Nature & Faune

Vol. 21, Issue 2

Human-Wildlife Conflicts

Editor: M. Laverdière
Assistant Editors: L. Bakker, A. Ndeso-Atanga
FAO Regional Office for Africa

Nature-Faune@fao.org
www.fao.org/world/regional/raf/workprog/forestry/magazine_en.htm

FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS
Accra, Ghana
2007

Table of Contents

Editorial

First of all, a very warm welcome to our new subscribers! We hope that while we expand our digital coverage, more people will get enthusiastic about reading Nature & Faune and sending us articles for publications. We would like to invite you to visit our website:

http://www.fao.org/world/regional/raf/workprog/forestry/magazine_en.htm

where you can find past and present issues of the magazine (in English and French); and download the "Guidelines for authors" if you would like to contribute manuscripts. You are welcome to send the link to colleagues and friends to support this effort to enrich the wildlife, forest and nature conservationist in everyone!

Secondly, thank you for the many positive feedbacks we received after our first digital edition on the theme 'Hunting and Bushmeat'. As we strive to continuously improve the magazine, your comments and observations play a leading role in shaping the path for Nature & Faune and moving it to greater heights.

The theme of the current edition is 'Human-Wildlife Conflicts'. Whereas conflicts between people and wild animals have always occurred throughout history, population growth and increased demand for natural resources as well as the decrease in natural habitat have aggravated the problem in many places. Wildlife species invade human settlements and raid crops, cause damage to personal belongings, injure or kill livestock and in some regrettable instances even injure and kill people. Humans respond by retaliation killings, indiscriminate poisoning and increased poaching of wild animals. The causes of the conflict cannot be eliminated easily or quickly, and human-wildlife conflicts are among one of the main threats to the survival and conservation of various wild species.

While insect plagues, fungal plant infections and cattle diseases are often seen as unfortunate spells of nature, large animals such as baboons, lions or elephants awaken people's natural respect and consequent anger and fear for these rampaging animals. Wildlife species negatively impact upon the food security and livelihood of affected people, resulting in high costs of food production, whilst people become hostile towards wildlife around their communities. Many species nowadays are protected for the sake of biodiversity conservation and the generation of tourism revenues. Restrictive laws prevent people from hunting problem animal species. Consequently, large animals are often seen as 'belonging to the government' and rural populations demand wildlife authorities and governments to protect them from animal menaces.

The wealth of literature and the quantity of organizations which work on the causes, consequences and solutions to Human-Wildlife Conflicts (HWC) is enormous (see the 'Links' section). Recently, a Human-Wildlife Conflict Collaboration was established to allow stakeholders from all over the world to share experiences and information (see the 'Special Feature'). However, the exact circumstances in a specific area need to be known before sustainable solutions can be found. The article by Packer *et al.*, for example, provides an overview of the factors that are responsible for lion attacks on humans in Tanzania (page 10), while Danquah *et al.* explore factors that influence crop raiding behavior by elephants (page 15).

Solutions to human-wildlife conflicts are not easily found, and successful methods and techniques are often based upon a long history of trial and error. Jones and Elliot share the experiences of WWF in Namibia (page 20). In the end, when solutions do appear to be effective, other challenges arise, such as the needed financial resources or expertise to implement them. Rooyen and Smallie discuss an innovative approach in their article on the partnership between an NGO and the South African national electricity supplier (see page 25).

'Country Focus' (see page 31) is a new section, where Nature & Faune celebrates the developments in natural resource management in a selected African country. Nature & Faune had the pleasure to speak with Mr. Ngoya-Kessy from the Republic of Congo, who informed the magazine of some interesting initiatives in his country, relevant to the theme HWC. 'Country Focus' will henceforth be a regular feature of this magazine; countries with innovative projects relevant to an upcoming theme could contact the editor.

We hope you will find the information and knowledge weaved into each article and news item in this edition inspiring and useful.

News

News in Africa

The African Forest Forum: A platform for stakeholders in African forestry

Source: Godwin Kowero

The African Forestry Forum (AFF) is an association of individuals who share the quest for and commitment to the sustainable management, use and conservation of the forest and tree resources of Africa for socio-economic wellbeing of its peoples and for the stability and improvement of its environment. The Forum will, besides individual members, have observers from key organisations.

The Forum seeks to provide a platform and create an enabling environment for independent and objective analysis, advocacy and advice on relevant policy and technical issues pertaining to achieving sustainable management, use and conservation of Africa's forest and tree resources as part of efforts to reduce poverty and promote economic and social development.

The Forum will, among other activities:

- Constitute permanent and *ad hoc* task forces, think tanks and committees from among its membership to analyse and give advice on specific issues, problems and potentials.
- Commission experts and institutions to carry out studies and research tasks to generate knowledge in general or for specific institutions and organizations on request.
- Organise workshops, seminars and conferences as and when appropriate.
- Be represented at relevant international and regional meetings on forests.
- Initiate and implement pilot projects, normally in collaboration with African and/or other partner institutions.
- Issue reports, publications and other relevant material emanating from its work.
- Provide a systematic information base on forests and trees in Africa, and a monitoring and evaluation mechanism for developments relevant to these resources.

For membership registration and other information please contact:

Prof. Godwin Kowero
Leader, Sustainable Forest Management in Africa
c/o World Agroforestry Centre (ICRAF)
P. O. Box 30677 00100, Nairobi, Kenya
Tel. +254 7224000 Ext.4203 and +254 721 734 864;
Fax: +254 7224001
Email: g.kowero@cgiar.org and
godwinkowero@yahoo.co.uk

Commission des Forets d'Afrique Centrale (COMIFAC) 14th Ordinary Session of the Council of Ministers

Source: COMIFAC

http://www.cbfp.org/facilitation/_Communique_final_CM_Mongomo_29novembre.pdf

The 14th Ordinary Session of the COMIFAC Council of Ministers was held on 21st September 2006 in Malabo, Equatorial Guinea. The following member countries took part: Cameroon, Congo, Gabon, Equatorial Guinea, Central African Republic, Democratic Republic of Congo, Sao Tome and Principe and Chad, as well as many representatives of organizations and donors.

Protection of marine tortoises along the Atlantic Coast of Africa: opening in Dakar of a regional coordination unit for the memorandum of understanding under the auspices of NEPAD

Source: Tomas Diagne

With the aim of improving the conservation of sea tortoises along the Atlantic Coast of Africa, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) of the United Nations Environment Programme (UNEP) and Senegal, coordinator of the Environment Initiative of NEPAD, have since October 2005 signed a Memorandum of Understanding and a Letter of Agreement. As part of this agreement, the Interim Secretariat of the NEPAD Environment Section has been entrusted with the supervision of a Regional Coordination Unit of the Memorandum of Understanding on measures for the Conservation of Marine Tortoises along the Atlantic Coast of Africa (URCMACTMCA).

The mission of this unit, headed by Madam Ndeye Sene Thiam, an official of the Ministry of Environment and Protection of Nature, is to:

- Provide support to African countries along the Atlantic coast, distribution site of sea tortoises, in application of the above Memorandum of Understanding;
- Channel and collect all available resources within the structures and programmes, for synergy of activities to conserve tortoises.
- Ensure the implementation of the plan for the conservation of marine tortoises along the Atlantic Coast of Africa.

For more information, kindly contact:
Madame Ndeye Sene Thiam, Coordinatrice 3, Boulevard Djily Mbaye, Immeuble Fahd 3e Etage Dakar, Sénégal
Tél. : (221) 8 23 83 65 / 842 73 11 / 6 53 41 80
Email: ndeyesenethiam2003@yahoo.fr

Animal kingdom that knows no bounds
Source: The Times
http://www.timesonline.co.uk/article/0,,3-2316397,00.html
To boost tourism and generate income for local communities, Mozambique, Zimbabwe and South Africa have joined the Limpopo National Park, Gonarezhou National Park and Kruger National Park respectively to create the Great Limpopo Transfrontier Park. It shall eventually cover 41,000 km^2 and is the largest transnational game park on the continent.

Emissions for forest conservation scheme could net Uganda $50 million or more per year
Source: Mongabay
http://news.mongabay.com/2006/1105-uganda.html
At climate talks last year in Montreal, a coalition of tropical developing countries proposed a rainforest conservation compensation initiative whereby industrialized nations would pay them to protect their forests to offset heat-trapping gas emissions. Deforestation - most of which occurs in the tropics - is responsible for about one-fifth of annual emissions of greenhouse gases. By reducing deforestation that would otherwise occur, industrialized countries could effectively "offset" emissions limits set under international agreements like the Kyoto Protocol.
Mongabay.com analysis of U.N. deforestation data suggests that an avoided deforestation initiative could be worth $10.4-172.8 million per year to Uganda, depending on how much deforestation it could "avoid" and the market price for carbon offsets.

Rebel poachers could wipe out Hippos in Congo Park
Source: Reuters
http://www.enn.com/today.html?id=11494
Mid October 2006, a rebel militia, Mai Mai fighters, killed over 400 hippos within two weeks in Virunga National Park in Democratic Republic of Congo. The Zoological Society of London (ZSL) working in the park reported that buffalos and elephants were also targeted by the rebels. The Virunga National Park is located at the border between DRC and Rwanda and is the oldest national park in Africa and at one time had the highest density of large mammals in the world. The area is still under the influence of sporadic insurgencies.

News Worldwide

United Nations Climate Change Conference - Nairobi November 2006
Source: UNFCC
http://unfccc.int/meetings/cop_12/items/3754.php
Kenya hosted the second meeting of the Parties to the Kyoto Protocol (COP/MOP 2), in conjunction with the twelfth session of the Conference of the Parties to the Climate Change Convention (COP 12), in Nairobi from 6 to 17 November 2006.
Environment ministers from more than 70 countries debated on how to extend the Kyoto protocol on global warming beyond 2012. Kyoto sets emissions cuts targets for 35 countries, and a deal, expected in 2009 or 2010, would further boost demand for renewable energy and rights to emit greenhouse gases, called carbon credits. Trading in carbon credits is expected to be worth US$25.62 billion this year, double the level in 2005 when Kyoto came into force and the EU's trading scheme started.

UN chief Kofi Annan has criticised a "frightening lack of leadership" in tackling global warming. Mr Annan told delegates the phenomenon was as grave a threat as conflict, poverty and the spread of weapons. He said sceptics were "out of step, out of arguments and out of time" and "It is increasingly clear that it will cost far less to cut emissions now than to deal with the consequences later,"

Mr Annan announced a plan by six UN agencies to help Africa receive funds for clean development projects, such as renewable energy and forestry.

It was agreed that a 2008 review of Kyoto can be a possible prelude to deeper emission cuts by rich nations beyond 2012 and steps by developing countries to brake rising emissions.

It was also agreed to establish modest schemes to help Africa adapt to the feared effects of climate change such as drought, storms, disease and rising seas. Ministers agreed to promote green technologies, such as wind or solar power, in the poorest continent. One possible problem looms -- while a deal to extend Kyoto beyond 2012 is expected, investors are worried about a possible gap before the new regime starts, if talks go to the wire.
For more information, please see:

- **UN chief issues climate warning**
  Source: BBC
  http://news.bbc.co.uk/2/hi/science/nature/6149340.stm
- **Green turns to gold in global warming battle**
  Source: Reuters
  http://www.planetark.com/dailynewsstory.cfm/newsid/39066/story.htm
- **UN Climate Pact Unlikely Until after Bush Experts**
  Source: Reuters
  http://www.planetark.com/dailynewsstory.cfm/newsid/39056/story.htm

Targeted vaccination could save endangered species
Source: Reuters
http://www.planetark.com/dailynewsstory.cfm/newsid/38467/story.htm
Vaccination against infectious diseases could save endangered animal species from going extinct. Researchers showed that vaccinating 25-30 percent of Ethiopian wolves could reduce the number of animals dying from rabies.

Scientists believe Bird's Head Seascape is richest on earth
Source: Conservation International
http://www.conservation.org/xp/frontlines/2006/091806 01.xml
Scientists of Conservation International who explored the reefs in a region known as the Bird's Head Seascape in Indonesia, found more than 50 new species.

Africa's Nobel Laureate Says Plant a Billion Trees
Source: Reuters
http://www.planetark.com/dailynewsstory.cfm/newsid/38899/newsDate/9-Nov-2006/story.htm
In an effort to contribute towards poverty reduction and to fight Climate Change, the United Nations and Wangari Maathai, a Kenyan environmentalist who won the Nobel Peace Prize in 2004, have initiated a project to plant a billion trees around the globe. The project which was launched early November 2006 expects the target of one billion trees to be achieved in 2007. Go to www.worldagroforestry.org for information on the types of trees to plant in your part of the world.

Thousands search for India's tigers
Source: Reuters
http://www.planetark.com/dailynewsstory.cfm/newsid/37844/story.htm
The remaining endangered tigers in India's jungles are being counted by 88,000 forest workers.

Log on to buy a bit of the Amazon
Source: The Sunday Times
http://www.timesonline.co.uk/newspaper/0,,176-2393778,00.html
A new project, called 'Cool Earth', allows people to buy a piece of rainforest from different locations in the world and impose a ban on logging in order to save it. More information:
http://www.coolearth.org/

Forests worth far more alive than dead
Source: IPS
http://www.ipsnews.net/news.asp?idnews=34897
Canadian researchers have calculated that northern forests provide 250 billion dollars per year in ecosystem services such as reducing atmospheric carbon causing climate change, water filtration and providing food and habitat for animals.

Global warming taking earth back to dinosaur era
Source: Reuters
http://www.planetark.com/dailynewsstory.cfm/newsid/38010/story.htm
Global warming over the coming century could increase temperatures higher than in the past 10 million years. Between 10-99 percent of the species evolved in cooler temperatures. As a result 10-50 percent of the species could disappear.

Paying for protected areas: money is not enough
Source: BIOSOC 8
http://www.povertyandconservation.info/docs/20061001-BioSoc_8(en).pdf
IUCN has recently carried out a review of financing options for protected areas. Mechanisms that generate funds for conservation are fiscal instruments (taxes and subsidies) and revenue sharing schemes. Market-based fees for protected area services are also a good alternative, although they are costly and difficult to implement. According to the report, a bigger challenge is

strengthening the capacity to manage the funds which includes the need for an effective policy and institutional framework. It is suggested that protected area authorities should be bold, innovative business managers.
For more information, please see:
Emerton, L., Bishop, J. and Thomas, L., 2006 Sustainable financing of protected areas: A global review of challenges and option. IUCN, Gland and Cambridge www.iucn.org/bookstore/HTML-books/BP13-sustainable-financing/cover.html

Indonesia finds signs of rare Javan Rhino breeding
Source: Reuters
http://www.planetark.com/dailynewsstory.cfm/newsid/37953/story.htm
Experts in Indonesia found signs that four rare Javan rhino calves have been born.

China to let tourists hunt endangered species
Source: Reuters
http://www.enn.com/today.html?id=11031
China will auction licenses to foreigners to hunt wild animals, including endangered species. Proceeds from the auction would be used for wild animal protection.

"Bushmeat" link to SARS outbreak confirmed
Source: mongabay.com
http://news.mongabay.com/2006/1123-sars.html
Chinese scientists say they have found a genetic link between SARS in civet cats, a racoon-like animal eaten as a delicacy in China, and humans.
Global warming over the coming century could increase temperatures higher than in the past 10 million years. Between 10-99 percent of the species evolved in cooler temperatures and as a result 10-50 percent of the species could disappear.

FAO News

AFWC inter-sessional meeting
The inter-sessional meeting for the African Forestry and Wildlife Commission (AFWC) took place between 28 and 30 November 2006 in Accra,Ghana. The meeting reviewed the recommendations of the 15th AFWC, the 16th Working Party on the Management of Wildlife and Protected Areas and discussed and reviewed the recommendations of the 15th AFWC Session for the attention of COFO 2007, to be held in March 2007 in FAO Headquarters in Rome. Furthermore, the meeting deliberated on International and High Level Fora, outcomes of UNFF6 relevant to AFWC, Sustainable Forest Management in Africa and the World Forestry Congress in 2009. Lastly, the preparations and organisation of the 16th AFWC were also discussed.

The full report of the AFWC inter-sessional meeting is available online:
http://www.fao.org/forestry/site/37735/en

The loss of biodiversity could undermine the achievement of the MDGs
http://www.fao.org/newsroom/en/news/2006/1000393/index.html
Environmental degradation and, in particular, the loss of biodiversity could undermine the achievement of some of the Millennium Development Goals (MDGs), according to FAO Assistant Director-General Alexander Müller. Therefore, the recent proposal of the UN Secretary General to establish a new target under MDG 7 to significantly reduce the loss of biodiversity by 2010 is very much welcomed.

Human-Wildlife Conflicts

Thematic News in Africa

Love-hungry apes move to island
Source: BBC
http://news.bbc.co.uk/2/hi/science/nature/6152594.stm
After being squeezed out of their territory by dominant males, five male reintroduced gorillas in the Republic of Congo have been straying into villages, raiding crops. The John Aspinall Foundation shall now release the gorillas on their own island to avoid future conflicts.

Africa: Green muscle test is beating locusts
Source: UN Office for the Coordination of Humanitarian Affairs
http://www.irinnews.org.asp?ReportID=56349&SelectRegion=East_Africa,%20So...
A biological agent designed to kill locusts has been produced in South Africa and tested in Mauritania in November 2006 by FAO and the Mauritanian Locust Centre. The biological product called "Green Muscle" contains fungi as the active ingredient. Depending on the doses applied the fungi take 3 to 21 days to kill off locusts. The biological agent acts through the spore of the mushroom. As the spores fall on the locust, they germinate on the locust's skin, penetrating and invading its internal system. A bane to African agriculture, locust is an insect related to the grasshopper, of warm and tropical regions, which travels in vast swarms, stripping large areas of vegetation.

Thematic News Worldwide

Activists slam birth control for elephants in India
Source: Reuters
http://www.planetark.com/dailynewsstory.cfm?newsid=38126&newsdate=18-Sep-2006
An Indian state wants to give contraceptives to domesticated elephants used for patrolling sanctuaries. Activists criticize the plans, saying the animals are already under pressure, and advocates releasing young bulls in the wild or finding a sponsor for their feeding.

Italy urges end to illegal culling of Alpine wolves
Source: The Independent
http://news.independent.co.uk/europe/article1962446.ece
Despite theoretical protection under EU law, wolves continue to be targeted by hunters in Europe. Italy is calling on its European neighbours to put a stop to the "extermination" of wolves, which it claims is jeopardising decades of effort in reintroducing the beautiful but ferocious mammal to the wild.

Tally-ho! Hunt followers ride roughshod over failing law
Source: The Independent
http://news.independent.co.uk/uk/crime/article1998833.ece
The government of Britain passed the Hunting Act in 2005 banning hunting with dogs. Evidences indicate that this law is not holding as hounds are still overtly used in hunting and some high ranking constables and police officers seem not too interested in going after offenders. Some critics say the 2005 Hunting Act is failing because it is "unenforceable, poorly drafted, and riddled with loopholes" and others say the law is simply ignored.

China offers hungry elephants 'Dinner Halls'
Source: Reuters
http://www.enn.com/today.html?id=10791&ref=rss
In 2005 alone, crops belonging to 12,000 families were ravaged by elephants and 3 villagers killed, all in the vicinity of the Chinese nature reserves in Xishuangbanna, southwest province of Yunnan. The wild elephant population in Xishuangbanna has exploded from 80 to 300 over the past twenty years. The Chinese wildlife authorities plan to lure these hungry elephants away from humans and farms to dinner halls of banana plantations and sugarcane, established for this purpose.

Indian court urged to end monkey business
Source: Reuters
http://www.enn.com/today.html?id=11613&ref=rss
The Madhya Pradesh state government in India has appealed to the Supreme Court to allow the state to refuse about 300 monkeys gathered from the streets of the Indian capital city New Delhi. In the past, attempts to relocate and lodge urbanized monkeys had caused conflicts between the local people and

the state government as the monkeys have a propensity to be aggressive, attacking humans, especially children. Moreover the city monkeys tend to carry diseases, a health hazard for native wildlife.

Fenced In, Kashmir's Leopards, Bears Stalk Villages

Source: Reuters

http://www.planetark.com/dailynewsstory.cfm/newsid/39130/story.htm

A fence along India's disputed border with Pakistan designed to keep out militants is curbing the movement of wild bears and leopards which are now wandering into villages and killing people, officials say.

Special Feature

Human-Wildlife Conflict: A Case for Collaboration

Madden[1], F. 2006

1. Introduction

Human-wildlife conflict (HWC) is a serious obstacle to conservation world-wide and is spreading as human population and development increase. When working separately, conservation and development organizations whose projects are affected by human-wildlife conflict (HWC) often lack knowledge, tools, resources and expertise needed to address the complexities of HWC. Practitioners in all sectors would benefit from opportunities to exchange ideas and information across project sites and with other organizations, in order to learn about and develop best practices in preventing and mitigating HWC. The Human-Wildlife Conflict Collaboration (HWCC) aims to prevent and mitigate HWC through a global network and partnership of diverse stakeholders across sectors and disciplines that facilitate collaborative learning, innovation, scientific analysis and development of best practices. Targeted activities of the collaboration will meet the collective need for improved information exchange, awareness raising and communication among key sectors; capacity building and training among practitioners; improved decision making and policy development; and enhanced understanding of the human dimensions of HWC.

2. Need

Human-wildlife conflict typically involves a direct and intense competition for resources resulting in real or perceived individualized harm to wildlife, humans or their property. Human-wildlife conflict may be characterized by instances of crop raiding, livestock depredation, destruction of property by wildlife, disease transmission, or killing of wildlife by people who experience or perceive actual or potential threats to themselves, their family or their property. The most serious conflicts are distinguished by death of humans and/or wildlife. And while HWC can be defined by a complex mix of characteristics, in every case HWC poses a serious threat to the success of conservation efforts around the world.

The challenges posed by HWC are increasing with population growth, success of conservation efforts and expansion of human settlement and development. The conflict is linked also to other factors such as poor land use planning and flawed development policies, in ways that are not always fully understood. Human-wildlife conflict reduces local support for conservation and engenders resentment and opposition to it. It can also hinder the pursuit of development and poverty alleviation goals when development projects inadvertently cause or exacerbate HWC.

Conservationists typically address the biological needs of wildlife, and fail to anticipate or address the human dimensions of potential or current HWC. Development is typically planned without consideration of HWC and thus often contributes inadvertently to it. Examples include the promotion of cash crops attractive to wildlife and the encouragement of settlement on migratory pathways. Because these professionals too often operate in isolation, their projects and missions drive policies that guide conservation and development to actually risk increasing opportunities for human-wildlife conflict. Consequently, addressing HWC also requires greater interaction between conservation, development and other policy and program areas such as land use planning, infrastructure development, agricultural policy and poverty alleviation.

[1] *Francine Madden, Executive Director, Human-Wildlife Conflict Collaboration (HWCC), c/o The Wildlife Society, 5410 Grosvenor Lane, Bethesda, MD USA 20814. Fmmadden@comcast.net Tel: 1 202 986 0067*

Improving our responses to HWC demands greater consultation and exchange of information between individual sites and programs and the institutions that support them. Successful responses to HWC frequently require individual professionals to reach outside their own disciplines for needed tools, skills and perspectives. For instance, the biological training and perspective typical of many conservation managers does not generally provide a basis to address the human side of the conflict, including its social, cultural, political, and historical roots. Such interdisciplinary collaboration is critical to improving the understanding of underlying causes needed to shift the emphasis from reactive mitigation of HWC to a greater reliance on proactive prevention strategies.

Practitioners have already recognized that human-wildlife conflict must be addressed to meet the respective goals of conservation and human development. Creative, innovative measures are being tested and some are succeeding. Others are failing, but with failure comes lessons learned that result in better methodology. These methodologies are not widely shared, yet they could benefit practitioners able to adapt them to local circumstances and mitigate the ecological, social, and economic costs of human-wildlife conflict. Finally, long term solutions that are proactive and preventative in nature and require skills and an understanding currently lacking among HWC professionals are in the conceptual stages of development and require collaboration and dedicated resources to ensure their further development, implementation and success.

3. Approach

The Human-Wildlife Conflict Collaboration (HWCC) is a global partnership that supports greater collaboration on HWC across disciplines, sites and policy areas. Its mission is to prevent and mitigate human-wildlife conflict (HWC) through a global network and partnership that facilitates collaborative learning, innovation, scientific analysis and the development and improvement of best practices and policies. It seeks to promote adoption of best practices for HWC prevention and mitigation by conservation, development and planning professionals and institutions. Improved prevention and mitigation of HWC will avoid or reduce its economic and social costs, in turn reducing the real and perceived costs of conservation to local people, improving quality of life and fostering greater tolerance of wildlife and support for conservation.

HWCC evolved out of consultations among HWC practitioners who realized that sharing ideas, information and experiences was an essential resource in preventing and minimizing human-wildlife conflict in the areas where they work, despite differences in culture, language, wildlife species managed, ecological conditions and political obstacles. The need for a partnership initiative like HWCC was identified by a workshop of HWC practitioners at the 5th IUCN World Parks Congress in 2003, in Durban, South Africa, and recognized in the Congress's formal recommendations.

In November 2006, more than fifty professionals representing over forty organizations convened in Washington, D.C. to identify priorities for collaboration in HWC and to develop a framework for pursuing those priorities. The result was the launch of the Human-Wildlife Conflict Collaboration (HWCC).

HWCC is working to improve collaborative learning, information exchange, innovation and capacity building among professionals across relevant institutions, disciplines and regions; to ensure that HWC tools, resources, best practices and guidelines are developed and incorporated in conservation, development, land-use planning and other program and policy decisions; and to use our collective strength to better address HWC and support the efforts of individual member organizations to be more effective in addressing HWC where they work.

If you would like more information about HWCC or if you or your organization would like to join this innovative, new collaborative partnership, please contact Francine Madden, Executive Director, HWCC via email at fmmadden@comcast.net or via telephone at 1 202 986 0067 or via letter at: c/o The Wildlife Society, 5410 Grosvenor Lane, Bethesda, MD USA 20814.

Articles

The Ecology of Man-Eating Lions in Tanzania

Packer[1], C., Ikanda[2], D., Kissui[3], B. and Kushnir[4], H. 2006

Abstract

Human wildlife conflict poses a threat to the lives of both humans and wildlife. Nowhere is this more apparent than in Tanzania, where lions currently attack over 120 people a year. Since Tanzania is home to the world's largest lion population, this conflict not only threatens human lives but also the country's economic growth through risks of indiscriminate retaliation against the lions. This article expands upon a recently published article in *Nature*, where we first summarized the current problem based on an analysis of district records and interviews about the context of attacks. Lion attacks on people have increased dramatically over the past 15 years, with the majority of cases occurring in the southern part of the country. Attacks are most common during the harvest season and, concurrently, the most common context of lion attacks is crop-tending particularly for people sleeping in makeshift huts to protect their crops against nocturnal pests.

1. Introduction

Human-wildlife conflict is a growing problem, which threatens both human lives and livelihoods and the survival of wildlife throughout the world (Woodroffe *et al.,* 2005). Nowhere is this more apparent than in countries like Tanzania, which hosts an array of large mammalian species. In Tanzania, conflict between wildlife and people not only affects peoples' livelihoods through crop destruction and livestock depredation but also directly threatens the lives of rural Tanzanians through attacks on people. Between 1990 and 2004, lions (*Panthera leo*) killed at least 563 people and injured more than 308. The problem has increased dramatically over the past 15 years, with the majority of cases occurring in the southern part of the country (Packer *et al.,* 2005) where lions enter agricultural areas and villages in search of human prey (Baldus, 2004, Packer *et al.,* 2005).

Attacks on livestock and people motivate opposition to the re-introduction and conservation of large mammalian carnivores (Kellert, 1996, Wilson, 2004, Treves and Karanth, 2003). Several recent studies have highlighted the ecological factors that increase the risk of livestock depredation (Ogada *et al.,* 2003, Hemson, 2004, Patterson *et al.,* 2004, Treves *et al.,* 2004, Woodroffe and Frank, 2005), but until recently, no systematic quantitative study has ever addressed man-eating by the big cats (Kerbis-Peterhans and Gnoske, 2002, Löe and Röskaft, 2004). Tanzania has the largest remaining population of lions in Africa (Bauer and Van Der Merwe, 2004, Chardonnet, 2002) and with attacks increasing, human-lion conflict poses a threat not only to people's lives but also to the survival of lions in Africa. Considering the magnitude of the problem and the emotions it elicits, it is surprising how little is known about carnivore attacks on people (Quigley and Herrero, 2005, Löe and Röskaft, 2004). Understanding the context of attacks is crucial for designing effective mitigation strategies to prevent future attacks. In this article, we present an overview of our current knowledge about lion attacks on people in Tanzania. This article is based on our recent article in the journal *Nature* entitled *Lion attacks on humans in Tanzania* (Packer *et al.,* 2005).

[1] *Craig Packer, Professor, packer@cbs.umn.edu, 612-625-5729*[*+]
[2] *Dennis Ikanda, Graduate Student, deni@africamail.com, +255-754-818034*[+]
[3] *Bernard Kissui, PhD Candidate, kiss0043@umn.edu, +255-784-761819*[*+]
[4] *Hadas Kushnir, PhD Candidate, kushn008@umn.edu, 612-625-7271*[*]
[+] *Tanzania Wildlife Research Institute, Box 661, Arusha, Tanzania*
[*] *Department of Ecology, Evolution and Behavior, University of Minnesota, 1987 Upper Buford Circle, St. Paul, MN 55108*

2. Materials & Methods

We used two methods to gather data for this study: (1) compilations of government records on lion attacks, and (2) surveys in affected areas to gather data on the context of attacks. Animal attacks in Tanzania are routinely reported to the District Game Officer. These records, however, usually remain in district offices. Working with the Tanzanian Wildlife Division (WD), records of lion attacks on humans over the past 15 years (1989-2004) were collected from the records compiled at the district level around the country. The WD reports do not provide detailed accounts of each individual attack, but they do record the date of the attack, sex, and age of the victim, and the ward (and sometimes village) where the attack occurred. Between June 2004 and April 2005, the WD sent a team of staff led by Bernard Kissui and Dennis Ikanda to conduct detailed surveys on human-lion conflict in the affected areas of southern, central, and northern Tanzania. Intensive interviews were conducted with survivors and victims' families of 237 lion attacks in a total of 20 districts. Interviews included questions on the time, location, and context of the lion attack, as well as information on local agricultural activities and contact rates with other wildlife species.

3. Results & Discussion

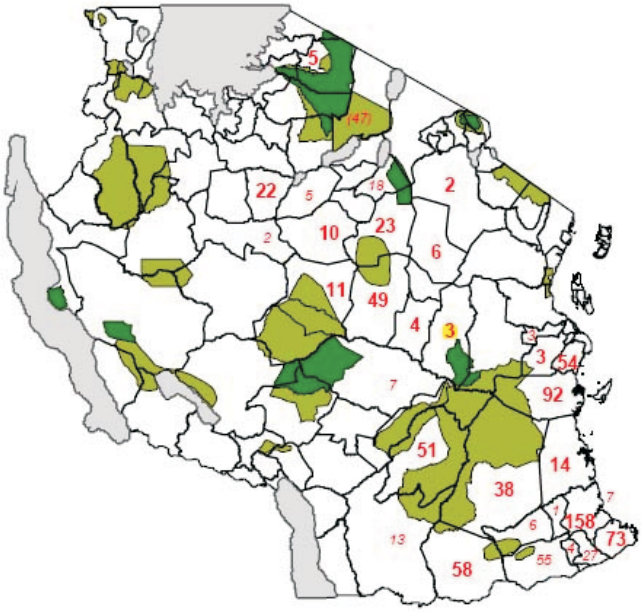

Figure 1. *Map of Tanzania showing the number of lion attacks on humans Jan. 1990 - Sep. 2004. Bold numbers indicate districts included in the field survey; italicized numbers rely solely on reports sent to the Wildlife Division in Dar es Salaam. Kilosa District is highlighted. Dark areas are National Parks; light areas are Game Reserves.*

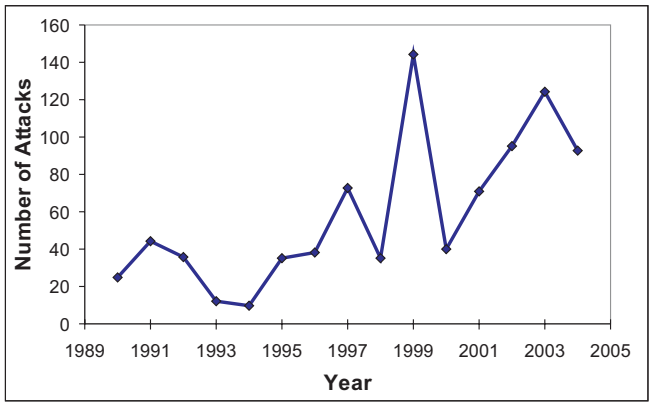

Figure 2: *Number of attacks each year.*

Figure 1 shows the reported number of lion attacks across the entire country from January 1990 to September 2004. Numbers in bold were verified by the survey team, but the italicized numbers underestimate the true extent of the attacks, since many of the District Game Officers have not reported any/all of their cases to the WD. There is striking heterogeneity in the incidence of lion attacks across Tanzania: 46% of all reported cases occurred in six coastal districts in the southern half of the country. This area has long had the worst reputation for man-eating, whereas lions in northern Tanzania seldom attack humans (Schaller, 1972, Rushby, 1989, Nicholson 2001).

In addition to the spatial heterogeneity of attacks, government records show a striking increase in attacks since the late 1990s (Figure 2). We are confident that this increase is not due to a change in reporting since there was no change in the methodology used by districts to gather these data over the course of the period reported in this paper. This upward trend is statistically significant (P=0.0030) even though the data for 2004 are only complete up to September.

The 15-yr trend is likely due to the population increase in the country (from 23.1 million in 1988 to 34.6 million in 2002) and an associated increase in illegal bushmeat hunting that has removed much of the lions' prey outside the protected areas (TRAFFIC 1998). In addition, there is a spike in attacks in 1999 that the interviewees largely attributed to the El Niño floods of 1997-98, which caused wildlife in many parts of the country to seek higher ground. As the floods receded in 1999, the wild ungulates returned to their normal ranges, leaving the lions with insufficient prey.

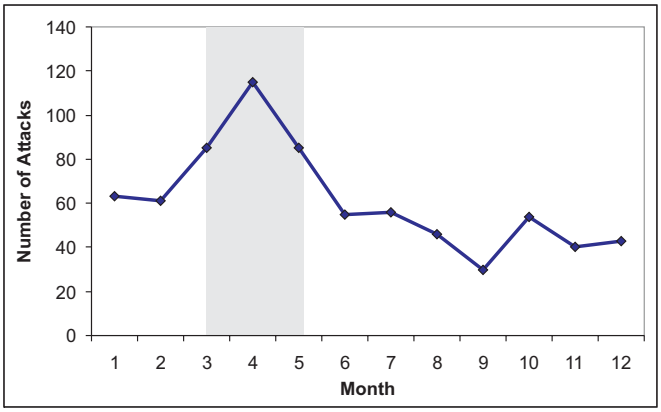

Figure 3: *Number of attacks each month of the year ($\chi^2 = 100.4$, $P < 0.001$). Most attacks occur in March, April, and May.*

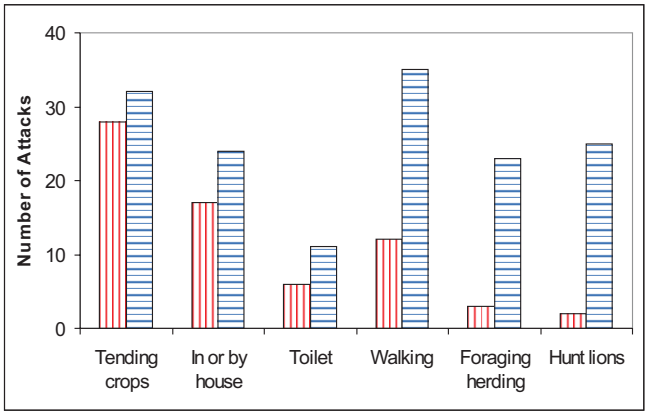

Figure 4: *Major context of attacks for men (blue horizontal lines) and women (red vertical lines). The most common context for both combined is tending crops.*

Attacks on humans are highly seasonal, with most cases occurring in the harvest season of March, April, and May (Figure 3). As indicated by Figure 4, the most common context of lion attack on both men and women (combined) is while tending crops. Within this category, the majority of people are attacked when asleep in a makeshift hut (Figure 5 & 6); lions force their way inside and pull their victims out of these small thatched shelters. People sleep in makeshift huts to protect their crops from nocturnal crop raiding pests such as bushpigs. Several interviewees specifically mentioned that lions entered their villages or fields in pursuit of bushpigs, and several villagers in Rufiji district (which suffered 92 lion attacks since 1990) reported a high tolerance for lions because the lions helped to control the bush pig population.

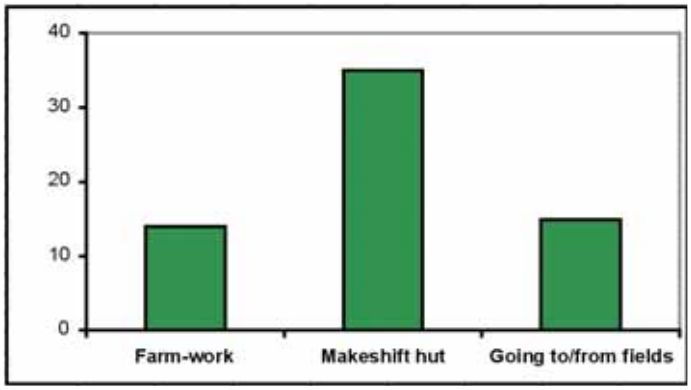

Figure 5: *Context of attacks while tending crops. Sleeping in makeshift huts is the most common.*

Figure 6: *Makeshift huts in Rufiji district.*

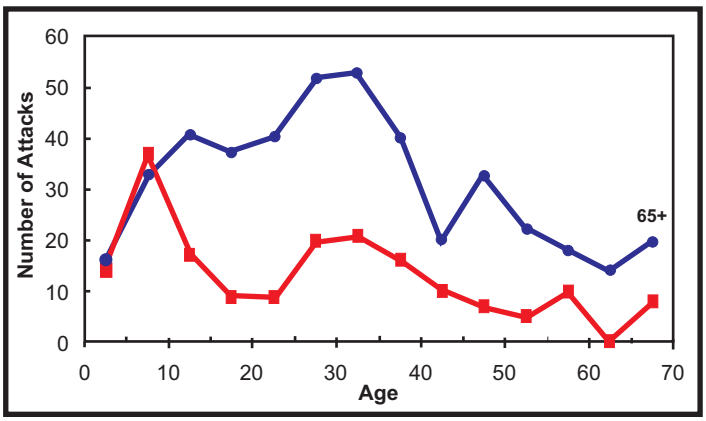

Figure 7: *Number of reported attacks on women (red squares) and men (blue circles) of each age*

Above 10 yrs of age, men are at much greater risk of being attacked than women (Figure 7; also see Treves and Naughton-Treves, 1999). This is because men are more likely to tend cattle or forage for bushmeat, and they are more likely to walk around alone at night (Figure 4). Men are also attacked when trying to retaliate against man-eating lions, often relying solely on nets and spears. Figure 4 shows the context of attacks broken down by the victim's sex. It is evident from this graph that although men are more at risk overall than women, both men and women are almost equally at risk when in agricultural fields or near their homes. In addition, since most rural houses lack indoor plumbing, people are at risk when performing activities as simple as going to the outdoor toilet.

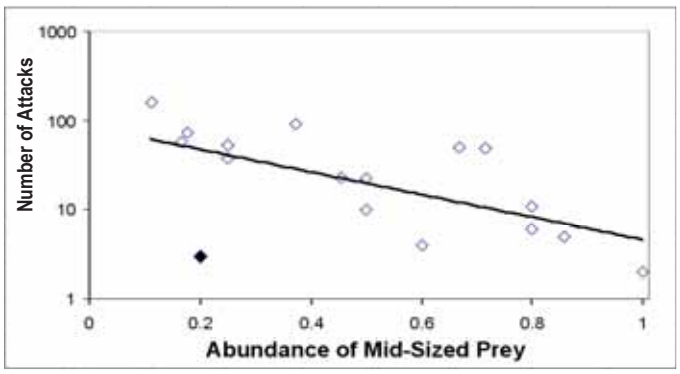

Figure 8: *Number of attacks versus abundance of medium-sized prey, P = 0.0091, n = 17.Solid diamond refers to Kilosa district where villagers were relocated out of problem-animal areas in the 1980s.*

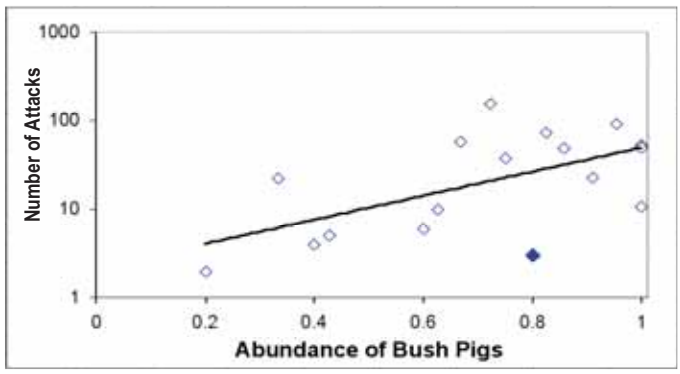

Figure 9: *Number of attacks versus abundance of bush pigs, P = 0.0129, n = 17. Solid diamond refers to Kilosa district where villagers were relocated out of problem-animal areas in the 1980s.*

We could not find any statistical relationship between the number of lion attacks in each district and human population density, cattle density, or percentage of land cover devoted to agriculture. Most problem lions originate from protected areas (Yamazaki and Bwalya 1999, Saberwal *et al.,* 1994), but the worst-affected district in Tanzania (Lindi Rural with 158 cases) does not directly abut a park or reserve. The number of lion attacks in each district was highly correlated with two factors: the abundance of medium-sized prey (as estimated by the proportion of interviewees who reported the presence of kudu, zebra, hartebeest, dikdik or impala) and the abundance of bushpigs. Lion attacks are most common in areas with the lowest abundance of normal prey (Figure 8) and with the largest numbers of bushpigs (Figure 9). A multiple regression analysis reveals that these two factors alone explain nearly half the variance in the number of attacks in each district (Figure 10).

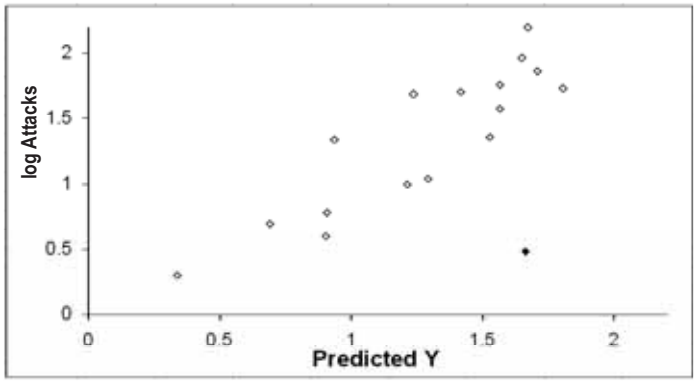

Figure 10: *Predicted number of attacks from multivariate regression model including medium-sized prey and bush pig numbers, adjusted r^2 = 0.45, P = 0.0059, n = 17. Solid diamond refers to Kilosa district where villagers were relocated out of problem-animal areas in the 1980s.*

The number of people killed by any one man-eater is unknown, but even in the worst outbreak, a single lion would not have captured enough people to have survived solely on human prey. The most likely maintenance diet of lions in highly disturbed agricultural areas is the bush pig. Pigs also cause farmers to sleep in their fields, and this seems the most likely situation where lions learn to eat people. Figures 8, 9, and 10 highlight an obvious outlier: Kilosa District (also highlighted in Figure 1), which had fewer lion attacks than expected on the basis of prey scarcity and bushpig abundance. Kilosa District consistently suffered high levels of lion attacks until large numbers of pastoralists were relocated to other areas in 1992. If Kilosa is removed from the multivariate analysis, prey scarcity and bush pig abundance account for over 75% of the variance in the number of lion attacks across districts (adjusted $r^2 = 0.76$, $P<0.0001$, $n=16$).

4. Recommendations & Suggestion for Further Research

In several parts of Tanzania, rural villagers live in almost constant fear of man-eating lions, and man-eating occurs at a comparable level across the border in northern Mozambique. In 1992, the Tanzanian government reduced the number of lion attacks in Kilosa District by relocating people away from the afflicted areas, but Tanzania's population is far higher today, and this option is no longer feasible. It would also be impracticable to try to increase prey populations in agricultural areas. Pig-control strategies in village farmlands, on the other hand, could potentially reduce the lions' attraction to populated areas in the first place.

Even greater numbers of pastoralists suffer livestock losses to lions. Cattle-killing is difficult to quantify, since

herders seldom report losses to the DGOs, but it is a serious problem throughout the species' continental range, and retaliation against problem animals has increased dramatically in the past few years. Kenyan pastoralists poisoned all the lions in Amboseli Reserve in 1990 and speared 27 of 40 lions in Nairobi Park in 2003. Lions are also poisoned by pastoralists in Chad and in several districts of Tanzania.

Our findings provide an overview of the factors that are responsible for lion attacks on humans in Tanzania. In order to better understand the current situation and to design effective mitigation strategies, future research must be focused on the specific factors responsible for attacks at a finer scale. In addition, a better understanding of lion ecology and feeding patterns in high-risk areas such as coastal Tanzania are badly needed. Such research is currently being undertaken in our research group, and it is our hope that through this research we will be able to provide viable prevention and mitigation strategies for direct human-lion conflict in Tanzania.

By attempting to sustain viable populations of African lions, conservationists place rural people at risk of their lives and livelihoods in some of the poorest countries in the world. Prevention and mitigation of this fundamental conflict is feasible, and humanitarian concerns must be one of the primary focuses for lion conservation strategies throughout Africa.

Acknowledgements

We are grateful to the senior management of the Wildlife Division, especially the Director of Wildlife, Mr. Severre, for instigating this study and recognizing the need for ecological and behavioral information on the impact of human-lion conflict on rural Tanzanians. We also thank the team members from the WD who participated as interviewers and field observers. This survey would not have been possible without the enthusiastic cooperation of local people throughout rural Tanzania, ranging from interview respondents, village leaders, District Game Officers, District Executive Directors and District Commissioners. The survey was financed by the Tanzania Wildlife Protection Fund and Conservation Force.

References

Baldus R.D. 2004. *Lion conservation in Tanzania leads to serious human-lion conflicts: with a case study of a man-eating lion killing 35 People*. GTZ Wildlife Programme in Tanzania, Wildlife Division Dar es Salaam: Tanzania Wildlife Discussion Paper No. 41:1-63 p.

Bauer, H. & Van Der Merwe, S. 2004. Inventory of free-ranging lions *Panthera leo* in Africa. *Oryx* 38(1):26-31.

Chardonnet, P. 2002. *Conservation of the African lion: Contribution to a status survey*. International Foundation for the Conservation of Wildlife, France and Conservation Force, USA.

Hemson, G. 2004. The ecology and conservation of lions: Human-wildlife conflict in semi-arid Botswana. Oxford University (Ph.D. Thesis).

Kellert, S.R., Black, M., Rush, C.R. & Bath, A.J. 1996. Human culture and large carnivore conservation in North America. *Conservation Biology* 10(4):977-990.

Kerbis-Peterhans, J. C. & Gnoske, T. P. 2001. The science of 'man-eating' among lions *Panthera leo* with a reconstruction of the natural history of the 'Man-Eaters of Tsavo'. *Journal of East African Natural History 90*:1-40.

Löe, J. & Röskaft, E. 2004. Large carnivores and human safety: a review. *Ambio* 33(6):283-288.

Nicholson, B. 2001. The last of old Africa. Safari Press.

Ogada M.O., Woodroffe R., Oguge N.O. & Frank, L.G. 2003. Limiting depredation by African carnivores: the role of livestock husbandry. *Conservation Biology* 17(6):1521-1530.

Packer C., D. Ikanda, B. Kissui & H. Kushnir. 2005. Lion attacks on humans in Tanzania. *Nature* 436(7053):927-928.

Patterson B.D., Kasiki S.M., Selempo E. & Kays, R.W. 2004. Livestock predation by lions (*Panthera leo*) and other carnivores on ranches neighboring Tsavo National Parks, Kenya. *Biological Conservation* 119(4):507-516.

Quigley H. & S. Herrero. 2005. Characterization and prevention of attacks on humans. In R. Woodroffe, S. Thirgood, and A. Rabinowitz, eds. *People and Wildlife: Conflict or Coexistence?* Pp Pages 27-48 Cambridge University Press, Cambridge, UK.

Rushby, G.C. 1989. *No more the tusker*. Trophy Room Books.

Saberwal, V.K, Gibbs, J.P., Chellam, R. & Johnsingh, A.J.T. 1993. Lion-human conflict in the Gir Forest, India. *Conservation Biology* 8(2): 501-507.

Schaller, G.B. 1972. *The Serengeti Lion.* Chicago Press.

TRAFFIC 1998. *Food For Thought: The Utilization of Wild Meat in Eastern and Southern Africa*, IUCN/WWF

Treves A., Naughton-Treves, L., Harper, E. K., Mladenoff, D. J., Rose, R. A., Sickley, T. A. & Wydeven, A. P. 2004. Predicting human-carnivore conflict: a spatial model derived from 25 years of data on wolf predation on livestock. *Conservation Biology* 18(1):114-125.

Treves, A. & Naughton-Treves, L. 1999. Risk and opportunity for humans coexisting with large carnivores. *Journal of Human Evolution* 36(3):275-282.

Treves A. & Karanth, K. U. 2003. Human-carnivore conflict and perspectives on carnivore management worldwide. *Conservation*

Biology 17(6):1491-1499.
Wilson, C.J. 2004. Could we live with reintroduced large carnivores in the UK? *Mammal Rev.* 34(3):211-232.
Woodroffe R., Thirgood, S., & Rabinowitz, A. 2005. The impact of human-wildlife conflict on natural systems. In R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. People and Wildlife: Conflict or Coexistence? pp. 1-12. Cambridge University Press, Cambridge, UK.
Woodroffe R. & Frank, L. G. 2005. Lethal control of African Lions (*Panthera leo*): local and regional population impacts. *Animal Conservation* 8(1):91-98.
Yamazaki K. and Bwalya, T. 1999. Fatal lion attacks on local people in the Luangwa Valley, Eastern Zambia. *South African Journal of Wildlife Research* 29(1):19-21

Aspects of Elephant Crop Raiding Behaviour in The Kakum Conservation Area, Ghana

Danquah[1], E., Oppong[1], S. K. and Sam[2], M. K. 2006

Abstract

An investigation into the factors that influence crop raiding by forest elephants (*Loxodonta cyclotis*) around the Kakum Conservation Area (KCA) was carried out during July 2001 to June 2002. The frequency and distribution of crop raiding was assessed by analysing crop damage report forms on all incursions by elephants into randomly selected sites around the KCA. The incidence of raids was then compared with environmental/natural and human variables for each month. Data on variables were collected through field measurements.

There were 117 elephant crop damage incidents involving 58 farms belonging to 43 farmers. June was the peak month (2.4 raids /km^2) of crop raiding activities whilst October experienced the least (0.1 raids /km^2). Natural factors like fruit availability within KCA greatly reduced the risk of raids in nearby farms. However, at the farm level, the maturation period of maize presented the strongest risk. Also, environmental factors like rainfall, indirectly affected crop raids by promoting the growth and maturation of maize around KCA.

Since the maturation of certain crops such as maize creates a favourable condition for elephant crop-raids, it is pertinent the farmers minimize subsistence farming close to the nature reserve. A buffer area of low-risk mono-crops or tree plantations may be ideal. Farmers should also be encouraged and supported to protect their crops especially during peak crop-raiding seasons.

1. Introduction

Human-elephant conflict is a serious problem in many conservation areas in West Africa (AfESG, 1999). As human populations increase and elephant populations become more concentrated in isolated protected areas and remnant forest habitats, these conflicts are almost certain to escalate (Barnes *et al*., 1995) making this problem one of Africa's most difficult conservation challenges (Hoare and Du Toit, 1999).

Similarly, crop damage by elephants around KCA is one of the multi-faceted management problems that confront the authorities of the Wildlife Division of Ghana (Barnes *et al*., 2003, Dickinson, 1998). Barnes *et al*. (2003) investigated some of the causes of crop raiding in this conservation area. However, certain aspects of elephant crop-raiding behaviour remain unanswered.

This paper addresses how fruit abundance and diversity within the forest influences crop-raiding incidents. The effect of maturation periods of major farm crops on crop-raiding was also studied. Further, investigations were also conducted on how rainfall affects the variables enumerated including crop-raiding. Finally, some recommendations to mitigate crop damage by elephants are made.

[1]*Emmanuel Danquah and Samuel Kingsley Oppong, Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science & Technology, Kumasi, Ghana. ekadanquah@yahoo.com, kobbyoppong@yahoo.com*
[2]*Sam Moses Kofi, Resource Management Support Centre, Forestry Commission, P. O. Box 1457, Kumasi, Ghana Osmo288@yahoo.co.uk*

2. Materials and methods

2.1 Study area

The Kakum Conservation Area is located in southern Ghana and composed of the Kakum National Park and its adjacent Assin Attandanso Reserve (Figure 1). Both forests form a 366 km^2 block in the moist evergreen zone (Hall and Swaine, 1976).

The rainfall pattern is bimodal; two rainfall seasons separated by a short dry spell in August. The major season is between March and July with a peak in June and the minor season between September and November with a peak in October. There is also a main dry season from December to February or March when many watercourses dry up.

Both subsistence and commercial agriculture are predominant in the communities surrounding KCA. The major food crops cultivated are maize, cassava, plantain, cocoyam, yam, rice and vegetables. The main cash crops include cocoa, oil palm, and citrus. The farming system is rain-fed mixed cropping based on shifting cultivation (Ghana Wildlife Division, 1996).

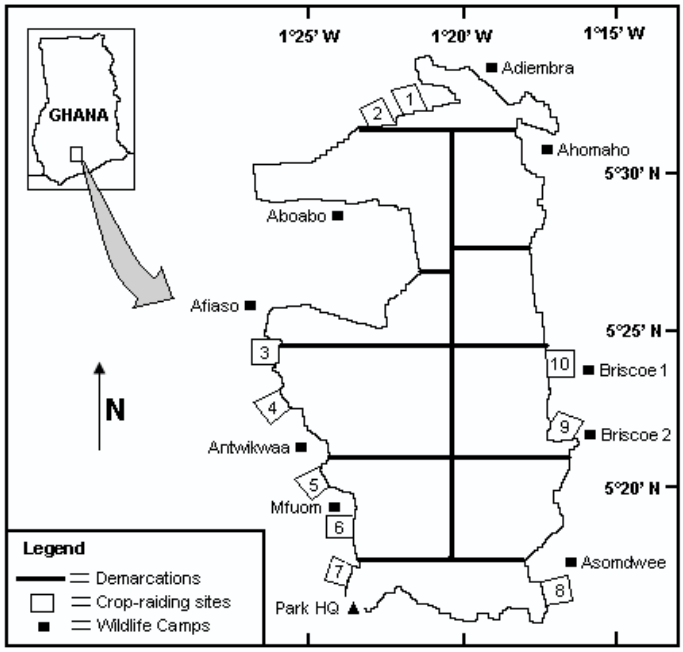

Figure 1: *The Kakum Conservation Area showing crop-raiding study sites. The map shows the location of KCA.*

2.2 Methods

A detailed study of elephant crop-raiding in KCA was conducted by randomly selecting and demarcating ten study sites, each 1km x 1km on the periphery of the study area (Figure 1). Each site, made up of crop fields, was assigned to a selected and trained farmer from the fringing village to monitor and record all incidences of elephant crop-raids within the site for two-years, 2001 to 2002. Questionnaires for each raided farm are completed when complaints are received from farmers or whilst on patrols within the conservation area. The questionnaire was designed based on the protocols of Dickinson (1998).

KCA was classified into 10 sections; Abrafo (Park HQ), Mfuom, Antwikwaa, Afiaso, Aboabo, Adiembra, Ahomaho, Briscoe I, Briscoe II and Asomdwee, based on existing wildlife anti poaching patrol zones (Figure 1). Four sections; Abrafo, Antwikwaa, Briscoe II and Ahomaho were selected using random numbers and within each, a non-linear strip transect (approximate length 3.4km and width 10m) for monitoring fruit availability and diversity was constructed. Strip transects were constructed by linking existing elephant trails with patrol trails to minimize excessive vegetation damage to the forest when cutting new transects. Trails for a particular transect were selected based on the tree species diversity, which was estimated using the Shannon Weiner's Index (Krebs, 1998).

Trees (defined as > 10 cm in diameter at breast height (dbh)) whose fruits are important elephant food sources (Short, 1981; Theuerkauf *et al.*, 2000) were marked along and within 5m of each side of strip transects. Fruit availability of marked species was monitored every two weeks by counting and recording the number of fresh fallen fruits (Chapman *et al.*, 1994). Fruit availability was expressed as number of fruits per km^2. Fruit diversity was assessed as the number of fruit species available at any particular sampling time.

Out of 280 farmers in the study area, 100 individuals were sampled (ten farmers per monitoring) randomly and the maturation period (months) of maize and cassava in their farms were compiled. Each farmer was interviewed alone to avoid any influence from the others.

Monthly averages of rainfall data recorded from seven rain gauges established at Abrafo, Asomdwee, Ahomaho, Antwikwaa, Briscoe I and Briscoe II were computed for the study period.

2.3 Data analysis

Regression analyses were conducted to explore the relationships that exist between elephant crop-raiding incidence and variables such as fruit availability and diversity, maize and cassava maturation and rainfall in each month using StatView software (SAS, 1999). The effect of lagged rainfall on crop raiding, fruit availability, fruit diversity and the maturation period of maize and cassava were also assessed. A correlation of the rainfall values of a given month and that of the preceding month up to the seventh with all other variables were established. The number of crop-raids is count data and were therefore normalised before being analysed statistically.

3. Results

3.1 Crop-raiding

Elephant crop raiding incidences varied (mean=10, SE=2) within the year. The major wet season (March-July) had the highest crop raids with a peak (24 raids/km^2) in June whilst the minor wet season (September-November) showed a decline in raids with the least in October (1 raid/km^2; see Figure 2). There were 117 elephant crop damage incidents involving 58 farms belonging to 43 farmers.

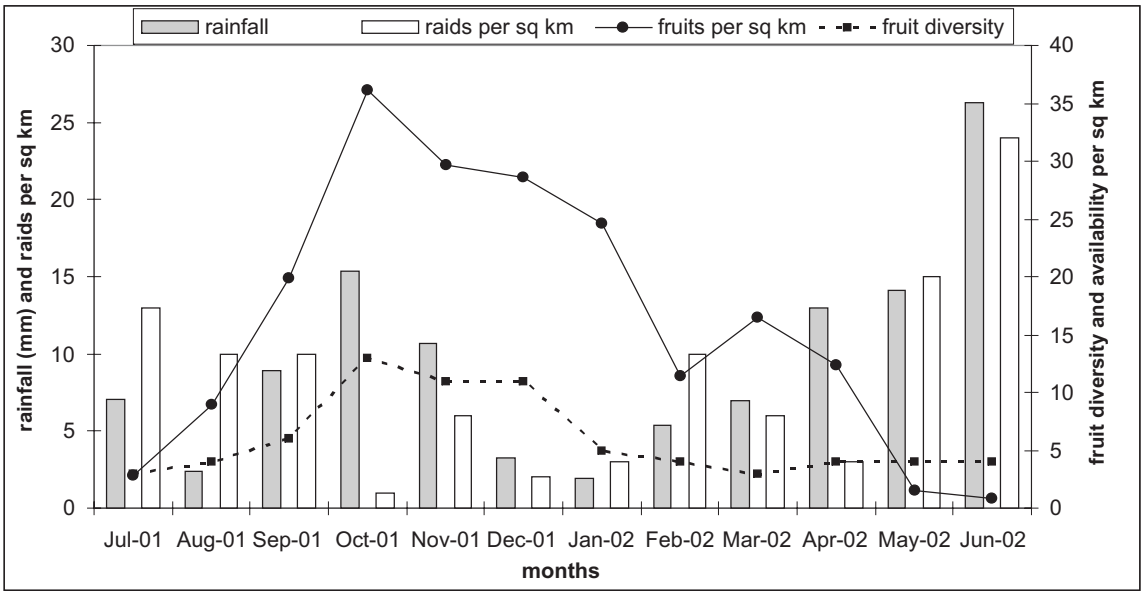

Figure 2: *Monthly rainfall trends in relation to crop-raiding, fruit diversity and availability in KCA*

3.2 Fruit availability and diversity

Fruit availability had a significant correlation ($r=0.775$, $P<0.05$) with fruit diversity. The minor wet season (September-November) to early dry season (December-January) had more diverse fruits with greater fruit availability. However, both variables especially fruit availability were least in June during the major wet season (Figure 2). Crop-raiding showed a highly significant inverse correlation ($r= -0.752$, $P<0.05$) with fruit availability (Figure 3).

3.3 Maturation periods of maize and cassava in farms

Most (93%) maize farms around KCA matured towards the end of the major wet season and peaked in June. Crop raiding correlated highly ($r=0.784$, $P<0.05$) with the maturation of maize farms whilst the maturation of cassava coincided ($r=0.738$, $P<0.05$) with high fruit availability in the major wet and main dry seasons.

3.4 Rainfall

Number of crop-raids declined one month after the start of the minor and major rainy seasons (September and March) and increased quickly two months later (Figure 3).

Crop-raids correlated highly (r=0.782, P<0.05) with rainfall in the previous two months whilst maize maturation had a high correlation (r=0.749, P<0.05) with rainfall in the previous month. Cassava maturation correlated (r=0.720, P<0.05) significantly with rainfall in the last five months. Fruit availability correlated with rainfall in the last four (r=0.857, P<0.05) and five (r=0.867, P<0.05) months.

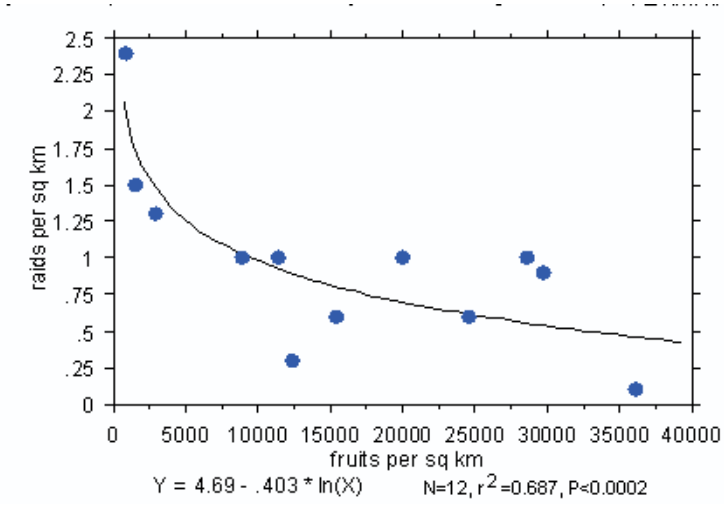

Figure 3: *Influence of fruit availability on elephant crop raids*

4. Discussion

The most serious crop raiding occurred in the major wet season (June) whilst the least raids occurred in the minor wet season (October). Barnes *et al*. (2003) observed a similar pattern. In the major wet season, fruit availability is low resulting in increased incidence of crop-raids. Raiding declined when fruits became more available and exacerbated with the reverse.

Figure 3 suggests that there is a threshold fruit density or availability (approximately 15,000 fruits per km^2) that influences elephant crop-raiding behavior. Beyond the threshold that is obtained from the minor wet season to main dry season, the number of raids decreases with increasing fruit availability. During this period, crop-raids are minimal and elephants are less attracted to outside sources of food due to abundance of fruits within the nature reserve.

The few raids that occur beyond the threshold fruit density may be the activities of habitual raiders that crave for food crops and venture outside the reserve to forage on crops even when there is abundant fruit supply. The identification and monitoring of such animals is vital because their activities may encourage other elephant groups to raid crops especially during peak raiding seasons. The diversity of fruits did not greatly influence crop raiding.

There is an initial decline in raiding activities just a month after the onset of rains which quickly rise after two months. The initial drop in raids is not readily understood, but may be due to the sudden burst of human activity around the reserve during land preparation and planting that deters the elephants from entering farmlands.

The later rise in crop raiding may be due to mature maize in the fields as the rainy season progresses. Hence rainfall may indirectly be influencing crop-raids by directly affecting the growth and maturation of maize crops. This observation was more pronounced during the major wet season than the minor season. Rainfall also influences fruiting several months into the dry season, and raiding is inversely related to fruit availability. Hence, rainfall has an interesting effect on crop raiding; it encourages raiding in the major crop-growing period while the reverse occur in the dry season due to the availability of fruits.
Maturation of cassava farms on the other hand coincided with high fruit availability in the dry season, hence were less likely to be raided. The upsurge in raids in the major crop-growing season may be a function of both the favorable environment created outside the KCA due to maturation of maize fields and unfavorable conditions resulting from low fruit availability.

The underlying factor in the crop-raiding problem is the intensification of agriculture around KCA (Boafo *et al*., 2004; Barnes *et al.*, 2003). Since it is the maturation of certain crops that creates a favorable condition for elephants to crop-raid, the best option is to work with the farmers to reduce subsistence farming close to the nature reserve. A buffer area of low-risk mono-crops or tree plantations may be ideal. Farmers should also be encouraged and supported to protect their crops from the elephants especially during peak crop-raiding seasons.

Acknowledgements

Conservation International, the Centre for Applied Biodiversity Science, the United States Fish & Wildlife Service (African Elephant Conservation Fund), Smart Family Foundation and the Betlach Family Foundation financed this study. We also wish to acknowledge the contributions of Dr. Richard Barnes and Dr. Brent Bailey for their untiring support of the Elephant Biology and Management Project (EBMP) and the Ghana Wildlife Division for staff and facilities. We are indebted to the EBMP team for the use of part of the crop raiding data for this paper.

References

AfESG 1999. *Strategy for the conservation of West African elephants*. IUCN/SSC African Elephant Specialist Group, Ouagadougou.

Barnes, R. F. W., Boafo, Y., Nandjui, A., Dubuire, U. F., Hema, E. M., Danquah, E. & Manford, M. 2003. *An overview of crop raiding by elephants around the Kakum Conservation Area.* Elephant Biology and Management Project, Africa Program, Conservation International. Washington, DC 20037, USA

Barnes, R. F. W., Azika, S. & Asamoah-Boateng, B. 1995. Timber, cocoa and crop raiding elephants. A preliminary study from southern Ghana. *Pachyderm* 19: 33 -38.

Chapman, C. A., Wrangham, R. & Chapman, L. J. 1994. Indices of Habitat Wide Fruit Abundance in Tropical Forests. *Biotropica* 26(2): 160 - 177.

Dickinson, B. 1998. *A summary of the elephant crop-raiding situation around Kakum National Park*. Unpublished report.

Ghana Wildlife Division 1996. *Kakum National Park and Assin Attandanso Resource Reserve-the management plan*. Wildlife Department, Accra.

Hall, J. B. & Swaine, M. D. 1976. *Distribution and ecology of vascular plants in a tropical rainforest. Forest vegetation in Ghana*. The Hague, Netherlands, Junk Publishers.

Hoare, R. E. & Du Toit, J. T. 1999. Coexistence between people and elephants in African savannas. *Conservation Biology* 13(3): 633-639.

Krebs, C. J. 1998. *Ecological Methodology. 2nd edition.* An imprint of Addison Wesley Longman, Inc. 2725 Sand Hill Road. Menlo Park, CA 94025.

Osbon, F. V. & Parker, G. E. 2002. Community-based methods to reduce crop loss to elephants: experiments in the communal lands of Zimbabwe. *Pachyderm* 33:32-38.

SAS Institute 1999. *Statview for windows version 5.1*, Cary NC USA

Short, J. 1981. Diet and feeding behaviour of the forest elephant. *Mammalia* 45:177 - 186.

Theuerkauf, J., Waitkuwait, W. E., Guiro, Y., Ellenberg, H. & Porembski, S. 2000. Diet of forest elephants and their role in seed dispersal in the Bossematie Forest Reserve, Ivory Coast. *Mammalia* 64(4): 447 460.

Human Wildlife Conflict in Namibia: Experiences from a Portfolio of Practical Solutions:

Jones[1], B. T. B. and Elliott[2], W. J. 2006

Taken from WWF study "Human Wildlife Conflict in Namibia" by Brian T.B. Jones with economic analysis by Jonathan I. Barnes.

Summary

This article discusses the effectiveness and relative cost of a broad portfolio of practical solutions to Human Wildlife Conflict that have been employed in Namibia.

1. Introduction

Unlike many countries, Namibia has increasing herbivorous wildlife populations (including such species as elephant and black rhino), and increasing or stable populations of large predators (including lions). Conservationists agree that Namibia's Community-based Natural Resource Management (CBNRM) Programme has played a major role in these increases. Under CBNRM, communities form local natural resource management institutions called conservancies, and are given rights by the government to manage their land and the wildlife living on it. As a result of the income derived from sustainable use of wildlife and ecotourism in conservancies, rural communities have generally positive attitudes towards wildlife. However, larger wildlife populations are giving rise to increased Human Wildlife Conflict (HWC), with 3,194 problem incidents by different species reported country-wide in conservancies during 2005. These incidents involve the destruction of crops and artificial water points by herbivores such as elephants, the killing of livestock by predators such as hyena, jackal and leopard, and sometimes, human injury and death. If community commitment to conservation is to be maintained, it is imperative that communities are able to generate more benefits from maintaining wildlife on their land than they suffer in losses, and the successful prevention and mitigation of HWC is central to achieving this aim.

2. Solutions

This article outlines a series of potential solutions to Human Wildlife Conflict (HWC) in Namibia, and assesses their implications, effectiveness, and cost in a comparative analysis that provides an illustrative framework for addressing this critical and increasing problem.

2.1 Prevention measures

2.1.1 Artificial barriers

Electric fences

Electric fencing can provide a useful barrier to elephants around crops (O'Connell, 1995, Hart and O'Connell, undated). However, experience in Namibia indicates that while electric fences can successfully deter elephants from entering a specific area, they fail mainly for institutional reasons. In Kunene Region for example, the NGO IRDNC (Integrated Rural Development and Nature Conservation) assisted conservancies to erect nine electric fences, none of which are currently functional as the conservancy did not take ownership of the fences, and did not therefore conduct the essential maintenance required to keep the fences operational (Esterhuizen, Pers. com.). Stander (Pers. com.) suggests that electric fencing rarely works even in game reserves because of a lack of capacity to maintain them, but could work in some private game parks, or to protect a house or garden. Owen-Smith (Pers. com.) suggested that such small fences could be powered by a solar panel that could provide electricity for the house, giving the inhabitants an even stronger incentive to maintain the fence and equipment.

[1] *Brian T.B. Jones, Independent environment and development consultant, bjones@mweb.com.na, Tel. and Fax: +264 61 237101*
[2] *Wendy J. Elliot, WWF Global Species Programme, WElliott@wwfspecies.org, Tel. +39 06 844 97 355.*

O'Connell (1995) reported that elephants usually found their way around the fences if they were not closed or narrowed at the ends as much as possible. For electric fences in Kunene Region the cost to cover an area of 5km² was approximately N$ 15.000 (≈2.150 US $) including double wire, alarm, energiser, one solar panel, battery, regulator, insulators, protection box and tester (Esterhuizen, Pers. com.).

Protection of water points

Experience from the #Khoadi //hoas Conservancy and from the work of IRDNC in Kunene Region suggests that well-constructed walls using appropriate specifications can effectively protect water installations from elephant damage (Guibeb, Pers. com., Esterhuizen Pers. com.). Walls need to be at least two large rocks in width, and 1.8m high and a sufficient distance from water tanks and pumps to prevent elephants reaching the installations from outside the wall.

The most successful model used in #Khoadi //hoas is where the wall does not completely surround the main water tank, but allows elephants access to drink from the outside (see Figure 1). At the same time, there needs to be a separate tank for domestic water provision that is protected completely within the wall along with the water pump. Leaving a small gap in the wall for human access can work if the wall is sufficiently strong, but if the wall is weak elephants will enlarge the gap and gain entry.

Elephant protection walls are probably one of the cheapest and most effective ways to protect any type of infrastructure in the North West due to the abundance of stone in most of the areas (Esterhuizen, Pers. com.) The cost for protection walls varied greatly as it depends on the availability of stone close to the infrastructure, transport cost of stone, cement and labour. The cost varied between N$ 5,000 to N$ 10,000 (≈ 715 - 1,430 US $) per site.

Chilli pepper fences

In Caprivi fences lined with a mixture of grease and chilli peppers are still being experimented with. Initial indications from Kasika Conservancy indicate that they can be effective[1].

Figure 1. *Successful protection wall against elephant at a water point in #Khoadi //hoas Conservancy, Kunene Region, Namibia. Photo: Olga Jones.*

Chilli "bombs"

Ground chilli is mixed with elephant dung and compacted into a brick mould and dried. The bricks are burnt along the edge of a field and the smoke acts as a deterrent to elephants. Initial indications from Caprivi are that this method can be effective in keeping elephants away from fields. More time is required to evaluate the method and to see whether elephants become used to the smoke.

2.1.2 Alternative water points for elephants

The provision of alternative water points for elephants away from the main source of water for livestock and domestic use has been tried in #Khoadi //hoas and by IRDNC in a number of other Kunene conservancies. In both cases there have been problems with the operation of such water points, again relating to lack of feeling of ownership by the conservancy and subsequent lack of maintenance. In addition, alternative water points fail if conservancies don't have enough diesel to pump water at both points. Solar pumps may be a solution to this problem. In addition, communities should agree not to settle at the water point or allow their livestock to drink there[1] (Guibeb, Pers. com., Esterhuizen, Pers. com.).

[1] *Such fences have proven effective in other countries such as Zimbabwe and Mozambique.*

The cost to build alternative elephant water points in conservancies assisted by the NGO IRDNC varied between N$ 20.000 to N$ 25.000, (≈2870 - 3580 US $) including piping from the source ranging between one to five km (Esterhuizen, Pers. com.).

2.1.3 Guarding fields

In the past, attempts have been made by villagers in Caprivi, conservancy game guards and Ministry of Environment and Tourism staff to guard crop fields at night against elephants. However, this method is only really useful if it is possible to predict where elephants will aim for.

2.1.4 Elephant trip alarms

Trip alarms, consisting of polyethylene string attached to a car siren, work well if the area covered was not too large or when deployed across a well-known route taken by elephants to reach certain fields (O'Connell, 1995). Problems included the potential for elephants to become habituated to the sound of the siren and potential disturbance of homesteads or tourism operations from the sound of the sirens. O'Connell found that the system was easy to erect and maintain and the low cost meant that farmers could afford it, particularly if a few farmers joined together. According to O'Connell-Rodwell *et al.* (2000) trip-alarms were a successful short-term measure for protecting individual farms, but did not have an impact on the overall number of conflicts.
Elephant trip alarms cost around N$800 (≈ 115 US $) at 1995 prices (O'Connell, 1995).

2.1.5 Improved livestock husbandry

Improved livestock management practices are crucial for reducing HWC involving predators. The use of a person and/or dogs to walk with the livestock can have a significant positive impact (Stander, 2005). However, herding practices are in decline, particularly as young boys who would normally be used as herders now go to school. The #Khoadi //hoas conservancy actively encourages its members to revert to herding livestock as much as possible. Anatolian Shepherd dogs have been shown to be particularly effective in guarding against cheetah (Stander, 2005), but have relatively high maintenance costs compared to village dogs which can also be effective.
Kraaling the cattle at night in strong enclosures is another important method of reducing predation and can be encouraged and financially supported as part of local HWC Management plans in conservancies.
Stander (2005) suggests that active management by controlling breeding times and grazing areas can lead to synchronised births, which aid the protection of cows and calves against carnivores.

2.1.6 Re-location

With regard to elephants, re-location is technically possible, but there are very high costs associated with moving large numbers of elephants, a lack of areas where elephants could be moved to, and the possibility that elephants would return to the original sites (Cumming and Jones, 2005). This method would also not resolve HWC in an area such as Caprivi where the elephants are not part of a stable resident population.
Stander (2005) suggests that re-location can be very effective for lions that can be described as "occasional raiders" rather than "problem animals" that habitually prey on livestock. Of 35 occasional raiders that were relocated, only two returned to the conflict area, while of 19 lions categorised as "problem animals" all returned to the conflict area and/or continued killing livestock.

2.1.7 Local level land use planning

Conservancies carry out local level land-use planning which minimizes HWC by ensuring that traditional and other authorities take HWC into account when allocating land for residential and agricultural purposes. In one example, Maynui conservancy, under strong traditional leadership, implemented a zoning plan leading to the relocation of people away from floodplains visited by elephants, and recorded a dramatic reduction in crop damage compared to their neighbouring Kwandu conservancy (see Figure 2) (NACSO, 2006).

[1] *It could be difficult to get such an agreement in a semi-arid to arid area such as Kunene Region where mobility is important for successful livestock farming and drought is a normal occurrence. Again theft of the solar panels and the pump could be a potential problem.*

2.2 Reactive measures

2.2.1 Traditional

In Caprivi, elephants have become habituated to the traditional deterrent methods of beating drums, using fire or shooting in the air. O'Connell (1995) found that in some cases elephants had become aggressive and charged the farmers trying to scare them away.

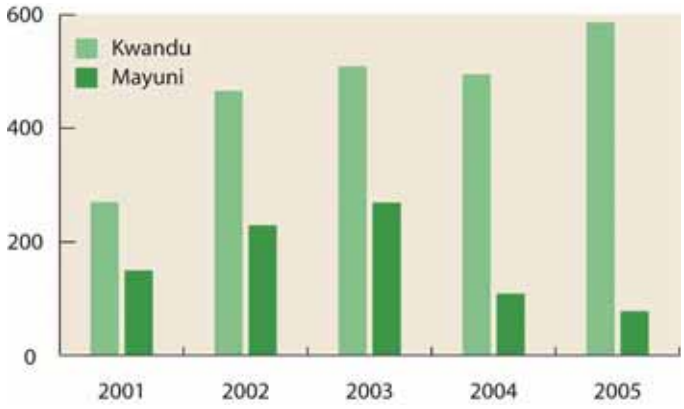

Figure 2. *Changing trends in the number of incidents of crop damage (Y axis) by wildlife in two neighbouring conservancies in east Caprivi between 2001 and 2005. Source: NACSO 2006*

2.2.2 Lethal Removal

Lethal removal may often be the only way to deal with predators, elephants, and crocodiles that repeatedly cause problems and/or kill humans. In some cases it is possible to offer identified problem animals to trophy hunters so that the local community can gain some income from the animal killed. Esterhuizen (Pers. com.) suggests that a small number of lions could be put on trophy quotas in problem "hotspots" where lions frequently kill livestock. However, for lethal removal to work effectively, the authority for identifying and removing problem animals must be decentralised to the local level (ie. the conservancy.) This is crucial to enable a quick reaction in the field and to ensure the right animals are removed.

2.3 Mitigation measures

2.3.1 CBNRM benefits as mitigation

Conservancies have provided the main platform for experiments in the prevention and mitigation of HWC. However, in addition to this, economic analysis demonstrates that the benefits provided to communities by CBNRM generate more income through wildlife use and wildlife-based tourism than the losses communities suffer from HWC. As a result, CBNRM in itself is able to internalise and off-set HWC costs (Jones *et al*., 2006), and could be the most sustainable HWC mitigation strategy available (Distefano, undated).
However these benefits are given to all members in the conservancy and do not differentiate between households that suffer more costs of living with wildlife than others. Neither do social projects specifically target people who suffer the most costs.

There are several solutions to this problem. In some instances conservancies have the potential to considerably increase their incomes and to make larger amounts available for direct household benefits. Currently one of the main constraints to fulfilling this potential is a lack of capacity to manage more business partnerships and enterprises.
There are also ways to specifically increase the income raised by problem causing species for communities. Stander (Pers. com.) suggests there is good potential in developing predator tracking safaris linked to tourism lodges in conservancies. Part of the income from these safaris could be put into a special conservancy fund that can be used to offset livestock losses. Furthermore, conservancies could, in their benefit distribution plans, specifically target households that suffer high HWC costs.

2.3.2 Insurance/compensation

The Namibian NGO IRDNC has worked with conservancies in Caprivi and Kunene Region to develop the Human Animal Conflict Self Insurance Scheme (HACSIS). Farmers are able to submit claims to partially off-set stock losses to predators. Claims are only paid out for losses under the following conditions:

- No payments will be made for livestock killed in a protected area or conservancy exclusive wildlife zone
- The cause of death must be verified by a community game guard (e.g. by checking spoor)
- No payments will be made if the livestock was killed at night without being in a secure kraal or other enclosure
- Conservancy staff and traditional leaders will inspect stock enclosures of members and advise where

strengthening is required. No claim will be valid if recommended improvements are not carried out.

- Claims will not be accepted if members were warned that predators were in the area and they took no action to bring the livestock to safety

During the pilot phase payments were made from donor funding. For the second phase it was agreed that conservancies would cover 50% of the costs themselves, but payments per year would be capped at N$10,000 (≈1,430 US $). The aim is that eventually conservancies would fully fund the scheme themselves. During the pilot phase in Caprivi, 20 claims were paid out in 2003 totalling N$22,600 (≈3,240 US $). In 2007 Kwandu Conservancy in Caprivi will pilot the use of the scheme for addressing crop damage.
There is some indication that the scheme could become a drain on conservancy finances if total annual payments are not capped, or if conservancies are not able to increase their incomes (Roman, Pers. com., Tjiho, Pers. com.). Some conservancies are considering establishing livestock herds that can be specifically used to replace animals lost to predators instead of making payments.

3. Monitoring and evaluation

Information is required by managers at the macro, meso, and micro levels to inform land-use and development planning, assist in developing appropriate HWC management strategies and in order to adapt strategies and actions over time as data indicates what works and why.

The variation in the characteristics of HWC across Namibia complicates the use of one standardised monitoring system (Stander, 2005), however there is clearly a need for some consistency in approach. Stander found "alarming discrepancies" between the Ministry of Environment and Tourism data base and the Event Book System (which is operated by conservancies) where for some species there were hundreds of records in the one system, but none in the other. He suggests the Event Book System is the most reliable and also notes that the data being produced by the HACSIS scheme (see above) in some conservancies is similar or better as it is able to provide a spatial perception of the impact on the community, identifying hot spots.

Different types of information are required by managers at different levels. There is a need to identify these needs and develop data bases that are appropriate and accessible at each level. For example at conservancy level, data should be gathered that assists the conservancy and its support agencies in developing its local land-use plan and HWC Management Plan and implementing it according to local priorities. At the other end of the scale, MET at HQ level, requires an overview of HWC in the country as a whole, the number of incidents, costs of damage, species involved etc.

4. Conclusions

Not all solutions are applicable in all circumstances, or to all species, and it is important that they are not used in isolation, but as part of a strategically designed package that reflects local conditions, needs and problems. At a conservancy level, local HWC Management Plans, where management strategies and actions are identified involving all relevant stakeholders, can provide this package.

However without appropriate institutional frameworks, the frequency and geographical spread of conflicts is set to increase. Attention needs to be given to the provision of supportive international and national policies, and efficient national and regional decision-making frameworks, particularly in land-use planning, that ensures current and potential HWC is taken into account.

References

Cumming, D. & Jones, B. 2005. *Elephants in southern Africa: Management issues and options*. WWF - SARPO Occasional Paper Number 11. WWF Southern Africa Regional Programme Office. Harare.

Distefano, E. Undated. *Human-Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices*. FAO. Rome.

Hart, L. A. & Caitlin E. O'Connell Undated. *Human Conflict with African and Asian Elephants and Associated Conservation Dilemmas*. University of California, Davis.

Jones, B.T.B. & Barnes, J.I. 2006. *Human Wildlife Conflict in Namibia*. WWF Global Species Programme and WWF Macroeconomics Programme Office.

NACSO 2006 (in prep). *Namibia's communal conservancies: A review of progress and challenges*. Namibian Association of CBNRM Support Organisations. Windhoek.

O'Connell. C. 1995. *Final Technical Report: East/West Caprivi Natural Resource Monitoring Project: Elephant/human conflicts*. Ministry of Environment and Tourism/USAID/WWF. Windhoek.

O'Connell-Rodwell, C.E., Rodwell, T., Rice, M. & Hart, L.A. 2000. Living with the modern conservation paradigm: can agricultural communities co-exist with elephants? A five year case study in East Caprivi, *Namibia. Biological Conservation* 93: 381-391.

Stander, P. 2005. *Situation Analysis of Human Wildlife Conflict in Namibia*. Ministry of Environment and Tourism Integrated Community-based Ecosystem Management (ICEMA) Project. Windhoek.

The Eskom-Endangered Wildlife Trust Strategic Partnership in South Africa: A Brief Summary

Rooyen[1], C. van and Smallie[2], J. 2006

Abstract

The Eskom Endangered Wildlife Trust Strategic Partnership was launched in 1996 in response to the problems associated with wildlife interaction with electrical infrastructure in South Africa. Issues addressed by the partnership include electrocution of birds and other wildlife on the infrastructure, collision of birds with overhead power lines, and the impact of birds and other wildlife on the quality of electrical supply by causing electrical faults or short circuits. This innovative partnership is addressing these issues through the implementation of a national wildlife incident register, a research programme, capacity building programme, input into design of new lines, reporting and advocacy. In the current climate of increased plans for electrification of the African continent, this partnership approach is potentially relevant to other African countries.

1. Introduction

The strategic partnership between Eskom, South Africa's national electricity supplier, and the Endangered Wildlife Trust (EWT), a non-profit organization dedicated to the conservation of biodiversity in southern Africa, commenced in 1996. Today this partnership, designed and implemented by Africans, serves as a model to the electrical utility industry worldwide on how to address the problem of wildlife mortality caused by electricity networks through non-confrontational, co-operative management.

Prior to the establishment of the Eskom-EWT Strategic Partnership, the South African experience with regard to wildlife interactions with electricity structures was characterised by an unsystematic approach, resulting in fragmented documentation of problems, inconsistent data capturing, and very little dedicated research. Limited success was achieved with mitigation efforts due to vast distances, poor co-ordination, limited biological expertise and the use of inappropriate products. In view of the complexity, scope and persistence of the problem of interactions between wildlife and power lines, Eskom and the EWT entered into a strategic partnership in 1996 to address these problems in a systematic manner on a national basis.

[1] *Chris van Rooyen*, chrisv@ewt.org.za*

[2] *Jon Smallie*, jons@ewt.org.za*

**EWT - Industries Partnership Programme, Endangered Wildlife Trust, Private Bag X11, Parkview 2122, South Africa. Tel: 082 444 8919*

The goal of the partnership is the implementation of an integrated management system to eliminate negative interaction between wildlife and electricity infrastructure in South Africa. Key elements of this integrated system are: an information and advocacy programme; an incident reporting and investigating system; a programme for the implementation of mitigation measures along with the ongoing development of new mitigation measures; and a research programme which researches various power line wildlife interactions. All of these programmes bring together a diverse set of skills and expertise from various stakeholders or participants, including in the biological, ornithological, engineering and electrical domains.

2. Background to wildlife power line interaction

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions take many forms, but common problems are electrocution of birds and other wildlife, birds colliding with power lines and birds causing short circuits in the electricity supply through various activities on electricity structures. Other "indirect" forms of interaction are destruction of wildlife habitat and disturbance of wildlife as a result of construction and maintenance activities.

Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC, 1994, van Rooyen and Ledger, 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen, 2004). Figure 1 shows the reported mortalities of Red Data (threatened) bird species on the Eskom Distribution network (<132kV) since August 1996. Species such as the vultures, eagles and other assorted raptors were mostly killed through electrocution. Note that these are only the reported incidents, a great number presumably go unreported. Due to the large clearances between live and earthed components on most overhead lines of above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components (see Figure 2).

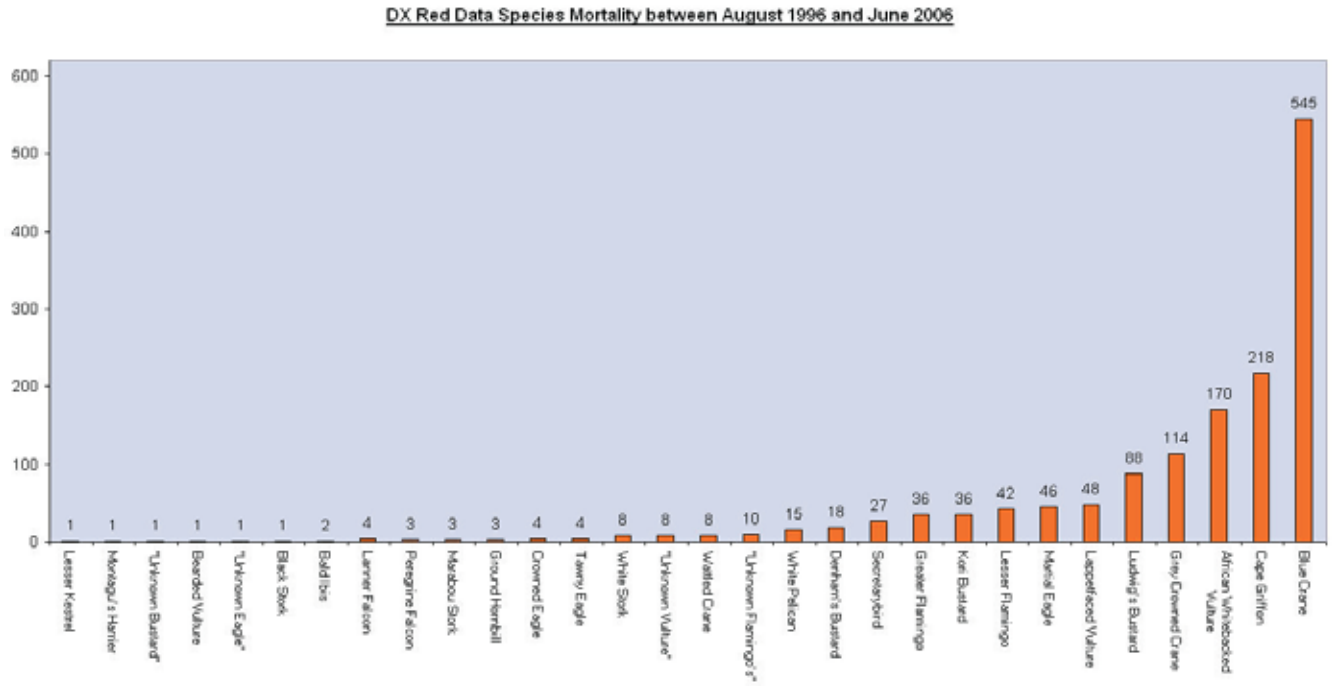

Figure 1: *Reported mortality of Red Data (threatened) bird species on Eskom Distribution lines (< 132kV). August 1996 to June 2006.*

Mitigation of electrocution of birds is usually achieved through insulating certain components on the poles to make them "bird friendly". Figure 3 shows the plastic insulators (Raptor Protectors) used to insulate conductors on wooden T poles.

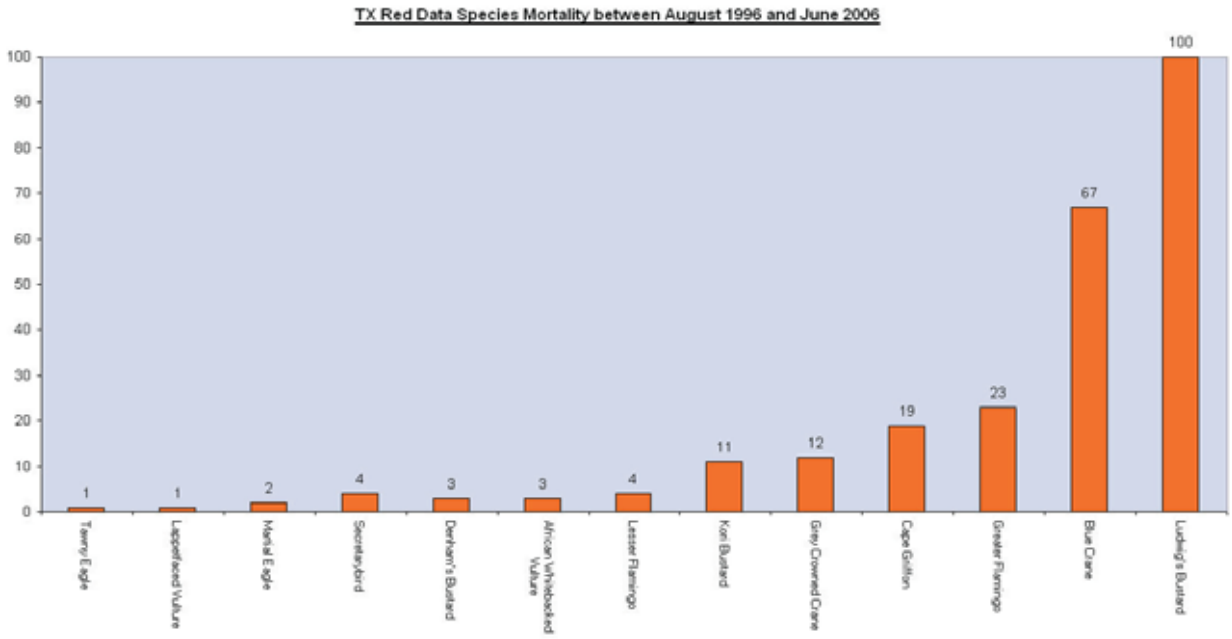

Figure 2: *Reported mortality of Red Data (threatened) bird species on Eskom Transmission (>132kV) lines, August 1996 to June 2006*

Collisions are the biggest single threat posed by overhead power lines to birds in southern Africa (van Rooyen, 2004). Most heavily impacted upon are the heavy-bodied birds with limited maneuverability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen, 2004, Anderson, 2001).

Many of the species shown in Figure 1 and almost all the species in Figure 2 were killed through collision. Species such as the cranes, storks and bustards are predominantly killed through collision. Of particular concern are species such as the Blue Crane 167 mortalities on Distribution lines and 545 on Transmission lines. Mitigation measures for collision involve marking the line with certain devices such as the Bird Flapper pictured in Figures 4 and 5 to make it more visible for flying birds. These devices are fixed to the conductors or earth wires at five or ten meter intervals along the line and have been extremely effective in reducing bird collisions.

Figure 3: *"Raptor Protectors" are used to insulate the conductors one meter either side of the cross arm on wooden T-pole structures.*

Figure 4: *A "Bird Flapper" device which is attached to the overhead conductor and moves with the wind.*

Birds can cause electrical faults on power lines through several mechanisms: bird streamers, bird pollution and nesting. A bird streamer is a long stream of excrement, which when produced by a bird perching on an electrical pole or pylon, may bridge the "air gap" between live and grounded hardware thereby resulting in a short circuit. Bird pollution is the accumulation of bird excrement on the insulator strings (the device insulating the conductor cable from the pole or pylon), again as the result of birds perching or roosting on the pole or pylon. This build up of pollution may compromise the insulation properties of the insulator string. Birds also sometimes breed on electricity structures, potentially bridging the air gap with

nest material. This is particularly likely with conductive materials such as the wire sometimes used by crows. When nests cause flashovers, the nesting material may catch fire leading to equipment damage or a wild fire.

Bird streamers and bird pollution are mitigated for by preventing the birds from perching on certain high risk areas on the towers, through the installation of perch deterrents such as the "Bird Guards" pictured in Figure 6. Nesting is generally managed by relocating problematic nests to safe areas of the towers under the guidance of ornithologists.

Electrical faults result in various problems for the end users of electricity including: interference and damage to electrical machinery and appliances; "down time" of industries; and interference with peoples domestic lives.

A study commissioned by EPRI's Consortium for Electric Infrastructure for a Digital Society (CEIDS) estimated that power quality phenomena (voltage sags, surges, transients and all other deviations from perfect power) are costing the US economy between $15 billion and $25 billion per year across all sectors (PRIMEN, 2001 in van Rooyen *et al,*, 2002). In South Africa, following actual surveys with customers during 1993, the cost of a voltage dip to the national economy was calculated at R60,000 (US$ 8,700) per dip (van Rooyen *et al.*, 2002).

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place through the construction of access roads, and the clearing of servitudes. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow line maintenance, and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in close proximity of the servitude, through modification of habitat and disturbance (particularly of brooding). These impacts are mitigated for through the adherence to a detailed Environmental Management Plan by all construction staff.

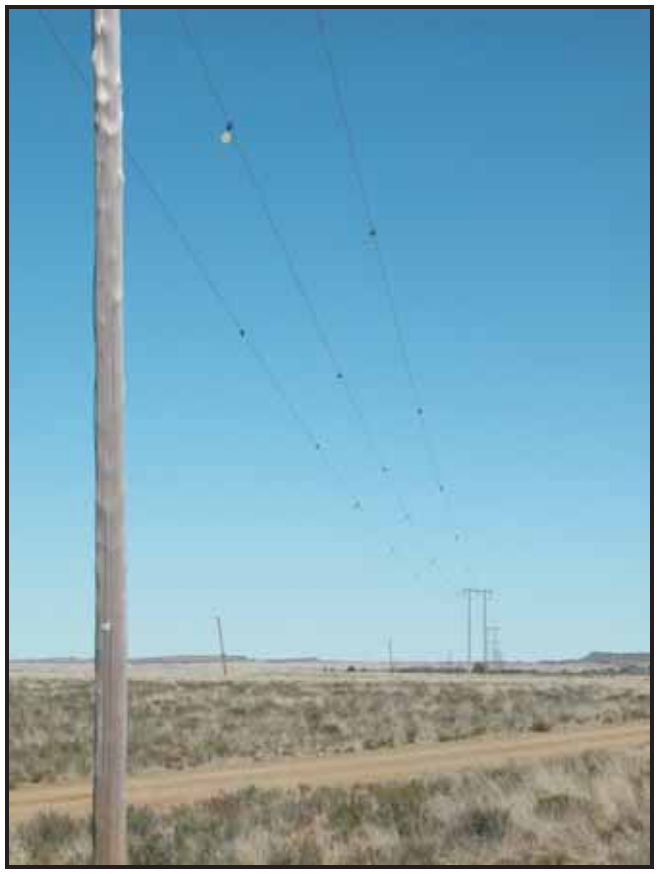

Figure 5: *"Bird Flappers" are fitted onto the overhead conductors at ten meter intervals to make the conductors more visible.*

Figure 6*: Plastic "Bird Guards" are placed on transmission towers to prevent birds from perching in critical areas (above conductors)*

3. Key activities of the Eskom-EWT Strategic Partnership in relation to the above interactions

Some of the key activities of the partnership are the following:

National wildlife incident register

A national incident register is maintained by the EWT for all wildlife-power line mortalities. All wildlife mortalities on electricity infrastructure are reported telephonically to either Eskom or the Eskom-EWT Toll free phone number (maintained by EWT). Wildlife mortalities are most commonly reported by land owners

(farmers), Eskom line staff or members of the public. The incident is then investigated as soon as possible by a dedicated and trained volunteer who visits the site of the mortality and captures relevant information on a standard report form. The EWT has over the years developed a network of suitable volunteers across South Africa. Once the report form reaches EWT, suitable mitigation measures are recommended by EWT and staff from the relevant Eskom region then implements these measures within 3 months.

Research
Ongoing research on the design and implementation of mitigation strategies and any other relevant issues is conducted and supervised by the EWT.

Capacity building
Capacity building within the electricity industry is achieved through dedicated training and awareness programmes for Eskom staff on the impact of and solutions for wildlife impacts on electricity networks.

Input into design of new power lines
The EWT investigates and assesses the potential for wildlife impacts that could be caused by new electricity lines and provides recommendations for the mitigation of those impacts. This is done as part of the Environmental Impact Assessment process which is carried out in South Africa for new developments.

Reporting to Eskom
The EWT reports regularly and comprehensively to the electricity industry on all issues of wildlife interaction with the electricity grid.

Advocacy
The EWT advocates and publicizes the successes of the Eskom-EWT Strategic Partnership through various means including participation at international conferences and publications in the general media and scientific journals.

4. Innovative aspects of the project

Investigation of power line mortalities on Eskom lines is largely conducted by EWT volunteers, making it possible to sustain the programme on its current limited budget, as Eskom has limited resources and expertise to conduct these investigations internally. Eskom can instead focus on electrification, its core business.

The main driver for this partnership is voluntary co-operation, and not regulatory pressure. This has resulted in an extraordinary level of mutual trust and co-operation between an environmental NGO and an industry giant, which serves as a model to the rest of the industry. Eskom has voluntarily entrusted the EWT with the investigation of wildlife incidents, as well as tracking the progress of mitigation of problem localities. This level of co-operation between industry-NGO partners is extraordinary. Furthermore, pioneering research conducted by the partnership on the causes of bird induced electrical faults on large transmission lines proved that the combination of ornithological expertise and innovative application of cheap technology could save the South African economy millions of Rands.

5. Conclusions

Wildlife interactions with electricity networks are a world-wide problem. The Eskom-EWT Strategic Partnership model can be replicated anywhere in the world, provided the parties have the will to make it work. Essential to the success of such a venture is sufficient trust and respect between the parties to allow for a non-confrontational approach to the solving of problems. Without co-operative management the problem can not be effectively addressed. The partnership model is particularly suited to African countries and to developing nations in any continent, where economic resources are scarce yet the potential for wildlife interactions are vast with significant economic consequences, both through the interruption of electricity supply and the mortality of wildlife, an important source of foreign currency for many African countries through eco-tourism.

The issue of wildlife interactions with electrical infrastructure is particularly relevant at present on the African continent. Large scale projects for generation of electricity are planned in various countries (a good example being the proposed hydro power schemes on the Congo River at Inga). These projects invariably necessitate the construction of hundreds or thousands of kilometers of overhead power lines to distribute the generated power to the end users. The potential for impacts of these new proposed power lines (and obviously the already existing networks) on the wildlife in these areas is massive. It is hoped that this article will lead to an increased awareness about these issues in the countries involved.

References

Anderson, M.D. 2001. *The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa*. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

Avian Power Line Interaction Committee (APLIC) 1994. *Mitigating Bird Collisions with Power Lines: The State of the Art in 1994.* Edison Electric Institute. Washington D.C.

PRIMEN 2001. *The cost of Power Disturbances to Industrial & Digital Economy Companies*. Report to EPRI's Consortium for Electric Infrastructure for a Digital Society (CEIDS). Madison. WI.

Van Rooyen, C.S. & Ledger, J.A. 1999. "Birds and utility structures: Developments in southern Africa" in Ferrer, M. & G..F.M. Janns, eds. *Birds and Power lines,* pp 205-230 Quercus: Madrid, Spain,

Van Rooyen, C.S. Vosloo, H.F. & Harness, R.E. 2002. *Eliminating bird streamers as a cause of faulting on transmission lines in South Africa*. IEEE 46th Rural Electric Power Conference. May 2002. Colorado Springs. Colorado

Van Rooyen, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In *The fundamentals and practice of Overhead Line Maintenance (132kV and above),* pp217-245. Eskom Technology, Services International, Johannesburg

Country Focus

Interview with Mr. Ngoya-Kessy from the Republic of Congo

On 18 September 2006, the Minister of Forestry Economy for the Republic of Congo, Henri Djombo declared that his country would create two protected areas to safeguard about 9842 km^2 (3800 sq. miles) of sand dunes, savannas and forests. The announcement was greeted with much joy in Africa as well as the entire world community. In response to this news event, Nature & Faune hosted a live chat with Alain Marius NGOYA-KESSY, PhD, the Economic adviser to the Minister of Forestry Economy for the Republic of Congo. Mr Ngoya-Kessy also teaches at the University of Marien Ngouabi in Brazzaville Congo. Here are excerpts from that conversation, which has been edited for publication.

Nature & Faune: Could you please throw more light on the plans that the Republic of Congo has for its wildlife and protected areas.

Mr Ngoya-Kessy: Yes indeed, the Republic of Congo has made concrete plans to promote wildlife and protected areas in 3 separate cross-border landscapes which hitherto were not protected. An intensive collaborative effort, initiated in 2004, between the people and government of Congo and WCS, has culminated in a declaration of intent to secure a total of about 9842 km^2 of landmass of varying vegetation categories. These include: the transborder protected area contiguous with Louki Park in DR Congo, the biosphere reserve of Dimonika in Republic of Congo and an area in Mayombe in the Cabinda enclave in Angola. The second area borders the Bambama-Leketi-Lekoni reserve within the savannas of Batekes plateaux at the Congo-Gabon border. The third is the Ntokou-Pikounda reserve straddling the Congo basin and the Sangha at the Congo-Gabon-Cameroun border. These parks will be fully operational by year 2009.

Nature & Faune: Can you tell us about the history of Wildlife and Protected Area conservation in Congo?

Mr Ngoya-Kessy: Throughout its history, the nation has had wildlife sanctuaries and protected areas but they were all well within the national territory e.g. Conkouati Douli, Odzala Kokoua, Nouabale-Ndoki, Lac Tele, Lesio Louna, Lefini, and Tchipounda to mention a few. The novelty about the newly announced wildlife protected areas is that it was designed in consideration of conservation initiatives of neighbouring countries, thus creating transfrontier protected areas, a contiguous expanse of land mass to serve as habitat for wildlife which does not recognize national territorial boundaries.

Nature & Faune: How is Congo faring in adhering to international conventions, the Forest Principles and other international regulations related to wildlife and protected areas management?

Mr Ngoya-Kessy: Congo is exemplary in natural resource management initiatives. It has 11.6 percent (about 3,800,000 ha) of its total national territory under protection; this is already above the norm of 10 percent stipulated by the IUCN. Another fact that sets Congo on a higher pedestal from many other countries is that the traditional practice for countries is to designate protected areas at locations with already depleted and degraded woodlands. Contrary to this general tepid attitude towards natural resource conservation, Congo has taken a bold step to set aside its premium forests as sanctuaries for wildlife. For example Nouabale- Ndoki is a very species-rich forest endowed with highly priced economic tree species such as Sappelli, Kossipo and Ayous that fetch high financial revenues both in local and international markets.

Nature & Faune: What in your opinion is the driving force for Congo's leadership in natural resource conservation in Africa?

Mr Ngoya-Kessy: On the impulse, I will attribute this to the unflinching support the President, H.E. Sassou Nguesso, continues to provide to the forestry and environmental protection sector. Moreover this sector of the economy has always benefited consistently from highly skilled professional Ministers. The stability of the leadership in the sector (the Ministry has seen only 3 Ministers for the past 20 years) ensures institutional memory and smooth evolution of developmental projects.

Nature & Faune: Are there any innovative practices in your country you may wish to share with other countries?

Mr Ngoya-Kessy: I would very much like to share a management practice Congo has put in place for the past 5 years to monitor hunting of wild animals and the unsustainable use of bushmeat. The government set up an anti-poaching unit, USLAB (*Unité de Suiveillance et de Lutte Anti-Braconnage*). The USLAB agents work side by side with logging companies, and also check the vehicles that transport timber to ensure that wild game is not illegally harvested at large scale for commercial purposes. Three pilot projects of this nature are currently operational in Congo.

Another innovative practice in Congo is that some leading logging companies such as *la Congolaise Industrielle des Bois* (CIB), *l'Industrie Forestière de Ouesso* (IFO), *Likouala TIMBER, MOKABI SA* and *THANRY Congo* now relate harmoniously with conservation groups. This situation was created with the government giving the logging companies a long period of lease for the concessions, some extending up to 30 years. Moreover the companies have been educated to understand that wild animals contribute to the health and regeneration of the forest stands. The logging companies are cognizant of the interconnectedness of the ecosystems. An example is that where elephants are killed and its population is decimated below a certain level, regeneration of certain trees becomes almost impossible, as the seeds need to go through the alimentary canals of the elephants to break their dormancy and be able to germinate.

Congo is one of the few countries in Africa where the logging companies promote wildlife conservation and protected areas. The realities of practice of Sustainable Forest Management in the Republic of Congo entails logging of concessions and allowing wild animals to migrate into the logged over area. The light streaming into the forest floor stimulates a teaming luxuriant vegetation of succulent fresh and nutritious herbs and shoots that spring up to colonize the space created in the logged- over compartment. This period is the most vulnerable in the cycle of migration of the wild games as the animals leave the security of the protected areas and wander into the logged-over compartments. The animals can easily be hunted down and killed by humans and if driven solely by economic gains, poachers can easily kill many wild animals as they become targets well within reach. This is where the logging companies such as CIB, and the USLAB work together to protect the wild animals from being hunted. An example where this is practiced in Congo is in Nouabale-Ndoki park under PROGEPP (*Projet de Gestion des Ecosysteme Périphérique*). PROGEPP ensures the protection of the buffer zone between the Protected Area and the logged area.

Nature & Faune: It appears all factors are well put together for Human-Wildlife Conflict in Congo where so much emphasis is put in protecting the wild animals amidst humans who have need of bushmeat; are there many incidents of human-wildlife conflicts?

Mr Ngoya-Kessy: Obviously, in view of the effective protection Congo provides to its wildlife populations, their numbers increase by leaps and bounds. This in turn creates a situation where the burgeoning wildlife population strays into crop farms and human settlements and destroys crops and terrorizes people in the rural areas. The Directorate of Wildlife and WWF are working towards developing an efficient Eco-tourism package which is expected to provide a long lasting solution to this problem. Eco-tourism has the potentials to ensure wildlife has a longer-term value for people, while bushmeat gives only short-term revenue under unregulated hunting practices. The hypothesis is that when wildlife provides substantial revenue to local resident population, it would become easier to safeguard and develop it. To illustrate, the Bomassa Forest Management Unit (FMU), located within FSC certified concession of CIB and managed by CIB is home to the best red wood and is now under conservation. The people living in and around this Bomassa conservation area are losing out on employment opportunities and other fringe benefits they were getting when the area was under commercial logging. This is not good and could radicalize people into enemies of conservation. Conservation and concerns for livelihood of people must be well balanced. Human communities living near protected areas ought to have amenities reflective of modern life e.g. potable water, electricity, schools, hospitals etc.

There have been unfortunate cases of Human-Wildlife Conflicts in the country where throngs of wild animals have eaten up or trampled upon crops, attacked and wounded, maimed or even killed humans. In such instances, the government paid compensations e.g. in Nouabale-Ndoki, and also in Lesio Louna parks, the Congo government paid out reparations to local people whose property and crops were damaged by marauding wild animals.

Nature & Faune: What, in your opinion, are the expectations of the Congolese people concerning wildlife and Protected Area conservation?

Mr Ngoya-Kessy: First and foremost, the people have explicitly expressed the need for a protected area adding value to the livelihood of the surrounding communities. An example of a conservation project that did not go down very well with rural people was a project which took great care of chimpanzees (milk and clean napkins for baby chimpanzees and medications) while the babies of the humans working for the project had no milk and napkins and were dying for lack of medication. The rule of the thumb is to protect and safeguard the humans first and create conditions that will enable humans become friends with conservation ideals.

It is widely accepted that aid to local communities is a delicate issue and thus must be done in accordance to the culture of a people. Most importantly, assistance to communities in conservation projects should be geared towards value-addition and creating enabling environment for food security.

Nature & Faune: You have mentioned food security as one of the important goals of Conservation initiatives. What are the alternatives to the restrictions in the Protected Areas? How does this play out in practice in Congo?

Mr Ngoya-Kessy: I would advocate creation of the right conditions for long-term food security and poverty alleviation through developing community micro-projects which should enable the local people to ultimately enjoy modern amenities. It is imperative to include local resident populations in conservation programs; for these programs should also serve the interests of people living within its vicinity, otherwise they will militate against conservation activities. The current situation in Congo is that conservation projects are perceived by local populations as islands of richness and wealth amidst rural poverty.

Nature & Faune: Given these challenges do you still hold the opinion that the Republic of Congo is a country leading in Wildlife Conservation and Sustainable Forest Management in Africa?

Mr Ngoya-Kessy: Congo is among the bright stars in the skies of environmental protection in Africa. I support this statement with the following facts and figures:

- At present 11.6 percent of our national territory in under protection;
- Our nation aims to bring more than 50% of its logging activities under certified management by 2011. COMIFAC requirements are only 20% in 2012.
- Precisely, as part of a cooperation between WWF and Danzer Group, an international timber giant and leading producer of hardwood, 31,080 km^2 (12,000 sq. miles) of forests are scheduled to be certified by the Forest Stewardship Council scheme beginning of 2008.
- CIB, a logging company with 1 million hectares of forest concessions in northern Congo, is the primary employer after the state, and is an important engine for sustainable forest management

These are huge achievements made possible by the commitment and hard work of the Congolese people and the government and our development and economic partners such as WCS, WWF, Danzer, CIB, CARPE etc. The Republic of Congo is working for the future; plant a tree now and four decades later the earth will still have green memories of you!

Nature & Faune: Thank you Mr. Ngoya-Kessy for sharing with us the very rich experiences the Republic of Congo has garnered over the years in conservation of wildlife and safeguarding protected areas and in Sustainable Forest Management.

FAO Activities

Ensuring Farmers' Livelihoods and Food Security around Kakum Conservation Area, Ghana

FAO Project TCP/GHA/2905

1. Introduction

The Kakum National Forest Park, considered as Ghana's premier protected area, covers 350 km^2 of moist tropical forest and represents one of the few remaining areas of West Africa's Upper Guinean Forest hotspots with most of its plants and animals relatively intact. The park contains isolated populations of several globally-endangered species, including the forest elephant (*Loxodonta cyclotis*). Kakum also constitutes an integral part of the local forest ecosystems on which neighbouring communities depend for their livelihoods. It is estimated that there are around 40 farming communities, with around 600 households, within a 5 km radius of the park.

The entire conservation area of 22,320 hectares (46.8 percent) outside the park is susceptible to elephant crop raiding. This is because all that area used to be part of the forest and therefore part of the elephant habitat. Crops planted on the periphery of the park, particularly maize and cassava, attract elephants that stray outside the park boundaries. Households lose about 60 percent of food crops cultivated annually to elephant crop-raiding alone.

In reaction to the losses being suffered as a result of the excessive crop raiding, the villagers resorted to heavy poaching, which threatened the wildlife populations. In order to improve farmer incomes and food security, and deter elephants from raiding their farms, there was an urgent need for farmers to acquire the capacity to apply innovative anti-crop-raiding techniques, and to diversify towards alternative cropping systems and land use practices in areas prone to raiding. FAO interventions were intended to yield clear and tangible benefits in terms of increased crop outputs, which would serve as longer term incentives for continuing and extrapolating project experience. Locally, such interventions contributed to the improvement of the food security situation in the Kakum Conservation Area.

The project received financial and technical support from FAO, and was implemented by Conservation International (Ghana) with support from the Ministry Food and Agriculture and the Wildlife Department of the Ministry of Lands and Forestry in Ghana. The general development objective of the project was to improve food security through the reduction of crop losses arising from human-wildlife conflict.

2. Activities

Project activities focused on capacity building of stakeholders and extension support to affected farmers.

2.1 Anti-crop raiding techniques

Through the establishment of demonstration sites, low technology methods were introduced in the area:

- Simple fence based systems: a piece of rope was used to fence off the farm, and from this rope bells and cloth impregnated with grease and chilli pepper were hung. The bells would alert the farmer that elephants were close to his field, while the chilli deters the elephant from coming close to the field. Elephants have a strong olfactory sense, and will try to avoid chili pepper.
- Chilli-dung bricks: elephant (or cow) dung was mixed with chilli pepper and other material to create bricks, which are to be set afire when the crops are matured. The smoke from the burning chilli-dung bricks also deters the elephants.

The material used for these fences and the chilli-dung bricks is common, locally available and relatively cheap. Farmers experimented with using alternative material, such as bush ropes and old used engine oil.
In each community, a cadre of crop raiding scouts was trained. These young men patrol the fields at night and notify sleeping farmers of approaching elephants, assist other farmers with setting up the fences and producing the bricks and train other communities in the use of the techniques.

Throughout the project people were encouraged to use a mixture of introduced and traditional techniques to avoid crop raiding. In this way it will be avoided that the elephants rapidly habituate to (get used to) the used techniques. The fact that the methods proved effective, with farmers whose fields were protected having a full harvest, sent a strong signal in the community.

2.2 Land use planning

Community discussions were organised to look at the land use situation in each community. The farmers realised that the problem of crop damage by elephants is the result of improper planning of the communities. Crops are cultivated in areas that are prone to crop damage by elephants. In groups, the farmers prepared land-use plans for their communities.

A training of trainers course was organised to identify alternative crops that are not attractive to elephants. Demonstration sites were set up to assist farmers to learn, by doing, and adopt proper production methods so as to realize the maximum returns from relatively smaller farm sizes; to enable farmers appreciate the comparative advantages of pepper and ginger over maize with respect to income, storability or post-harvest losses and problems with elephants raiding; to demonstrate the production of pepper and ginger as the best alternative to reducing human- wildlife conflicts in the project area.

2.3 Agricultural extension

Intensive agricultural extension support was given to teach farmers about compatible farm production planning, crop diversification, increasing yields and farm record keeping for participatory monitoring. The farmers recognised that the long-term or permanent solution to the protracted human-elephant conflict in the KCA is the production of non-target crops. In addition, farmers were assisted to improve upon maize production and reduce post harvest losses of crops. The project also provided marketing advice and guidance regarding newly introduced crops.

3. Discussion

In some communities a special scheme was set up to supply the scouts with the necessary equipment such as boots, rain coats and batteries for flash lights. One particularly interesting scheme is that hunters are obliged to pay a fee to the community on the animals they caught. The fund thus created provides the resources to buy the materials for the scouts.
Farmers from other communities have visited farmers in the project to study the techniques and methods and implement them on their own farm. The project's impact is larger than the initially planned 10 communities and fifty farms due to the spontaneous adoption of farmers in the project communities and from other communities.

The project was considered successful with regard to the avoidance of crop-raiding: the techniques which were introduced had a 100% success rate, implying that none of the farms which were protected got raided. Together with the improved agricultural practices, this ensured more food security for farmers in the area.
Besides that, community members felt empowered; farmers took up the responsibility of protecting their field instead of calling in the help from Wildlife officers in the area. Communities organized themselves to trade in chilli, provided assistance with putting up the fence, and supplied the scouts with necessary materials and taught techniques and methods to each other. It is seen as a great achievement of the project that farmers experiment with the techniques to come to innovative solutions to protect their field.

The overall perception of the fringe communities concerning the park and the elephants was greatly improved. This should lead to better communication between Kakum National Forest park management and the surrounding communities, facilitating the resolution of possible conflicts of interest in the future.

Strategies to Mitigate Human-Wildlife Conflict in Mozambique

FAO Report by Anderson, J. L. and Pariela, F.

In Mozambique, wildlife still represents a very valuable opportunity for the country and, properly managed, it can benefit the people that share the same area of land through sustainable utilization and tourism. National Parks and Reserves have been created, yet people continue to live within them (e.g. Banhine, Zinave). There are also significant wildlife populations in some Coutadas (hunting zones) and game ranches and in some areas occupied by resident communities. Unresolved human-wildlife conflict (HWC) is creating negatives attitudes towards both the government and proposed wildlife related developments.

The report describes short, medium and long term strategies to mitigate HWC. Under the category 'short term strategies' the authors discuss the adoption of a Human-Wildlife mitigation Policy, a revision of legislation, the establishment of Problem-Animal Control (PAC) units, improved record keeping and database establishment.

The report describes problem species mitigation strategies, such as:

- Elephant: the development of appropriate land use plans, the creation of effective, low-cost barriers and other deterrents, the phasing out of hunting of elephants by community members in order to avoid wounding and consequent aggressive ('rough') elephants and a review of the prospects for increase of benefits to fringe communities.
- Crocodile: education programmes on how to reduce crocodile attacks, provision of materials to make protective barriers, a change in the allocation of CITES permits for exporting crocodiles and skins, removal of crocodiles from unsuitable habitats.
- Lion: removal of lions out of unsuitable areas, training and provision of materials to PAC units for the culling of problem lions.
- Buffalo: creation of buffalo-free areas where the cattle industry is prevalent, erection of buffalo cordon fences, removal of buffalo from cattle areas.
- Hippo: development of appropriate land use planning, construction of protective barriers around crops, planting of sisal barriers around fields.

The medium term strategies described in the report are the development of land use plans, taking into account human settlements and areas for the cattle industry, the establishment of PAC units, surveys on specific species to obtain data needed for management plans.
In the long term, the report mentions the ongoing capacity building of Problem Animal Control units, furthering land use planning, the consolidation of wildlife related Directorates and a revision of compensation for elephant damage.

The 16th Session of the Working Party on Wildlife and Protected Areas - Addressing Conflicts between Human Activities and Wildlife Conservation in Africa

In March 2006, the 16th session of the Working Party on Wildlife and Protected Areas (WPWLPA) took place in Maputo, Mozambique, before the 15th session of the African Forestry and Wildlife Commission took place.
Due to organizational constraints, the intended in-session seminar on Human-Wildlife Conflicts during the WPWLPA lasted only one afternoon, leaving only little time for discussion. The participants listened to presentations outlining potential solutions and strategies and shared their experience on the severity of HWC in their respective countries.

For a copy of the AFWC CD Rom, containing all documents and presentations, kindly contact the FAO Regional Office for Africa, Forestry Department.

Links

Documents

WWF - Human Wildlife Conflict Manual, 2005
http://www.panda.org/index.cfm?uNewsID=88920

People & Wildlife
Practical manuals on non-lethal techniques to alleviate human-wildlife conflicts, targeted to various stakeholders and specific problems.
http://www.peopleandwildlife.org.uk/crmanuals/index.shtml

- Crop raiding primates. Searching for alternative, humane ways to resolve conflicts with farmers in Africa By Claudio Sillero-Zubiri and David Switzer
- A review of human-elephant conflict management strategies. By Alastair Nelson, Posy Bidwell and Claudio Sillero-Zubiri
- Management of wild canids in human-dominated landscapes. By Claudio Sillero-Zubiri and David Switzer
- Large carnivores and conflict: Lion conservation in context. By David Macdonald and Claudio Sillero-Zubiri

Human-Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices, Elisa Distefano, undated
http://www.fao.org/SARD/common/ecg/1357/en/HWC_final.pdf

AWF - Human Wildlife Conflict: Lessons Learned From AWF's African Heartlands, July 2005
http://www.awf.org/content/document/detail/3227

WWF - A numbers game: Managing elephants in southern Africa, Mark Schulman, July 2006
http://www.panda.org/news_facts/newsroom/features/index.cfm?uNewsID=75340

Elephant Pepper Development Trust - Investigating the potential for chilli Capsicum spp. to reduce human-wildlife conflict in Zimbabwe, Guy E. Parker and Ferrel V. Osborn, January 2006
http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=467931

Watson Institute - Human Animal Conflict in the South Luangwa Valley of Eastern Zambia, Lindsay Clarida, undated
http://www.watsoninstitute.org/ge/watson_scholars/Clarida.pdf

Namibia Ministry of Environment and Tourism - Human Wildlife Conflict Management (HWCM) Policy Workshop, March 2006
http://www.span.org.na/HWCM_Policy_workshop_proceedings1.pdf

Kenya Wildlife Service - Diseases of Importance at the Wildlife/Livestock Interface in Kenya, Elizabeth Wambwa, October 2005
http://www.wcs-ahead.org/book/chapter03.pdf

University of California, Davis - Human-carnivore conflict over livestock: The African wild dog in central Botswana, Matthew Swarner, 2004
http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1006&context=cas

African Elephant Specialist Group - A spatial analysis of human-elephant conflict in the Tsavo ecosystem, Kenya, R. J. Smith and S. M. Kasiki, 2000
http://www.kent.ac.uk/anthropology/dice/resources/Smith_&_Kasiki_HEC_report.pdf

Problem Animal Control Strategies in Human Elephant Conflict Areas of Dande Communal Lands, Zimbabwe: A Study in Sustainability, J. F. Mupangwa, T. Nyabadza, I. Mberengwa, and I.Chaipa, 2006
http://www.jsd-Africa.com/Jsda/Spring2006PDF/ARC_Problem%20Animal%20Control%20Strategies%20in%20Human%20.pdf

Conservation in practice Taking the bite out of wildlife damage, the challenges of wildlife Compensation Schemes, P. Nyhus, H. Fischer, F. Madden and S. Osofsky, 2003
http://www.conbio.org/cip/article42TBW.cfm

Organisations

Savannas Forever
Source: Kushnir, H.

This is a collaborative team of scientists, researchers and economists who work with the private and public sectors to manage human-animal conflict is sub-Saharan Africa. Interrelated research and partnerships are used with other conservation groups, trophy hunting and ecotourism companies to develop practical tools and strategies to protect people and threatened wildlife species in Tanzania and Mozambique.

Savannas Forever mission is to provide practical solutions that protect people and promote their livelihoods while conserving African wildlife.
http://www.savannasforever.org/

IUCN - Human-Elephant Conflict Working Group (HECWG)
Source: Niskanen, L.
The African Elephant Specialist Group (AfESG) is one of the most active of the over 100 taxonomic Specialist Groups of the IUCN Species Survival Commission (SSC). The mission of the AfESG is to promote the long-term conservation of Africa's elephants throughout their range. Recognizing human-elephant conflict (HEC) as a major conservation priority, the AfESG established in 1996 a five person Human Elephant Conflict Task Force (HECTF) to carry out research into and develop "tools" for the management of HEC in Africa. Since that time the HECTF, subsequently renamed the Human Elephant Conflict Working Group, has produced numerous reports, technical briefs and practical guidelines on HEC. These products include a comprehensive Decision Support System for HEC managers, a standardized data collection protocol and accompanying manual for training local enumerators, a review of compensation schemes for elephant damage, review of problem elephant policies and management options, technical briefs on the use of fencing and other barriers, plus numerous case studies from across the continent.
Most products are available in French, English and Portuguese as free PDF downloads from the AfESG's website: http://iucn.org/afesg/hec . This site contains a wealth of information on conflict mitigation, including updates on new innovative initiatives to tackle HEC. For more information contact: Leo Niskanen, Senior Programme Officer, IUCN/SSC AfESG at afesg@iucn.org .

Elephant Pepper Development Trust
Source: *Parker, G. E.*
The Elephant Pepper Development Trust aims to promote the livelihoods of rural farmers living in elephant range through training, the deployment of appropriate conflict mitigation methods and development of agricultural techniques which promote elephant conservation.
Since 1997 Elephant Pepper Development Trust has engaged with rural communities in Zimbabwe to develop practical solutions to conflict with elephants. It has pioneered the use of community-based methods for crop protection, using chilli and a range of locally appropriate techniques that help farmers solve their own problems.
Today Elephant Pepper works in seven African countries and runs training courses in conflict management for African elephant managers. For more details please visit our website at:
http://www.elephantpepper.org

The Crocodile Specialist Group
http://www.flmnh.ufl.edu/herpetology/crocs.htm
http://www.wmi.com.au/csgarticles/

IUCN African Lion Working Group
http://www.african-lion.org/

IGF International foundation for the conservation of wildlife
http://www.wildlife-conservation.org/

Conservation International Centre for Applied Biodiversity Science
http://www.biodiversityscience.org/xp/CABS/research/human_dimensions/wildlife_conflicts.xml

WWF
http://www.worldwildlife.org/conflict/hwc.cfm
http://www.worldwildlife.org/action/projects_conflict.cfm

AWF Large carnivore research project
http://www.awf.org/content/solution/detail/3500

De Wildt Wild Cheetah and Wildlife Trust
http://www.dewildt.org.za/index.htm
Information about the use of Anatolian dogs to guard livestock
http://www.dewildt.org.za/wildcheetahupanatolian.htm

Cheetah Conservation Fund
http://www.cheetah.org
Using livestock guarding dogs as a conflict resolution strategy on Namibian farms
http://www.cheetah.org/ama/orig/Using-Guarding-Dogs-as-Conflict-Resolution--CDP.pdf

CARACAL - Human Wildlife Conflicts
http://www.caracal.info/Human%20wildlife%20conflict%20Project/Human%20wildlife%20conflict%20General.htm

Desert Lion Human Wildlife Conflict
http://www.desertlion.info/hwc.html

Other Links of Potential Interest

AGORA
The AGORA program, set up by FAO together with major publishers, provides free or low cost access to major scientific journals in agriculture and related biological, environmental and social sciences to public institutions in developing countries. AGORA provides a collection of 918 journals to non-profit organisations in 107 countries. Through AGORA, researchers, policy-makers, educators, students, technical workers and extension specialists have access to high-quality, relevant and timely agricultural information via the Internet.
http://www.aginternetwork.org

Ask FAO
This service allows Internet users to pose questions to FAO
http://www.fao.org/askfao/home.do

Carcasses - The Bushmeat Trade is eating your Heritage
Born Free's exciting new Kenyan film, entitled 'Mizoga' (Carcasses) was premiered on the 24th August 2006 in Nairobi. The film, set in rural Kenya, explores the complex issues surrounding the illegal commercial trade in meat from wild animals, also known as 'bushmeat'.
http://www.bornfree.org.uk/global/carcasses.shtml

UN Forum on Forests
In October 2000, the Economic and Social Council of the United Nations (ECOSOC), in its Resolution 2000/35 established the United Nations Forum on Forests (UNFF), a subsidiary body with the main objective to promote "... the management, conservation and sustainable development of all types of forests and to strengthen long-term political commitment to this end..."based on the Rio Declaration, the Forest Principles, Chapter 11 of Agenda 21 and the outcome of the IPF/IFF Processes and other key milestones of international forest policy.
http://www.un.org/esa/forests/

Theme and deadlines for next issue

The theme for the next issue of Nature & Faune magazine is "The value of biodiversity". This theme will embrace vast and very diverse topics such as: rural population's dependence on their natural environment; ecological indispensable services delivered by ecosystems such as fertilization of agricultural crops; medicinal substances derived from wildlife and forestry products; eco-tourism; trophy hunting; benefit sharing schemes; financing mechanisms for protected areas; payments for carbon sequestration in forestry plantations etc.
Deadline for submission of articles, announcements and other contributions is 15 May 2007.

Guidelines to authors, Subscription and Correspondence

In order to facilitate contributions by authors, we have created guidelines for the preparation of manuscripts for Nature & Faune. Please visit our website or write us an email to receive a copy of these 'Guidelines for Authors'.

If you would like to subscribe to this magazine, please send us an email indicating your contact details such as full name, contact details, organization, position and country of residence.

If you have suggestions, comments, questions or remarks, or you would like to contribute to the contents of this magazine with news, articles, reports or events, please write to us.

Contact Details

Nature & Faune
FAO Regional Office for Africa
P. O. Box GP 1628 Accra
Ghana

Tel.: (+233-21) 675000 or (+233-21) 7010930
Fax: (+233-21) 7010943 or (+233-21) 668 427

E-mail : Nature-Faune@fao.org
Website: www.fao.org/world/regional/raf/workprog/forestry/magazine_en.htm