aircraft-wildlife collisions in Namibia

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The Birds and Aircraft Research Namibia Project (BARN-P) was initiated in 2009 to provide scientific analysis of the problem of aircraft-wildlife collisions in the vicinity of Eros and Hosea Kutako airports in Namibia. The focus of the project over the past two years has been to identify proactive measures to address the problem, as opposed to symptomatic responses currently being used by the aviation industry. This has been done by assessing ecosystem parameters such as relative abundance of grass species, density and diversity of small mammals, and bird species abundance.

The assessment showed that the ecological parameters differ significantly between differently managed habitats within and surrounding the airport properties, thereby affecting their potential to attract and sustain populations of birds or other wildlife which may pose a risk to landing and ascending aircraft. The results of the assessment were used to evaluate the effectiveness of current management actions applied at the Namibian airports.

This paper proposes a toolkit for Southern African airports based on the findings of the assessment as well as on observations of aircraft wildlife hazards at the Namibian airports. The toolkit focuses on proactive, ecosystem based solutions to the threat of aircraft-wildlife collisions and recommends that remedial solutions, such as shooting or repelling of wildlife, be used as secondary measures only. This ensures that the hazard is addressed before it poses a safety or damage risk to aircraft, and reduces the impact of such actions on the disturbance of wildlife populations in the vicinity of airports.

Living with predators: A focus on the issues of human crocodile conflict within the lower Zambezi valley

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Human wildlife conflict (HWC) is a global problem and increasing worldwide as people and wildlife compete for limited resources. Conflict between people and crocodiles, especially in Africa is recognised as a serious problem. The people of the Chiawa Game Management Area are heavily dependent on the Zambezi River for a number of resources from potable water and irrigating fields to a source of food (subsistence and small scale commercial fishing).

A questionnaire survey and Zambia Wildlife Authority (ZAWA) data were utilised to estimate the scale of human-crocodile conflict (HCC). Between 2000 and 2009 there were 98 crocodile attacks on people, 62.2% were fatal. Most of the attacks occurred whilst canoe fishing (57.1%) and collecting water (29.6%). Crocodiles were disliked and seen as a 'problem' by the majority of the populace. Even though crocodiles are a charismatic mega fauna species (an important tourist attraction for those visiting the Zambezi River), being employed within the tourism industry only had a minor positive effect on people's attitudes. An increase in the number of boreholes in the villages was suggested by the local people as the primary mitigation measure as well as the removal of crocodiles by various means. Although people displayed an understanding of the risks of crocodile attack, very few actually employed mitigation techniques or utilised protective barriers when at the river.

The negative attitude towards crocodiles is an issue that has to be addressed to allow successful implementation of long-term conservation strategies. Crocodile ranching and farming as a conservation tool will be discussed.

The status of free-roaming wildlife on tribal land in the NW Province

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Free roaming wildlife in the North West Province is an important component of our region and can contribute significantly to the economies of rural communities, but is not managed accordingly. The annual quotas for the hunting of free roaming wildlife on tribal land amounted to 1 223 head of wildlife allocated to 58 villages in 2010.

A total of 47 sites (87 farms and farm portions) were surveyed in 2010 covering 240 210 ha. Although not all hunting areas were covered, the survey aimed to concentrate on the areas where most hunting took place as per information received from the regional offices.

A total of 913 kudu were counted on the area of 240 210 ha, with an average observed density of 3.69 kudus per 1000 hectares. A total of 2102 impala were counted on the area within their current natural range of 197 854 ha (39 sites), with an average density of 10.2 impala per 1000 hectares. On an area of 22 554 ha only 2 springbok were observed in prime habitat.

The aerial survey results indicate that the populations of the huntable wildlife species are under serious stress, of which illegal hunting is the most likely cause.

Ethics and exploitation of the Cape Parrot *Poicephalus robustus*

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The Cape Parrot is traded legally, and almost certainly illegally, in South Africa and probably overseas, although it is an Endangered species. It meets many of the criteria for CITES Appendix 1 registration, including low numbers and threatened habitat (by logging yellowwoods), but, as yet, international trade cannot be proven.

Wild birds are taken from nests in the wild which generates income for the poor rural people of the Eastern Cape and KwaZulu-Natal, while traders make huge profits, as a pair of birds can be sold for R 100 000. Nest-poaching not only reduces natural recruitment into the population but may encourage breeding pairs to move to new nest sites, or to abandon nesting all together. In addition, many wild parrots are infected with psittacine beak and feather disease which is causing significant levels of mortality, so trade can spread the disease. This resource is not sustainable, and causes conflict between indigenous people, irresponsible bird traders and conservation biologists.

Confiscated birds are placed in a captive breeding programme but birds cannot be released into the wild owing to problems, inter alia, of disease transmission. Since it is an afro-montane species, climate change through increasing environmental temperatures, will force the species to higher altitudes where their habitat, nest sites and food supply have been depleted.

Theme 4: Stewardship, policy, planning and socio-economic issues

Publishing primary biodiversity data: information overload or conservation necessity?

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The world's biological diversity is in crisis. Species extinctions continue largely unabated despite growing efforts to reverse this trend. Biodiversity is the cornerstone of ecosystem functioning and the services upon which everything depends: including food and fresh water, fuel, fibre, purification of the air and decomposition of wastes, flood protection, to name but a few. To proactively address uncertainty and risk from threats such as climate change, biodiversity data are essential to underpin science, conservation, sustainable development and adaptive management. Information technology has increased the collection and access to primary biodiversity data on a global scale. The Global Biodiversity Information Facility (GBIF) and its participant nodes use the internet and associated infrastructure to make global data sharing possible.

The Endangered Wildlife Trust (EWT) is one of three participants based in South Africa, and is responsible for facilitating access to biodiversity information of a trans-boundary or regional nature. The EWT and its partners generate a vast amount of data each year, including species specific data such as location, breeding, mortality and its causes, and details of interactions between wildlife and people including conflict, persecution and poisoning events. A comprehensive Knowledge Management System has been developed to house data that is generated both in-house and by collaborators. This array of datasets is collected through a network of monitoring projects, which are often independent, and at multiple geographic scales.

Here we report on the results of a recent survey to assess biodiversity data needs among data partners and provide some feedback on new advances for sharing and publishing data. We illustrate how shared datasets can contribute to conservation decision-making for the purposes of mining, infrastructure development, agriculture, protected area expansion and wildlife management.

A preliminary examination of decision support approaches for South Africa's natural resource management programmes

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Natural resource managers need to make decisions with limited knowledge and funds in complex real world settings. They therefore have to account for cost constraints and uncertainty. But arguably one of the most important constraints is the human factors such as implementation effectiveness and the willingness of stakeholders to co-operate. Fortunately the economic sciences have a battery of tools and policy mechanisms to assist natural resource management decision makers with this. Decision support systems can play a vital role in this process.

Using South Africa's natural resource management programmes as our case study—we examine the strengths and weaknesses of different prioritisation approaches in a decision support system environment.

Our preliminary results highlight the importance of incorporating not only costs constraints but also human factors into the prioritisation process. We end by discussing the potential for market based instruments to cope with the human factors.

Management of complex ecosystems: a transboundary perspective

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The institution of the Great Limpopo Transfrontier Park (GLTP) comprising Gonarezhou National Park (Zimbabwe), Kruger National Park (South Africa) and Limpopo National Park (Mozambique) establish a larger and more resilient ecosystem, formally recognizing what nature already knows: the environment is intrinsically integrated and interconnected, and does not recognize borders or artificial divisions. While natural processes are taking place on a large scale, human practices and management is still divided and lack coordination and integration, mainly focusing on the single scale of single problems. This is even truer where human made barriers are set in place, such as in the case of National borders.

Managing a complex ecosystem such as that of the GLTP is a challenging task and dealing with different national practices and policies adds to the difficulty. The Italian Cooperation, by launching the Limpopo Transboundary Programme, aims in supporting transboundary management, focusing on the sustainable and rationale use of resources to benefit communities interacting with the surrounding environment, by accessing and using natural resources for their livelihood.

To achieve this goal a sound management has to be set in place, supported by objective information and knowledge. Issues and problems have to be dealt with a regional perspective in mind, and not confined to “national” priorities. A Decision Support System can support stakeholders, institutions, and managers, to achieve informed and integrated management and planning, to address the challenges of transboundary management of complex ecosystems.

The human-marine interface: how can genetic methods promote fisheries conservation and fair trade in SA?

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The mislabelling of fish species is not only of major economic and health concern, but it also threatens the sustainability of the world's ever-dwindling fish stocks. Molecular methods are valuable for species authentication, however, the lack or complete absence of reference genetic sequence data for many fish in South Africa precludes accurate species identification. The aim of this study was to assess the fish species most commercially available in South Africa, to generate a reference database of DNA sequences for these species and to utilise this database to evaluate the extent of fish mislabelling on the South African market. Surveys were conducted in 215 restaurants and 200 retail outlets throughout South Africa to evaluate the most commercially available fish species. Reference samples of 53 commercial fish were obtained and were taxonomically identified at the species level. DNA sequence data was generated for reference samples based on PCR amplification and sequencing of three mitochondrial genes (COI, 16S and 12S rRNA genes). The established DNA sequence database was used to identify more than 240 fish samples from fish distributors and retail outlets. Surveys revealed that fish of conservation concern continue to be actively marketed to South African consumers. Previously unavailable DNA sequence data was generated for a large number of reference fish samples, and the COI gene was shown to be the most suitable DNA region to allow unambiguous identification of fish species in South Africa. The established genetic database was used to show that 9% of fish samples derived from a

distributor level and 31% from a retail level were mislabelled. The established genetic database will greatly aid the industry and regulators to prevent fraudulent trading and to promote the sustainability of South African fish species.

Theme 5: General ecology and assessing human impacts on biodiversity

Is rehabilitation of mining sites possible? - Achievement at the Oaks Mine

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The De Beers Oaks Mine (Oaks) was established in 1998, mining activities ceased in July 2008 and closure activities were completed in 2010. Before 1998 the Oaks was utilised for dryland crop farming and commercial beef production. Given the climatic conditions prevalent to the area and the scarcity of groundwater, these types of land uses were not feasible in the closure plan for end land use options.

Closure was designed to be a model for the De Beers Family of Companies (DBFoC) ensuring that DBFoC leaves a positive legacy of diamond mining. The design adopted a concept of “begin with the end in mind” including concurrent rehabilitation. Overburden and waste rock was used to construct paddocks to contain the coarse and fine residues produced during mining operations. Waste rock was placed over the residues once the paddocks had been filled, acting as a capillary break layer. Slope angles and lengths were reduced by reshaping and a stormwater design was based on a non-water shedding system, preventing erosion, enhancing penetration and the overall moisture regime of the growth medium.

Chemical analysis of the growth medium indicated nutrient deficiencies, high sodium concentrations as well as an overall neutral to alkaline pH value. Additional limitations included low annual rainfall (~350mm) coupled with high temperatures (>40°C) and a high evapo-transpiration rate. Gypsum, inorganic fertilizers and organic material were incorporated into the topsoil to displace excess sodium, reduce dispersion properties and increase the moisture and nutrient retention capacity of the soil. The cover layer was ripped to mix the soil and underlying waste rock, thereby creating a robust cover capable of supporting a sustainable vegetation cover. Mixtures of indigenous perennial and annual grass species were established in accordance with baseline vegetation surveys done in surrounding undisturbed areas. Annual vegetation surveys were used to measure progress and highlight areas of concern.

The rehabilitation can be considered to be successful, based on the stability of the newly established environment. The chosen end land use of game farming will result in changes from historical overgrazing problems to selective utilization management with correct herbivore species selection and grazing models.

A population viability analysis for the threatened endemic plant *Aloe peglerae*: Determining thresholds of potential concern

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Aloe peglerae Schonland is an Endangered succulent plant species that is endemic to South Africa and is confined mainly to the Magaliesberg Mountain range. The species has specialized habitat requirements and is currently found in small fragmented populations throughout its natural distribution range.

This study entailed the use of a stochastic population projection model to assess the viability of nine *Aloe peglerae* subpopulations, and also to determine extinction-risk thresholds under varying harvest scenarios. Estimates of total population size and population size structure were obtained from a field survey conducted in the year 2010. The size of the subpopulations ranged from 291 to 6224 plants. The model was initially developed in 2004 to evaluate the sustainability of the collection of *Aloe peglerae* from the wild. Demographic data collected between 1976 and 1995 were used to build the model, and parameters were allowed to vary randomly between observed minimum and maximum values. Nine model scenarios were evaluated for each subpopulation, which included one control and eight scenarios simulating varying levels of harvest of adult plants ranging from one to 30 adults per year. Under each scenario, the model was projected to 500 years and involved 500 simulations.

The results of the control scenario predict a stable, slightly increasing population, with not one simulation resulting in extinction. The rates of population increase varied from 5.33% for Site 3 (N = 681), to as much as 72.49% for Site 9 (N = 2772) over a 100 year period. However, when harvesting of adult plants was introduced into the model, all the subpopulations showed a downward trend. Under the scenario of harvesting five adult plants per year, Site 3 showed a decline of 71.56% over 100 years, while Site 9 showed a decline of 7.34%. Furthermore, under this scenario, the model predicted an extinction probability of 100% for Site 2 (N = 323) and Site 4 (N = 291) over a 100 year period, and a probability of 0.6% for Site 3. *Aloe peglerae* is therefore very sensitive to harvest.

The collection of long-term demographic data and further research on the population dynamics of *Aloe peglerae* is recommended, for the purpose of improving the predictive ability of the model.

Some drivers of movement of elephants in the GM-TFCA

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During the past few years there have been several publications on how elephants utilise their landscape but little on how the availability of new habitats and human disturbances influence elephant distribution and movements. In this paper we demonstrate how the distribution of herds in the GMTFCA population has responded to climate, water distribution, the availability of new habitats and hunting.

Movement data from individual satellite collared elephants show annual home ranges with a high degree of fidelity to a particular area in different years over a four year period. However, comparison of the distribution of elephants in six aerial surveys in the GMTFCA range over a 10 year period indicates that large shifts in the distribution of herds occur. The fission and fusion of groups are related to rainfall with the number of small groups declining as rainfall increases. Rainfall further affects the size of wet season home ranges but not that of the dry season home ranges. The size and shape of dry season home ranges may however be influenced by water provisioning within the area.

As new range becomes available large shifts in the overall distribution of the population occurs as herds first explore the new territory in small numbers, but then move into the new territory in larger groups, reducing density in the previous range. Hunting pressure causes movement out of the regions in which hunting occurs and an increase in density in areas where there is no hunting.

Genetic relatedness reflects competitive and conflict behaviour in female African elephants

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Elucidation of the mechanisms determining the competitive interactions must capture individual differences in social behaviour in order to understand the nature and magnitude of benefits and costs incurred by those individuals in social groupings. According to kin-selection theory, the degree of kinship is predicted to influence the types of behaviour exhibited among competing individuals in a group. When a population is structured into groups, the intensity of between-individual competition among group-members influences the form and function of its social organization. Studies comparing the frequency and relative intensity of competition at individual level are rare and African elephants have well-structured social relations, providing an excellent system for such a study.

We hypothesized that individual-based aggressive interactions among adult female African elephants would vary according to degree of kinship with closely related dyads showing less aggression among each other in resource-limited environments thereby leading to indirect fitness benefits for kin-selected individuals. As predicted by kin selection theory, females showed cooperation to their close kin most often, and the frequency and intensity of aggressive interactions was inversely related to the degree of relatedness of the interactants. Female elephants significantly showed high frequency and intensity of aggression to other female of similar age implying that, aggressive interactions were also driven by age among adult females. Our results suggest that high genetic relatedness between-adult females induce tolerance among group members, which in combination with age provide the stability and cooperation in elephant sociality.

This study provides new insight into the proximate mechanisms by which group-living adult female elephants distribute themselves across patchy resources in a way that minimizes detrimental actions to fitness. The study further demonstrates the importance of individual genetic variability for elephant social organization at the level of the individual that may not be predicted by a general application of group selection models.

Brown hyaenas on roads: Estimating carnivore occupancy and abundance using spatially auto-correlated sign survey replicates

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Carnivore survey protocols that properly address spatial sampling and detectability issues are seldom feasible at a landscape-scale. This limits knowledge of large-scale patterns in distribution, abundance and their underlying determinants, hindering conservation of globally threatened carnivore populations. Occupancy analysis of data from logistically efficient sign surveys along consecutive road segments (spatially auto-correlated replicates) offers a potential solution. We adapted and applied this newly-developed method over 62,979 km² of human-

modified land in South Africa. Our aims were to (1) generate unbiased estimates of brown hyaena occupancy and abundance (2) investigate two suspected determinants of occupancy using a combination of biological and socio-economic sampling techniques, and (3) use simulations to evaluate the effort required for abundance and occupancy estimates with acceptable bias, precision and power. Brown hyaena occupancy was estimated at 0.748 (\pm SE 0.1), and estimated overall density in agricultural land (0.15/100 km², \pm SE 0.08) was an order of magnitude lower than in protected areas.

Positive attitudes to carnivores and presence of wildlife farms exerted strong positive effects on occupancy, so changes in these factors may well exert monotonic impacts on local metapopulation status. Producing reliable occupancy and abundance estimates would require P6 replicates and P12 replicates per site respectively. Detecting 50% and 30% declines in brown hyaena occupancy with adequate power would require five annual surveys at P65 sites and P125 sites respectively. Our results suggest that protocols based on spatially auto-correlated sign survey replicates could be used to monitor carnivore populations at large, and possibly even country-wide spatial scales.

Wildlife road traffic accidents: a new technique for counting flattened fauna

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Despite recognition that roads are a threat to biodiversity, very little is known about actual impacts on wildlife populations. Road density and traffic volumes are on the rise, and although huge budgets are devoted to the construction and upgrading of roads there is little or no allocation to mitigation measures to protect fauna. Road traffic is a recognised cause of wildlife mortality, and yet studies on the topic are poorly represented in the scientific literature. Here we present a standardised protocol for the rapid assessment of roadkill.

This protocol outlines the most economical and time-saving approach to assessing roadkill rates and was developed by examining variables likely to influence detection, assessed using a combination of experimental methods and transect sampling. In experimental trials, artificially deployed roadkill was detected most reliably at speeds of between 40 and 50 km/h, although detection was still high at 80 km/h (96.7%). Detection rate was influenced by light conditions with observer error greatest when the sun was low in the sky (88% detection vs. 96% detection), therefore sampling is most effective between 1.5 hours after dawn and 1.5 hours before dusk. Detection rate was also influenced by the position of roadkill on the road surface, with lower detection probability for items near the road verges.

A total of 374 roadkills were observed on a 67 km transect that was driven daily over a 30-day period. These comprised 81 different species from all terrestrial vertebrate groups. Our preliminary data indicated that roadkill rates peaked at weekends, although this could not be related to traffic volumes which were not measured during this pilot study. Future testing will be implemented to obtain baseline rates of roadkill in the Greater Mapungubwe Transfrontier Conservation Area (GMTFCA) in the northern Limpopo Valley of South Africa, a World Heritage Site.

The prospect of excessive traffic in the way of labour, transport and other heavy vehicles on the eastern fringe of the GMTFCA, is a major cause for concern, since this comes with the proposed Vele Coal mine and associated power station site at Wiepe.

Determination of feedstuffs nutritional composition and diet nutritional quality of black rhinos in the National Zoological Gardens of South Africa

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The processes of making the right diet choices and limitations in the supply of nutrients are special challenges to diet management in the zoological communities. However, having a working knowledge of the nutrients needed by the animal, and what feeds will supply those nutrients, is one of the most important steps in managing an animal in captivity. For several years, the National Zoological Gardens of South Africa (NZG) suffered because of the absence of feeding and sound nutrition. The feeding practices were based on common nutritional knowledge, human understanding, and livestock nutrition. NZG food items are mainly composed of plants, vegetables, meat, fish, invertebrate and vertebrates, pellets and some supplement.

Literature survey and laboratory analyses were used to determine the nutrient composition of selected feedstuffs. Furthermore, the variation in the composition of feed components such as lucerne (*Medicago sativa*) and mealworms (*Tenebrio molitor*) according to season and developmental stages respectively, were determined as well as that of eggs and day old chicks according to processing methods. International Network of Feed Information Centres (INFIC) nomenclature were adopted to describe the items. The evaluation of the diet sheet were done with the Zootrition™ programme.

Results revealed that there were significant nutritional differences between lucerne procured in winter and in summer in terms of protein; between day-old chicks eviscerated and non-eviscerated concerning protein and fat content ($p < 0.05$); and in the case of ash content between eggs with and without shell. Calamari (*Loligo spp.*), Hake (*Merluccius spp.*), and Maasbanker (*Trachurus capensis*) did not differ significantly within species. Sardines showed significant differences between them. Lastly, fish differed significantly between species ($p \leq 0.05$).

Evaluation of the Black Rhinoceros (*Diceros bicornis*) diet sheet with Zootrition™ programme, in-house mix diet showed a high crude protein level and of calcium and phosphorus compared to the percentage recommended. Excess protein could lead to animal health problems characterised by obesity, bleached hair coat, anaemia, and ataxia. High content in calcium and phosphorus with strong imbalances between them and can alter the gut rate passage and bone deformities.

Coupling grass type and historic large herbivore distribution patterns in the Cape lowlands of South Africa: a carbon isotope analysis

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We hypothesise that insufficient amounts of green C₄ grass on the western lowlands of the Western Cape during the times of peak nutritional stress (the very hot and dry summer months) were responsible for the historically absence of three ruminant grazing antelope species (buffalo, blue antelope and bontebok) from this region. This is in contrast with the southern lowlands where C₄ grass is more abundant due to a higher incidence of summer

rainfall and where the three antelope species did occur. We call this idea the Summer Nutritional Stress (SNS) hypothesis.

We tested the SNS hypothesis by determining with stable carbon isotope analysis whether contemporary, historic and pre-historic bone collagen samples of bontebok from the lowlands showed a higher utilization of C₄ grasses than that of the grazing ruminant red hartebeest, non-ruminant zebra and mix-feeding elephant, ostrich and eland that inhabited both lowland areas.

Tested eland, ostrich, elephant, and red hartebeest individuals indicate that they could have survived with as little as 14% C₄ grass in their diet. The lowest C₄ grass consumption by contemporary bontebok was 26%, and they utilize at least 43% C₄ grass biomass in more natural habitat. The prehistoric bontebok samples indicate a diet of at least 54% C₄ grass. Tested mountain zebra ate at least 24% C₄ grass, but used much less C₄ grass than co-occurring bontebok. Some pre-historic red hartebeest samples sourced from areas in close proximity to azonal wetland and saline estuaries indicate an unexpectedly high C₄ grass consumption on the western lowlands and this needs further investigation.

The results of the carbon isotope analysis are broadly consistent with the SNS hypothesis that geographic variation in C₄ grass availability in the summer lean season could account for the discrepancy in at least bontebok distributions on the coastal lowlands in historic times. We suggest that timing of grass senescence should be considered in studies of especially ruminant grazer species' distribution patterns.

The bontebok and blesbok hybrid dilemma

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The deliberate mixing of blesbok with bontebok on game farms and translocation of animals outside their former distribution range have resulted in a hybrid dilemma. At a bontebok breeders interest group meeting held in Kimberley in 2009, conservation agencies and the breeders association raised their concerns in regards to the accuracy of the photographic test used to detect hybrid animals. The need for a more sensitive and specific test to detect pure or hybrid animals was identified.

The development of a DNA based test was highly significant. With the assistance of the various conservation agencies and the breeders association, pure bontebok (76) and blesbok (70) as well as known hybrids (2) samples were collected to serve as reference material. A DNA typing test consisting of five cross-species and eight species-specific microsatellite markers was developed. The markers indicated the presence of private and shared alleles that can distinguish between the two sub-species and hybrid animals. A total of 136 samples tested indicated a frequency of hybridisation of 40%.

According to the IUCN there is approximately 2500 bontebok in South Africa. Our results thus imply that a large proportion of bontebok may be hybrids. Although hybridisation between closely related species can be a natural evolutionary process and has the potential of increasing genetic diversity over a timescale, conservation implications are relevant with regards to the Convention of Biodiversity to secure pure populations. We also found that the genetic variation in the bontebok is low compared to the blesbok. This may suggest that this sub-species is inbred which can be explained by a bottleneck that occurred in the 1800s.

The DNA typing test will ultimately contribute to the accurate identification and genetic integrity of bontebok populations. This is a valuable tool for conservation agencies and breeders to confirm purity.

Dinner Address: “Jakkals trou met wolf”^{*} - musings on conflict in wildlife management

^{*}“Jackal marries wolf’s wife”

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Conflict between humans and wild animals is as old as the written word. From the *Epic of Gilgamesh* we have reports of wolves taking both game and livestock, from the clay fragments of Tell el-Amarna, Akhetnaten tells of marauding lions and hyenas, Herodotus reported on this issue and from South Africa we have the detailed accounts of Anders Sparrman. To this day the same problem persists universally with only the problem animal changing in time from badger to lion, leopard, otter, coyote, jackal and caracal. In historic attempts to solve these issues, kings were pitted against serfs and Karoo farmers against conservation authorities.

It is my belief that we need to develop a new *lingua franca* – a way of talking and dealing that will bridge the divide between science and those who rely on a livelihood from the land. Environmental ethics holds that our moral duties with respect to the natural world are ultimately derived from the duties we owe to one another as human beings. If we cannot respectfully deal with people, we will fail in solving conflicts in wildlife management.

Wednesday, 21 September 2011

Keynote address: Interactions between small predators and livestock

Petrus de Wet

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In 1650 the Cape and the greater South Africa was vastly different than what we experience today in 2011 - vast plains, rolling hills teeming with wildlife, - totally undisturbed by man. Lion and hyena found themselves at the top tier of the feeding pyramid and life on the open plains and in the mountains was the same as it had been for thousands of years - undisturbed.

Settlers from Europe started developing agriculture in the Cape and soon inroads were made into the hinterland. At this time the great tribes were migrating south from central Africa, also developing agriculture and bringing with them livestock. Conflict arose between the predators of Africa and these pioneer farmers moving into southern Africa. There was only one loser and very soon the large vulnerable predators at the top of the feeding chain were removed.

With lion and hyena conveniently out of the way of human development, the conflict shifted to the small stock farmer and the smaller predators. A few species were hunted almost to extinction, but black-backed jackal and caracal showed their resilience after facing a huge onslaught over centuries - they have survived and in many instances, even thrived. The reasons are many and the situation is complex, but we can quite correctly analyse and blame massive human intervention in all its guises for this skewed situation we face in 2011.

We can also rightly predict that South Africa will not revert back to the way it was prior to this human intervention and the luxurious life we as modern South Africans enjoy will not be forfeited to restore the imbalance we have created. We can only manage the situation and “lest we forget” the commercial farmer who feeds southern Africa, and is at the forefront of this conflict and struggle!

Theme 6: Carnivore management and predator-livestock interactions

The ecological and economical benefits resulting from sustainable management practices for damage causing animals

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Predators were in conflict with humans since the first stock farmers set foot in the country. Historical records highlighted the frustration that these early farmers experienced with the stock/predator conflict. A bounty system whereby people were rewarded for the killing of predators was installed. In later years hunting clubs were registered and subsidized by government to carry out the killing of predators and rewards were given to hunters for every animal killed. Today, after almost 400 years of prosecuting predators, with new methods and better technology available to assist producers to hunt predators even more successfully, the problem is escalating out of control.

Research has shown that predators have a very sophisticated social structure within which they operate. In this structure, they mark and defend their home range or territory against intruders and suppress profound breeding to be in balance with the natural prey available. The historic management practices of killing predators to limit stock losses, has disturb this balance to a point where the social structure of predators on most stock farming areas does not exist any more. There is profound breeding, natural prey species is declining and stock losses are escalating.

Through the introduction of holistic farming practices, producers can ensure sound ecological management practices on their land that will focus on good veld management, sound husbandry practices, less conflict with predators and associated control costs, an increase in natural prey species, a higher percentage of lambs weaned and producing an end product that consumers would prefer to buy.

The effectiveness of livestock guarding dogs for livestock production and conservation in Namibia

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The use of livestock guarding dogs (LGDs) as a tool for reducing livestock losses to predators on farmland has recently gained popularity in southern Africa. We examined the effectiveness of LGDs bred and placed by the Cheetah Conservation Fund (CCF) on commercial and subsistence farms in Namibia.

Our main objectives were to quantify the effectiveness of LGDs in reducing livestock losses and their impact on predator and prey species on Namibian farmlands. Most of the LGDs in this study effectively reduced livestock losses to predators: 64.6% of the LGDs evaluated in 2009-2010 eliminated livestock losses to predators and theft; a further 26.2% reduced livestock losses (n=65). Among the 83 LGDs surveyed regarding wildlife-killing, 37 killed a minimum of 3.4±0.69 black-backed jackal; nine killed 1.2±0.20 baboon; three killed 3.0±1.73 caracal and

one LGD killed one cheetah in the survey year. Furthermore, 15 of the LGDs killed 1.8 ± 0.30 non-carnivorous species and two killed non-target small carnivores (one bat-eared fox, unknown number of African wildcat respectively). Subsets were created to compare predator elimination before and since the LGD only for those farmers that removed each predator species and/or had a LGD that killed predators.

Significantly more jackals were removed on farms by the LGD and the farmer combined than by the farmer before the LGD ($p < 0.05$, $n = 36$). A similar pattern was found for caracal, but this was not significant ($p = 0.50$, $n = 5$). This trend was reversed for cheetah, as no farmers removed cheetah since the LGD, but this was not significant ($p = 0.13$, $n = 5$). A single leopard was removed before the LGD; none of the farmers removed leopard since the LGDs and no LGDs killed leopards. Black-backed jackal, baboon and caracal were the most negatively affected predators; these species are among the most problematic for livestock farmers in southern Africa and are of least conservation concern.

Cheetah and leopard benefitted from the presence of the LGD, as farmers removed fewer of these species since the LGD. Additionally, the LGDs in our study area had a minor impact on game and non-target carnivore species relative to the non-target effects of other commonly-used predator control methods.

Does the reintroduction of apex predators influence Jackal diet?

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Mesopredator theory states that the presence of apex predators can influence mesopredator diet through two possible processes; 1) by out competing the mesopredator for food items, or 2) by supplementing the mesopredators diet with another food source not previously available to the mesopredator (i.e. large herbivores). Thus far, the majority of the research conducted on mesopredator-apex predator interactions has been directed at wolf (*Canis lupus*) coyote (*Canis latrans*) interactions, with little research conducted on this relationship in an African context.

We assess the role that apex predators play in driving mesopredator diets in an African ecosystem by investigating how reintroduced lions (*Panthera leo*) affect the diet of black-backed jackals (*Canis mesomelas*) in the Karoo National Park. Prior to lion reintroduction, jackal diets consisted predominantly of small (<1 kg) and medium sized prey items (1-20 kg) with large prey items (>20 kg) rarely consumed. Post lion introduction, large mammals have become more prominent in the diet, with medium sized mammals consumed less often. Small mammals have been consumed in similar proportions prior to and after lion introductions. Lion predation on larger, previously inaccessible large ungulates provides a supplementary source of food for jackals to scavenge, resulting in an increase in the presence of these species in the diet. Additionally, this supplementation reduces jackal reliance on medium sized prey items. Alternatively, lion may be out-competing jackal for medium sized prey items, although analysis of lion diets does not suggest this is the case.

Therefore, the introduction of an apex predator into the Karoo National Park resulted in a shift in the diet of the jackal and this shift may have population level ramifications on medium sized prey items in the ecosystem.

Predations by black-backed jackals *Canis mesomelas* and caracals *Felis caracal* on small – medium size ungulates: which way to go?

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Traditional approaches to reduce predations by black –backed jackals and caracals on livestock have had poor performances over an extended period of not less than 300 years. Between the 1920's, and the 1970's, massive financial contributions which amounted to billions of rand, were provided by the government for predator control. This financial backing by the government largely supported a focused attempt by farmers and predator hunting clubs, to reduce chiefly jackal and caracal population numbers on rangelands, as well as the livestock mortalities associated with these two predator species.

However, despite the intense and prolonged use of a variety of predator control options, such as the hunting of jackal and caracal with dogs, and the use of gin-traps and poisons to catch and kill jackal and caracal, these two predators successfully thwarted attempted eradications. In addition predations on livestock by jackal and caracal continued unabated.

The failure of attempted jackal and caracal persecutions to address the objectives of this prolonged attack on these two species, as outlined above, could be seen in two ways. Firstly, jackal and caracal persecutions failed to significantly reduce jackal and caracal population numbers, or the mortalities to livestock, which were associated to these two predator species. Secondly, many jackal and caracal control methods such as those outlined above, resulted in incalculable damages to biodiversity, in areas where these predator controls options were used. In this respect, thousands of harmless wildlife species were annually injured and killed as a by-catch to the predator control methods described above, and as a result, some wildlife species became locally extinct.

Unfortunately the use of the predator control methods discussed above and the associated collateral damages to biodiversity still continue today in 2011. The apparent resistance by rangeland managers to embrace alternative scientifically sound approaches towards resolving predation conflicts with jackal and caracal will hamper future progress in this regard.

Will the game industry follow on the footsteps of the livestock industry imprint or.....?

Habitat-specific livestock predation by leopards *Panthera pardus* in the Baviaanskloof, South Africa: Implications for biodiversity conservation

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Carnivore-livestock conflict has been a driver of human-carnivore conflict since the domestication of ungulates and is one of the fundamental problems that need to be solved to secure the conservation of large carnivores. Leopard (*Panthera pardus*)-livestock conflict is a contentious issue in the Baviaanskloof Mega-Reserve (BMR), South Africa. This results in the retaliatory killing of an average of 4.3 leopards per year. Little is known about the spatial distribution of livestock losses and the associated management responses by landowners.

Our objectives were to investigate the habitat specific livestock predation by leopards in the BMR, as well as the consequences of this for livestock management and biodiversity preservation. Landowners responded to the leopard predation in the BMR by the removal of livestock from 150 km² of grazing area. Eighty-nine percent (133

km²) of this corresponds with areas that have been identified as Critical Biodiversity Areas by the Eastern Cape Biodiversity Conservation Plan. Thus, leopard predation on livestock leads to predator-induced-human mediated behavioural effects on livestock which resembles the behavioural responses of herbivores to “landscapes of fear”.

This suggests a potential trophic cascade induced by leopard predation on livestock, which is consistent with trophic cascade theory. Given the high levels of herbivory exerted on the vegetation by livestock, this cascade may create plant refugia from herbivory by livestock. This, in turn, may assist in the achievement of biodiversity conservation targets in these Critical Biodiversity Areas by reducing the impact of domestic livestock on the vegetation and increasing the effective conservation estate. This study also reveals potential ‘hot spots’ of leopard-livestock conflict, where research, conservation and management actions should be focussed in order to better understand the factors involved in leopard-livestock conflict, and to reduce leopard-livestock conflict.

Unusually high occurrence of predation on Chacma baboons (*Papio ursinus*) by female leopards (*Panthera pardus*) in the Waterberg Mountains, Limpopo, South Africa

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Leopards are baboon's primary enemy; however, previous research suggests that leopards do not favour baboons. Even in areas where baboons are abundant, their contribution to leopard diet seldom exceeds 5% of the biomass. It is suggested that the extreme aggressiveness of baboons and their ability to escape may limit leopard predation. Male baboons are particularly aggressive towards leopards and in many cases retaliation has led to the death of the leopard. However, evidence suggests that leopards may learn the skill to catch and kill certain dangerous prey.

This study reports on the predation on Chacma baboons (*Papio ursinus*) by three female leopards on a private game reserve (Welgevonden Private Game Reserve) in the Waterberg Mountains. Potential leopard feeding sites were identified using global positioning system (GPS) location clusters obtained from GPS collars. Over a five month period we investigated 200 potential leopard feeding sites and located 96 leopard feeding/kill sites. Baboons consisted 18.7% of the leopard's biomass intake.

The majority of the baboons preyed upon were adult and 70% of the kills were diurnal. The learned skill of specialised baboon-killing and the associated risks are discussed.

Detecting and evaluating status of sub-dominant members of large carnivore guilds in savannah ecosystems

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The Kruger National Park (KNP) and its neighbouring conservation areas represent an important stronghold for the conservation of both wild dogs *Lycaon pictus* and cheetahs *Acinonyx jubatus*.

In this study we evaluated the integrity of wild dog and cheetah populations within the large carnivore guild of KNP. We made use of photographic-based mark-recapture techniques to estimate population sizes of both species. We then collated historical information since 1989 to evaluate trends after correcting for sampling constraints. Between August 2008 and April 2009 we received information from 564 sightings of wild dogs and 455 sightings of cheetahs from tourists visiting the park. Mark-recapture analyses provided estimates of 166-191 wild dogs and 369-545 cheetahs. Sighting rates varied across the different regions in KNP with most originating from the south.

The number of tourists visiting in a particular month did not influence the number of wild dog sightings but did affect the number of cheetah sightings, and when plotting new individuals recorded against the number of entries, wild dog data reached an asymptote, but cheetahs did not. Cheetah distribution stayed relatively unchanged over time while wild dogs mostly disappeared from the northern region from 1999/2000 onwards. Reasons for the decline in wild dog numbers are unknown but could be attributed to various factors including increased predation by lions due to water provisioning (and subsequent removal) in the north, possible disease outbreaks or limiting ecological factors. The current numbers could thus represent restoration to conditions pre-dating the first photographic survey.

Further research is needed to understand this decline in wild dog numbers and changes in their distribution in the Kruger National Park.

Metapopulation-based management plans for lions on small conservation areas in South Africa

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Lions (*Panthera leo*) have been listed as vulnerable by the IUCN since 1996 and their population is known to be declining across the continent at an alarming rate. Currently South Africa only has two large viable populations of lions in the Kruger National and Kgalagadi Transfrontier Parks.

Starting in the early 1990s, lions have been reintroduced into many small, intensely managed conservation areas in South Africa, mainly for tourism purposes. Today these reserves house approximately 600 lions in just over 40 conservation areas; nine of which are publicly owned, the rest being private reserves/conservancies.

Despite this success in terms of numbers, concerns regarding the conservation value of these lions have been raised. These concerns are based on the isolation of the groups and their independent management, leading to specific worries such as inbreeding and social structure abnormalities. A metapopulation management approach has been suggested as a possible solution to these problems. Lions have a complex social structure and as such present many challenges to managers. Managers use a variety of tools including translocation, contraception, culling and supplementation to control their lion populations. Ideally this should be done to attempt to mimic natural processes; however, management often seems to be based purely on numbers. Here we explore the impact of the current management approaches on these various lion groups. We calculated basic demographic and social parameters such as birth rates, association rates and tenure length for these lions and compared them between each other and to lions in more open systems where management is not as intensive.

Preliminary results suggest that some parameters have been hugely affected by the current management approaches. For example, male tenures are longer with some stretching to over ten years and natural takeovers have been virtually eliminated. Shorter interbirth intervals and very high cub survival result in high growth rates. We will present these and other results, and explore metapopulation-based management options designed to

more closely mimic natural processes. If implemented, the conservation value of these lions should improve thus adding to the viable populations of lion in Africa.

The managed metapopulation approach to expanding resident range of wild cheetahs in South Africa

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Cheetahs *Acinonyx jubatus* have been extirpated from almost 90% of their historical range in South Africa outside of protected areas. The high level of persecution faced by cheetahs in these areas erodes conservation efforts. One method that has been used to increase the resident range of cheetahs in South Africa is reintroduction. To date more than 280 cheetahs have been reintroduced into 37 private and national reserves across the country. These reserves range in size from 2,000 ha to over 45,000 ha and hold between two and 36 cheetahs. Many of these reintroductions have been carried out in an *ad hoc* manner without much consideration for the genetic origin of these animals and long term management of the reintroduced populations.

Here we present a managed metapopulation approach to promote the management of cheetahs in small fenced reserves of South Africa as if they are a single population. This approach includes translocating individuals among reserves to ensure long-term demographic and genetic viability of the metapopulation as a whole. The project will include collation and management of cheetah and reserve data, genetic management of the population as well as a strong liaison and networking component. We aim to increase the probability of cheetahs in small fenced reserves being sustainable in the long term and increase the resident range of cheetahs in South Africa.

Fear of the dark: Does reintroducing apex predators affect the timing of movement of co-occurring species?

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Predators have considerable top down impacts on prey species, and this includes both direct and indirect measures. Indirect measures are commonly applied to spatial data where “landscapes of fear” have been coined to describe the indirect impact that predators have on prey species movement across space. Predators should similarly affect the temporal activity patterns of prey species, forcing potential prey species in timing their movement to avoid that of predators. We used camera trap data from neighbouring sections of the Addo Elephant National Park to assess if the temporal activity pattern of prey species differs in the presence (following the reintroduction of) and absence of apex predators, namely lion (*Panthera leo*) and spotted hyaena (*Crocuta crocuta*). Species not expected to be predated on, such as elephant (*Loxodonta africana*) and black rhino (*Diceros bicornis*), showed high overlap ($\Delta > 0.8$ on a 0-1 scale) in their temporal activity patterns between the two sections. Alternatively, species predated on regularly in the presence of lions and hyaena, namely kudu (*Tragelaphus strepsiceros*) and buffalo (*Syncerus caffer*), showed low overlap (Δ 0.55 and 0.56 respectively) in

their temporal activity patterns between the two sections. Kudu movement differed to such an extent that where predators were present they exhibited diurnal behaviour and where predators were absent they conformed to the expected crepuscular behaviour. In Addition, when comparing the degree of overlap with lion and hyaena in each of the sections, species consumed regularly by lion and hyaena exhibited considerably higher declines in overlap in comparison to species not regularly consumed. As a consequence we show that predators can influence not only the spatial use of the landscape, but also the timing on when prey species is active on the landscape.

Poster Abstracts

(1) Faecal nitrogen of browsing game species as indicator of nutritional status

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The study was conducted in the Grassland Biome of the central Free State, but vegetation is classified as riparian thicket. In common with many game ranches in the region some game species were not historically present. Therefore it is essential to study these species' adaptation to their introduced habitat.

Objectives were to compare faecal nitrogen (N_f) concentrations of browser- (giraffe and kudu) and mixed feeder (eland and impala) species with seasonal changes in woody vegetation and to use N_f as nutritional status indicator in comparison to known critical values. Phenology (time of budding and percentage presence of mature- and senescing leaves) was recorded fortnightly for *Acacia karroo*, *Asparagus larycinus*, *Diospyros lycioides*, *Lycium echinatum*, *L. hirsutum*, *Searsia pyroides* and *Ziziphus mucronata*. From these observations, seasonal leaf carriage patterns were calculated.

Fresh droppings were collected fortnightly, dried, powdered and nitrogen content determined. Phenology and N_f patterns were positively correlated ($p < 0.05$) – when phenology percentages were low, N_f also decreased and vice versa. Newly sprouted leaves presumably contain more phenolic compounds (tannins) and this was reflected in higher N_f concentrations. A distinctive seasonal pattern was distinguished where browsers' N_f increased from winter to summer, peaked in December, then gradually decreased through autumn to winter.

Differences were observed annually, but in general kudus appeared to be in poor physical condition for a period of two months (end of July to middle September) when they excreted less nitrogen (13 – 16 g N/kg DM) than known values for kudus in poor condition (18.1 g/kg). N_f of impalas (16.8 – 17.5 g/kg) were close to, but above the nutritional threshold established for this species (16.6 g/kg). Minimum N_f concentration for giraffe during winter was 18.3 g/kg, which is above critical values for browsers (16 g/kg). Lowest N_f values of eland was 16.3 – 17.5 g/kg that is above critical values for grazers (14 g/kg) and browsers, respectively. N_f concentrations of mixed feeders increased between May and July when that of browsers decreased, indicating selective feeding for more nutritious food. Faecal nitrogen thus proved to be a useful indicator of nutritional status of game species on fenced game ranches.

(2) Status of game species on private and provincial game reserves in the Free State, including exotic and TOPS species

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An estimated 23% of South Africa's total land size was used for private and government protected wildlife areas in 2006. In recent times, establishment of game ranches on former livestock ranches have increased dramatically.

Objectives of this study were to quantify the number of privately owned game ranches in the Free State Province at the end of 2010; compile a list of large wildlife species present; and identify species not historically present, as well as exotic and TOPS species.

Data were obtained from the database of the Department of Economic development, Tourism and Environmental Affairs. All the privately owned game ranches in possession of non-obligatory Adequate Fencing Certificates were included in the database in the form of location in relation to the nearest town, game species present and their average numbers. Game ranches in the vicinity of each town were counted and presented along with provincial nature reserves on a map of the province. Thirteen proclaimed and one non-proclaimed provincial nature reserves, one national park, one RAMSAR site and 343 private game ranches were recorded in the database. However, many other private and government wildlife areas were excluded due to absence of a fencing certificate.

A total number of 64 game species was listed for the province with an additional seven colour variants of some species. Of these species, 18 were not historically present in the province and 17 are exotic. Threatened or protected species (TOPS) numbered 16 in total. The large number of private game ranches and the possibility of creating corridors between wildlife areas emphasize the potential important role that these areas can play in conservation of specific plant and animal species, as well as unique ecosystems. In general, this conservation potential is not realized due to the profit driven objectives of game ranches that do not always comply with conservation objectives. There are concerns that the over-commercialization of wildlife may in the long term have a negative impact on conservation of species and ecosystems. Some of these concerns include deliberate breeding of colour mutations, hybridization of species and subspecies and the introduction of exotic species.

(3) The diet selection, habitat preferences and spatial ecology of relocated giraffe (*Giraffa camelopardalis*) in the Kgalagadi Transfrontier Park

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Relocation of herbivore game species such as giraffe (*Giraffa camelopardalis*) to areas in which there is limited information as to their adaptation success or potential impact on the environment, requires careful consideration. Old records and historic eyewitness accounts of giraffe in the Kalahari, led to the decision by park management to reintroduce giraffe in 1991. Twenty years ago (1991) the translocation of 8 giraffe from the Etosha National Park took place to an area in the dry Auob river in the Kgalagadi Transfrontier Park which there is limited information as to their adaptation success or potential impact on the environment. The key food species of giraffe in the Auob riverbed is *Acacia haematoxylon*, and there is concern regarding the increased impact of a growing giraffe population on *A. haematoxylon*.

The objectives of the study are to: (i) assess the current seasonal and annual ranges of giraffe in the KTP, (ii) to study movement patterns and social behaviour of the giraffe, (iii) to establish the age structure, reproductive and survival rates of the giraffe population, (iv) to provide appropriate data to the park management and other interested parties to aid in future decision making, (v) to assess the adaptation and distribution of the population 20 years after relocation and (vi) to evaluate the impact on vegetation and use of waterholes and monitor specifically the impact of the giraffe on *A. haematoxylon* and other food plants such as *A. erioloba*, *A. luederitzii* and *Boscia albitrunca*.

Proposed methods include determining the spatial ecology and home range of the giraffe by equipping animals with specially developed GPS collars to display the spatial distribution of the giraffe and to identify feeding stations and food preferences. Surveys of the tree layer will be done within survey plots stratified with radius dimensions 100m, 200m and 300m around waterholes. The species composition, dry matter production and structure of all rooted, live trees will be measured in accordance with the BECVOL-model (Biomass Estimates from Canopy Volume) which is based on the quantitative description technique.

(4) Metapopulation-based management plans for lions on small conservation areas in South Africa

(Susan Miller and Paul Funston (also presented as paper – see abstract on page 38)

5) Reserve management plans: Design and implementation dilemmas

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The updating of the integrated environmental management plan for the Cradle of Humankind World Heritage Site raised some issues around the development and implementation of management plans in general. The updating of the existing management plan for the Cradle of Humankind site, a protected area by definition, followed closely on the completion of a short dissertation on management effectiveness of protected areas in Gauteng. The management effectiveness study did give an insight as to where conservation actions seemed to be falling short. The results of the survey did show that conservation initiatives were weakest at implementation level. In other words - the setting of specific biodiversity targets and the implementation of specific activities to achieve targets scored the weakest.

In addition no direct monitoring appears to be taking place that can show that there is, indeed, a measure of success. On the contrary, monitoring did not seem to consider the conservation targets at all. There was also no link between the management plan and monitoring activities. The management plan and its content are central to achieving conservation targets and the overall output of conservation actions but this seems to not happen in practice.

A number of local and international management plans were consulted in an attempt to make the new plan conceptually and structurally correct. Although a trend could be followed there was a massive difference between the plans consulted. The final management plan for the heritage site yielded some interesting deductions about the development of site management plans and how they are implemented. This poster will highlight the problems that were identified, for example, management plans contain copious amount of superfluous information; conservation targets are poorly defined; action plans are generic rather than site specific; management actions do not address the conservation targets and monitoring is often unrelated to either; management activities or conservation targets.

The paper will also highlight possible solutions to design identifies different levels of implementation that seem to be missing in practice.

(6) The Knysna elephants as candidates for the refugee species concept

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Over 300 years ago about 9000 elephants occupied the Western and Eastern Cape and had access to 8 different biomes. Between 1652 and 1870 this population was virtually wiped out, leaving only three relict populations. One of these populations, now confined to the Knysna forest and surrounding fynbos, has access to only 2 biomes, forest and fynbos. Even though the Knysna elephants were afforded protection in the 1900s, the population slowly dwindled and today, only between 1 and 5 individuals remain.

This poster presents our study proposal, which hypothesises that the Knysna elephant population is a refugee, confined to its forest habitat, a marginal habitat, originally used by the elephants as protection from human disturbance and persecution. The objectives and proposed research approaches are discussed.

(7) Crowned Eagle Conservation Status in the Southern Cape Forests: what monitoring is showing us

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The crowned eagle (*Stephanoaetus coronatus*) is restricted to the forested and heavily wooded areas of Tropical Africa from Guinea eastwards to western Ethiopia and southwards through the subtropical region to the temperate region of South Africa. The southern Cape population represents the most southern and western (with the exception of one breeding pair at Grootvadersbosch near Swellendam) distribution of this species in South Africa. Although not globally threatened, the species is near threatened in South Africa and needs close monitoring due to persecution by small stock farmers and loss of forest habitat. Most identified nests occur within the Garden Route National Park (GRNP), and SANParks' Crowned Eagle monitoring Project has recorded crowned eagle activity and nesting sites since 2000. Identified nests are inspected annually, during the breeding season, to monitor breeding frequency, breeding success, nesting distribution and diet. The majority of the 139 observations recorded were in 2002, 2004 and 2006 during late winter to early spring at locations where known breeding occurred. There was a gradual drop in crowned eagle observations since 2006. This study aims to shed more light on the diet and activity of crowned eagle and potential reasons for a decline in observations will be discussed.

(8) Wildlife road traffic accidents: a new technique for counting flattened fauna

Wendy Collinson, Harriet Davies-Mostert, Ric Bernard, Dan Parker & Brian Reilly (Also presented as paper. See abstract on page 30)

(9) Using Cybertracker software in vegetation monitoring

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Vegetation monitoring can be a laborious task, with lots of data sheets and data that needs to be captured into the computer afterwards. Not only is it extremely time consuming, but also leaves space for errors during capture. The cybertracker software was originally developed to use on a handheld computer to assist illiterate Bushmen trackers to collect field data of their observations. In the mean time the software has developed further into an efficient method of GPS field data collection, but is still almost exclusively used to collect data on animals. We have used the cybertracker software on a handheld computer to assist us in collecting and capturing vegetation data in our annual monitoring programme.

We found that it did not only save time when capturing the data, but was much easier to use than a clipboard and paper in the field. It also assisted the field staff to collect the correct data because it instructs them what to collect, thereby excluding errors. The biggest advantage was during the data capture stage, as the handheld device only needs to be connected to the computer, and data are automatically downloaded and backed up. In this poster we present our experience when using the software, information on the programming, and extracts from the data that was collected. We also investigated the time that was saved when using the software compared to the capturing of data by hand.

(10) Cross boundary movements of cheetah and the threats they face outside the western boundary of the Kruger National Park

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The cheetah (*Acinonyx jubatus*) is listed by the International Union for Conservation of Nature (IUCN) as vulnerable. Habitat fragmentation, human persecution and inter-specific competition continue to threaten the species. In South Africa, the Kruger National Park (KNP) has the largest remaining protected population of Cheetah. Recent photographic census results have shown consistently low cheetah numbers, with 212 individuals identified in 2009. Cheetahs are extremely wide-ranging and thus often leave the boundaries of protected areas where they come into conflict with humans. A structured, questionnaire survey was conducted in areas adjoining the southern and western boundaries of the KNP in order to determine distribution, understand population dynamics and investigate threats. An examination of land use practices, as well as geographic and anthropogenic factors were used to correlate cheetah distribution with areas where management practices and threats may differ.

Our results indicated that while cheetahs do move between the park and the private areas outside, a number of individuals live solely outside the boundaries of the KNP. Cheetahs on the western boundary do come into direct conflict with humans and persecution through shooting, poisoning, snaring and cage trapping have been recorded. This may further limit cheetah survival outside the KNP, with knock-on effects on the population inside the park. A greater understanding of the population dynamics, dispersal habits, impacts of removals and the drivers of conflict are fundamental in establishing management strategies to effectively conserve populations in the region.

(11) A habitat suitability approach to predict the occurrence of leopards *Panthera pardus* in South Africa

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Reliable estimates of animal distributions are a central component of efficient management of species and ecosystems. However, it is logistically challenging to collect reliable data on species distributions, particularly data on species absences. New predictive modeling techniques allow presence-only data to be used as an alternative to traditional techniques relying on presence-absence records. We used a maximum entropy approach implemented in the software Maxent to use presence-only data together with a set of environmental variables to model the probability of leopard *Panthera pardus* presence throughout South Africa. Data on leopard presence were compiled from our own research, collaboration with other research projects on the species and from governmental agencies.

After rigid model evaluation, we constructed a detailed occurrence map for leopard in South Africa with a resolution of 10 km². Our map generally agrees with previous estimates of leopard distribution. We found that the probability of leopard presence was most closely linked to topography and distance to nearest human settlements.

Maps such as this can be of great value for several aspects of leopard management, such as population viability assessments and determination of regional harvest quotas, and could be equally useful for other large mammals in the country as well.

(12) Evolving African predator-prey models: from species-level diet analyses and carrying capacity models to incorporating prey demographics and predator social structure

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There is a need for better information regarding managing large carnivores in small (<30 000 ha) game reserves in southern Africa. The recent surge in the development of small, fenced and intensively managed conservation areas has meant an increase in reintroduced carnivores that had previously been extirpated from the region. Protected from human persecution, carnivore populations can increase rapidly, resulting in ungulate population declines, and even collapses. Managers are faced with potential overabundance of reintroduced carnivores, without realistic carrying capacity estimates. The majority of predator-prey relationship models in Africa, to-date, have been descriptions of carnivore feeding ecology, with little attention paid to the numerical or functional response of the predator and the prey. In African savannas, the density of large carnivores has been linked to the biomass of all available prey species for lion *Panthera leo*, and the biomass of prey weighing between 15 and 60 kg for cheetah *Acinonyx jubatus* and leopard *Panthera pardus*.

With the increase in studies on carnivore feeding ecology allowing for more accurate calculations of prey preference, attempts have been made to refine predator-prey relationships. Significant linear relationships have been found between carnivore density and the biomass of the preferred prey species of lion, leopard, spotted hyaena *Crocuta crocuta* and African wild dog *Lycan pictus*, and the biomass of prey in the preferred weight range of cheetah. Such relationships have been used to predict carnivore carrying capacity, but species-level

models fail to address the importance of individual-level factors in predator-prey interactions. A prey population/community may have an initial biomass theoretically sufficient to sustain predators, and yet still suffer severe negative effects if that predator is systematically eliminating females or a population's annual recruitment. Such a situation may be avoided if the influence of prey demographics (sex and age) on prey preferences was accounted for.

Furthermore the size and composition of the predator hunting group can affect prey size and quantity. We propose that preferences at the prey demographic level and the social structure of the carnivore populations should be incorporated into predator-prey models, thereby improving their application to small reserves.

(13) The impact of climate change on predator prey preference

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Knowing the prey preferences of Africa's large predators in differing climatic conditions will provide conservation managers with data helpful to manage prey and predators through varying climatic conditions. This can be used to help predict and test the carrying capacity of Africa's large predator guild at sites throughout southern Africa. We used the kill data and climate data from up to 40 years from Kruger National Park, Shamwari Game Reserve, Hluhluwe-iMfolozi Park and Pilanesberg National Park for five predators (African wild dog *Lycaon pictus*, Cheetah *Acinonyx jubatus*, Leopard *Panthera pardus*, Lion *Panthera leo* and Spotted hyaena *Crocuta crocuta*). We used these data to detect patterns in predation as a result of varying climatic conditions. The results show that during dry periods lions tend to prey more on buffalo *Syncerus caffer*, giraffe *Giraffa camelopardalis* and greater kudu *Tragelaphus strepsiceros* where as during wet periods they tend to prey more on wildebeest *Connochaetes taurinus* and zebra *Equus burchelli*. The remaining predators did not show a significant change in the prey throughout the differing seasons. The usefulness of these data to managing wildlife is discussed.

(14) Dimensions, determinants and impacts of human-carnivore conflict in the Waterberg area of Limpopo Province

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Alleviating the increasingly common phenomenon of human-carnivore conflict is central to carnivore conservation and of great economic importance to people that co-exist with carnivores. However, effective conflict mitigation requires a clear understanding of conflict characteristics, and their underlying human and natural drivers.

In South Africa, such information is lacking, so our aim was to investigate; 1) the dimensions; 2) socio-economic and ecological determinants; and 3) impacts of conflict on farming livelihoods and sustainability of carnivore populations in Limpopo province, South Africa.

We carried out semi-structured socio-economic questionnaire interviews with land owners between March and August 2011, focusing on agricultural areas in and around the Waterberg Biosphere Reserve. Eighty nine percent of land owners reported predation losses in the previous year totalling 546 animals worth an estimated R511,530. This represents 1.6% of total stock holdings and equates to a loss of R3.9/ha of land area surveyed. Forty three percent of land owners said that they had killed carnivores in the last year, including several

threatened or near threatened species. Seventy eight percent of participants were interested in non-lethal anti-predation methods. Most people perceived carnivores as having a negative financial impact, nearly a third are unwilling to tolerate even low levels of predation, and a similar proportion would like to see carnivore numbers reduced. African wild dogs and cheetahs were the species least likely to be tolerated if regularly present on farmland. Information theoretic analysis of potential determinants of predation losses and attitudes to carnivores revealed (TBA).

Our findings suggest that (TBA) will improve prospects for people and carnivores in the Waterberg, and in other study areas with similar conflict characteristics.

(15) African Wild dog (*Lycaon pictus*): Are there any left in Northern Cameroon?

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The African wild dog (*Lycaon pictus*) is one of Africa's rarest and most endangered carnivores. In North-Cameroon, their population has declined dramatically through the years due to a number of factors. A Recent study carried out in the Bénoué complex found no evidence to support the existence of a viable painted dog (wild dog) population in the area and therefore declared the wild dog as functionally extinct in North-Cameroon.

In line with the recommendations of the report, the need for continued research to try and identify the presence of wild dogs within both protected and community areas, was identified. CAMNARES (Cameroon Natural Resources) therefore initiated a three-year study to ascertain the occurrence of wild dogs within the three national parks (NP) in the Northern region of Cameroon (Faro NP, Bénoué NP and Bouba Ndjida NP), the hunting areas around the parks and community areas of the Adamaoua region. Daily patrols were undertaken in the study area between March and April 2011 to search for wild dog individuals and activities as well as to collect samples for further genetic analysis. Interviews were also conducted in the form of questionnaires to find out whether the locals have recently sighted any painted dog.

The preliminary results of this research revealed the presence of active dens, scats and footprints but no direct sighting of wild dog individuals was done. Faecal and hair samples were collected for DNA analysis. The interviews among the locals revealed that the majority of the respondents have recently sighted wild dog in the study area. In the light of this investigation one cannot confirm the total extinction of this species in the area. More search efforts are needed in the area.

(16) Visitor perceptions at selected False Bay coast nature reserves, Cape Town South Africa

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Conservation areas such as nature reserves are integral parts of our society. Apart from its conservational significance, nature reserves also offer people access to green open spaces which is an essential measure of a healthy city. The research was aimed to investigate perceptions of visitors at selected False Bay Coast nature reserves. Three reserves were selected namely, Rondevlei, Wolfgat and Macassar Dunes nature reserves. These reserves are all managed by the City of Cape Town. Data collection methods included questionnaire surveys, observations and interviews with reserve visitors and relevant stakeholders such as teachers and resort

managers. Although there are biophysical and ecological similarities at the three reserves there remains a notable difference, particularly with regard to the perceptions of people visiting the reserves. These perceptions are largely influenced by the socio-economic characteristics of individuals who frequent the respective reserves. From the research it has emerged that visitors had diverse perceptions of nature in its entirety, and that their preferences for visiting nature reserves and interaction with nature was based on their perceptions.