



FIELD REPORT Cheetah Conservation in Namibia

Project scientists

Dr. Laurie Marker

Country

Namibia

Research site

Near Otjiwarongo and the Waterberg National Park

Date field report completed

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Period covered

1 Jan 2010 to 31 Dec 2010

Report completed by

Laurie Marker, DPhil.



Dear CCF Earthwatch Volunteer,

Thank you for volunteering to spend time with us in Namibia to help save the wild cheetah. Over the years, volunteers have been the backbone of CCF's programmes and the successes we have achieved in our efforts to save the wild cheetah. Since 1996, CCF has worked closely with Earthwatch and, since that time, volunteers have come to our Namibian Centre every month for work experience and to make their own personal contribution to saving the cheetah.

The projects that Earthwatch volunteers contribute to during their stay are many and varied, and each task, large or small, routine or exciting, all contribute to the whole. You help us on so many different levels, from collecting and reviewing data, to building and maintaining cheetah-holding pens, or caring for Livestock Guarding Dogs and their goat herds. Some of you might remember our on-going scat collections! Earthwatch volunteers have also frequently assisted with game counts that are so important to our ecosystem research and habitat management plans. Who can forget the thrill and satisfaction of caring for the 50+ non-releasable cheetahs currently residing at CCF or perhaps a litter of Livestock Guarding Dog puppies we eventually will place with farmers to protect their herds? Behind the scenes, volunteers contributed invaluable office time helping to update and maintain our bio-medical inventories and research databases that are the basis for so many of our programs.

Public education and the development of an active grassroots constituency are integral components of our overall cheetah conservation programme. CCF is educating farmers, teachers, and the public about the need and methods to conserve Namibia's rich biodiversity and the role of the cheetah and other predators in healthy ecosystems. Many of you helped to conduct guests through the Education Centre or went along on a school presentation. In 2010 alone, CCF hosted over 6400 visitors from around the world, including students, teachers, scientists, farmers, and tourists. We could not have managed all this without your help and enthusiasm.

While at CCF you became part of the team and, we hope, you remain a part of our team after you return home. Some of you have returned to CCF, bringing more people eager to learn about our work, while many continue to support our efforts back home by spreading the word about the magnificent cheetah and the survival challenges it faces. A common denominator amongst our Earthwatch family is the transcendancy of their experience with us...

Thank you.

Most sincerely,

Laurie Marker

Director
Cheetah Conservation Fund (CCF)

SECTION ONE: SUMMARY REPORT

Top highlights from the past field season

CCF was able to successfully complete the re-wilding of four captive female cheetahs, thus perfecting a cheetah release model that other countries can follow. An important factor to this success was yet another research project by CCF - the utilisation of swing gates to allow the free-range movement of small mammals while keeping the re-introduced cheetahs inside a pre-release "training camp." Swing gates - a less destructive passageway for animals that normally would dig under a fence and thus provide an entrance for predators - are a unique, low-cost, predator-friendly tool that has the potential to offer farmers a far less costly preventative measure to protect their livestock.

Another effective method to prevent conflict between livestock farmers and predators is the use of livestock guard dogs. The programme, initiated by CCF in 1994 with Anatolian shepherds, is so successful that the demand for puppies continues to grow. To address this need in our breeding program, CCF attempted, for the first time, artificial insemination (AI). In 2010, the first puppies produced through AI were born. Additionally, bloodlines of a second breed of dog, the Kangal, were expanded with the arrival of three puppies donated by French and German breeders and the donation of sperm from three males from the United States. These achievements will provide CCF with a greater opportunity to work with even more Namibian farmers through its Livestock Guarding Dog Programme.

Non-technical overview of results

CCF remains a global leader in the struggle for the long-term survival of the cheetah. We continue to successfully pursue our mission through rigorous research on cheetahs and their ecosystems and by educating and working with all stakeholders to achieve best practices in conservation and management of the world's cheetahs. This approach to the problem - pioneering the integration of scientific research with ecosystem conservation efforts and an array of education programs and other public outreach activities - serves as a model for other organizations, and CCF continues to lead the way. Our geographic location and physical presence is no accident -- we live and work in the heart of cheetah country, Namibia, amongst the largest population of wild cheetahs in the world. Yet our work, our mission, and our support extend around the world.

In March 2010, Dr. Laurie Marker, CCF's Executive Director, was able to confirm the presence of cheetah in Angola during a three-day rapid survey conducted in Iona National Park. The park, located in the Namibe province in southwest Angola bordering Namibia, is very dry. However, it is perfect cheetah habitat with thousands of hectares of open savannah and a growing prey base that includes springbok (*Antidorcas marsupialis*) and oryx (genus *Oryx*). On Dr. Marker's last day in the park, the team was investigating scat found in one of several play trees by a dry river bed when two big male cheetahs ran out. After this successful mission, CCF hopes to develop a program to census cheetah populations in the country and to help community, government and non-government organizations develop a plan to educate local Angolans about cheetahs and the role of a predator in a healthy ecosystem.

Genetic samples of CCF's famous ambassador cat, Chewbaaka, were taken to be sequenced as part of a project called Genome 10K, which includes DNA mapping of 10,000 vertebrates, and of which CCF USA's Chairman, Dr. Stephen O'Brien, is a participant.

Monitoring the "NamibRand Boys," (five male cheetahs that CCF released into the NamibRand Nature Reserve), continued in its second year, with the cheetahs continuing to hunt successfully. Back at home, CCF worked on its fourth cheetah re-introduction project as it soft-released four captive females in a 4,000-hectare enclosure on Bellebenno farm. The females

were re-captured in late December for their final release in January. The Bellebenno re-introduction camp, which is well-stocked with prey species, serves as a training ground for orphaned cheetahs that show good potential for release. The goal is to release the cheetahs that do learn to hunt into safe, unfenced areas. With the prior successes of this protocol, CCF has created a release model that other countries can follow and is working with both Zambia and India for future re-introductions.

One of CCF's flagship programmes, the Livestock Guarding Dogs, continued its success. This year, thanks to frozen sperm donations from the United States, CCF conducted its first successful artificial insemination. An Anatolian female gave birth to three live puppies in early August. In addition, as part of CCF's efforts to expand its breeding programme, the Kungur bloodlines have grown thanks to the donation of three puppies as well as semen from three males.

Cheetah censusing methods continue to be explored at CCF through the utilisation of non-invasive techniques such as camera traps, as well as satellite collars. In addition, two scat-sniffing dogs continue to be trained to assist with the systematic collection of cheetah scat for DNA analysis at the Applied Biosystems Genetics Laboratory, which will facilitate estimating animal densities. Additionally, this research will benefit from CCF's Scat Sniffer Dog Programme, which continues with the training of two dogs. Both dogs have successfully found cheetah scat at cheetah play trees and on CCF roads. The dogs are being trained with the assistance of renowned Australian dog trainer Steve Austin, who is also training two Springer Spaniels in Australia to be donated to CCF.

CCF's rhino reserve not only continues to be an eco-tourism attraction, but is also the stage for CCF's efforts to preserve indigenous species and biodiversity, with a focus on endangered species such as the cheetah and the black rhinoceros. In addition to 20 trail cameras deployed across the reserve, a new project to match spoor with individual rhinos was started in August. In the future it is hoped that it will be possible to identify rhinos from spoor measurements alone.

Sharing best management practices continues to be a priority for CCF. For the third consecutive year, and thanks to a generous grant from the Howard G. Buffett Foundation, CCF hosted five international courses for wildlife managers and conservation biologists from 10 cheetah-range countries. The courses included field trips that not only offered participants the opportunity to put into practice questionnaire techniques to assess community needs as they pertain to human-wildlife conflict, but served also as an opportunity to bring farmers' training on the road. Also, for the first time, conservation biology participants were able to perform a DNA extraction as part of a practical in the genetics laboratory.

CCF's Bushblok once again attracted world attention when it helped earn CCF's Executive Director the Tyler Prize for Environmental Achievement, considered by many the Nobel Prize of conservation. CCF's Bush Project, one of the largest habitat restoration efforts in Africa, must increase its bush-harvesting capacity significantly to meet demand for Bushblok and other products.

SECTION TWO: TECHNICAL RESULTS

REPORTING AGAINST RESEARCH OBJECTIVES

Objective 1. Biomedical research

All cheetahs handled by CCF, both captive and wild, are assessed using standard protocols for overall health as well as, in the case of males, reproductive fitness in the form of semen collection, assessment and, where possible, banking in the Genome Resource Bank (GRB). At the end of 2010, there were 62 captive cheetah residents at CCF (some of which will be scheduled for release in early 2011).

1.1 Medical Evaluations

Between 1 January and 31 December 2010, CCF performed 107 veterinary exams on 67 captive and wild cheetahs (Figure 1). Of those, 48 were annual captive exams, 16 were wild cheetah exams, sperm was banked from 11 male cheetahs both captive and wild, five were dental exams, three were health re-evaluations or sutures, six were research/collar placement exams, 13 were herpes treatment exams on a single captive male, seven were eye exams, three were kidney failure exams, five were necropsies, and one was a nasal exam. Of the 16 wild cheetah exams, ten were orphaned cubs, one of whom was subsequently released; the other five will be released early in 2011.

1.2 Parasite Loads

For the second year, wild and captive cheetah scat has been collected. Analysis was performed on wild cheetah scat to determine their parasite load and assess their overall health. The parasite load of CCF's captive cheetahs was also analysed to compare different seasons and to determine the need for de-worming. Results from this study found that parasite prevalence and abundance were highly variable and there was no significant correlation between parasite load and age, sex, density of cheetahs in enclosure or time since last anti-parasitic treatment. The study also found that treatment with anti-parasitic treatments fenbendazole or pyrantel pamoate was effective in decreasing parasite load.



Figure 1. Earthwatch volunteers take a wild cheetah's vital signs at the CCF Clinic. (c) Cheetah Conservation Fund / Rob Thomson.

Recommendations on how to lessen parasite transmission and an anti-parasitic treatment schedule were made from the results of this project.

Parasite prevalence and load of CCF livestock and wildlife species were also studied to compare the parasite loads of livestock to that of the wildlife and to determine if an overlap of livestock and wildlife has an influence on the parasite load of each species. Results were variable, but indicated that there was no universal effect of livestock and wildlife overlap on parasite prevalence or abundance.

1.3 Gastritis Research

Internationally, cheetahs suffer from gastritis, an inflammation of the stomach that is caused by spiral bacteria and impacts negatively on the animal's health. Stress is implicated as one of the possible causes of this disease. The long-term research into the causes, levels, and effects of gastritis in cheetah continued with annual collections from CCF's cheetah.

All CCF's captive cheetah were endoscoped to monitor presence or absence of gastritis. CCF's cheetahs are very healthy and provide a baseline from which to compare other captive populations. Along with the endoscopies, 14 days of faecal samples are collected on each of CCF's cheetahs and processed and shipped to the United States to evaluate cortisol levels. The samples were collected between the months of March and May.

1.4 Genome Resource Bank

Since 2002, a total of 290 semen collections have been added to the CCF Genome Resource Bank (GRB). During 2010, 11 semen collections were banked into the CCF GRB. The CCF GRB now contains a total of 301 cryo-preserved sperm samples from captive and wild cheetahs in Namibia, representing 91 individual cats.

CCF continues to bank sperm, serum, plasma, white and red blood cells as well as hair and skin samples on all cheetahs that undergo medical workups. Additionally a scat sample collection from wild cheetahs in Namibia and neighbouring countries is kept at CCF and increases continuously. Since 1991, blood samples have been obtained from over 600 individual cheetahs. Blood samples are used for veterinary and genetic purposes, with backups stored at both CCF and the Genomic Diversity Laboratory at the National Institutes of Health in the United States. Currently, the GRB holds the world's largest wild cheetah database.

Objective 2. Ecological genetics research

CCF's Applied Biosystems Genetic Conservation Laboratory was established at the end of 2008 thanks to the generous support of Applied Biosystems and the Ohrstrom Foundation. The laboratory's main aim is to contribute to the ongoing research and conservation of cheetahs, working together with the ecology and biomedical departments in CCF's cross-disciplinary mode of operation. The scat detection dog programme is part of the cross-disciplinary approach and was put into place in order to provide the necessary samples to the various genetics projects. The main genetics projects are related to cheetah population structure, determination of relatedness, and assignment of individual ID to non-invasive samples such as scat. Projects related to other species are performed with outside funding and are, so far, limited to collaborative projects.

2.1 Genetics Projects

In the beginning of 2010, working in cooperation with the Laboratory of Genomic Diversity (LGD) at the National Cancer Institute in the United States, CCF geneticists spent three months as visiting scientists, during which time they extracted about 100 samples and assessed the quality of close to 200 cheetah samples. Many of these were CCF's own samples that had been sent to the U.S. before the establishment of the CCF genetics

laboratory, along with cheetah samples from other cheetah-range countries. Three multiplexes were optimized (a multiplex allows work on several markers simultaneously) thereby allowing researchers to obtain results of multiple markers at the same time and for similar cost as the individual markers. At the end of the year, one of our geneticists returned to the LGD and finished the experiment, bringing back to CCF a large amount of data that will be used in various CCF projects.

In CCF's own laboratory, DNA was extracted from more than 100 blood samples stored at CCF from 2009 and the second half of 2008. In addition, laboratory work was performed to optimize a multiplex of four markers to specifically differentiate two wild male cheetahs that live on CCF property (the "Wild Boys") and are part of a long-term biomedical study which began in July of 2008. Scat from the Wild Boys is searched for and collected daily, to allow for long-term monitoring of their stress and testosterone levels, diet, and parasite load; over 500 samples are currently available. In a related project, genetic IDs are being obtained from the past two years of Wild Boys samples.

CCF continues to foster relationships within other cheetah range countries to secure samples for CCF's cheetah genetic diversity studies. Over the last 12 months we were able to secure samples from Angola, Algeria, Botswana, South Africa, and from other previously under-sampled regions of Namibia. Eighty of these samples were extracted in 2010 and are currently being genotyped in CCF's genetics lab. Of these, 31 samples ran with a multiplex of four markers, 64% amplified with at least 2 markers, and 23% with none. This success rate falls within the range usually expected when working with non-invasive samples, as these tend to be poor quality samples.

As part of the International Courses in Cheetah Conservation Biology, 22 international students participated in an eight-hour conservation genetics class and were trained in sample collection and labelling. As part of the practical training, the students also performed a DNA extraction in the genetics laboratory.

2.2 Collaborative Genetics Projects

In the scope of an ongoing collaboration on carnivore diversity with the University of Brazil, CCF performed preliminary data analysis for a grant report; the final results of the laboratory work performed in Brazil are expected any time. Future laboratory work will be performed at the CCF laboratory as soon as additional outside funding for this study becomes available. As part of a collaborative effort between World Wildlife Fund, the Namibian Ministry of Environment and Tourism, and Oregon State University, CCF's Applied Biosystems Genetic Conservation Laboratory extracted DNA from 49 buffalo blood samples in 2009. These are currently being analysed at the Department of Fisheries and Wildlife of the Oregon State University.

The genetic work on white rhinoceros, performed in collaboration with the Ongava Wildlife Reserve's Research Centre, was completed this year and a pedigree for the rhinos was finalized using genetic data. The results will be part of an MSc thesis, and a manuscript is currently in preparation. A project on black rhinoceros is expected to begin with Ongava Research Centre in the near future.

As part of a collaborative project with Stanford University, CCF collected genetic samples of "spotted" and "background" areas from cheetah skin, in order to better understand the molecular mechanisms underlying the formation of spots. The results have been very interesting and confirmed the involvement of pigmentation genes as well as keratin genes; keratin being responsible for structure and thus explaining the fact that cheetah spots are softer than the light background colour. A manuscript is currently in preparation.

A new project in planning is the evaluation of genetic diversity of the lion prides in Ongava and Erindi Reserves in collaboration with their research teams. Samples are currently being collected and analysis will start in 2011.

2.3 Scat Detection Dogs

Ongoing training of CCF's two scat detection dogs (Finn and Isha) to find cheetah scat in the field continued through 2010. The dogs are also being trained to differentiate cheetah samples from other carnivore samples that are brought to the genetics lab; they alert the handlers to the cheetah scat by sitting next to it without touching the sample itself. Finn and Isha have both made a lot of progress in their obedience during this year and are now sitting next to the scat for extended periods of time, if needed, waiting for the handler to give them their reward and they are pointing to the exact location on command (which is a very useful command since scat can be hard to see in the tall grass and thick bush). The dogs are also in the process of being trained to alert the handlers to cheetah scat by barking. Finn works exclusively off-leash and Isha is continuously improving her off-leash obedience and will also soon be working off-leash.

Renowned Australian dog trainer Steve Austin visited CCF in early September to mentor staff and help guide CCF's Scat Detection Dog Program. CCF and Steve Austin continue to collaborate, and he is currently training two Springer Spaniels which he will donate to CCF's program.

In November, CCF staff attended a meeting in South Africa on using detection dogs in conservation. A main focus for the meeting was determining a proper survey method using scat detection dogs so that results could be comparable between studies. The meeting also addressed regions in Southern Africa where dogs could be used for surveys studying cheetahs and wild dogs. CCF hopes to collaborate with Endangered Wildlife Trust in creating a Southern African Detection Dog Association to ensure that certain accreditation standards are met for detection dogs working in the Southern Africa region.

Objective 3.

(A) Cheetah ecology

(B) Ecosystem research

(C) Habitat restoration

3A.1 Cheetah Census

Range-wide population estimates for cheetahs are critical for their conservation, but they are particularly difficult animals to study because they are highly secretive and have widespread home ranges. For the fifth year, CCF continued its census research using non-invasive photographic captures via camera traps. CCF's objective is to replicate camera trap surveys for establishing technique reliability and to conduct surveys in other parts of the country to acquire further knowledge of species abundance (Figure 2).

The cheetah census on CCF's property involves 15 camera trap stations, each equipped with two cameras. In total, the cameras take approximately 3200 photos of animals each week. Since the start of this census in June 2010, 10 of the camera trap stations have captured over 7300 images of cheetah. From those images, 11 different individuals have been identified, including one cheetah with four cubs and another cheetah with three cubs. The camera trap stations with the most cheetah activity are located near the Big Field on Elandsvreugde Farm and on Bellebenno Farm. However, cheetahs have also been photographed on Osonanga, Bynadar, and Boskop Farms. The cameras have also captured more than 2100 photos of leopards and occasional photos of other carnivores such as brown hyaena, caracal, and serval.



Figure 2. Camera traps used on CCF's cheetah censusing techniques are checked by CCF staff and Earthwatch volunteers. (c) Cheetah Conservation Fund.

3A.2 The Wild Boys

Over the past few years, the home range and territory of a coalition of two resident male cheetahs, the “Wild Boys” (Sam and Hi-Fi), have been anecdotally known to include CCF property and neighbouring properties to the northeast. Sam was fitted with a VHF radio collar in March 2008, and Hi-Fi was fitted with a GPS-recording satellite collar (also with VHF capability) in August 2009. Since collaring, CCF staff and volunteers have recorded VHF signals, GPS data points from the satellite, and visual sightings of these animals in order to better understand their ranging patterns, diet, and general activity (Figure 3).

In June 2010, Hi-Fi's satellite collar stopped working; however, VHF signals and regular sightings of the two cats continued. In mid-August, after 10 or 12 days of no signals or sightings from Sam, he was found dead. Hi-Fi was recaptured in September 2010. A replacement satellite collar was installed and he was released. In December, Hi-Fi was again recaptured and the satellite collar replaced with a VHF collar before release (the satellite collar will be fitted to a wild cheetah soon to be released elsewhere on CCF property).

The loss of Sam raises the question of how Hi-Fi will respond in terms of his ranging patterns and efforts or ability to defend the territory established with his coalition partner. A new project has been designed for implementation in 2011 to explore and monitor possible outcomes, by analyzing the available historical data to more fully understand the ranging and behaviour patterns of the Sam/Hi-Fi coalition, and to monitor future activity going forward without Sam. Important insights on cheetah societal dynamics following dissolution of a sibling coalition may be gained from this work.



Figure 3. Regular radio-tracking surveys are conducted at CCF's Rhino Reserve with the help of Earthwatch volunteers. (c) Cheetah Conservation Fund / Rob Thomson.

3A.3 Release and Re-introduction

CCF has conducted research on re-introductions and we are currently conducting our fourth such project. Suitable habitat for re-introductions can be difficult to find, due to the extent of land under livestock production, and the fact that habituated cheetahs need large areas uninhabited by people if the re-introduction is to be successful. Once released, it is very important to closely monitor the behaviours of the individual cats to ensure their health and adaptation to their new environment.

CCF has conducted research on several cheetah releases that includes:

- 2004: Two captive raised females released into the ~4000ha Bellebenno Game Camp (on CCF property). After six weeks, they had moved out of the Game Camp and caused problems with a neighbour's small stock. The two females were subsequently returned to captivity.
- 2006: A single captive female and four cubs released into Bellebenno Game Camp. These began hunting and were self-sufficient after 3 months. Subsequently, they were released into the 50,000 ha Erindi Game Reserve.
- 2008: Seven previously captive-held cheetahs (five males and two females) were released at NamibRand Nature Reserve.
- 2010: Four previously captive-held females were released into Bellebenno Game Camp.

The NamibRand Re-introduction

The five males released into the NamibRand Nature Reserve (NRNR) in 2008 were monitored via satellite collars fitted to one of the five up until May 2010. At this time the collar sent its final report and shut down with its batteries exhausted. Local NRNR staff continued monitoring on an ad hoc basis and reported that the group left the reserve a few weeks later. They have since been seen on farmland to the east of the reserve and appear to be continuing to thrive.

A female cheetah that was also released into NRNR in 2008 has been monitored on a weekly basis throughout 2010 with GPS points from a satellite collar being generated on a twice-daily schedule. These data show that she is living almost exclusively on farmland in a fairly mountainous area. Towards the end of 2010 however, the owner of two of these farms has been cooperating with CCF and the NRNR with regard to cheetah monitoring. At the end of 2010, it was reported that the female had been seen with two young cubs, which is consistent with recently observed movements that show her repeatedly returning to the same exact location. This is the third litter to be observed with this female.

Releasing captive cheetahs back into the wild has had many challenges. However, the NamibRand re-introduction has been a success as there are now cheetahs living in an area where they had once been exterminated.

Bellebenno Game Camp "Training Ground" Re-introduction

On 1 September 2010, four female cheetahs were released into the Bellebenno Game Camp as part of CCF's goal to establish a "training ground" in which to prepare previously captive cats for life in the wild. Based on earlier successes CCF has had with releasing cheetah, the decision was made to use the camp as a means of gathering information on the behaviour of the cats as well as feeding ecology, habitat preference and survival techniques/strategies. The cheetahs were observed daily using an intensive tracking and monitoring program which was gradually reduced as the cheetah achieved ever-greater independence. CCF staff followed the cheetah closely throughout the day and sometimes even during the night.

On average, the cats moved 3.8km a day. There was little difference between the distances moved from week to week for the first eight weeks; thereafter, they were tracked and followed less intensively and so movement could not be calculated as reliably. The cheetah moved the greatest distances between 0600-0900 in the morning and 1800-2100 in the evening. They moved on average 1.2 km overnight, between the points where the tracking teams left them in the evening and found them again in the morning. During the first four weeks, the cheetah had ranged over much of the ~4,000ha Bellebenno game camp.

In the first days after the release, the cheetahs were fed twice - on two consecutive days. They quickly began to hunt, however, and they achieved their first kill after only 9 days of freedom. After those two early feedings, we never had to feed them again, as they had become successful hunters. Over 118 days, and out of a 150 hunting attempts, 63 kills were made. Initially, only one of the females was observed to be actively hunting, but after their 20th day of release, the others also made kills of their own. Since then, the four worked as a group to catch the majority of their prey.

Their main prey base consisted of eland - mainly calves, but sub-adult animals were occasionally targeted. They had a very high success rate with eland calves with 35 successes out of the 42 hunts that CCF staff witnessed. Other species were hunted much less frequently but also with high percentage rates for attempts versus successes. It was noted that many of the hunting attempts on warthog were witnessed to be insincere and may have been a result of the cheetah displaying play behaviour as opposed to serious attempts at hunting. Their overall hunting success rate was 42%.

Data were also analysed to determine their preferred vegetation type, especially during hunts. Interestingly, it was found that open areas of vegetation had the highest numbers of attempts but with the fewest successes (81 attempts vs. 27 successes, or 33%). In denser and closed vegetation, they would hunt less frequently but with a higher success rate: in closed, 39 attempts vs. 20 successes (51%) and, in dense, 30 attempts vs. 16 successes (53%). The four cheetahs were briefly returned to captivity in late December 2010 to await transfer and release to Erindi Private Game Reserve in early January 2011. CCF hopes to continue to

use this training method to release many more cheetahs that have been held in captivity, as well as use it as a basis for which other organizations and countries can implement for their own cheetah reintroductions and releases.

3A.4 Collaborative Behavioural Studies

A PhD student affiliated with University College in Cork, Ireland, spent six weeks at CCF in 2010 conducting research on the behaviour of captive cheetahs from a range of zoological institutions and breeding centres worldwide. He aims to develop novel forms of enrichment for cheetahs in captivity and promote natural behaviour while reducing stereotypical behaviour.

Figure 4 demonstrates one type of captive enrichment in the form of a scented zebra dummy. While at CCF he collected behavioural data on many of CCF's captive cheetah as well as high speed videos of cheetahs during enrichment activity.

The student helped design, and is now collaborating with CCF on, a project looking at pre- and post-release behaviour of the four-female coalition released into Bellebenno Game Camp (described above). This study will allow clear comparisons of cheetah behaviour under captive and wild conditions, and will provide additional insights into the success of the release by providing precise information on the activity budgets of the four cats. These data should prove useful for zoological institutions by allowing them to directly compare behaviour in captivity vs. the wild, and the adequacy of certain captive environments in promoting normal cheetah behaviour, and also provide insights for institutions looking to release captive cats into the wild.

Figure 4. As part of CCF's captive cheetah enrichment programmes, Earthwatch volunteers



assist with making a scented zebra dummy. (c) Cheetah Conservation Fund.

3A.5 Cheetah in Angola

Iona National Park comprises 1.6 million ha located in the Namibe province of Angola, an arid area in the extreme southwest of the country known as a former range area for cheetah. However, due to Angola's three-decade long civil war, the cheetah's current status in the country has long been unknown. As such, CCF has had an interest in working with Angolan conservationists to establish the status of the species there. A brief, 3-day survey was thus undertaken to:

- (1) create relationships with Angolan conservationists, government entities, and business institutions;
- (2) perform a general, rapid ecological survey in the Park to confirm the presence of cheetah and other carnivores; and
- (3) obtain information on the distribution and relative abundance of the potential prey base.

The survey produced significant information for the development of a conservation strategy for cheetahs in Angola.

The presence of cheetah was confirmed by a visual sighting of two adult cheetahs fleeing from a play tree. Additionally, cheetah presence was confirmed at three additional sectors where other play trees were found. Cheetah scat found at these sites was collected for dietary and genetic analysis. The presence of other carnivores in the Park was also confirmed through indirect means (i.e., interviews, scat, and spoor). These results indicate a possible resident population of cheetahs in the park, and provide an indication of what needs to be considered in terms of logistics and planning for potential future studies (e.g. terrain).

CCF recommends that future and longer surveys are conducted to collate more basic information about the biology and ecology of the Park. The use of occupancy modelling is recommended as it can simultaneously address a number of different scientific/research questions (Mackenzie et al. 2002, 2006). Further, as a result of meetings in Angola's capital, Luanda, CCF hopes to develop collaborations with local universities and relevant government officials. The goal is to develop a program using CCF's proven methods for censusing cheetah populations and assisting community, government and non-governmental organizations in education awareness of cheetahs and biodiversity to show the benefits of a predator's role in a healthy ecosystem and ecotourism.

3A.6 Cheetah in Zambia

The cheetah population in Zambia is estimated at only ~100 individuals, and Zambia is interested in reintroducing some carnivore species into their former range, including the cheetah. CCF has been asked by the World Wildlife Fund for Nature (WWF) to assist with the reintroduction of cheetah into the Bangweulu Wetlands area in the northeast area of the country. As a potential reintroduction site, Dr. Laurie Marker participated in a rapid survey of the area in December 2010.

The rapid survey assessed various factors within the Bangweulu landscapes, including habitat, prey base, other carnivores, and local communities. The team concluded that re-introduction of the cheetah into Bangweulu Wetlands is feasible; it recommended that managing the small population using scientific planning and management and the established principles of conservation biology were necessary and possible.

The founder population for the Bangweulu Wetlands would be derived from wild free-ranging populations of cheetah in one of the closest breeding populations available (acknowledging that wild cheetah populations in Zambia should not be sourced for reintroductions as the status of cheetah populations in areas of Zambia where they are known to occur is not well documented). As the cheetah subspecies are the same between Zambia and Namibia, the experts agree that Namibian cheetah should be sourced for reintroduction into Zambia.

The CCF team used the population viability analysis program Vortex to model the viability of maintaining a reintroduced population and determine the necessary level of supplementation needed to retain a 90% genetic diversity from the original diversity after 20 years. Baseline parameters were drawn mostly from long-term research conducted by CCF and looked at the feasibility of supplementation (e.g., export permit, logistics). CCF has suggested supplementing a minimum of 16 cheetahs over a period of four years and subsequently 8 individuals every other year.

Future analysis will include site-specific recommendations for reintroducing the cheetah in terms of development of a holding area for soft release, radio-telemetry monitoring and the long-term strategy, commitment, and likely costs involved in the successful establishment of a viable cheetah population.

3B. ECOSYSTEM RESEARCH

Because an estimated 70% of Namibia's game and perhaps 95% of its cheetah inhabit farmlands, assessment of the country's farmland ecosystem for long-term habitat viability for the cheetah and its prey is part of CCF's primary, ongoing research. Much of this focuses on game and prey monitoring and analysis of one form or another, and this is a key area in which Earthwatch volunteers contribute.

3B.1 Cheetah Feeding Ecology

A long-term study on feeding ecology of cheetah continues, using analysis of hairs found in cheetah scat to identify the prey that cheetahs feed on (Figure 5). Past CCF research has shown that cheetahs prefer game to livestock; thus the project provides key information for use in human-wildlife conflict management. This year university interns worked on washing scat, burning hair slides, and identifying the hairs found in the scat.



Figure 5. An Earthwatch volunteer assisting in scat analysis by looking at hair from scat to ID what the cheetah was eating. (c) Cheetah Conservation Fund.

All previously “unidentified” hair samples from scats collected from 1993 to 2010 were re-analysed and combined to create a much larger sample size than any other study on the diet

of the free-ranging Namibian cheetah. Results indicate that cheetahs take wild game much more frequently than livestock (7.3% of samples contained livestock, 87.3 % contained game species), which is similar to findings from previous studies. This is despite the fact that up to two-thirds of available prey is made up of domestic livestock. There was no significant difference between the percentages of livestock eaten on game farms vs. livestock farms (6.25% vs. 7.94%), indicating that even when livestock are available cheetah continue to feed mainly on game species.

Kudu and eland were found in more scat samples than any other species, 34% and 32% respectively. When converting this to the number of individual animals taken, accounting for different animal size and digestibility, then the species with highest numbers taken were of warthog and scrub hare. CCF will continue to collect scat samples from trapped animals as well as from the wild in order to add to this growing database.

3B.2 Game Counts

A series of monthly and annual game counts are a large part of CCF's long-term wildlife monitoring programme. This research is conducted mainly on CCF farms and is designed to understand patterns and trends of game density, movements, demographics, and habitat utilisation. Monthly monitoring involves visual game counts from a vehicle travelling a series of established transects, and categorizing vegetations, densities, and distributions of game species. Game counts are also conducted from an established series of waterholes, typically over a 12-hour observation period (Figure 6). Information from the game counts is also correlated with data collected on rainfall and temperature.

Circuit Counts A & B

Since 1996, CCF has been conducting two "circuit counts" comprising a 55km road strip count transect on farm Elandsvreugde to investigate game distribution in relation to habitat type and trends in density. During 2010, a total of 44 game counts were conducted on these circuits (A & B). Of these, 25 were conducted between January and June, and the remaining 19 in the second half of the year. Trends were similar to those of 2009. Oryx encounters in 2010 were highest, followed by red hartebeest and warthog. Game sightings were most common on circuit B with 81.6% of the total number of observations. Both cheetah and leopard sightings were prominent on the circuit counts in comparison to previous reporting periods. Cheetah sightings were confirmed on five occasions in May, July and December and comprised a female with four sub-adult cubs, a single male, and a coalition of two males. Two leopard sightings were also confirmed in July and December. Game sightings were confirmed to have declined in this reporting period, a trend similar to the 2009 period.

A total of 21 species were observed during the circuit counts and included small, medium, and large ungulates, game birds, and predators. Density estimates were calculated using both the variable and fixed strip methods. Evaluations of these estimates against actual population densities were not performed; however a synergy between these techniques, local knowledge, and long-term data were incorporated in the final decisions.

Fixed strip estimates showed an overall decline of the seven most common species, from 427 individuals per 1000 hectares (ind/ha) to 272 ind/1000 ha in the 2009 and 2010 years, respectively. Estimates derived from the distance methods were higher in all species than the strip counts. As such, the results were found to be more reliable especially the springbok which has a known population size.



Figure 6. Earthwatch volunteers stop to seek out wildlife during one of the 44 game counts carried out by CCF in 2010 as part of its eco-system research. (c) Cheetah Conservation Fund.

Bellebeno 12-hour Waterhole Counts

To assist in developing a management plan for the ~4000-ha game-fenced Bellebeno camp, CCF started monthly 12-hour waterhole counts in 2008. Earthwatch volunteers and other CCF volunteers assist with these ongoing counts, which involve sitting in a hide at Bellebeno's four waterholes and counting all the animals that come to the waterhole over a 12 hour period. Information such as species, age, sex and condition are recorded on standard data sheets, as well as whether the animal utilised the waterhole or the salt lick placed at the site. These counts are designed to help us understand patterns and trends in game numbers, such as survival rates in juveniles and sub-adults, and recruitment from one age class to the next. The counts take place from 6 a.m. to 6 p.m., with two to three counters in each hide. During 2010, 10 waterhole counts were performed. From these, a total of 8432 animals were counted from 37 different species (Figure 7). Warthogs (*Phacochoerus africanus*), guinea fowl (order *Galliformes*), and oryx were the most common species sighted. The average number of warthogs counted in 2010 was 387, which was higher than the previous two years. Kudu (genus *Tragelaphus*) also showed an increase from previous years with an average of 17 being counted this year.



Figure 7. Local and international students and volunteers gathered to participate in CCF's Annual Waterberg Conservancy waterhole count, which in 2010 included 29 waterholes across 11 farms. (c) Cheetah Conservation Fund.

Oryx showed a similar number of animals to previous years with an average of 91 animals being counted. A similar average number of red hartebeest were counted this year than last, three, which was lower than 2008. The average number of Eland counted was 59, which is also higher than the past two years.

Of the five main game species (warthog, oryx, eland - *Taurotragus oryx*, kudu, and red hartebeest - *Alcelaphus caama*), warthogs consistently show the highest densities over the years, followed by oryx and eland. Red hartebeest and kudu have consistently been at very low densities since the start of the counts.

Looking at the data from over the years, a clear correlation between rainfall and density of animals counted is seen. When rainfall is high, the numbers of game counted are low. This is likely due to the widespread availability of water at locations other than waterholes and, rather than reflecting actual changes in population numbers, the low counts are the result of animals not using the waterholes.

In the past year, warthog density estimates range from 5 to 296 animals per 1000 ha, oryx from 1 to 93 animals per 1000 ha, eland from 5 to 81 animals per 1000 ha, red hartebeest from 0 to 10 animals per 1000 ha, and kudu from 0 to 21 animals per 1000 ha. It must be kept in mind, however, that the high rainfalls in March and November led to only small numbers of animals counted, so density estimates and mean number of animals counted have a large range and are possibly (on average) lower than the actual densities in Bellebenno. Warthog seems to be showing a population increase since the start of the waterhole counts, from a mean number of around 100 animals counted per count to over 250. Oryx numbers seem more stable but tend to fluctuate from one half of the year to the other. Eland numbers also seem to be quite stable over the years, fluctuating around 30 animals per count. Kudu and Red Hartebeest are both at low densities and show considerable variation, through no obvious decline or increase is evident.

Field Counts

CCF's "Big Field", known also the "Little Serengeti", is a 1492 ha area of formerly cultivated land. The field, one of the largest open uncultivated areas in the north central farmlands, attracts a high number of free-ranging game. This area provides an ideal case study to monitor ecological succession trends. Apart from being a high prey density area for cheetahs and leopards, this area has great potential for ecotourism. For these reasons, CCF has been conducting monthly game counts ("field counts") since 2004. During 2010, a total of 37 replicate counts were conducted on the Big Field, with the assistance of Earthwatch volunteers, students, and CCF staff, with 19 occurring in the first half of the year (Jan - Jun), and 18 in the second half (Jul - Dec). All data from these surveys were entered into the main database and preliminary results on trends were produced. For another consecutive year, the density of common wildlife on the Big Field showed a decrease during 2010. Declines were significant amongst oryx red hartebeest and eland. Warthog was the only species that showed a slight increase during the current period under review.

Analysis of the Big Field counts reveals that oryx, red hartebeest, and warthog were the most common animals, which is consistent with the 2009 counts. Non-frequent species observed have included eland and steenbok, but no eland were recorded in 2010. The highest number of springbok was recorded during November with a density of 29 individuals. Game densities were highest during the Jan - June period and declined by 53% during Jul - Dec. Mean densities per 1000 ha were highest between January and April, the hot and wet season (217 ind/1000 ha), and declined between May and August, the dry and cold season (111 ind/1000 ha). This trend was consistent with the 2009 results during the same period.

Annual Waterhole Count & Strip Counts

For the past 16 years, CCF and the Waterberg Conservancy have conducted annual waterhole counts. In addition, CCF conducts annual road strip counts after the waterhole counts in order to look at the variation between these counting methods. During August 2010, 18 replicate strip counts (x3 per farm) were conducted on CCF farms Bellebenno, Bynadaar, Elandsvreugde, Boskop, Cheetah View, and Osonanga.

Annual Waterhole Count

CCF, along with other members of the Waterberg Conservancy conduct an annual 12-hr waterhole count timed to coincide with that late-July or early-August new moon. In 2010, this occurred on 10 August. This annual count provides population and density estimates and trends of various game species on the Waterberg Conservancy farms. The count also provides information on group sizes and population demographics and is vital for long-term monitoring. Through continued regular monitoring of wildlife populations utilising the Conservancy lands, more effective conservation of game species will be possible. Data from the counts is used to determine which species (and sex) can be hunted to sustain a healthy population, as well as to highlight those that need to be conserved. Regular monitoring of key indicator species gives an indication as to the health of the ecosystem in general, signalling problems as they emerge and while they are still manageable.

This year 29 waterholes were counted across 11 farms within the Conservancy. The observers included CCF staff and volunteers, volunteers from the Otjiwarongo Arts Centre, 4H Otjiwarongo, and CCF farm staff. A total of 5963 individual animals representing 32 species (24 mammals, 8 birds) were recorded, with warthog, guinea fowl, kudu, oryx and francolins (genus *Francoelinus*) being the most common species.

Some trends can be seen over the past 16 years among the five main game species across the Conservancy. Red hartebeest have increased in numbers since 1995 but still remain at relatively low densities. Kudu numbers have fluctuated since 1995, but appear to be increasing

since 2008. The density of eland, although higher than 1995-2001, is still quite variable. Warthog densities appear to be on a steady increase, as do oryx.

Strip Counts

Strip counts were performed on six CCF farms concurrently, for three consecutive days in August 2010, timed to occur just after the Conservancy waterhole count. All game animals seen on these transects were counted and the perpendicular distance from the car recorded. Over the three days, a total of 1412 animals were counted from 23 species. The most common species were guinea fowl and oryx. Highest numbers of game were recorded on farm Osonanga, followed by Elandsvreugde, Bellebenno and Boskop. The main species counted on Osonanga were guinea fowl (47%) and red hartebeest (21%). The main species counted on Elandsvreugde and Bellebenno were oryx (35% and 30%) and warthog (28% and 17%). For Boskop, the main species sighted were guinea fowl and warthog (32% and 14%), for Bynadaar, guinea fowl and kudu (35% and 27%) and for Cheetah View, kudu and warthog (24% and 16%).

Density of common game species were determined by using both a fixed width and variable width approach. The fixed width was calculated from measuring visibility distance for human subjects along each of the transects. The recorded strip widths were then averaged to estimate total area surveyed, which was used to calculate density. The variable width was calculated using the perpendicular sighting distances recorded for each animal. This allows us to calculate an estimated strip width and the probability of detecting an animal within a strip area to then estimate the density.

Comparison between Strip Counts and Waterhole Counts on CCF Farms

A comparison of density estimates (animals per 1000 ha) derived from the waterhole counts, as well as the strip counts using fixed width and strip counts using variable width, for all CCF farms combined shows a general agreement between the different methods of estimation. Although there is a lot of variation with all of these methods, there is no statistically significant difference between the density estimates for each species for either the strip counts using fixed or variable widths or the waterhole counts. This precision gives us greater confidence in these density estimates; however, taking into account the high level of variation, using multiple methods to estimate density is still recommended.

3B.3 Fixed Point Photography

To monitor long-term vegetation changes over time, CCF takes fixed-point photography photos. This has been conducted since 1997. During the last year, fixed-point photography was taken during the hot and wet (Sept - Dec) and dry and cold (May - Aug) seasons at 11 locations on farms Elandsvreugde and Osonanga. Photos are taken using a digital camera.

3B.4 Swing Gates

In preparation for the re-introduction of cheetah into the ~4000-ha Bellebenno Game Camp, CCF's research into swing gates continued in 2010. CCF's goal with swing gates is to keep the re-introduced cheetahs inside the camp, while allowing smaller animals (especially those that are natural "diggers," such as warthogs) to come and go. CCF will continue to promote the swing gates concept as a reliable and cost-effective tool to protect game-fenced farmland structures from damage due to burrowing/digging animals by excluding predators from an enclosure whilst allowing the free-range movement of smaller mammals (Figure 8). This is a unique predator-friendly management plan that could potentially help to reduce unnecessary radical actions (shooting, trapping, poisoning, etc.) and save the farmers on costly preventative measures such as electrical fencing, jackal proofing, etc.



Figure 8. A camera trap captures the image of a warthog utilising a swing gate during CCF's cheetah re-introduction research. (c) Cheetah Conservation Fund.

Throughout 2010, swing gates were repaired and assessed and repairs were made as necessary to holes in the fence line. New swing gates were installed in place of larger, continually used holes (Figure 8). All the swing gates were cleared of surrounding overgrown material to create a “game path” leading to/from all swing gates, on both sides of the fence, providing the animals with a path of least resistance. In March all the gates were opened and existing holes filled in and/or blocked to enable the animals to get used to these “game paths”. The use of brush and thorn branches to block “undesirable” paths proves to be a good method of plugging washed out areas. In April all gates were closed and monitoring began.

During May, June and July, spoor checks at gates were carried out every five days and camera traps were set in place to establish which species were using the swing gates. The most common animals that were using the swing gates were warthog, porcupine, and jackal (genus *Canis*). From July, the fence line was checked daily for any new or reopened holes. The number and location of these holes was recorded. Results have shown a substantial decrease in the number of new or reopened holes since the beginning of the study (-50%). The lowest number of holes produced was in October. In November and December there was a slight increase in the number of holes. This increase may potentially be due to the start of rain in November, which softens up some substrate types, making digging holes easier. The average number of holes produced daily decreased from 20 in July to 10 in December. Interestingly, the number of holes produced tends to increase around the time of the full moon. The locations of holes will later also be correlated with substrate and vegetation type and compared between wet and dry seasons.

3B.5 Non-target Camera Trap Photos

Beginning in late 2010, CCF began investigating the use of non-target camera trapping photos to estimate game species richness and density. Remote camera traps have been used to investigate a wide diversity of research questions ranging from ecological to behavioural studies. However, their use for estimating density from non-target species has been limited. CCF staff are using a new approach that models the underlying process of contact between animals and cameras to investigate abundance indices. The model provides a factor that linearly scales trapping rate with density, depending on two key biological variables (average animal group size and day range) and two characteristics of the camera sensor (distance and angle within which it detects animals). Its primary assumptions are that cameras are independent, the population is demographically and geographically closed during the sampling period, and the sampling follows a systematic approach. Camera trap studies on rare carnivores often do not follow a random or systematic sampling approach.

However, these stations can be considered random sampling sites for other wildlife species. This study's primary goal is to establish the monitoring value of these non-target datasets. Therefore, as this study progresses, we will test, evaluate, and refine Rowcliffe's density estimator for non-target species. Obtained estimates will be compared to those obtained from other count-based estimates (i.e., waterhole and strip counts). We will also assess to what extent camera traps detect all species known in the area using rarefaction curves. Findings from the study are relevant for monitoring purposes as non-target datasets are by-products for any camera trap based survey.

3B.6 Bellebenno Giraffe Project

The second half of 2010 saw a revamp of the Bellebenno Giraffe Project. In 2003, all the giraffe in Bellebenno were identified and research into their feeding ecology carried out. The feeding ecology research was repeated again in 2004, 2005 and 2006.

In the second half of 2010, the Bellebenno Giraffe Identification Book was updated to include new giraffes as well as to identify which giraffes had escaped from the Bellebenno camp. For each individual, photos of the left and right side were compiled and individual spot patterns or markings identified. At the end of 2010, 33 giraffes were identified in Bellebenno: 10 adult males, nine adult females, seven sub-adult males, four sub-adult females, and three male calves. Nine other giraffe that have either escaped from Bellebenno or are living on other CCF farms have also been identified.

In October and November research into the feeding ecology of the giraffes in Bellebenno was carried out. Individual giraffes were followed for 15-minute focal observations whilst feeding, to establish which species of trees they were eating, how much time was spent eating per tree, and the distance moved between trees. As well as these focal observations, the locations of giraffes as well as the identity of individuals in groups were recorded to establish how they are using the Bellebenno camp as well as to define any social groups or social networks. This research is planned to continue into 2011.

3C. HABITAT RESTORATION

Habitat restoration work and research continued, centred on CCF's Bush project. While bush encroachment is considered a major problem in Namibia, harvesting also has potential as a renewable resource for alternative energy, especially in rural areas, and to alleviate electricity shortages projected to affect Namibia in the near future.

During August - October, a bird and camera trap survey was conducted in areas of restored habitat. The aim of the project was to evaluate the response of the local biodiversity towards bush thinning operations on a short-, medium- and long-term basis. GIS methods were used to design the study area, which comprised 140 hectares of restored and non-restored habitat. In each site, sample points were located at least 100 meters apart in a square pattern. Bird surveys were conducted at randomised locations using seven to nine points in the morning

and afternoon periods. Surveys were repeated over five to eight times (depending on sampling variance) on different days. In addition, a camera trap survey was conducted per treatment site and was rotated within the study site on a ten day interval. Cameras were active for a period of three months. Analysis of the results is underway with preliminary results showing visitations in restored habitat, especially by cheetah and leopard.

Objective 4. Human-wildlife conflict

Livestock loss to cheetahs is an economic and emotional issue. Farmers perceive cheetahs as having an excessive economic impact on their livestock and wild game industries. Many Namibian farmers have done little to alleviate their problems in a non-lethal manner through appropriate livestock and predator management. By addressing the farmer-predator conflict through a conservation management strategy that benefits both humans and cheetahs, CCF is ensuring the species' survival on Namibian farms and has raised greater awareness of better farm practices.

4.1 Livestock Guarding Dog Programme

The Livestock Guarding Dog (LGD) programme at CCF is considered one of the most successful conservation projects in regards to human/predator challenges, and plays a crucial part in CCF's mission of conserving the wild cheetah. As of December 2010, the programme comprised 158 live dogs, 118 of which are working dogs and 40 are retired or pets. Of the working dogs, 52 are on commercial farms, 21 are on communal farms, 27 are on emerging commercial farms, and eight are on resettled farms. One male dog is working in Kenya and nine are working in South Africa. In 2010, 17 puppies were born alive from four litters produced by three of our breeding females.

On 27 January 2010, the first puppy produced through artificial insemination was born to Uschi; unfortunately, however, the puppy was stillborn. In June, CCF conducted artificial insemination again on an Anatolian Shepherd and a Kangal, utilising frozen sperm imported in 2009. Uschi produced four puppies after insemination with Anatolian sperm; one of which was stillborn (Figure 9). The other three puppies (all female) from this special litter will be used for breeding. The Kangal, Cazgir, did not become pregnant, despite two attempts with the imported Kangal sperm. Artificial insemination with frozen sperm is particularly challenging, as frozen semen has a very short lifespan. Our half-breed Anatolian, Penda, gave birth to nine healthy puppies on 6 June 2010. A month earlier, she had been bitten by a puff adder and was under medical treatment. The puppies were born healthy and grew well under the care of CCF staff and volunteers. Tragically, one puppy fell out of the back of a farmer's truck on the way to his new home; he was lost, presumed dead. On 19 August 2010, Tylee, an Anatolian, gave birth to 13 puppies; however eight of these were stillborn. The surviving five puppies were healthy. Tylee, now seven years old, has produced 58 puppies from six litters; in November she was spayed at the CCF clinic and retired from breeding and working. She now lives with CCF staff at the Boskop farm house.

CCF guard dogs continue to be in high demand, with 109 farmers in our applicant database. In line with CCF's goal to expand the guarding dog breeding programme, three donated puppies from Germany and France (1M, 2F) were imported to be used as breeding dogs in 2010. All three dogs have settled down well in the CCF goat kraal and have started their working careers; these young Kangals, with their diverse bloodlines, are an important addition to CCF's guarding dog breeding programme. Continual care and monitoring of the Livestock Guarding Dogs is essential for the programme's success (Figure 10).



Figure 9. The first successful artificial insemination on one of CCF's Livestock Guarding Dogs resulted in the birth of three puppies in 2010. (c) Cheetah Conservation Fund.



Figure 10. Caring for CCF's future livestock guarding dogs is an important task performed by staff and volunteers. (C) Cheetah Conservation Fund / Rob Thomson

After CCF staff conducted preapproval visits to farms, at eight weeks of age the above-mentioned puppies were placed with 13 farmers. Puppies are given out after a day-long farmer training course held at the CCF research centre to educate the farmers about proper nutrition, medical needs and training methods. These puppy days took place on 7 August for the June litter and 23 October for the August litter. Following the course, puppies are adopted and farmers are encouraged to buy a bag of high-quality dog food at CCF's cost price.

Between January and March 2010, CCF conducted a country-wide survey of its Livestock Guarding Dogs during the annual visits, which involved 74 dogs and interviews with each dog's farmer or herder. If the farmer reports that the dog displays any unsatisfactory behaviour, the visiting CCF staff gives advice on how best to correct these problems. Follow-up calls to farmers are made throughout the year, particularly when it is not possible to visit certain farms that are far from the CCF centre.

The June litter puppies were visited in September (at three months old) and at the end of November (at five to six months old) to ensure that the correct care and training is being provided at this crucial stage of their working lives. The August litter puppies were visited in November when the puppies reached 3 months of age. The puppies from both litters were reported to be working well and the farmers have followed the guidance provided by CCF satisfactorily.

During the visits, CCF provides vaccinations, de-worming tablets, veterinary supplies for minor injuries, topical anti-parasitic agents, and dog food for purchase. The medical supplies help ensure that the dog's health is a priority. The dog's working success has been correlated with good care. Unfortunately, not all farmers provide the proper care. Therefore, the follow up visits are critical and the removal of dogs that are not cared for is necessary.

Two female dogs had to be removed from the farms where they were working in January and December, respectively. In both cases, the owners believed that the dogs were too old to work, however the reason for the dogs not working was malnutrition. Both dogs were brought back to the CCF centre and slowly regained their health under the care of staff and volunteers. One has since been re-homed as a working dog on a nearby farm; she is now in excellent condition and is working well. The other is still being nursed back to good health. She will be re-homed to another farm once she has regained her condition.

A male dog was removed from the farm where he was working as it appeared that he had an injured hind leg and could no longer work. He was brought into the veterinary clinic in Otjiwarongo where an X-ray was taken, from which it appeared that the cause of the injury could be bone cancer. A bone biopsy has since been conducted at CCF to ensure a correct diagnosis. The sample was sent to the pathology lab; CCF is awaiting the results of the biopsy.

4.2 CCF Farm and Livestock Model

CCF's farm provides the opportunity to practice and experiment with optimum methods of livestock and non-lethal farm management practices, especially acting as a showcase model of success. We aim to demonstrate to farmers that they can operate a farm successfully, protect their livestock, and avoid conflict with predators by applying appropriate husbandry and management techniques. CCF's cattle, goat and sheep herds continue to increase and selected herds have been used during various farmer training programmes. At the end of 2010, CCF livestock herds reflected the following numbers: 436 cattle, 128 Boer goats, 34 dairy goats, and 75 Damara sheep.

Objective 5. Rhino reintroduction

Intensive monitoring continues in CCF's 14,640-ha rhino reserve, where five (3M, 2F) south-western black rhinos (*Diceros bicornis bicornis*) reside. CCF is part of the Namibian Ministry of Environment and Tourism (MET)'s Black Rhino Custodian Programme. This programme fits perfectly with CCF's goals for our own land, which include the preservation of indigenous species and biodiversity, with a focus on endangered species such as the cheetah and the black rhinoceros.

CCF's monitoring programmes provide ongoing protection for these critically endangered animals. Regular radio-tracking surveys are conducted, and maps showing rhino movement are shared with MET on a monthly basis. In addition, 20 trail cameras are deployed across the reserve at key points that include waterholes, game trails and roads, and rhino dung middens. Their placement is determined by a number of factors, including data obtained from the radio-tracking, along with spoor and scat sighted by the monitoring teams. Cameras are regularly moved, as the rhinos themselves migrate across the reserve. Individuals can be identified in photographs by a number of features, including ear-notches, horn profiles, and skin folds. At this time we have over 2,300 positively identified photographs of our rhinos. Waterhole counts and night-time monitoring patrols are also conducted, while a number of additional, hi-tech monitoring methods are under investigation.

A new project to match spoor with individual rhinos was started in August. Tracks found in front of cameras are measured and matched with positively identified photographs. In the future it is hoped that it will be possible to identify rhinos from spoor measurements alone.

As part of our ongoing commitment to environmental education all volunteers have spent time with our rhino patrols and are taught about the rhino's 50 million-year history and the current problems they face from the multi-million-dollar illegal horn trade.

REPORTING AGAINST MEASURES OF SUCCESS (MoS)

Partnerships

Large Carnivore Management Association (LCMAN)

CCF continues to collaborate with other researchers, farmers, NGOs and the government to pave the way for conserving large carnivores in Namibia. This group of experts and stakeholders has come together under the banner of the Large Carnivore Management Association of Namibia (LCMAN). CCF functions as the secretariat to LCMAN.

Since the inception of LCMAN, there has been a drive to provide the Ministry of Environment and Tourism (MET) with expert advice and guidance during policymaking procedures. In 2010, CCF representatives attended five LCMAN general meetings and two special meetings focused on specific aspects of carnivore research and management.

The Cheetah and Wild Dog National Plan, the National Lion Management Plan and the Captive Carnivore Policy were discussed during the LCMAN meeting of 13 January 2010. On 11 June 2010, a day-long planning session took place to develop a Terms of Reference for the organization and discuss the way forward for the group. At the Annual General Meeting on 12 June 2010, Faith Chambara was officially introduced as the new LCMAN coordinator/Secretariat working within the Namibian Nature Foundation, thus reducing the responsibilities that CCF has carried for over 10 years in this role. These important developments will help in communications with MET and increased the flow of information among LCMAN members.

The increased communication with MET led to LCMAN members providing expert advice to MET at a special meeting on 12 July 2010 regarding their pending census of leopards in Namibia. By combining the experience of all the LCMAN member associations, a plan for obtaining a good estimate of leopard numbers in the country was put forward to the MET. Once completed, the census will guide the quota system for hunting leopards in the country to ensure that this species is not overexploited.

Several committees were developed to drive LCMAN's actions, and Dr. Laurie Marker became the Chair of the Research Committee. This committee held a special meeting to develop a protocol for the pickup and release of large carnivores captured by Namibian farmers. Their recommendations were presented at the 25 November 2010 LCMAN meeting. This is an important step towards standardizing the methods and defining best practice procedures among carnivore conservation NGOs in Namibia.

Conservancy Association of Namibia

For the past five years, Dr. Laurie Marker has served as the Conservancy Association of Namibia (CANAM) Chairwoman. She recently stepped down and took the position of Vice Chair. During the first six months of the year, Dr. Marker attended four meetings including a successful visioning meeting with key conservation partners in February to brainstorm the future direction for CANAM. A number of key issues were identified throughout the session including a concise vision for the organization.

Dr. Marker helped to plan and manage the Annual General Meeting in April. The main work of CANAM for the year was to finalise the first edition of the Commercial Conservancy publication which has been spearheaded by Dr. Marker and CCF. This publication is due to be printed in early 2011.

Contributions to conventions, agendas, policies, management plans

- **International**

CCF assists in international programme development and adapts model programmes developed in Namibia for use in other countries, distributing its materials and information throughout Africa and the rest of the world.

International Cheetah Studbook

The International Studbook questionnaire returns from 2010 year-end are being processed and will be analysed in early 2011. CCF is working to update out-dated files from institutes that have had little contact with the International Cheetah Studbook before finalising the 2009 International Cheetah Studbook in early 2011.

See also Conference Proceedings under Dissemination.

International Meetings

In March, Drs. Laurie Marker and Bruce Brewer attended the Iranian Cheetah Strategic Planning Meeting in Switzerland with a small group of cat specialists and Iranian officials. The group reviewed the past 10 years' work and planned the next 10 in order to help the small Iranian cheetah population survive into the future. CCF has trained over 25 Iranian conservation scientists and is committed to continue its help.

In June, CCF staff member Ezekiel Fabiano attended the Mozambique National Action Planning Workshop for cheetah and wild dog. The workshop was promoted by the Regional Cheetah and Wild Dog co-ordinator and the Mozambique Ministry of Tourism. During this trip, Fabiano was able to meet with the National Directors for Tourism and Agriculture and discuss how CCF could be of assistance during the implementation of their national action plan.

In August, Dr. Marker travelled to Tanzania to attend the Leadership for Conservation (LCA) in Africa 2010 Council Meeting. As a Namibian representative for the LCA, she was sponsored to attend the workshop by Howard Buffett. Marker presented on the Cheetah Regional Strategies and how LCA could become involved. LCA chose cheetah projects for Angola, Zambia, and Mozambique and suggested that they potentially could help with sponsorship in these countries.

In September, Dr. Marker joined international cat specialists in South Africa to evaluate the progress of the South China Tiger Rewilding and Reintroduction Project undertaken by Save China's Tigers (SCT), and to assess its role in conserving the South China tiger in the wild.

- **National or regional**

Please see the section above, under the title "Partnerships" for a discussion of CCF's contributions to the following:

- Cheetah and Wild Dog National Plan
- National Lion Management Plan
- Captive Carnivore Policy
- Census of Leopards in Namibia
- Vice Chairmanship of the Large Carnivore Management Association of Namibia (LCMAN)
- Chairmanship of the Research Committee, LCMAN
- Vice Chairmanship of the Conservancy Association of Namibia (CANAM)

Dissemination

Printed

In addition to the 2009 Annual report, the following materials were produced during 2010:

Theses:

Richards, R. (2010) The potential for biomass certification to fuel landscape restoration in Namibia. MSc Thesis . University of Maryland, USA.

Vercrujisse, L. (2010) Patch use as an indicator of habitat preference or competition for the cheetah (*Acinonyx jubatus*) in North-Central Namibia. MSc Thesis . Wageningen University, Netherlands.

Book Chapter:

Marker, L., Dickman, A. J., Mills, G. L. Macdonald, D.W., (2010). Cheetahs and ranchers in Namibia: a case study. In: *Biology and Conservation of Wild Felids*. Ed. Macdonald, D.W. and Loveridge, A. Oxford University Press. pp. 353-372.

Conference Proceedings:

Passmore, B. R., Marker, L. (2010) How ancient methods of livestock management are helping to save cheetahs (*Acinonyx jubatus*) from extinction. Proceedings, Animal Behaviour Management Alliance (ABMA) 2010 Annual Conference. Pittsburgh.

Terrell, K. A., Wildt, D.E., Anthony, N. M., Bavister, B.D. Leibo, S.P., Penfold, L.M., Marker, L.L. and Crosier, A.E. (2010) Oxidative Metabolism Is Required for Sperm Motility and Viability in Felids, but May be Impaired in Cheetah (*Acinonyx jubatus*) Ejaculates. In: *Cell Adhesion Dynamics in Reproduction* session, poster and paper. 43rd Society for the Study of Reproduction 2010 conference in Milwaukee, WI.

Harris, J., Nghikembua, M., Tregenza, T., Marker, L. (2010) Interactions between bush encroachment and large carnivore habitat selection: a case study using GIS software to track GPS satellite collared cheetahs in Northern Namibia. (accepted for the special poster session GIS in Wildlife Ecology). Wildlife Society Annual Conference.

Papers Published:

Terrell, K. A., Wildt, D.E., Anthony, N. M., Bavister, B.D. Leibo, S.P., Penfold, L.M., Marker, L.L. and Crosier, A.E. (2010) Evidence for Compromised Metabolic Function and Limited Glucose Uptake in Spermatozoa from the Teratospermic Domestic Cat (*Felis catus*) and Cheetah (*Acinonyx jubatus*). *Biology of Reproduction* 83 (5): 833-841

Stein, A.B. Stein, Fuller, T.K., Damery, D.T., Sievert, L. & Marker, L.L. Farm management and economic analyses of leopard conservation in north-central Namibia. *Animal Conservation* 13(4): 419-427. August 2010

Digital

After the successful launch of CCF's new web site last year, focus has now shifted to taking a more active role in social networking web sites. In addition to the re-vamped Cheetah News blog and Twitter account that continues to attract new followers, CCF's "fan" page on Facebook started in April with 866 followers, grew to 3,224 members at the end of this reporting period. Web-based social networking also continues to spread with independently created pages on Facebook: two CCF alumni (volunteers) pages and two general CCF pages, as well as one CCF Causes page which accepts donations and currently include 9,656 members, an increase of 4,287 since 31 December 2009.

CCF's increased popularity on Facebook resulted in its selection by Kruger Park online's (www.krugerpark.com) Facebook community as the recipient of a portion of the proceeds of every booking. KrugerPark.com is a tour operator based in South Africa that books tours and

holidays for the national parks in South Africa. CCF was chosen among seven very worthy causes, including World Wildlife Fund South Africa, the International Anti-Poaching Foundation and Save the Rhino.

Three e-newsletters were sent out during 2010 worldwide, to an average of 25,000 e-mail addresses. Seven new CCF videos were posted on the CCF's YouTube.com channel during this period, and have been viewed nearly 15,000 times:

- The Indianapolis Prize 2010: Dr Laurie Marker
- Chewbaaka Challenge
- There are Cheetah in Angola!
- After a Long Civil War: There are Cheetah in Angola!
- Counting Cheetahs at the Cheetah Conservation Fund
- Jeff Corwin Introduces CCF

Bernard Data Solutions was selected to be the provider of CCF's new donor information management system. The implementation began with Phase 1 which involved the migration of all donors from our prior system. Phase II covers the migration of the historical gift information from the prior system to Bernard. The completion of this phase enabled us to run in-depth queries from the new system, which has a very extensive, easy-to-use interface for querying data as well as a robust report selection. Phase II is targeted for completion by mid February. Subsequent phases will be implemented as soon thereafter as is reasonable.

Mass media

Press Releases

During this reporting period, 19 CCF-related press releases were issued, including the announcement of Dr. Marker's research trip to Angola, where cheetah presence was confirmed after nearly 30 years of civil war. This press release received ample worldwide coverage resulting from its being picked up by the Associated Press. Ample international attention was also given to a press release issued by Sony Online Entertainment -and re-distributed by CCF, regarding Wildlife Reserve, a new virtual online game that will benefit CCF. Press releases were as follows:

17-Jan-10, Cheetah Conservation Fund to Conduct Country-wide Health Survey of Livestock Guarding Dogs (Namibia)

1-Mar-10, International Conservationists attend courses at the Cheetah Conservation Fund (Africa)

16-Mar-10, Cheetah Presence Confirmed in Angola (Worldwide)

13-Apr-10, Laurie Marker Named Finalist for the 2010 Indianapolis Prize US - (Africa)

27-Apr-10, Cheetah Conservation Fund Education Programmes Highlight 2010 United Nation's Year of Biodiversity (Africa)

3-May-10, Tyler Prize Laureate Discusses Cheetah & Habitat Conservation Reflects on Gulf of Mexico Oil Spill's Devastation to Wildlife (California)

5-May-10, The Gulf of Mexico Oil Spill and the Need for Alternative Fuel Sources (Worldwide)

23-Jun-10, CCF Announces its 2010 Annual Fundraising Gala (Africa)

19-Jul-10, CCF held its 12th Annual Fundraising Gala and Conservation Awards (Africa)

10-Aug-10, Cheetah found in Swakopmund now safe at CCF (Africa)

12-Aug-10, First AI Litter of Livestock Guarding Dogs Born at CCF (Worldwide)

2-Sep-10, U.S. Trade Mission Visits CCF and Bushblok (Africa)

11-Sep-10, CCF Joins Army Ten-Miler Youth Run (Washington DC)

4-Oct-10, Award Winning Authority to Speak at the Oregon Zoo Local (Oregon)

5-Oct-10, Scientists Confirm the Role of Rewilding Captive Populations to Save the South China Tiger (Worldwide)
3-Nov-10, CCF Founder Receives Prestigious Lowell Thomas Award (Worldwide)
7-Nov-10, Rare Kungai Puppies join the Cheetah Conservation Fund (Worldwide)
24-Nov-10, Sony announces online game to benefit CCF (Worldwide)
5-Dec-10, Reducing Predator Conflict During Calving Season (Namibia)

Print & Broadcast Outlets

The two PR agencies representing the Tyler Prize and the Indianapolis Prize worked closely with CCF to promote these awards. The Tyler Prize award resulted in ample coverage worldwide, and included publications and media outlets such as Discover Magazine, Los Angeles Times, Associated Press, and BBC Radio. At least 42 news and mass media reports resulted (too numerous to specify here).

CCF staff directly handled some 100 media inquiries, including 45 print (magazines/newspapers), 46 electronic (radio/ film/TV), and one media trip. These resulted in 45 published, aired, or scheduled for publication/airing stories.

CCF handled two film crews. News and Pictures Fernsehen GmbH & Co. (Germany) visited CCF in January to film a TV documentary titled Planetopia that aired in two parts on SAT1 TV Germany in February. In June, a crew from One Planet (France) shot the documentary "Save the Wild Orphans" hosted by renowned French journalist Olivia Mokiejewski. This will be a six-part documentary that aired on several international networks such as France 5 (the educational station), YLE (Finland), and Discovery Channel.

In total, the following five shows/documentaries filmed by crews in Namibia aired between January-December 2010:

- BBC (UK): "Inside the Perfect Predator," July-August 2009, aired 25 March 2010 on BBC One. <http://www.bbc.co.uk/programmes/b00rfh1s#clips>, <http://press.discovery.com/us/apl/programs/inside-perfect-predator/>
- Fernsehen GmbH & Co. KG (Germany): Planetopia, 21-23 January 2010, aired in two parts in February 2010. <http://www.planetopia.de/archiv/news-details/datum/2010/07/11/geparden-in-not-wissenschaftler-retten-die-bedrohten-raubtiere.html>
- Namibian Broadcasting Corporation: Good Morning Namibia, April 2010, aired April 16 - 7:00 a.m.
- FL Concepts (France): ExtinctionsTV aired July 26 on France 5. Interviews and teasers available at <http://www.youtube.com/user/EXTINCTIONStv>
- Rovi Film (Germany): Jerome: The Story of a Cheetah, 5-19 November 2009, aired 30 May 2010 on ARD's "W wie Wissen" Germany - http://www.rovi-film.de/index.php?go=show_video&id=v004 / <http://www.ardmediathek.de/ard/servlet/content/3517136?documentId=4538704>

Finally, CCF staff monitors media through Google's free News Alerts service. During 2010, Google reported 250 articles or electronic media items in connection with CCF or its projects. All but 9 mentioned CCF and/or Dr. Laurie Marker. 86 articles were the result of CCF's proactive media outreach, such as press releases and announcements, with the Angola press release obtaining the most coverage: 22. Efforts of PR agencies representing the Tyler Award and the Indianapolis Prize, as well as the new cheetah exhibit at the Indianapolis Zoo, resulted in 68 articles. The remaining articles resulted from volunteers' lectures or other cheetah-related topics.

Meetings and conferences

In March, Drs. Laurie Marker and Bruce Brewer attended the Iranian Cheetah Strategic Planning Meeting in Switzerland with a small group of cat specialists and Iranian officials. The group reviewed the past 10 years' work and planned the next 10 in order to help the small Iranian cheetah population survive into the future. CCF has trained over 25 Iranian conservation scientists and is committed to continue its help.

In June, CCF staff member Ezekiel Fabiano attended the Mozambique National Action Planning Workshop for cheetah and wild dog. The workshop was promoted by the Regional Cheetah and Wild Dog co-ordinator and the Mozambique Ministry of Tourism. During this trip, Fabiano was able to meet with the National Directors for Tourism and Agriculture and discuss how CCF could be of assistance during the implementation of their national action plan. Dr. Bruce Brewer and Dr. Marker travelled to South Africa to meet with CCF major sponsor, Howard Buffett at his farm to update him on the success of the International Courses. In August, Dr. Marker travelled to Tanzania to attend the Leadership for Conservation (LCA) in Africa 2010 Council Meeting. As a Namibian representative for the LCA, she was sponsored to attend the workshop by Howard Buffett. Marker presented on the Cheetah Regional Strategies and how LCA could become involved. LCA chose cheetah projects for Angola, Zambia and Mozambique and suggested that they potentially could help with sponsorship in these countries.

In September, Dr. Marker joined international cat specialists in South Africa to evaluate the progress of the South China Tiger Rewilding and Reintroduction Project undertaken by Save China's Tigers (SCT), and to assess its role in conserving the South China tiger in the wild. In addition to Dr. Marker, the workshop included Dr. Peter Crawshaw of Centro Nacional de Pesquisa e Conservação de Mamíferos Carnívoros, Cenap/ICMBIO, Dr. Gary Koehler, Dr. Jim Sanderson of Small Wild Cat Conservation Foundation, Dr. Nobuyuki Yamaguchi of Department of Biological and Environmental Sciences of Qatar University, and Dr. David Smith of Minnesota University, Chinese government scientists as well as representatives of SCT. Results of the workshop detailed the progress to date on the South China Tiger Rewilding Project and provided guidance in the way forward in tiger conservation.

Educational resources

Public education and the development of an active grassroots constituency are integral components of CCF's overall cheetah conservation programme. CCF educates farmers, students, educators, public-policy makers and the public on the value of sustainable practices in conservation, as well as on the importance and value of predators for a healthy ecosystem. Public education and the development of national pride in the cheetah are critical to its survival.

International Training Course on Integrated Livestock, Wildlife, and Predator Management
In February 2010 and March 2010, CCF held its fourth and fifth international training courses on Integrated Livestock, Wildlife and Predator Management. A total of 38 participants from Namibia, Botswana, Ethiopia, Iran, Kenya, Mozambique, and Zambia spent two weeks immersed in lectures and hands-on activities related to integrated management systems and mitigation techniques for dealing with human-wildlife conflict situations. A training field trip was conducted at a re-settled farm, Queen Sophia, where course participants learned about questionnaire techniques and community -based needs assessments around livestock and predator management.

International Course in Conservation Biology

The fourth international course in Conservation Biology was held from 3 June until 1 July for 20 international wildlife professionals from four continents and 11 countries. Participants learned about CCF's programmes and conservation initiatives within Namibia. The training received by course participants --who came from countries including Iran, Zambia, Botswana, the United States, Ethiopia, Niger, Namibia, Brazil, Zimbabwe, and Kenya --focused on capacity building to conserve cheetahs and their ecosystems.

Lectures and exercises included theory-based talks and field practice on integrated and holistic rangeland management, techniques for estimating and monitoring cheetah populations, cheetah biology, health and genetics, conducting rapid surveys, and the role of conservancies in achieving conservation goals. Modules were conducted in cooperation with CCF staff and lecturers from the Polytechnic of Namibia, World Wildlife Fund, the Otjiwarongo Veterinary Clinic, AGRA, and other businesses and organizations. For many of the students, the course provided their first introduction to these topics and techniques.

To put theory into practice, participants visited the Ehirovipuka and Grootberg Conservancies near Etosha National Park. During this time, participants surveyed local farmers on human-wildlife conflict issues, conducted predator identification workshops, and assessed the region for sustainable land use.

Farmers' Training

During the field trip for the International Cheetah Conservation Biology Course, three farming communities comprising 57 people from two conservancies were visited and engaged in an interactive learning exercise with CCF staff, based on the CCF model for farmers' training courses imparted at the CCF Centre.

The first exercise was to determine their knowledge of the predators in Namibia using pictures of eight different predator species. In the Ehirovipuka conservancy, 45 people from two different communities participated in the identification exercise and 29 identified all of the predators correctly. Only five of them incorrectly identified the cheetah as a leopard and vice versa. The other most commonly confused predators were the caracal and African wild cat and the spotted and brown hyenas. In the Khoadi/Hoas conservancy, of the 12 people from one community who participated in the exercise, 6 identified all of the predators correctly. Only two people identified the cheetah as a leopard.

Another exercise was conducted with these communities to teach the people how to identify the predator that killed livestock by investigating the signs around and on the kill. The people were separated into groups that were shown four model goat kills and asked to find out what killed the goats. Several of the older members of the communities had excellent knowledge of the signs to look for at a kill and could easily identify the culprit predator. These elders were asked to explain how they knew the answer and thus taught the other men and women in their group.

At the end of the exercise, the groups were given two important messages about livestock protection. A similarity was drawn between people in cities protecting their possessions from thieves and farmers needing to protect their livestock from predators. The second message made it clear that predators are opportunistic by nature and could start killing vulnerable young livestock that are left without the protection of a herder and/or a livestock guarding dog. The communities agreed with these two principles and thanked the CCF team for coming to their conservancies to present the demonstrations.

Other

Community Outreach

CCF continued to visit farmers' associations as part of its outreach and education programme. Outreach and education are essential to creating positive attitudes towards predators on farmland. During these interactions, the CCF staff form important relationships with farmers from different regions in Namibia.

In March 2010, CCF was invited to attend two meetings held by emerging farmers' associations from Kunene and Oshikoto. The purpose of these meetings was for the farmers to discuss their training needs in their regions and to communicate with organisations such as CCF that provide this training. During these meetings, CCF extended support to the emerging farmers and offered to provide training courses on livestock and farm management.

CCF has actively involved communities from the Kunene region in conducting surveys and training during the international courses. The resettled emerging farmers at Queen Sofia farm were surveyed during the Integrated Livestock and Wildlife Management course in February. During the Conservation Biology course in June, more Kunene region farmers west of Etosha were surveyed and trained by course participants and CCF staff (See section on International courses for details of survey results).

In August 2010, CCF attended a commercial farmers' association meeting in the Outjo district. During the meeting, 14 farmers provided data on their game numbers, rainfall, livestock management and predator problems to CCF. The results of these surveys indicated that some farmers have few or no losses, whilst others in the same area experience high losses. These differences were explained by the intensity of livestock management and the use of herders and guarding dogs that were employed by farmers with no livestock losses.

Through these activities, CCF has emphasised its concern about the welfare of farmers that live with cheetahs and are willing to help them conserve these predators on their land.

Furthermore, CCF remains a centre for advice and help for all farmers in Namibia. Farmers that suspect livestock losses to cheetahs and other predators contact CCF to enquire about the Livestock Guarding Dog Programme and other methods of livestock management.

In addition to visiting specific groups of farmers, CCF also attended four agricultural shows in Gobabis, Grootfontein, Okakarara, Outjo and Windhoek. The displays at the shows were both interesting and educational, with 51 groups of people (mostly children, with only six adult -only groups) and an average group size of 2.4 playing the 'name the carnivore' game. The average score was 8.5 out of 12 animals correct and 1.6 out of 4 paw prints correct (only 27 groups played the spoor game, due to the difficulty level).

After playing the game, the participants were engaged in a discussion on the size, behaviour and general distribution of the carnivores. The 12 carnivores used were: lion, leopard, cheetah, wild dog, caracal, black-backed jackal, spotted hyena, brown hyena, serval, bat-eared fox, aardwolf and African wild cat. The most common incorrectly identified animals were the aardwolf, brown hyena and serval. The most common correctly identified animals were the lion and black-backed jackal. The most commonly confused group of animals were the hyenas and the aardwolf, with the leopard and cheetah only occasionally being confused.

The agricultural shows also provide an opportunity to speak to farmers about predators and ways to live with them in harmony. The CCF staff collaborated with Frances Magaldi, a PhD student from the UK, who used the agricultural shows as an opportunity to conduct a pilot survey on farmer-predator conflict in Namibia. She intends to use her findings to further refine her survey and return next year to conduct a full study, the results of which will be shared with CCF.

The combination of interactive games, educational videos, posters and information for children, teachers and farmers was a very effective tool for creating awareness about cheetahs in Namibia. In addition, the books "Cheetah Survival on Namibian Farmlands" and "Integrated

Livestock and Predator Management” were given to farmers who showed interest. The educational material was accompanied by a kill identification demonstration using a fibreglass goat and the kill identification page handout. This will help farmers identify the predator that is causing their livestock losses and adapt their livestock management accordingly. In addition to addressing the livestock farming community, CCF continues its active involvement with the game farming and hunting community. To reach game farmers that use trophy hunting as a form of income, CCF joined the Namibian Professional Hunters' Association (NAPHA) road show in July. The road show comprised six meetings held in different parts of the country, with a total of 57 farmers attending. During these meetings, the CCF representative discussed the management of predators on game farms. The opinions and needs of the farmers are very important for CCF to develop solutions with organisations such as NAPHA. In November, CCF attended the NAPHA Annual General meeting as part of our continued involvement with the trophy hunting industry.

Developing Environmental Leaders

Primary through High School

CCF organises outreach programmes for youth throughout Namibia that focuses on 5th through 12th grade classes and environmental and conservation clubs and are designed mainly for groups accommodated at CCF's Camp Lightfoot. Groups usually spend three days and two nights with CCF. All participants are exposed to CCF's research and conservation efforts by presentations and to the Namibian farmland ecosystem through the nature trail and a game drive through CCF's Little Serengeti. Team-building activities are designed to highlight the importance of team efforts in conservation. Role-play and drama are also included in the programme and include scenarios of livestock and predator management.

The number of Namibian school groups visiting the Cheetah Conservation Fund has been increasing rapidly over the last two years. CCF has moved from 370 school children and 19 visiting groups in 2009 to 833 school children from 27 regional schools in 2010. The increased interest in CCF over the past year can be attributed to the increased environmental education subjects in school curriculums.

CCF is also actively involved in community outreach programmes for its environmental education project. Throughout 2010 a total of 22 schools in the Erongo and Kunene regions were visited and a total of 2030 pupils attended the CCF field educator courses. In June, during the International Cheetah Conservation Biology Course, participants were taught how to do school assembly programmes by imparting a course to 1,000 students at one school in the Khoadi/Hoas Conservancy.

Higher Education and In-Service Training

CCF is committed to empowering Namibians to take over the conservation and protection of their wildlife. Toward this goal, for many years CCF has fostered Namibian college students' interest in wildlife conservation. CCF offers six-month in-service training programs for Nature Conservation and Agriculture students from the Polytechnic of Namibia. The students conduct research projects, with the goal of completing a research paper at the conclusion of their internships. Several former interns have gone on to work at conservation organizations or in the government's Ministry of the Environment.

Ngundjii Tjizera was our student for the first 6 months of this year. CCF's student from 2009, Joeseph Jonas, was subsequently hired to work with CCF's small stock and livestock guarding dogs.

CCF Staff Education

Research Assistant Ezekiel Fabiano started his PhD in March 2009 with a scholarship from the Wildlife Conservation Network and from Dr. Eduardo Eizirik at Pontificia Universidade Catolica do Rio Grande do Sul, Brazil. He continued his research toward his doctorate throughout 2010. Priskila N. Nepela joined CCF for in-service training in 2008 and is now working for CCF's ecotourism department as an education aide. She holds a national advanced diploma in Tourism from the International Training College Lingua and is responsible for customer service and guiding.

Masters Degree student Gail Potgieter from Nelson Mandela Metropolitan University joined CCF in early 2009 to conduct her Masters project on Human-Wildlife Conflict. Gail's project focuses specifically on CCF's Livestock Guarding Dog Programme. To date, Gail is in the process of analyzing data from farmers dating back to 1999 and writing her thesis. Education Officer Gabriel Angala is studying Environmental Economics through the Institute of Bankers.

Other Collaboration with Educational Institutions

CCF was instrumental in bringing together the Namibian Environmental Educators Network group. This group, comprising 84 primary and secondary school teachers from all over Namibia, came together at CCF for networking, discussions and experiences they face in the shortcomings that present itself in the field of environmental education. Presentations and formal discussions were conducted by various Namibian University lecturers and staff from the Namibian Ministry of Environment and Tourism.

For the fourth year, 24 teachers enrolled in continuing education through Miami University of Ohio participated in Earth Expeditions projects at CCF. The program, for teachers across the US, involves training in using learning-centered techniques focusing on the cheetah and its Namibian ecosystem. The course included teaching presentations on Namibian wildlife and cultures by participating teachers from the United States, a trip to Etosha National Park, hands-on activities, as well as a variety of individual and group projects. Participants also spent time with CCF Farm Manager Johan Britz learning more about what it means to be a predator-friendly farmer.

CCF was visited by three university groups to participate in our Environmental Educational Course. The students all formed part of an Environmental Restoration and Learning programme hosted by their respective institutions. At CCF they all participated in various lectures and field classes that ranged from predator identification and their role in the ecosystem, the biology of the cheetah, the ecology of the cheetah, land management practices and presentations offered by the CCF geneticist and resident vet.

Long term impact of project

Taxa of conservation significance enhanced, restored or maintained

Species: Cheetah (*Acinonyx jubatus*)

Significance: Listed as Vulnerable by the International Union for the Conservation of Nature (IUCN) Red List. Listed as a Convention on International Trade in Endangered Species (CITES) Appendix I species. Listed as Endangered under the U.S. Endangered Species Act. Listed as a Protected Game Species in Namibia.

Rate of Population Decline: Around 1900, there were an estimated 100,000 cheetahs in Africa; by 1975 the estimate was on the order of 30,000; in 1990 the number had dwindled to ~15,000. Today, the estimate is ~10,000

Impact on the Species: (1) fundamental and applied research to better understand cheetah biology, genetics, and conservation; (2) development, demonstration, and dissemination of livestock husbandry and farm management techniques that avoid conflict with cheetah and other predators; (3) farmer education on the importance of predators in a healthy ecosystem, and methods to live with and tolerate predators without lethal controls; (4) habitat restoration to increase suitable cheetah ecosystems and range.

Species: Black rhinoceros (*Diceros bicornis*)

Significance: Listed as Critically Endangered by the International Union for the Conservation of Nature (IUCN) Red List. Listed as a Convention on International Trade in Endangered Species (CITES) Appendix I species. Listed as Endangered under the U.S. Endangered Species Act. Listed as Critically Endangered and Conservation Dependent in Namibia.

Rate of Population Decline: Around 1900, there were at least several hundred thousand black rhino in Africa; by 2004, the estimate had ebbed to ~2400. Today, the estimate is somewhere between 4000 and 5000.

Impact on the Species: All rhinos in Namibia are considered government property. CCF participates in a Ministry of Environment sponsored program of rhino custodianship. Five black rhinos are conserved and protected within a secure 14,000 ha rhino reserve on CCF property.

Habitats enhanced, restored or maintained

Approximately 14% of Namibia (25 million acres) is now seriously infested with undesirable bush species. Over past decades human activities such as grazing, fencing and wild fire suppression have caused a severe loss of grassland and productive farmland through a process called 'bush encroachment'. Mostly composed of various species of thorn bush, these plants have progressively entered then dominated these lands, severely changing the habitat to the detriment of wildlife and farmers alike.

The thickened bush impacts the local water cycle creating competition for local herbaceous species (an acacia tree can consume up to 7 times the water of a desirable fodder species). This change in the water cycle also increases the probability of an artificial drought event, a particular worry for a low-rainfall country like Namibia. The transformation from savannah to thick bush changes the mix of food available for wild animals (both browsers and grazers), changes local soil temperature (impacting seed germination patterns) and ultimately changes the type of grass or bushes that thrive. Even the overall fertility of soil can change after the arrival of invader bush species. In short, bush encroachment causes widespread, severe, and negative impacts on the habitat. This bush encroachment is the first stage of desertification and is increasing, posing a major threat to the livelihood of nearly three quarters of the population as well as to cheetah and other indigenous Namibian wildlife species. For marquee predators such as the cheetah, bush encroachment causes specific habitat changes that impact their ability to survive. The change from mixed grassland/bush land savannah to encroached bush land changes the mix and quantity of prey species available in the habitat. Since cheetah hunt using bursts of speed to overcome prey, the presence of thick bush hinders their ability to successfully hunt.

CCF is combating the issue of bush encroachment through its Bushblok project. Established in 2001 with a grant from the USAID, CCF Bush Pty Ltd. makes fuel logs from harvested bush with the dual purpose of reducing brush density and providing a sustainable alternative fuel source locally and, wherever feasible, worldwide. CCF is developing ecological standards for bush harvesting with the goal of restoring landscape-scale patches of cheetah habitat throughout Namibia. Meanwhile, the Bushblok plant is providing jobs for local Namibians with the potential to create many more.

The Forest Stewardship Council (FSC) inspected CCF for major (5-year) certificate renewal in April 2010. Both Bushblok and CCF are now FSC certified.

Livelihood assets enhanced, restored or maintained

Humans must co-exist with cheetah if the world's fastest cat is to survive in the wild. The following progress has been made on CCF's activities that assure the economic wellbeing of people living within the cheetah's range and provide resources to support CCF's long-term activity.

Direct Employment

CCF employs 29 paid staff in managerial, professional, and technical positions, 17 of whom are Namibians. In addition, 28 Namibian farm and domestic workers are employed, most of whom live onsite with their families. Our subsidiary, CCF Bush Pty Ltd, employs an additional 25 local workers.

Bushblok

Sales remained fairly flat in 2010 with a total of 451 tons of Bushblok fuel logs. Continuing problems with the extrusion presses hampered production. Solutions have been investigated and the problems are not expected to impact 2011 production. Advance requests for 2011 are over 1000 tons.

The low sales and a large increase in electricity charges negatively affected the profitability of the operation. However, late in the year we recovered part of a bad debt from a failed distributor in Cape Town. CCF's General Manager met with the Otjozondjupa Regional Council and German Development Corporation (GTZ) regarding the possibility of applying for Clean Development Mechanism credits and collaborated with the Finnish research corporation VTT in submitting grant requests to the EEP (Energy and Environment Partnership Programme with Southern and Eastern Africa). CCF assisted the Community Based Economic ND (CBEND) project by loaning them a wood chipper.

Former intern Ryan Richards completed his paper, "The potential for biomass certification to fuel landscape restoration in Namibia." This had been prepared at our request and was shared with Namibia's Department of Forestry. CCF remains active in the government's Woodlands Management Council.

The Forest Stewardship Council (FSC) inspected CCF for major (5-year) certificate renewal in April. Two inspectors spent three days examining not only the woodlands harvest and chipping operations but also CCF's general environmental and social operations (what pesticides we might use, how we manage our waste, are workers appropriately trained and paid, etc.). Both Bushblok and CCF are now FSC certified.

Cheetah Country Beef

Cheetah Country Beef has not been active in 2010. However, from our work in this process, MeatCo has established an eco-friendly label; Nature's Friendly, with a price premium to farmers who agree not to kill predators. However, this is not a certified product and is not monitored. CCF continues to discuss co-branding with MeatCo. CCF presented MeatCo with the Smart Partnership Award at CCF's Gala Dinner in July, thus highlighting the importance of eco-labels. MeatCo has been able to introduce a code of conduct which helps farmers identify predators and teaches humane methods of predator management. We hope that this will lead to more initiatives and higher price premiums for our "Cheetah Friendly Beef" plans.

Cheetah Country Crafts

CCF has been involved in a Cheetah Country Crafts programme with local women for over 18 years to provide supplemental income. CCF provides materials to programme participants and then buys back the finished products to sell in the eco-tourism gift shop and overseas during the Director's international travels. Since 2009, the primary focus of this programme has been on beaded necklaces. The programme has gained momentum through the training of local women in the production and sale of these crafts.

Cheetah Country Goat Cheese

CCF began making fresh goat cheese in August 2009 using the milk from CCF's dairy goats. The programme aims to facilitate training and skill development around the production of goat dairy products. The project will ultimately enable livelihood diversification on Namibian farms and provide supplemental income to community members. During 2010, goat cheese produced at CCF has been used for CCF staff meals. As of the end of 2010, however, a management plan for CCF's dairy goats and cheesery, along with marketing plans, have been developed to begin selling the cheese to local lodges, restaurants, and businesses. In 2010, CCF's milk production reached a peak December, after several of the does kidded, for a total of 900L of milk in the month. CCF has been experimenting with several cheeses and, currently, four kinds of cheese are being made: feta, ricotta, chevre, and a hard cheese.